DTE Distribution Grid Plan Technical Conference

The meeting will begin promptly at 9:00 am.

August 31, 2023

9 AM – 1 PM

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

DTE Distribution Grid Plan Technical Conference: Welcome and Overview

Joy Wang, Ph.D.
WangJ3@Michigan.gov
Distribution Planning Section Manager
Michigan Public Service Commission

Agenda

9:00 am	Welcome and Opening Comments	Dr. Joy Wang Manager – Distribution Planning, MPSC
9:05 am	DTEE Distribution Grid Vision	Sharon Pfeuffer Vice President – Distribution Operations Engineering, DTE
9:10 am	State of the Grid/Future forces impacting the grid	Husaninder Singh Manager – Distribution Planning, DTE
9:30 am	Strategic Pillar - Infrastructure resilience and hardening	Morgan Elliott Andahazy Director – DO Programs, DTE
10:00 am	Strategic Pillar - Tree Trim program	Brian Hill Director – Distribution Operations, DTE
10:20 am	Strategic Pillar - Technology and Automation	Joseph Jacunski Manager – Engineering Standards and Design, DTE
10:50 am	Break	All
11:00 am	Strategic Pillar - Infrastructure Redesign and Modernization	Edward Karpiel Manager – Business Performance, DTE
11:30 am	Global Prioritization Model (GPM) model updates	Edward Karpiel Manager – Business Performance, DTE
11:50 am	Environmental Justice (EJ) plan	Grace Musonera Manager – Engineering Support, DTE
12:10 pm	Detroit targeted study	Jamie Kryscynski Acting Director – Distribution Operation, DTE
12:25 pm	Break	All
12:35 pm	Open discussion and conference feedback	Moderated by Dr. Joy Wang Manager – Distribution Planning, MPSC
12:55 pm	Closing Remarks & Next Steps	Dr. Joy Wang Manager – Distribution Planning, MPSC
1:00 pm	Adjourn	

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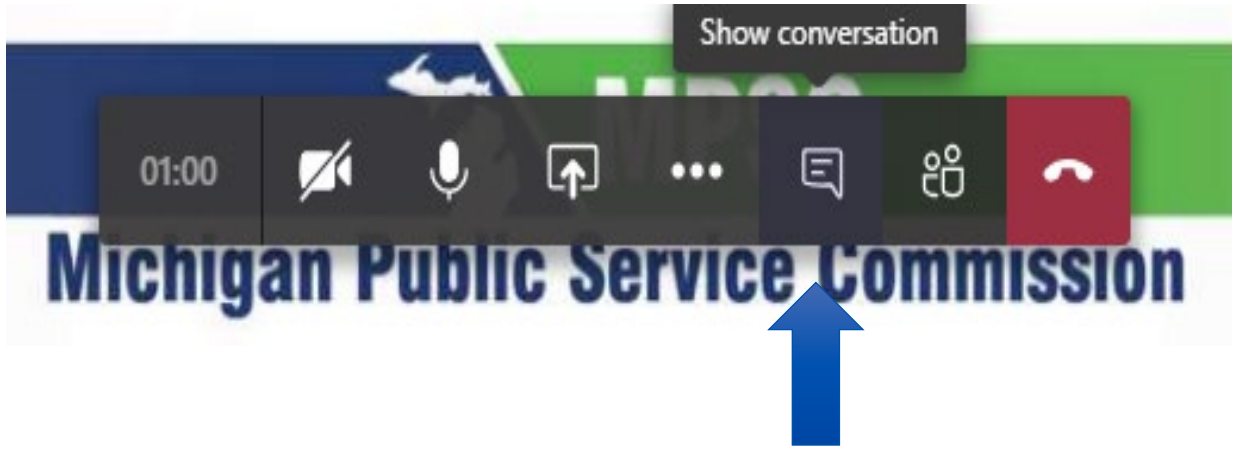
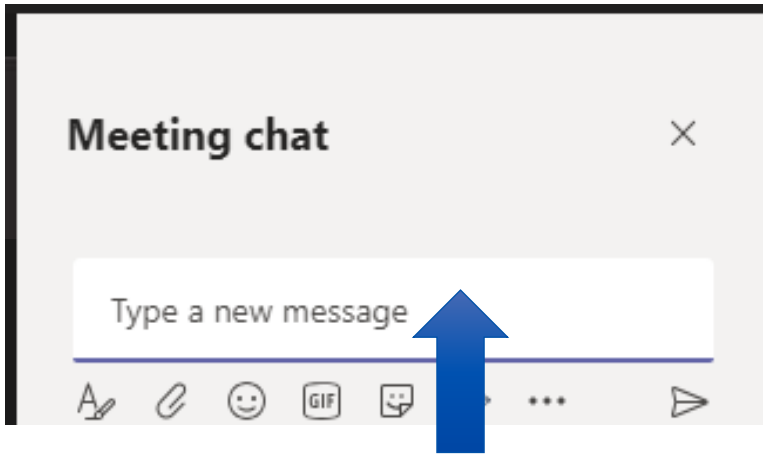
Housekeeping

- This meeting is being recorded
- Recording and slides posted after the meeting
- All audience members will be muted
- Please type questions into the chat box
  - To access chat box:





- Staff will ask chat box questions during Q&A

Housekeeping, cont.

- During the meeting, if clarification of your question is needed, we will ask you to unmute.
  - To unmute:
    - Phone: Press *6
    - Teams: Click mic button
  - Please mute yourself again after your clarification.

- If you are not a session speaker, please turn off your video.

- If Teams via web browser is not working, try a different web browser.

DTE Distribution Grid Plan Technical Conference: Opening Comments

Joy Wang, Ph.D.
WangJ3@Michigan.gov
Distribution Planning Section Manager
Michigan Public Service Commission

Disclaimer

- All views expressed are solely my own and do not express the views of the Michigan Public Service Commission.
- The Commission speaks through its orders.

Background: Today's Technical Conference

- 4.8kV Technical Conference on March 22, 2023
  - Explored benefits and costs of 4.8kV hardening vs. alternatives
  - Commission ordered one or more technical conferences covering:
    - Analyze 4.8kV capabilities and constraints
    - Analyze and compare hardening alternatives
    - Analyze reliability focused distribution technologies
    - Plan for arriving at an equitable future for environmental justice and other disadvantaged communities
- Today's technical conference will provide details on:
  - Some topics touched on previously
  - Environmental justice plan

Background: Distribution Planning Start

- DTE Electric ordered to file 5 year distribution plans in Jan 2017 (U-18014)
- Commission desired plans to:
  - Provide better visibility into investments long into the future
  - Detail strategies addressing aging infrastructure
  - Have guiding principles of:
    - Safety
    - Reliability and resiliency
    - Cost effectiveness and affordability
    - Accessibility
- U-20147 created as single repository for all distribution plans

Background: Distribution Planning Evolution

- Still relatively new:
  - DTE DGPs filed: Jan 31, 2018 Sept 30, 2021 by Sept 29, 2023
  - MPSC Distribution Planning section started: December 2022

- Committed to improving distribution planning process to help generate distribution plans that are informative and responsive to needs

Background: Ongoing Efforts May Inform Future Plans

- 3rd party audit of electric distribution system
  - October 5, 2022, order in Case No. U-21305 for DTE Electric and Consumers
  - Will provide recommendations on possible actions to:
    - Reduce outages and durations
    - Increase safety
    - Estimated timeline for recommended measures to improve reliability performance
- MI Power Grid Incentives/Disincentives Workgroup
- Michigan specific benefit-cost analysis guidance development
- Improved data collection and communication
  - Distribution system reliability metrics data provided MPSC Customer Information – Electricity page
  - Monthly reliability metrics collected in U-21122
    - Census tract and zip code data available for DTE Electric

Distribution Grid Plan Technical Conference

August 31, 2023

Today's Agenda

- Conference kickoff (10 minutes)
- **Grid Vision (5 minutes)**
- State of the Grid/Future Forces Impacting the Grid (20 minutes)
- Distribution Grid Plan Strategic Pillars:
  - Infrastructure Resilience and Hardening (PTMM) (20 minutes)
  - Tree Trimming (20 minutes)
  - Technology and Automation (30 minutes)
  - Infrastructure Redesign and Modernization (Conversion and Subtransmission) (30 minutes)
- Global Prioritization Model (GPM) Updates (20 minutes)
- Environmental Justice (EJ) Plan (20 minutes)
- Detroit Targeted Analysis (15 minutes)
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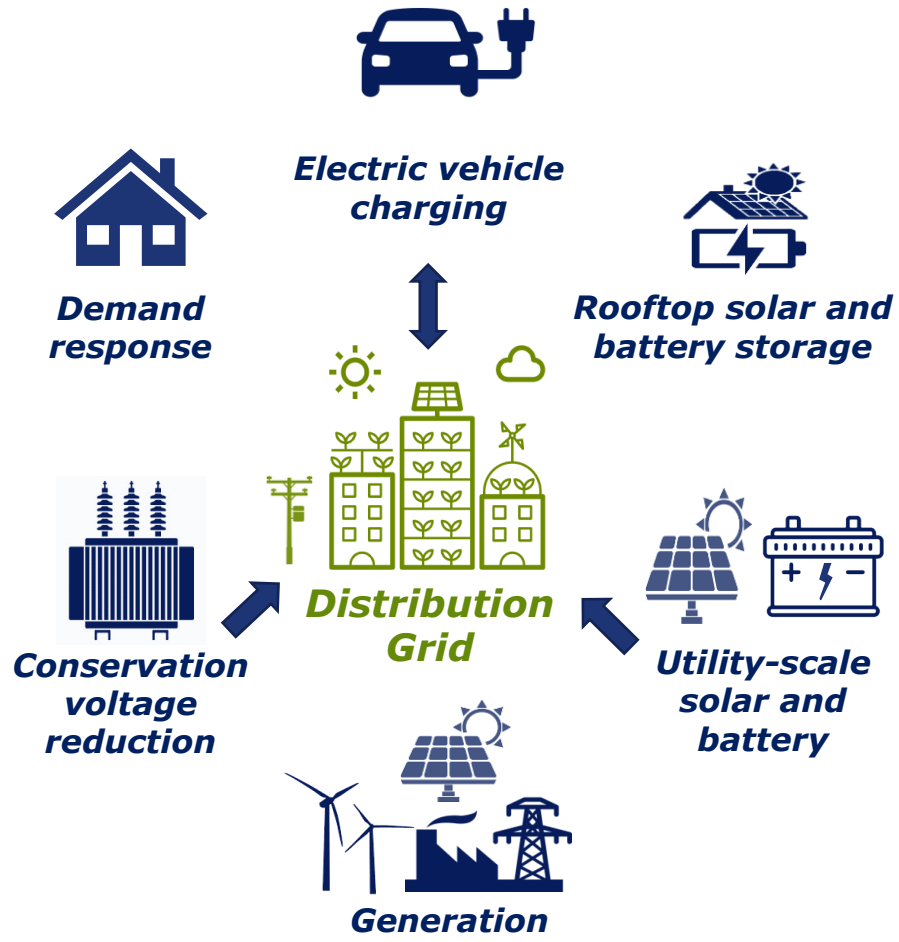
- Closing Remarks (5 minutes)

DTEE's 2023 Distribution Grid Plan is built around our vision that will support improving customer reliability, communication, electricity use, and affordability

Vision for the Distribution Grid

- Increase reliability and resilience to withstand extreme weather, and ensure that power stays on for our customers during storms that bring wind, rain, ice, and heat
- Accelerate response to customer outages, driven by a smart grid that supports quicker power restorations, identification and de-energization of downed wires, and provides customers with accurate restoration estimates
- Plan and build a grid that can accommodate the future energy needs of our customers
- Execute work efficiently and timely, while maintaining energy affordability for customers as improvements are made to the grid

Grid of the Future



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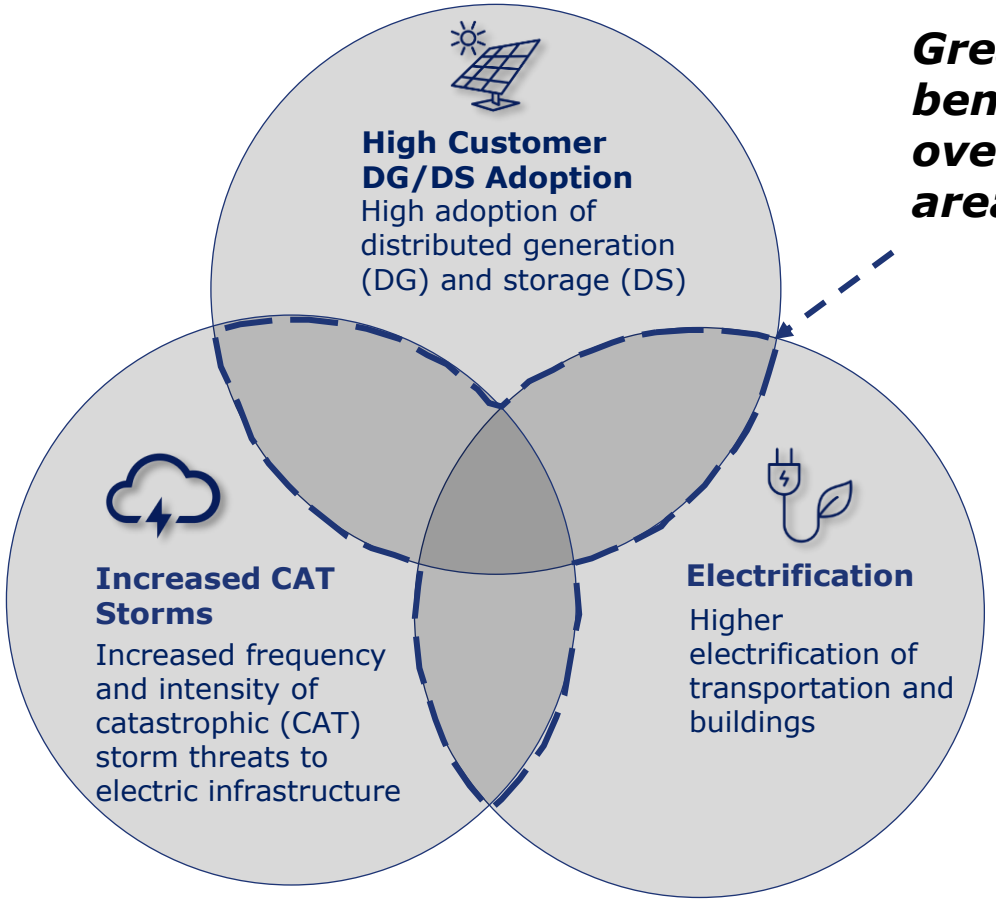
DTEE first incorporated distribution scenario planning in the 2021 DGP and continues to use the same approach in the 2023 DGP to develop a long-term strategic investment plan

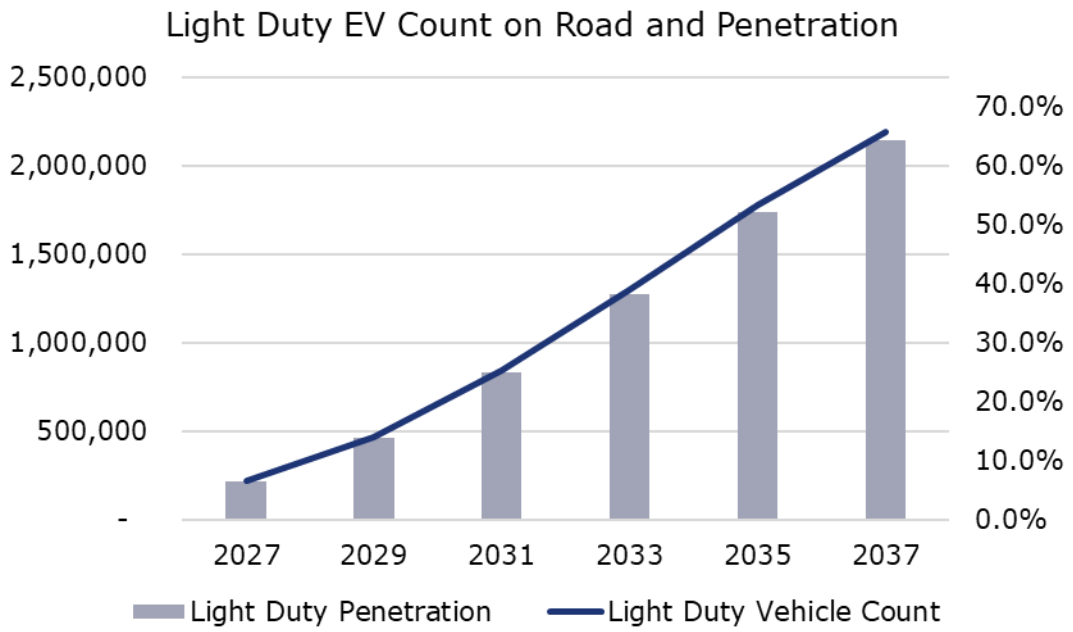


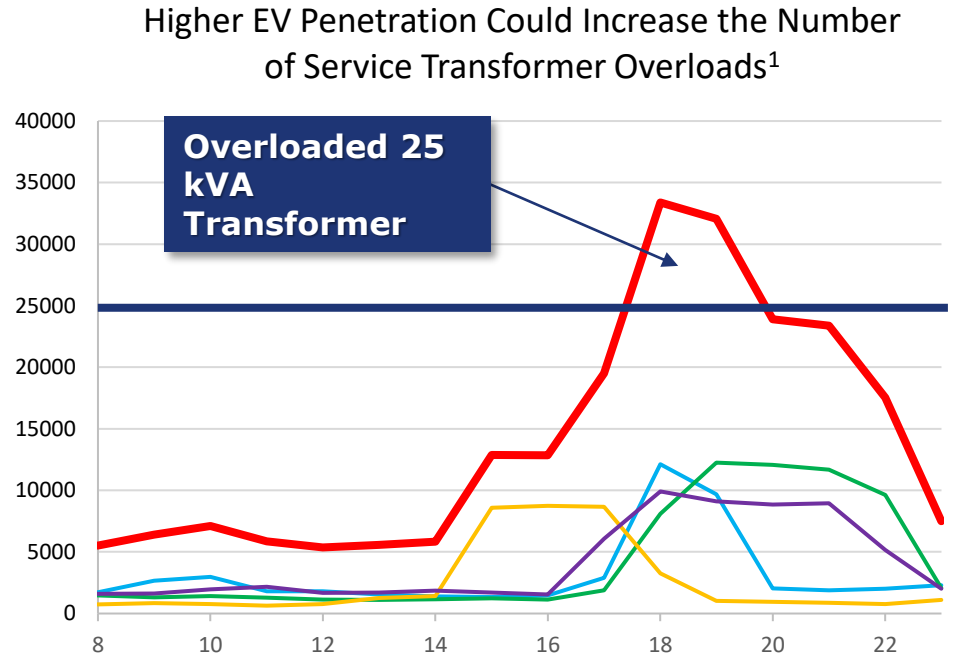
Greatest benefit in overlapping areas

- Three scenarios were developed to analyze the range of potential impacts to the grid if one or multiple scenarios materialize
- Scenarios are driven by unique sets of drivers that are expected to impact the grid over the next 15 years and beyond
- Each scenario includes three components to determine the potential investments needed for the grid:
  1. Plausible forecasts
  2. Grid impacts
  3. Signposts

While the Company invests in projects and programs that support individual scenarios, the **greatest benefit** is achieved by **identifying investment opportunities across multiple scenarios**

Under the **electrification scenario**, DTEE's distribution system would face increasing capacity constraints as EV adoption continues to rise

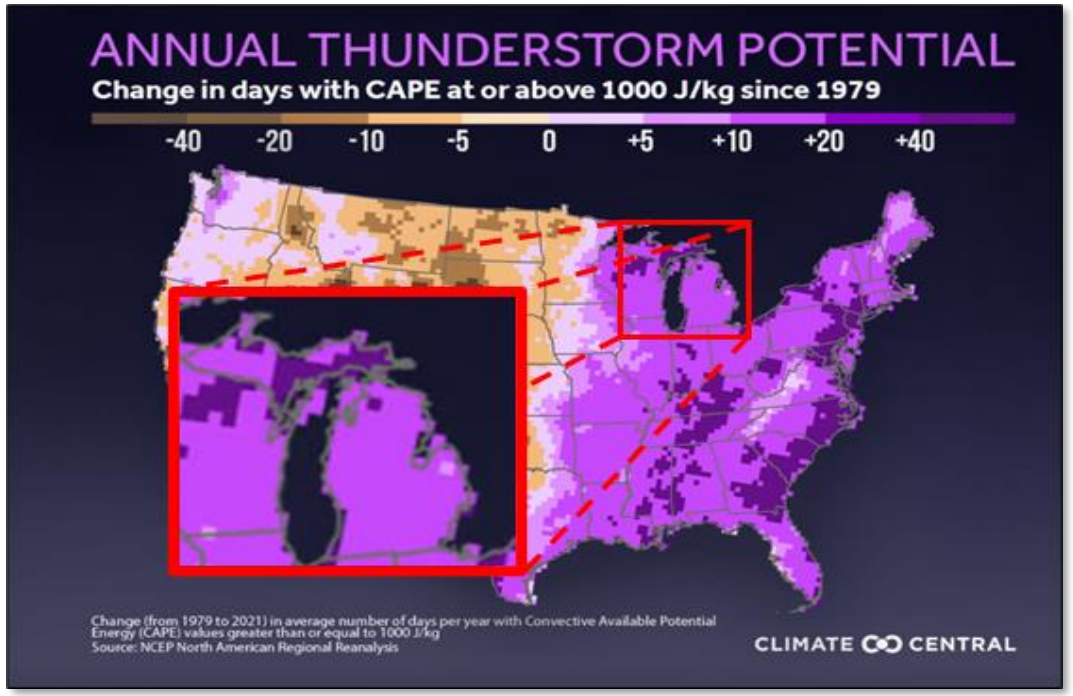


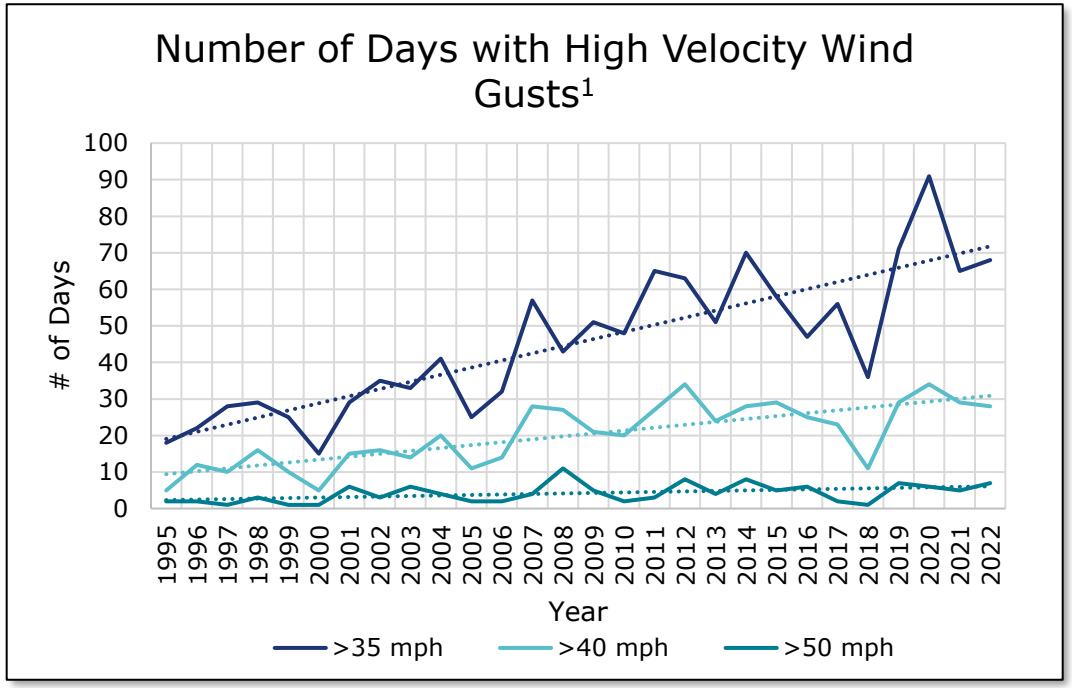


- As electrification-driven load growth continues, existing grid capacity constraints will increase; assets nearing or past their useful life posing risks of accelerated equipment aging/failures due to high loading
- The impacts of electrification will likely emerge first on "grid edge" assets (customer transformers, secondary wires) and can occur in pockets of early adoption under low levels of electrification
- Increased investment to add system capacity in some areas will be needed to be ready to serve customer needs in the next 5-15 years

DTE

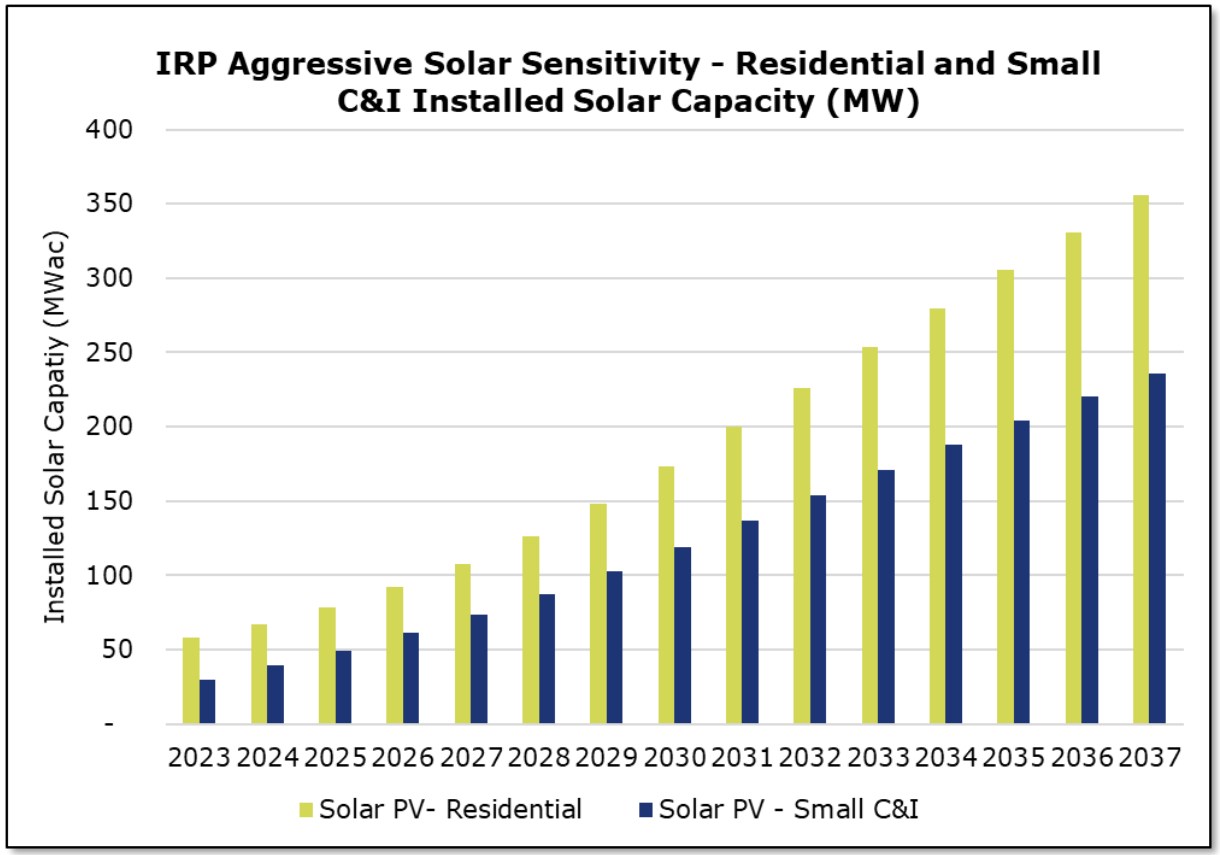
The **increasing catastrophic storm scenario** analyzes the risk to DTEE's infrastructure stemming from the increasing intensity and frequency of severe weather





- This scenario considers the frequency and severity of storms to increase over the coming years
- An indicator that severe weather is increasing in the number of days with higher Convective Available Potential Energy (CAPE)
- Weather data recorded at DTW airport shows days with wind gusts above 35 mph are on an increasing trend

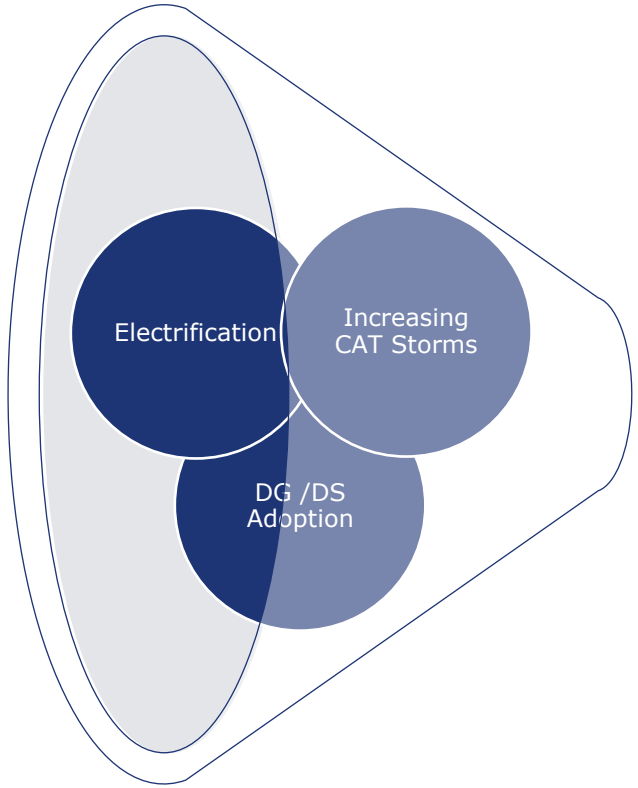
The **Distributed Generation/Distributed Storage (DG/DS) scenario** focuses on the adoption of distributed generation and storage technologies that can reduce customer electricity demand and export power back to the grid



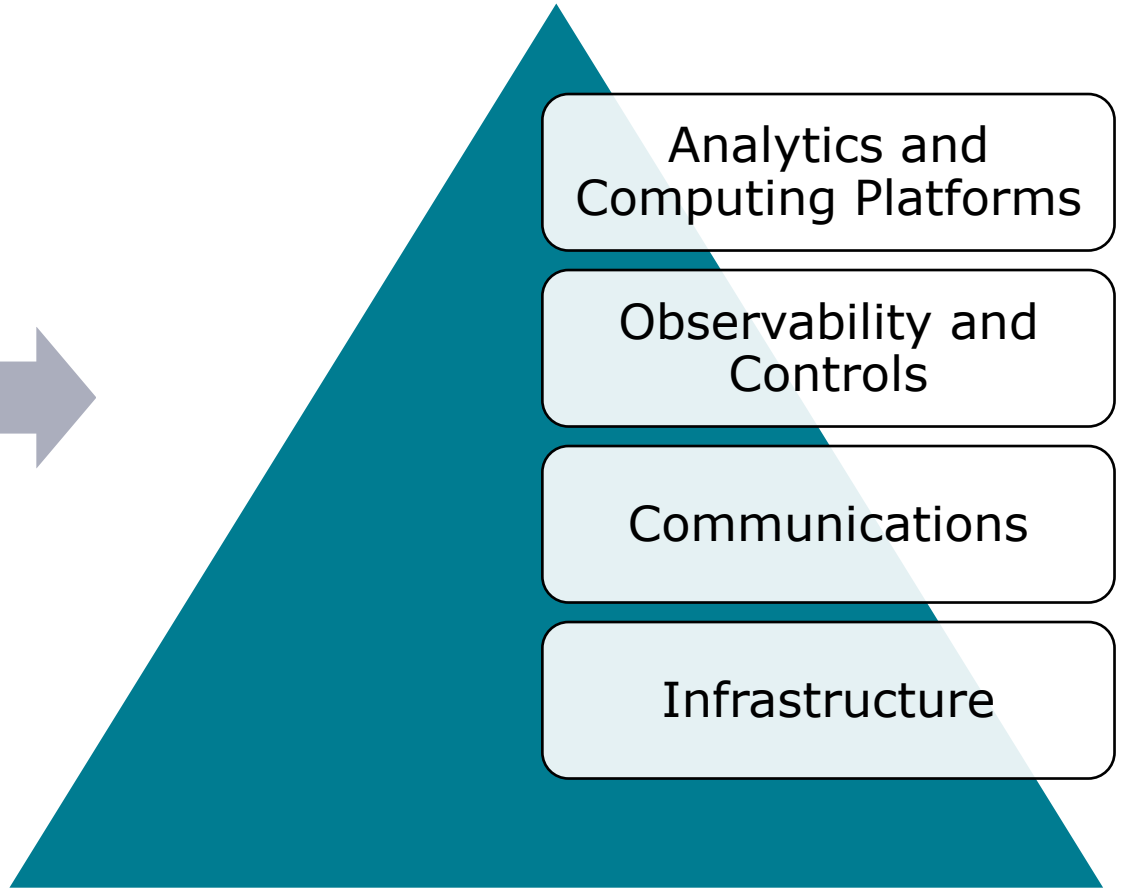
- The plausible forecast utilized in this scenario is from DTEE's aggressive growth forecast included in its IRP filing
- The introduction of DG / DS into the distribution grid provides DTEE with the opportunity to achieve a variety of operating benefits. However, doing so requires that the Company invest in the necessary upgrades to maintain grid stability and reliability
- Moderate to high levels of DG/DS can create certain challenges, including mainline and lateral voltage and thermal issues impacting power quality, as well as protection malfunctions

DTE

Scenario planning identifies grid investments that are needed to address long term grid needs



Scenario Planning



Grid Investments

Today's Agenda

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  - Tree Trimming (20 minutes)
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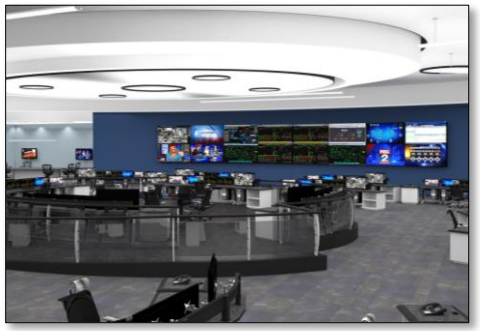
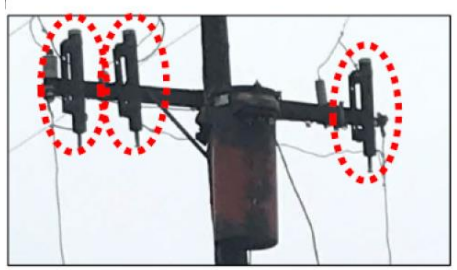
The DGP will remain rooted in the four pillars established in 2018, with the strategic focus within each pillar refined to accelerate reliability and resiliency improvements

	Infrastructure Resilience and Hardening	Tree Trimming	Technology and Automation	Infrastructure Redesign and Modernization
				
Strategic Focus	• **Ramp PTMM to 10-year pole and pole-top cycle**	• **Complete tree trim surge** • **Optimize trim cycle**	• **Fully automate system in next 5-6 years with**	• **Accelerate conversion of 4.8kV system**
Pillar Overview	• Harden system to reduce outages and increase storm resiliency • Replace aging, at-risk infrastructure	• Enhance tree trimming plan with a particular focus on specification and quality of work – to improve reliability, trouble costs and customer satisfaction	• Widely deploy remote monitoring and control • Invest in additional applications to leverage automation investments • NWAs, CVR/VVO	• Convert 4.8kV system to higher grid voltage • Eliminate loading constraints on the 13.2kV • Rebuild 40kV sub-transmission system

DTE

The Company's Pole Top Maintenance and Modernization (PTMM) Program identifies damaged or defective poles and pole top equipment, and replaces them prior to failures

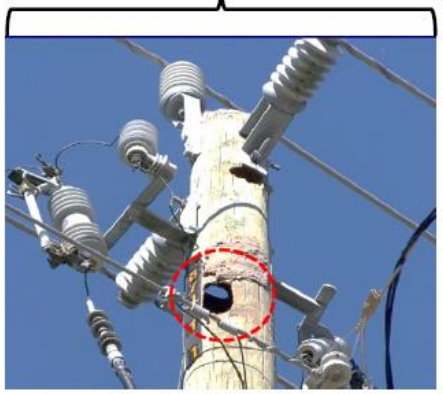
Poletop Equipment Inspection



Obsolete Cutouts

Broken Ground Wire

Pole Inspection



Holes and/or decay that affect hardware

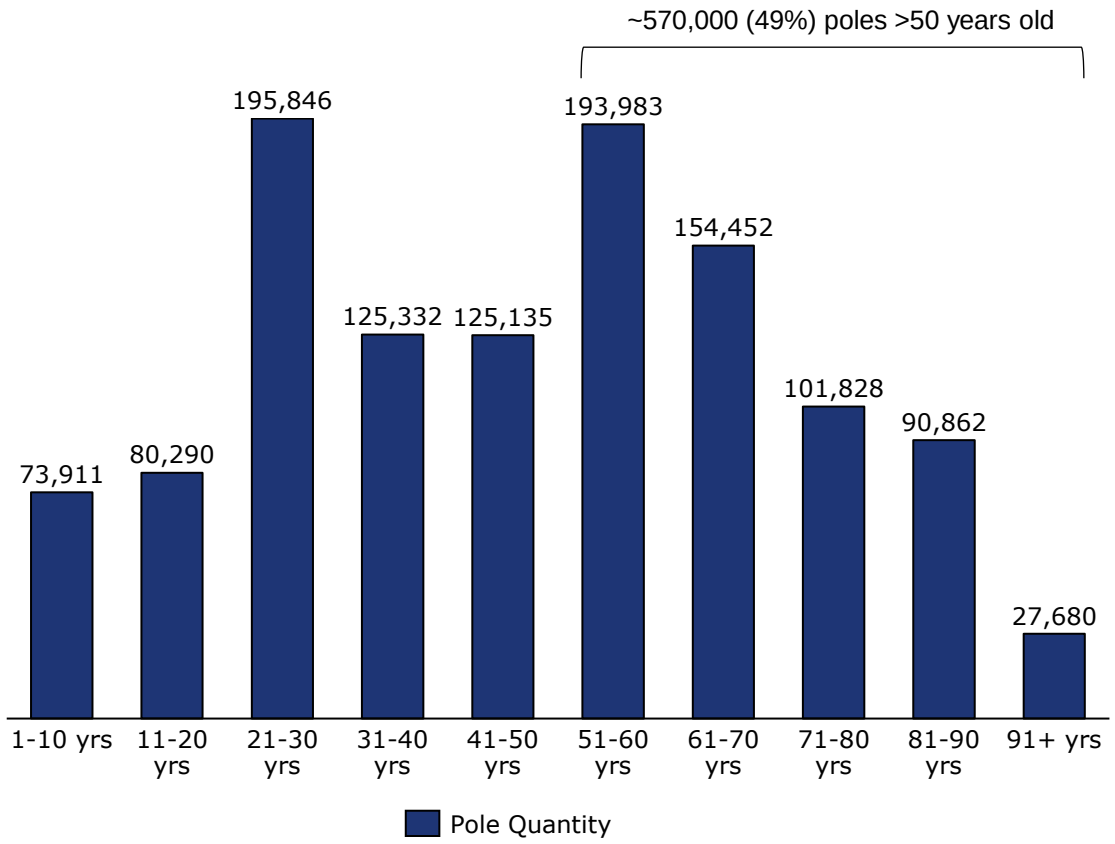
- Approximately 70% of DTEE's distribution infrastructure is overhead equipment
- Overhead equipment failures cause nearly 25% of all outages that customers experience
- Overhead equipment is continually exposed to harsh conditions (e.g., ice, heat, rain, sunlight, wind, and trees), causing them to degrade and weaken over time
- Replacing and upgrading our existing infrastructure continues to improve the safety, reliability, and resilience of the electric grid
- The PTMM program consists of two parts:
  1. Pole Inspection, Testing, & Remediation
  2. Visual Pole Top Equipment Inspection & Remediation

The PTMM program has undergone a major transformation in the past four years, which will set DTEE up for future success

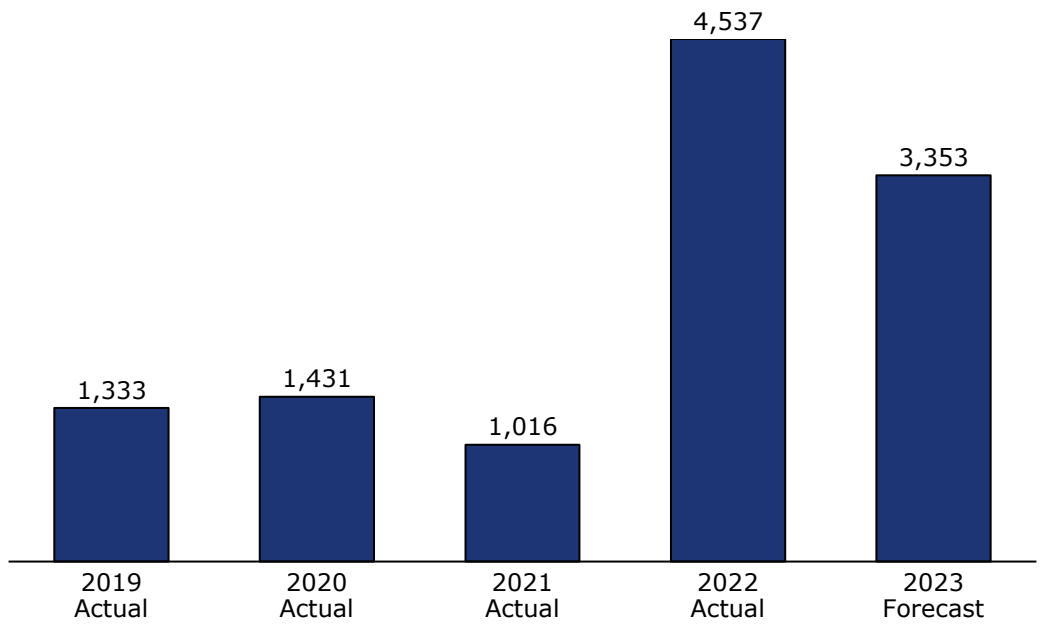
Year	Event
2019	• PTM program upgraded to PTMM with enhanced material specifications • New inspection standards established for contractors
2020	• COVID impacted quantity of inspections as only critical work performed
2021	• PTMM program ramped up to address the pre-COVID construction backlog
2022	• Focused team to improve execution of the PTMM program • Substantial process enhancements and inspection process improvements
2023	• Clearing pre-2022 PTMM construction backlog • Significant increase in identification and replacement of failed equipment

DTEE has over 1.1 million poles on its Subtransmission and Distribution Systems; the PTMM program is on track to replace 3,353 poles in 2023

Pole Quantity by Age



Poles Replaced by PTMM



DTEE enhanced the PTTM program in 2019 to include a rigorous pole test inspection to determine if the pole has enough structural integrity to remain in service

1. The first step of pole inspection is **notifying owners and preparing the work site**
2. The crew then performs a **visual above ground inspection** to assess pole condition, identify the age of the pole, and ensure it has proper tagging
3. **Physical excavation, boring, and evaluation** is performed as required by the work standard
    - Our standard involves excavation, drilling into the base, and applying treatment to prevent decay on all poles >20 years old

- PTM was transformed to include "Modernization" which indicates **enhanced pole and pole top material specifications**
    - Poles that fail inspection are now replaced with stronger pole classes than in the past
        - Stronger class 3 & 4 poles are the new minimum standard
        - Class 6 poles were the prior minimum standard

DTEE pole top inspection identifies damaged and/or defective equipment that needs to be replaced; inspection quality has been significantly improved in 2023

1. Pole tops are **inspected for damaged and/or defective** crossarms, insulators, and cutouts in need of replacement
   - Wooden crossarms that fail inspection are replaced with **fiberglass crossarms**
   - Porcelain cutouts and insulators that fail inspection are replaced with **polymer cutouts and insulators**
2. Additionally, inspections are performed on transformers, wires, cables, sleeves, hot taps, ground wires, arresters, and fault indicators and **either remediated or recorded and escalated to the appropriate parties**

- New processes initiated:
  - **Training site established** for all contractors to utilize prior to inspecting circuits
  - **Field manual created for inspectors** to recognize defective equipment and ensure consistent outputs
  - App created to **properly document defective equipment and automatically order new items**
  - Developed **new inspection database to track defective equipment**

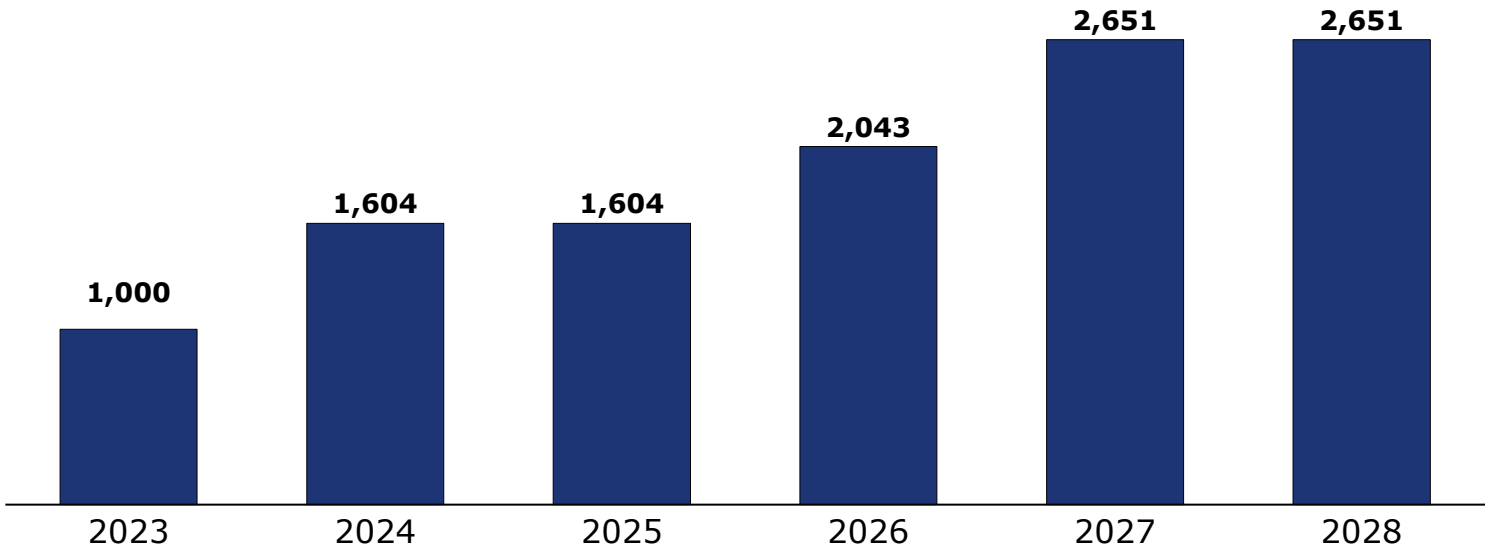
Because of these improved inspection practices, work scope per mile has increased due to both identifying more pole top defects and higher pole condemnation and replacement rates

	2021	Percent Increase/ Decrease	Current Assumptions
Number of poles per mile	35	-	35
Pole condemnation rate[1]	5.5%	+64%	9%
Pole replacement rate	3%	+167%	8%
Pole reinforcement rate	2.5%	-60%	1%
Pole top defects per mile	4.6	+96%	9

- New inspection standards are identifying more:
  - Failed poles
  - Failed pole top equipment
- Additional work scope per circuit mile improves future pole reliability, also increases the program cost per mile

The first cycle of enhanced PTMM will be more work-intensive as we address backlogs of equipment replacements

PTMM miles addressed over the next 5 years

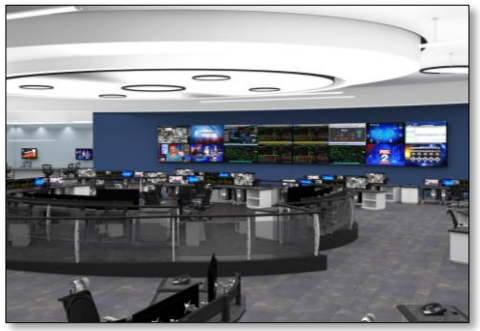


	2023	2024	2025	2026	2027	2028
Cycle Time[1,2]	27	20	20	16	12	12
Annual PTMM Investment ($M)	$63	$121	$121	$151	$192	$188

In addition to tree trimming, the PTMM program is targeted to quickly address reliability/resilience grid challenges across the entire system

- Poles are replaced with poles of a stronger class that are more able to resist storm winds
  - 35’ class 3 poles have approximately 2x more ultimate tensile strength at groundline and 20% more strength against bending at groundline when compared to 35’ class 6 poles
- Fiberglass crossarms are stronger and longer-lasting than wooden crossarms
  - Fiberglass crossarms have 5x more mechanical strength than wooden crossarms and have a 70% longer expected life while exposed to sun, ice, heat, and wind
- Polymer cutouts and insulators are stronger and longer-lasting than porcelain cutouts[1]
  - Polymer cutouts and insulators have approximately 6x more mechanical strength than porcelain versions
- At the planned level of investment, by 2028, DTEE will complete PTMM on over 1/3 of overhead circuits to the enhanced standards

The DGP will remain rooted in the four pillars established in 2018, with the strategic focus within each pillar refined to accelerate reliability and resiliency improvements

	Infrastructure Resilience and Hardening	Tree Trimming	Technology and Automation	Infrastructure Redesign and Modernization
				
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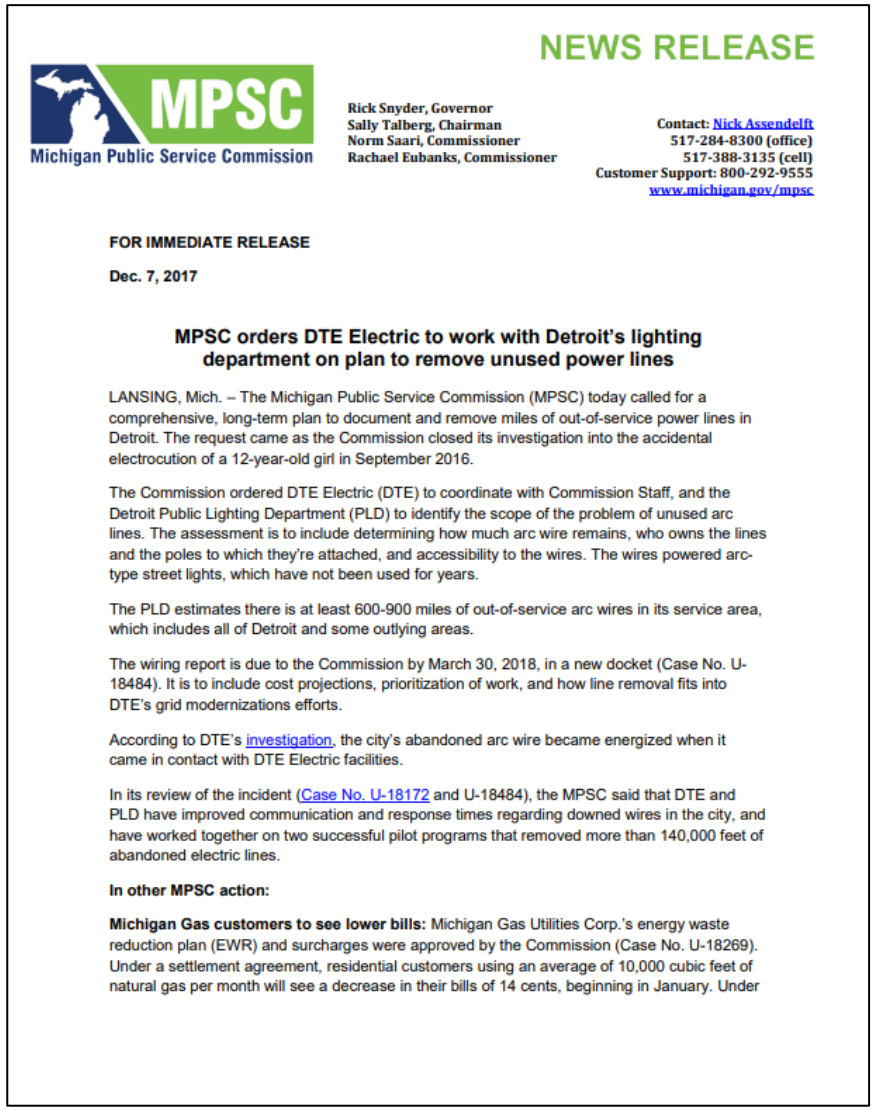
DTE

In December 2017, the Commission issued an order for DTEE to work with Detroit Public Lighting to remove unused DPLD arc wire co-located on its infrastructure

- The Order in Case No. U-18484, required DTEE to work with relevant entities to accomplish a long-term comprehensive plan to address out-of-service Detroit Public Lighting Department owned arc wire
- The Company closely examined the options to best address the issue and concluded that addressing the DPLD arc wire as a standalone program was not the option that best addressed the safety and reliability needs of the grid
- In response, the 4.8kV Hardening Program was developed that balanced safety, cost, and reliability improvements



NEWS RELEASE

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FOR IMMEDIATE RELEASE

Dec. 7, 2017

MPSC orders DTE Electric to work with Detroit's lighting department on plan to remove unused power lines

LANSING, Mich. – The Michigan Public Service Commission (MPSC) today called for a comprehensive, long-term plan to document and remove miles of out-of-service power lines in Detroit. The request came as the Commission closed its investigation into the accidental electrocution of a 12-year-old girl in September 2016.

The Commission ordered DTE Electric (DTE) to coordinate with Commission Staff, and the Detroit Public Lighting Department (PLD) to identify the scope of the problem of unused arc lines. The assessment is to include determining how much arc wire remains, who owns the lines and the poles to which they're attached, and accessibility to the wires. The wires powered arc-type street lights, which have not been used for years.

The PLD estimates there is at least 600-900 miles of out-of-service arc wires in its service area, which includes all of Detroit and some outlying areas.

The wiring report is due to the Commission by March 30, 2018, in a new docket (Case No. U-18484). It is to include cost projections, prioritization of work, and how line removal fits into DTE's grid modernizations efforts.

According to DTE's investigation, the city's abandoned arc wire became energized when it came in contact with DTE Electric facilities.

In its review of the incident (Case No. U-18172 and U-18484), the MPSC said that DTE and PLD have improved communication and response times regarding downed wires in the city, and have worked together on two successful pilot programs that removed more than 140,000 feet of abandoned electric lines.

In other MPSC action:

Michigan Gas customers to see lower bills: Michigan Gas Utilities Corp.'s energy waste reduction plan (EWR) and surcharges were approved by the Commission (Case No. U-18269). Under a settlement agreement, residential customers using an average of 10,000 cubic feet of natural gas per month will see a decrease in their bills of 14 cents, beginning in January. Under

The 4.8kV Hardening Program was created to address the removal of arc wire while at the same time providing additional safety and reliability benefits

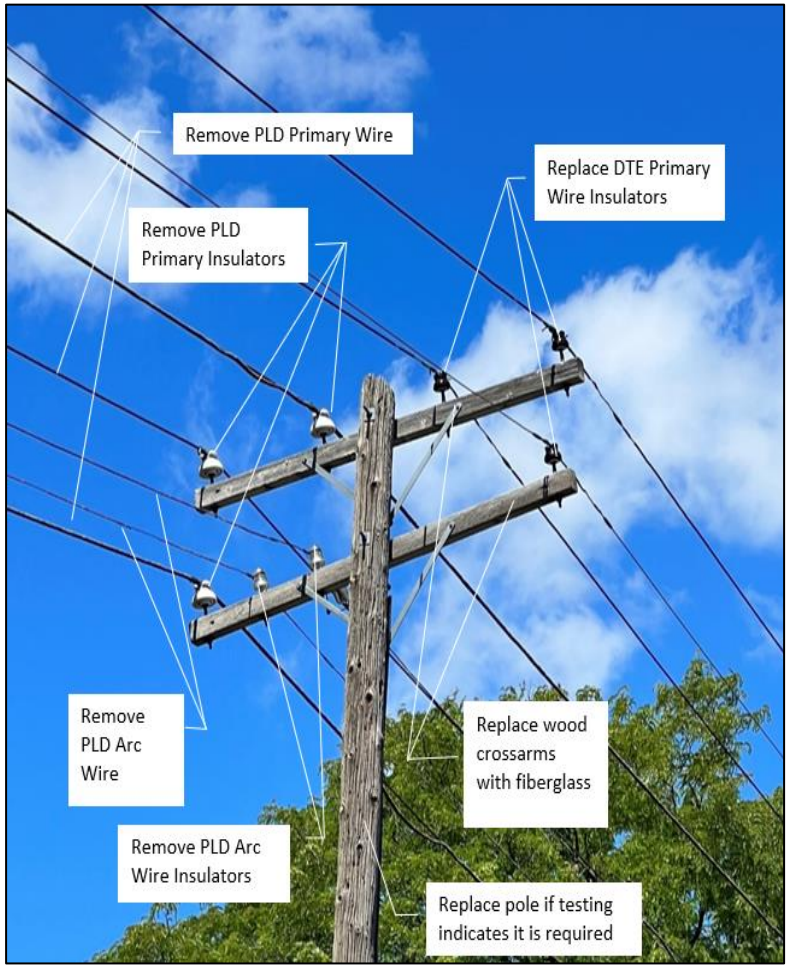
Objectives

- Remove Detroit Public Lighting Department (PLD) arc wire and distribution wire
- Harden and stabilize the 4.8 kV distribution circuits to improve safety, reliability, and storm resiliency
- Improve reliability and extend the life of the 4.8 kV circuits until DTEE completes conversion

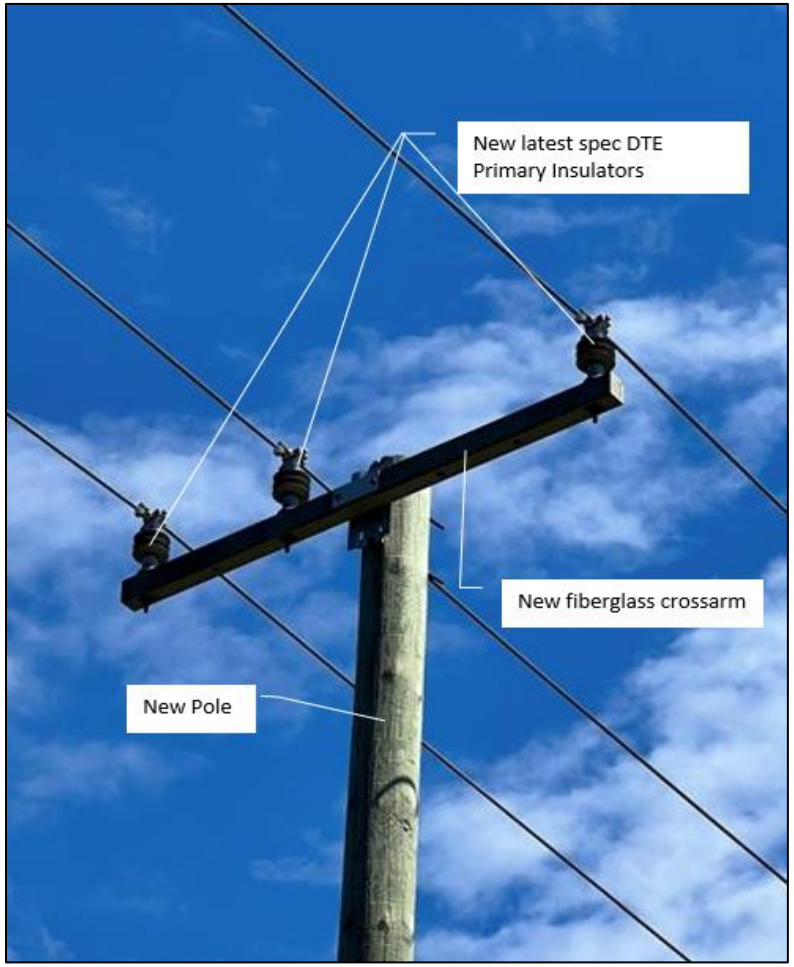
Scope of Work

- Replace or reinforce condemned poles
- Replace wood crossarms with fiberglass
- Remove Detroit PLD arc wires and distribution wires that are co-located with DTE assets
- Remove service lines to abandoned properties
- Trim the trees to construction specifications

Before Hardening

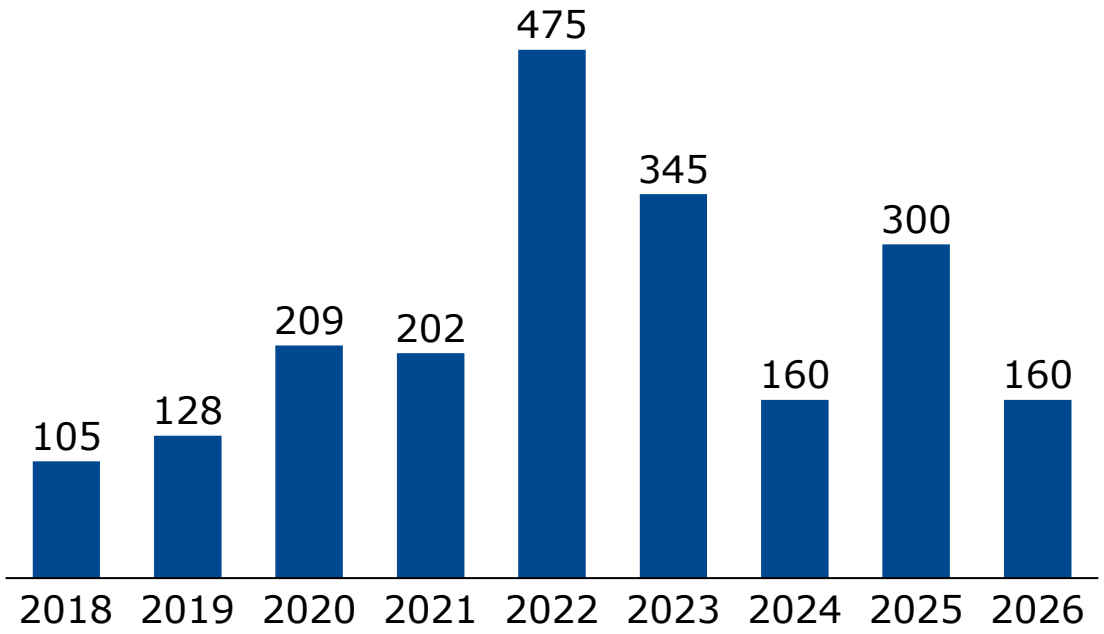


After Hardening

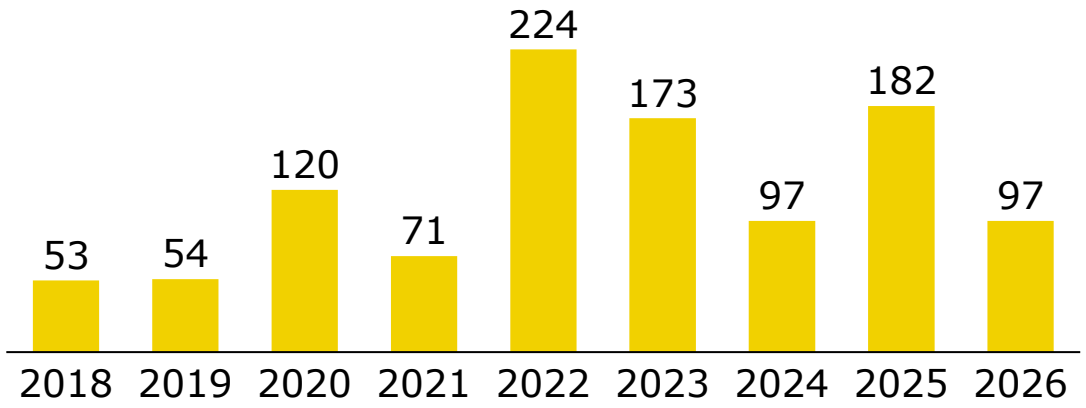


Since 2018, the 4.8kV Hardening Program has addressed ~185 circuits impacting over 144,000 customers in the City of Detroit and surrounding areas and, by the end of 2023, will have removed over 700 miles of arc wire

4.8kV Miles Hardened
~2,100 miles total



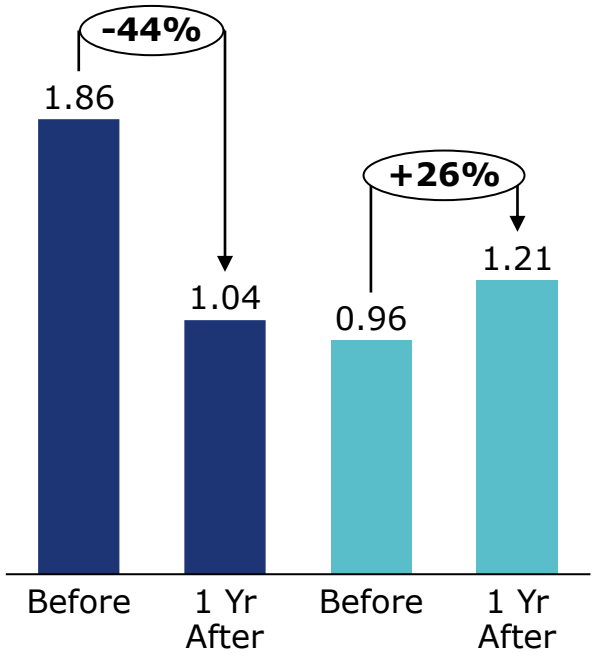
Miles of Arc Wire Removed
~1,100 miles total



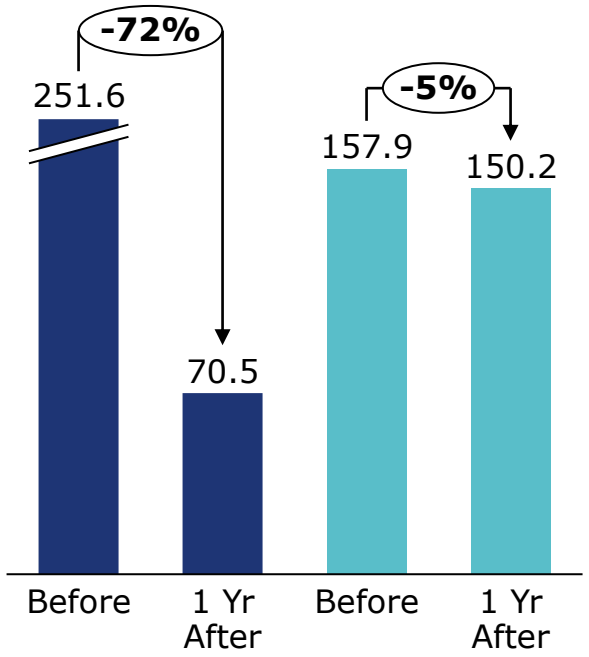
Through 2023 we estimate that we will have removed over half of the arc wire that is co-located with DTEE owned assets, and estimate that 400-600 miles of arc wire remain

Performance of circuits addressed by the 4.8kV Hardening program have seen significant improvements in SAIFI, SAIDI ex-MEDs, and wire down events

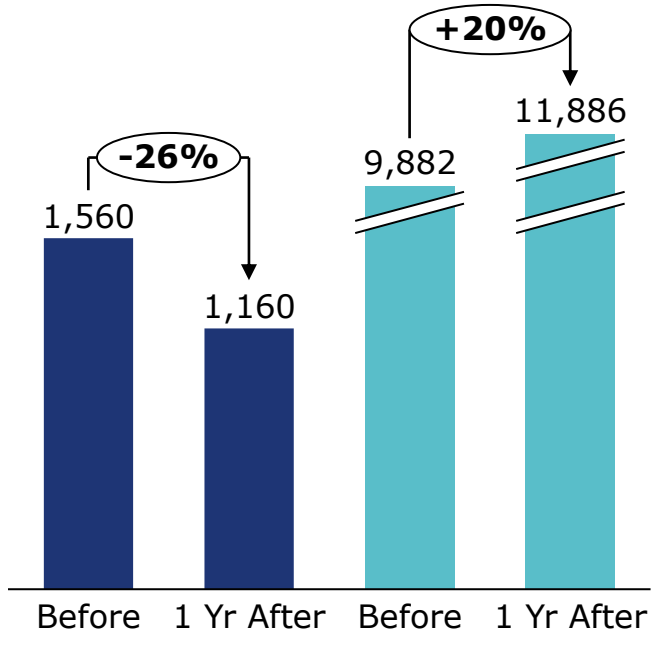
All Weather SAIFI



SAIDI ex-MEDs (min)



Wire Down Events



4.8kV Hardened Circuits Control Group

Today's Agenda

- Conference kickoff (10 minutes)
- Grid Vision (5 minutes)
- State of the Grid/Future Forces Impacting the Grid (20 minutes)
- Distribution Grid Plan Strategic Pillars:
  - Infrastructure Resilience and Hardening (PTMM) (20 minutes)
  - **Tree Trimming (20 minutes)**
  - Technology and Automation (30 minutes)
  - Infrastructure Redesign and Modernization (Conversion and Subtransmission) (30 minutes)
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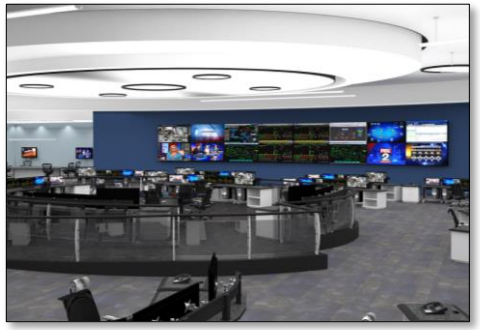
The DGP will remain rooted in the four pillars established in 2018, with the strategic focus within each pillar refined to accelerate reliability and resiliency improvements

	Infrastructure Resilience and Hardening	Tree Trimming	Technology and Automation	Infrastructure Redesign and Modernization
				
Strategic Focus	• **Ramp PTMM to 10-year pole and pole-top cycle**	• **Complete tree trim surge** • **Optimize trim cycle**	• **Fully automate system in next 5-6 years with**	• **Accelerate conversion of 4.8kV system**
Pillar Overview	• Harden system to reduce outages and increase storm resiliency • Replace aging, at-risk infrastructure	• Enhance tree trimming plan with a particular focus on specification and quality of work – to improve reliability, trouble costs and customer satisfaction	• Widely deploy remote monitoring and control • Invest in additional applications to leverage automation investments • NWAs, CVR/VVO	• Convert 4.8kV system to higher grid voltage • Eliminate loading constraints on the 13.2kV • Rebuild 40kV sub-transmission system

DTE

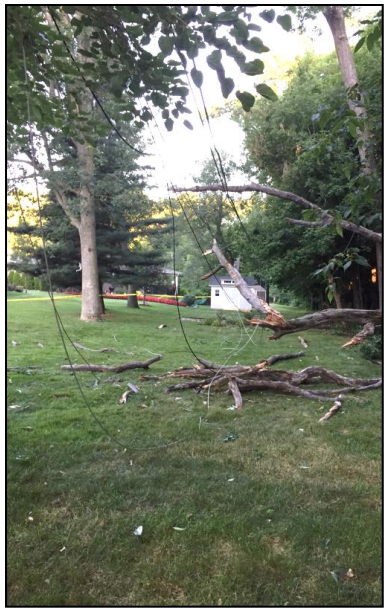
Tree trimming poses one of the greatest opportunities to improve the reliability and safety of our distribution system. DTEE's Tree Trimming Program is targeted at preventing trees from damaging equipment, reducing tree-related safety hazards, and customer outages

Reliability

- Trees are one of the leading factors in electric reliability performance
- Historically, trees have caused:
  - 2/3 of outage minutes
  - 1/2 of customer outages
  - 1/3 of outage events
- Tree branches can also cause momentary outages for customers

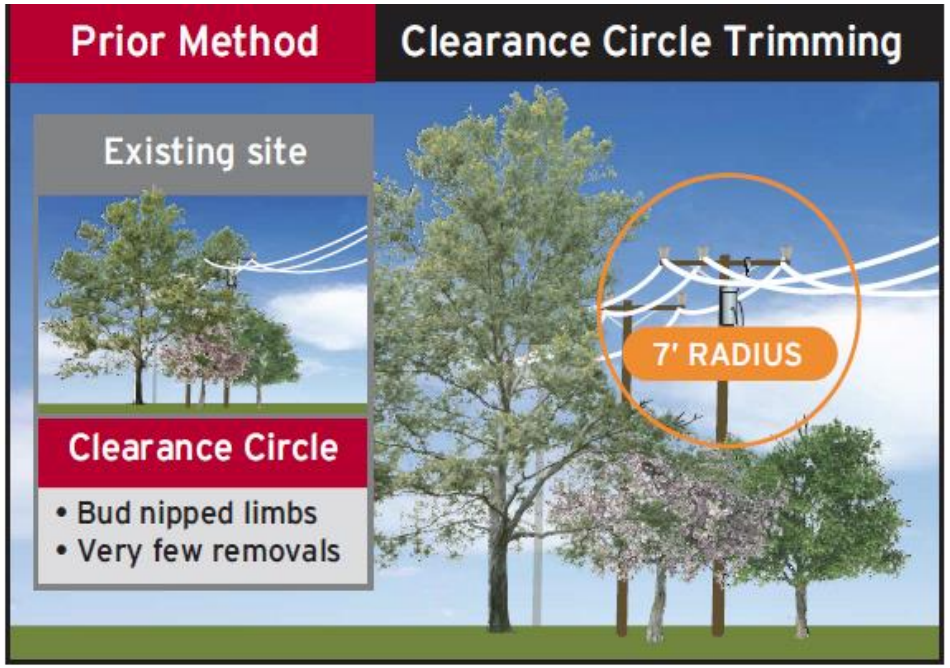
Safety

- Trees can cause wire downs, posing risks to public safety
- DTEE prioritizes addressing wire downs when they occur

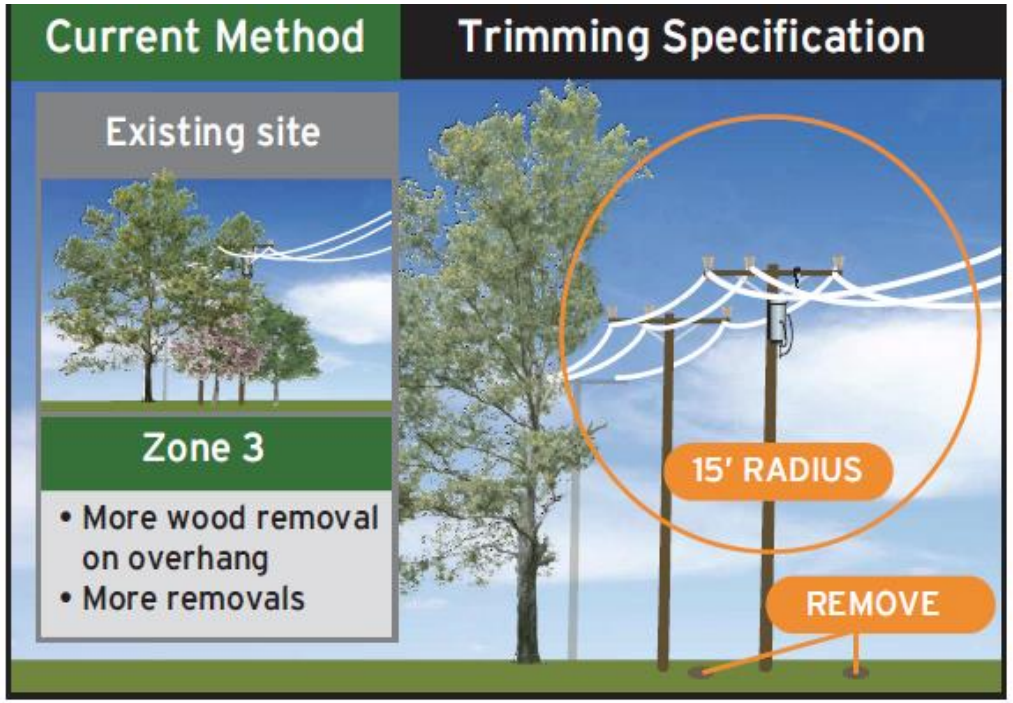


In 2016, DTEE moved to an Enhanced Tree Trim Program (ETTP) which provides additional clearance and reliability compared to the previous "circle trim", and aligns with industry benchmarking

Illustrative "Clearance Circle" Trimming



ETTP Trimming Specification



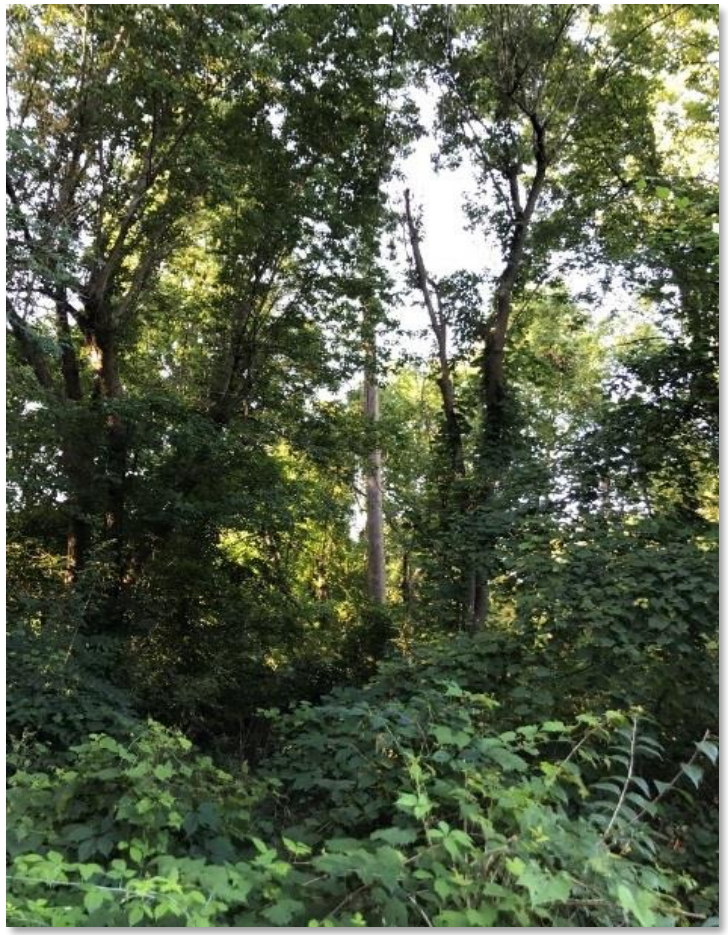
- The ETTP is designed to reclaim right of ways, reduce and remove vegetation hazards from distribution infrastructure, and properly define trim specifications for vegetation encroachment

DTEE ETTP program uses a four phased execution approach that focuses on community and customer outreach

	Phase 1: Initiate	Phase 2: Plan	Phase 3: Execute	Phase 4: Close
Time Frame	8 -12 weeks	2 - 7 weeks	Start → Finish	1 - 4 weeks
Action	• Identify circuits to be trimmed • Contact municipalities & communities • Communicate with Senior Leaders & public relations • Reach out to affected customers via mail & phone calls	• Dispatch planners to the field • Hang pre-job door hangers • Communicate face-to-face with affected customers if needed • Set up plan of specific trees to be trimmed / removed	• Complete tree trimming plan (contractors) • Record work in Work Management System	• Audit of contractor trimming work • Conduct customer satisfaction survey • Communicate final status to government and community officials

Tree trimming provides necessary clearance around poles and wires according to DTEE’s Enhanced Tree Trimming Program (ETTP)

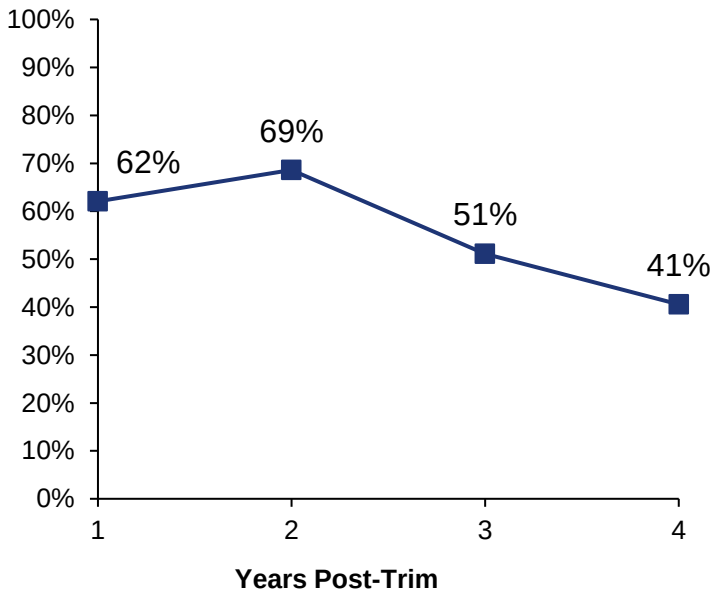
Before Trimming



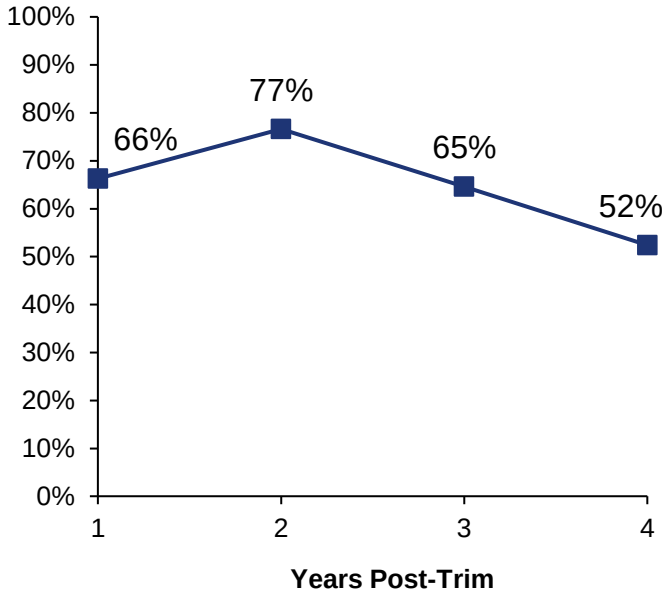
After Trimming

The ETTP standard is continuing to provide significant reliability improvements over circuits that have not been trimmed to the ETTP standard

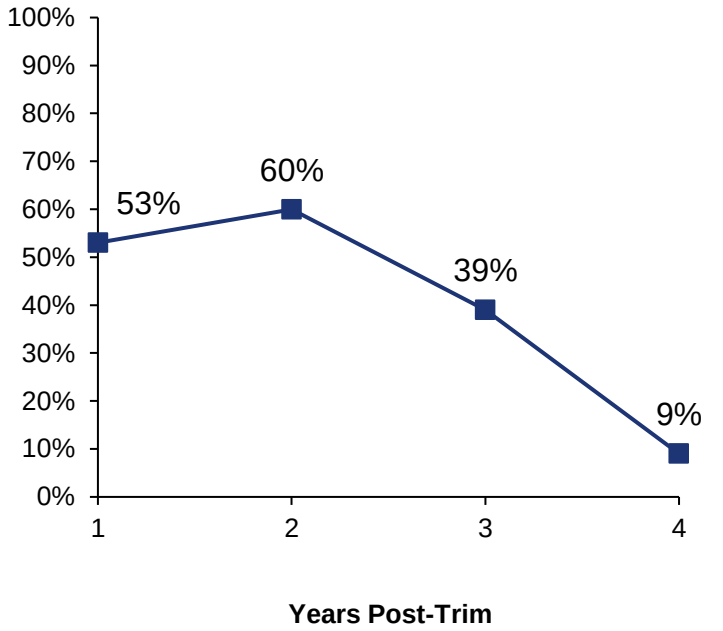
Tree-Related Outage Event Reduction



Tree-Related Customer Interruption Reduction



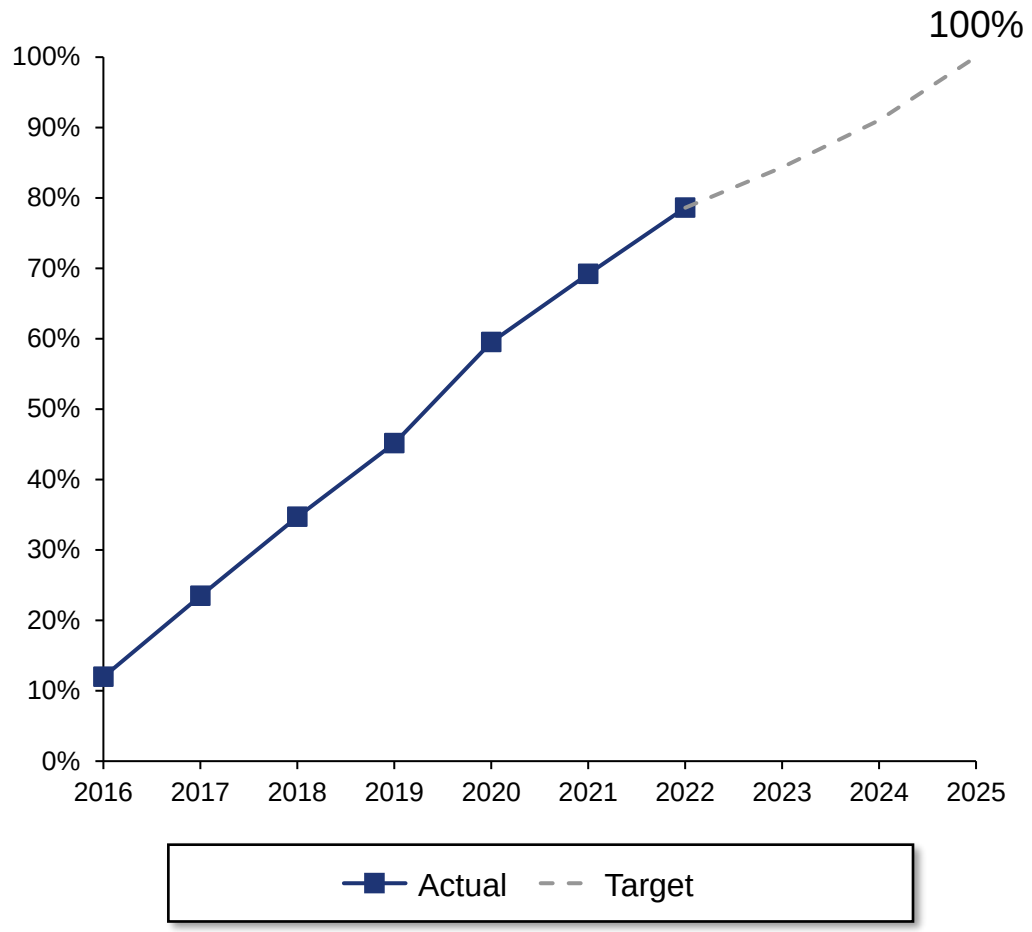
Tree-Related Wire Down Reduction



Measured Reduction[1]

DTEE plans to trim the remainder of our system to the enhanced standard by the end of 2025

Percentage of DTEE's system trimmed to the enhanced specification



- As of the end of 2022, DTEE has trimmed over 24,000 miles to ETTP specifications, with 1,800 miles of additional miles to be trimmed by end of 2023
- At the end of 2023, DTEE will have 4,910 miles remaining to trim to the ETTP specification with a target plan to complete the Surge by the end of 2025
- All Subtransmission is on a 3-year cycle of approximately 850 miles a year of trimming

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			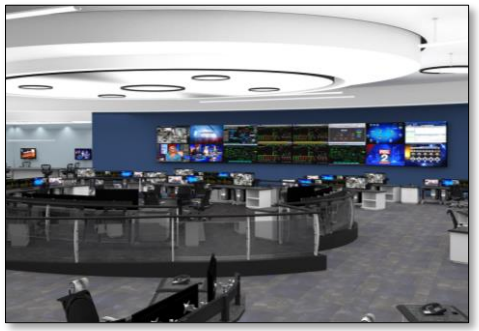	
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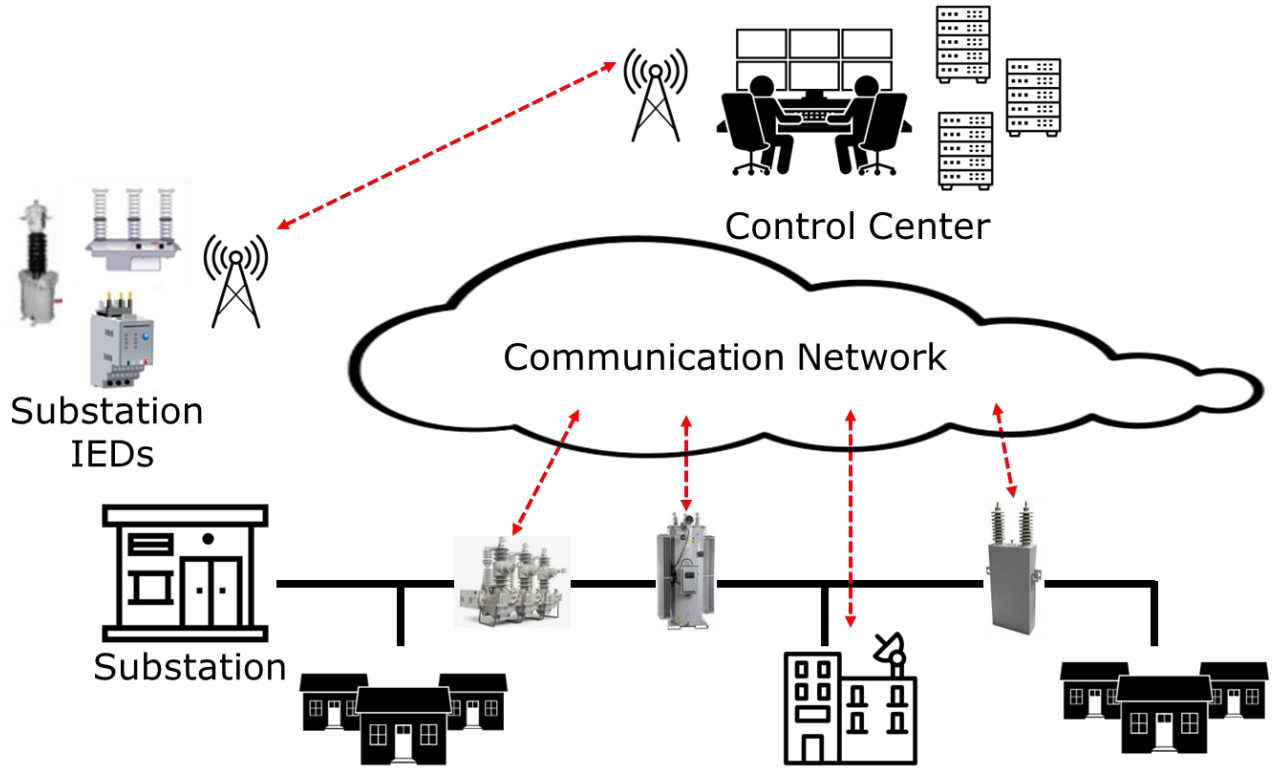
DTE

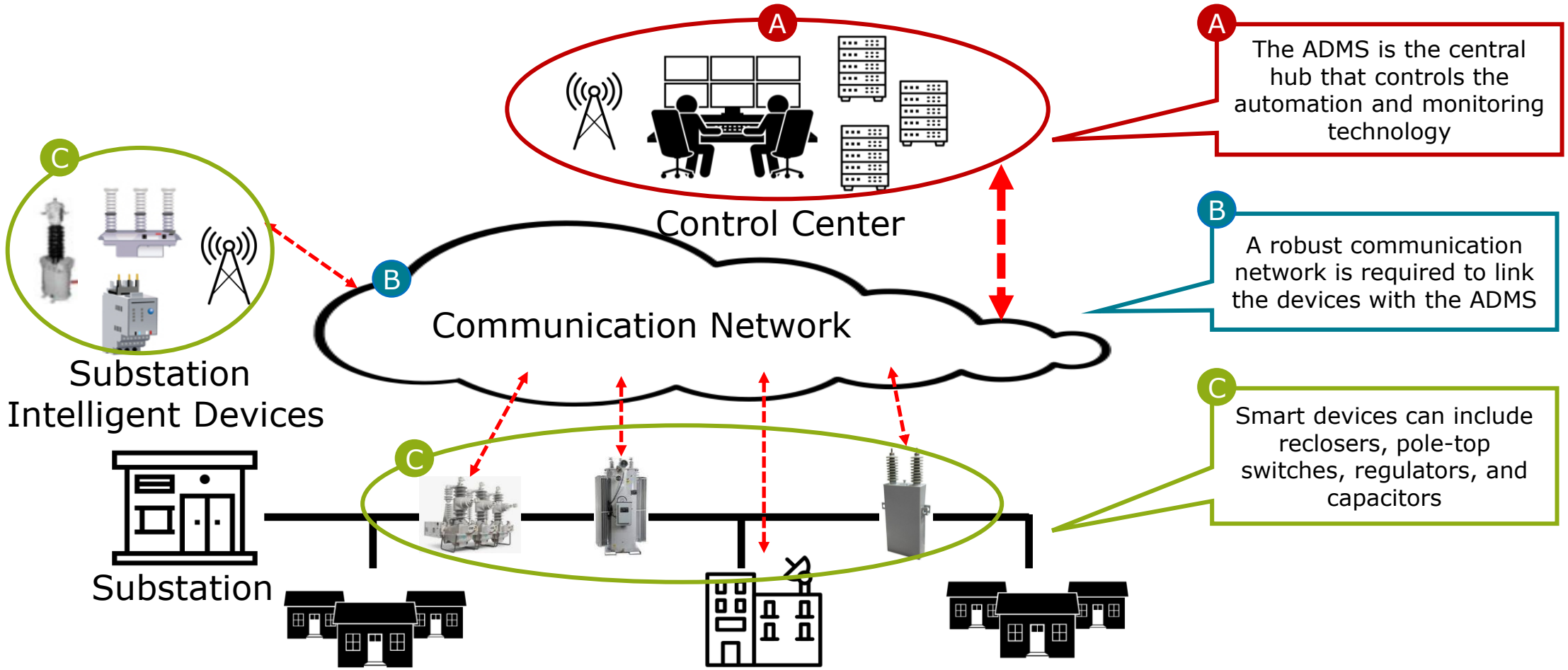
Distribution Automation and Monitoring technology makes the electric grid safer, smarter, and more dynamic

Distribution Automation and Monitoring

- System can immediately detect and locate faults and automatically restore a portion of affected customers
- Real time outage, voltage, and reactive power management
- Equipment health monitoring
- Direct dispatch of crews to outage locations improving reliability and reducing restoration time and cost



Distribution Automation and Monitoring contains three main components: ADMS, a robust communication network, and smart electrical devices



A

DTEE’s new Advanced Distribution Management System (ADMS) will be the hub for all smart equipment and will allow for improved restoration of customers on the distribution grid

- ADMS and its various applications provide a consistent integrated view of the system
- Provides the ability to visualize, monitor, and control the electrical system
- The fault location, isolation and service restoration (FLISR) module of ADMS is being deployed later this year; circuits will be added to FLISR as automation is installed
- ADMS paired with monitoring and automation will allow real-time grid decisions for faster restoration times

B

To enable the smart devices to provide data to the ADMS, a robust communication network, made up of several technologies is essential

- DTEE's telecommunication network consists of:
  - Fiber backbone system that traverses between critical infrastructure locations
  - Wireless mesh networks that support end-point SCADA and AMI meters
  - Wireless point-to-point and point-to-multi-point systems that allow data collection

As more smart devices are installed, more communication technology will be required to connect with it

C

Distribution Automation and Monitoring relies on multiple types of distribution circuit electrical devices equipped with communication capabilities that transmit data to ADMS for processing, analysis, and action

Electrical Devices	Fault Detection	Fault Isolation	Service Restoration	Voltage Support
Reclosers	✓	✓	✓	
Pole top switches		✓	✓	
Capacitors				✓
Regulators				✓
Line sensors	✓		✓	

There are many types of smart equipment, each with its own purpose

C

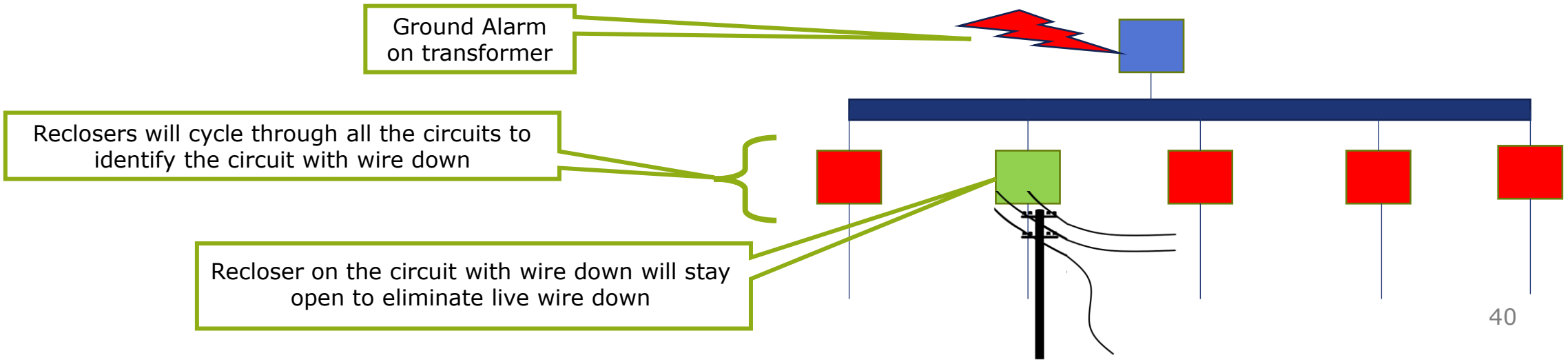
DTEE's future distribution automation strategy will be primarily focused on reclosers which will be used to isolate faults when detected; reclosers function differently on grounded systems (13.2kV) vs ungrounded systems (4.8kV)

Standard Wye (13.2kV) Reclosers

- Detect and isolate wire downs on the Wye circuits (13.2kV)
- Reclosers operate up to three times to allow temporary faults to clear (falling branch, animal interference)
- Reclosers will lock open upon sustained fault
- Antennae equipped locations provide live system data to the ADMS

New Delta (4.8kV) Technology

- For detecting and isolating wire downs, the 4.8kV system operates the same as 13.2kV for ~20% of events
- For the remaining 80% of events, a single wire down will not trip the recloser and lock open; however, we have developed a new solution
- Our new ground detection scheme detects potential wire downs and will de-energize the problematic circuit by cycling through all the circuits at the substation

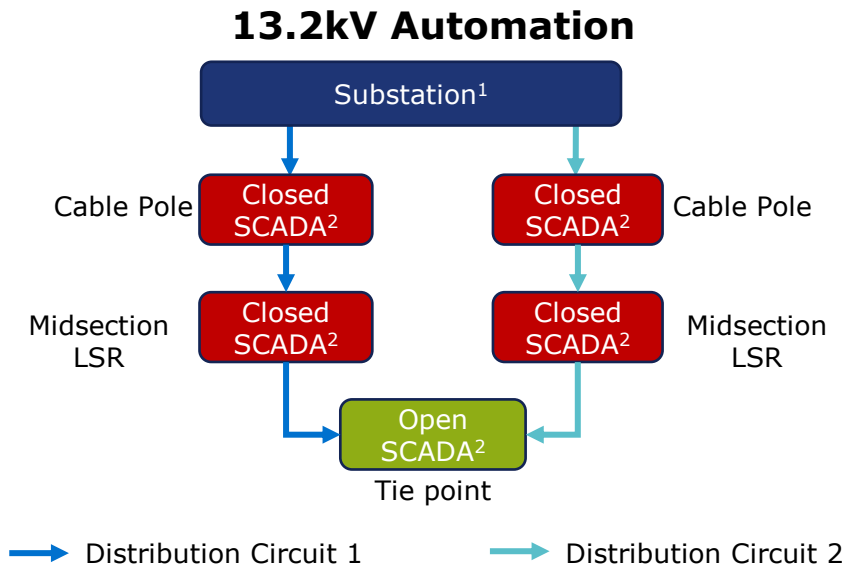


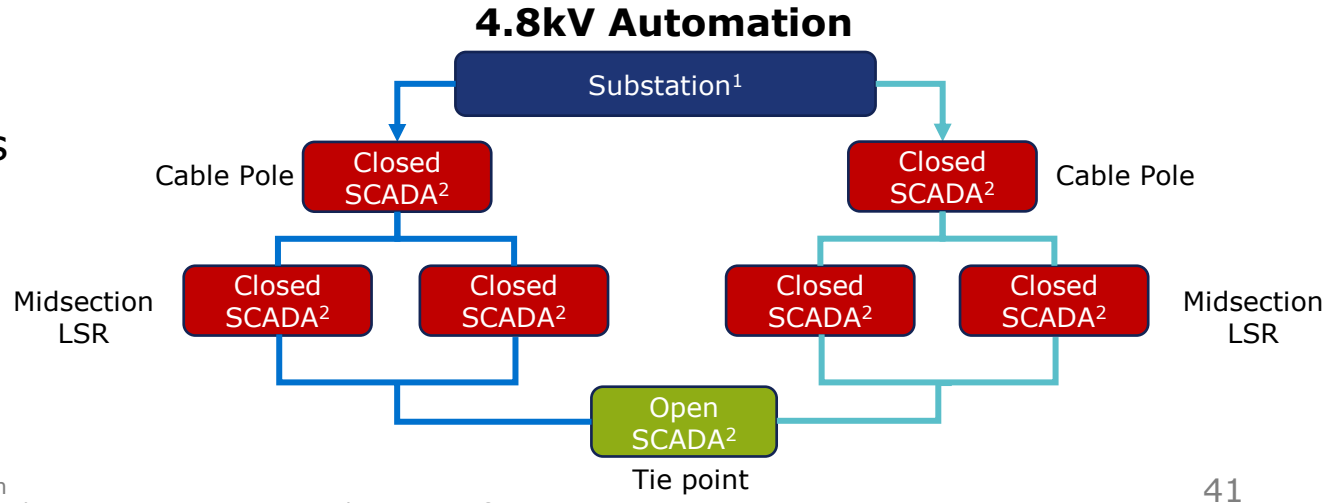
DTE

C

The automation strategy will utilize reclosers to allow for automated restoration

- A common local automation scheme is an automated restoration scheme comprised of multiple reclosers installed between two OH distribution circuits
- Each distribution circuit will have one or more Line Sectionalizing Reclosers (LSR) installed at the circuit's approximate midpoint of customer load
- Each circuit will also have one recloser at a tie point to connect it to an adjacent circuit
- Approximately 5% of the distribution circuits (13.2kV) in the Company's territory currently have automatic loop schemes

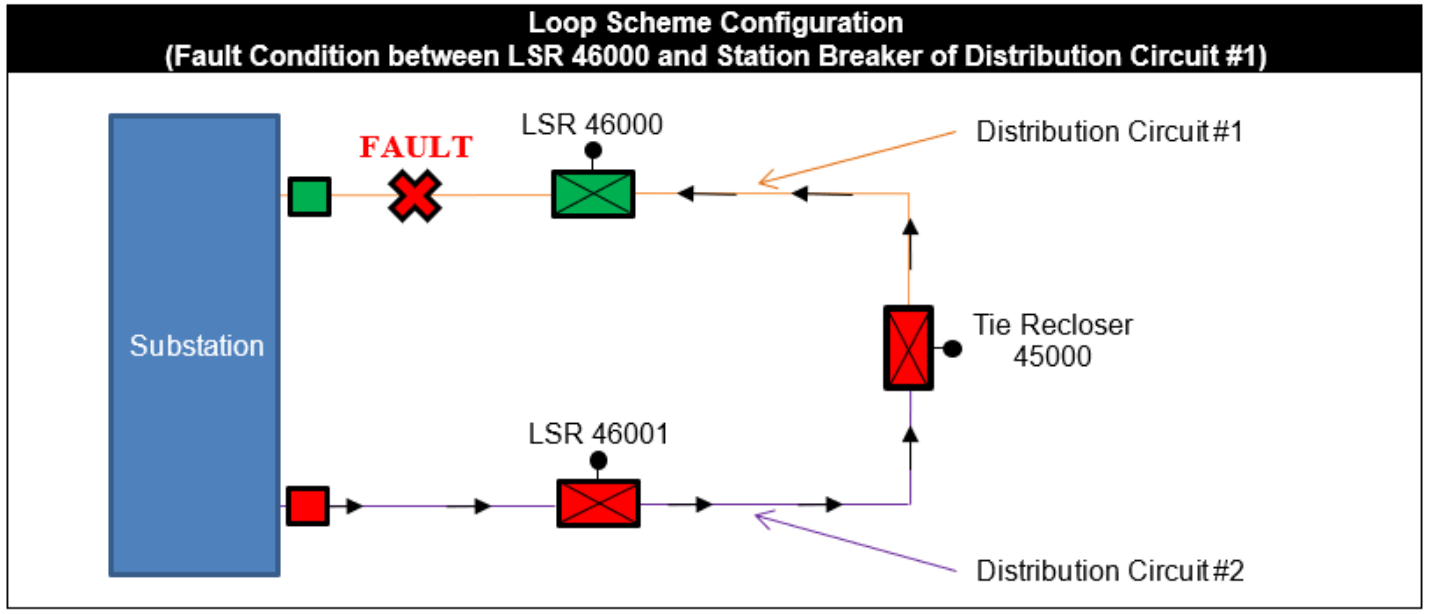




DTE

1: Automation schemes may pair circuits on the same substation or neighboring substation
2: SCADA – Supervisory Control And Data Acquisition – SCADA controlled devices allow for the remote communication and operation of equipment

Illustration of a Loop Scheme operation scenario when a fault occurs



Substation breaker

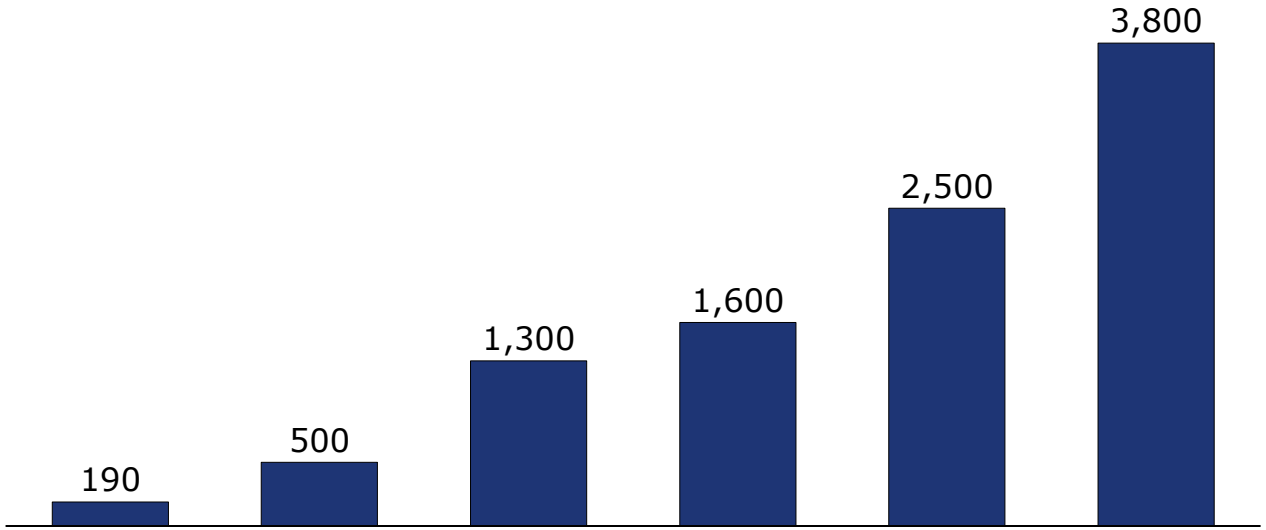
Open – No powerflow

Closed – Energized

- If a fault occurs the substation breaker will open and lockout after completing its reclosing cycle
- This automatic action will re-energize ~50% of the customers on Distribution Circuit #1
- The loop scheme provides efficient customer restoration, and demonstrates the sectionalizing capability of fault conditions

To execute on our automation plan to improve restoration time for our customers, we will quickly accelerate recloser deployment

Annual Automation Units Completed



	2023	2024	2025	2026	2027	2028
Total Investment	$34M	$65M	$160M	$200M	$310M	$475M
System % Complete	2%	7%	20%	36%	62%	100%

In addition to the improvement in reliability, automation will provide additional benefits

- Local control of the circuit by OH line workers – reduces the need for substation operators
- Full visibility on circuits to understand the status of the system
- Improved load management – understand the real-time load of all circuits to allow for improved jumpering and switching plans
- Protect aged substation breakers that could fail resulting in a costly replacement
- Reduces costly retrofits of breakers that are otherwise required to install SCADA

DTE Distribution Grid Plan Technical Conference
August 31, 2023

Break: 10:55 – 11:05 AM

Agenda		
9:00 am	Welcome and Opening Comments	Dr. Joy Wang Manager – Distribution Planning, MPSC
9:05 am	DTEE Distribution Grid Vision	Sharon Pfeuffer Vice President – Distribution Operations Engineering, DTE
9:10 am	State of the Grid/Future forces impacting the grid	Husaninder Singh Manager – Distribution Planning, DTE
9:30 am	Strategic Pillar - Infrastructure resilience and hardening	Morgan Elliott Andahazy Director – DO Programs, DTE
10:00 am	Strategic Pillar - Tree Trim program	Brian Hill Director – Distribution Operations, DTE
10:20 am	Strategic Pillar - Technology and Automation	Joseph Jacunski Manager – Engineering Standards and Design, DTE
10:50 am	Break	All
11:00 am	Strategic Pillar - Infrastructure Redesign and Modernization	Edward Karpiel Manager – Business Performance, DTE
11:30 am	Global Prioritization Model (GPM) model updates	Edward Karpiel Manager – Business Performance, DTE
11:50 am	Environmental Justice (EJ) plan	Grace Musonera Manager – Engineering Support, DTE
12:10 pm	Detroit targeted study	Jamie Kryscynski Acting Director – Distribution Operation, DTE
12:25 pm	Break	All
12:35 pm	Open discussion and conference feedback	Moderated by Dr. Joy Wang Manager – Distribution Planning, MPSC
12:55 pm	Closing Remarks & Next Steps	Dr. Joy Wang Manager – Distribution Planning, MPSC
1:00 pm	Adjourn	

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

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			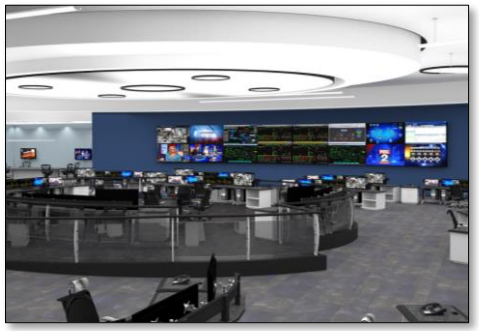	
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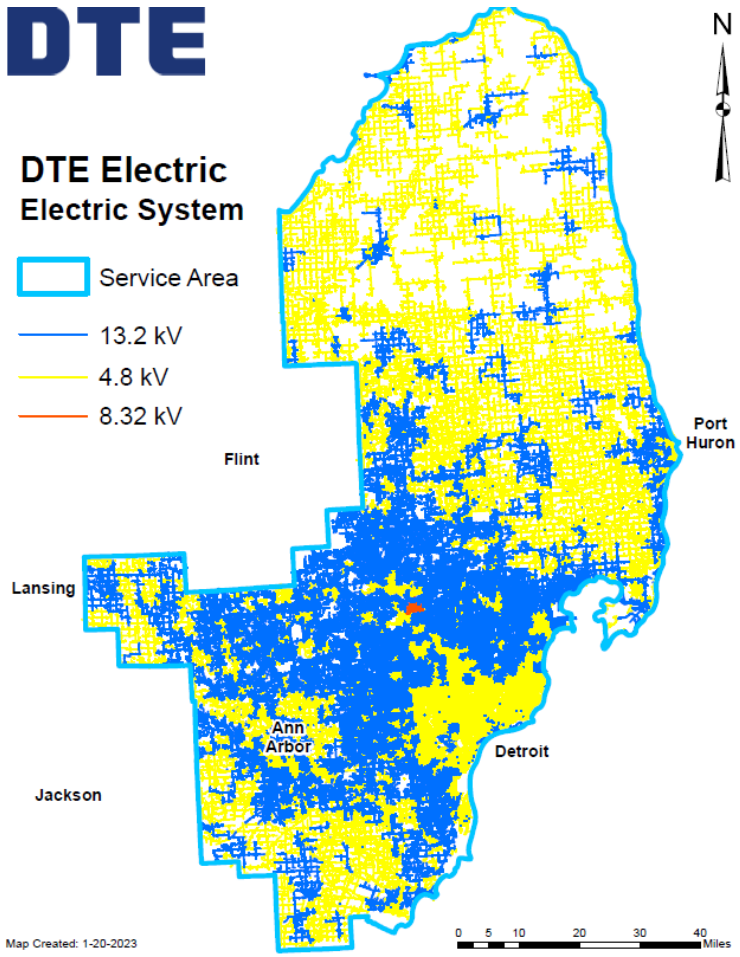
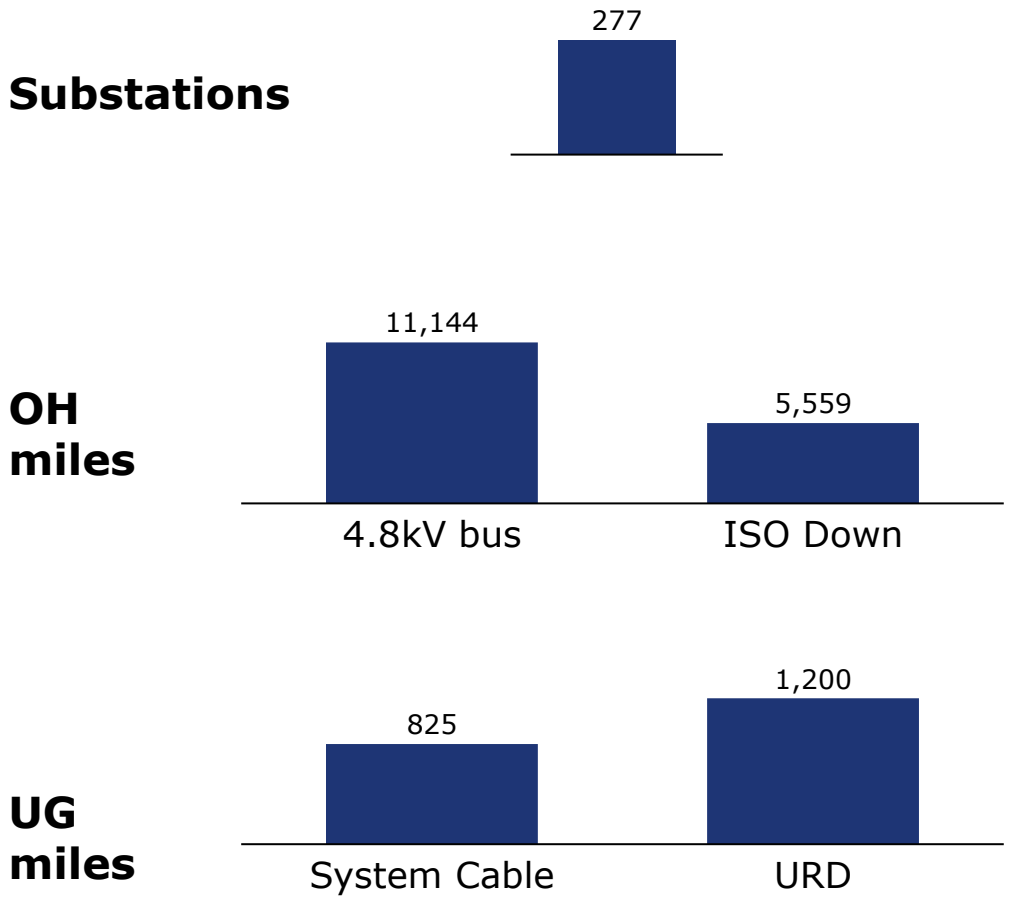
DTE

DTEE's 4.8kV distribution system serves over 1 million customers

System Map (Circuit voltage)



System Statistics



The age, configuration, and loading on the 4.8kV system poses safety, operational, and reliability challenges

	Description	Impact
Age	• Overhead, underground and substation equipment is beyond expected lifespan • Conductor is often old, small diameter copper	• High volume of outages/trouble events including wiredowns • Poor reliability performance (All-weather SAIDI) • Equipment is challenging to retrofit to latest automation standards • Difficult to implement grid controls to support increased adoption of DERs
Configuration	• 4.8kV ungrounded delta • Ringed circuits • Rear-lot construction	• Wiredowns can remain energized • Locating fault/trouble events is challenging • Accessibility challenges for trouble locating and restoration
Loading	• 1/3 of substations have loading constraints – either within the substation or on their circuits • Capacity needs are projected to increase significantly in some areas due to electrification and localized load growth	• Lack of operational flexibility – load loss/outage events upon single failure and inability to transfer load to adjacent substations or circuits • No headroom for load growth, either new business or electrification

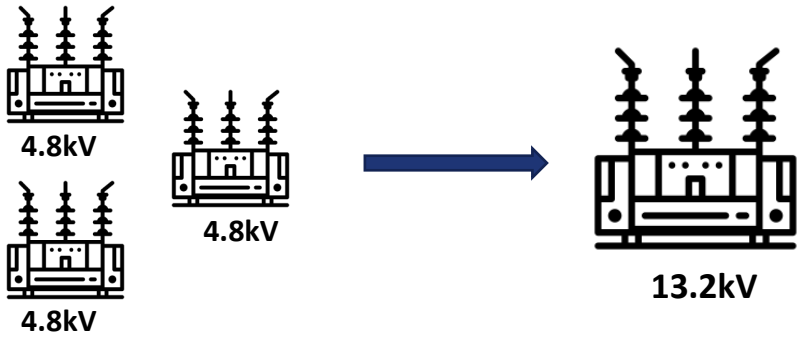
DTE

Conversion of the 4.8kV system will occur in three different investment areas based on scope required

	Description	# 4.8 kV Substations	OH Miles
CODI Conversion	• Conversion within downtown City of Detroit • Driven by economic development • Includes construction of new substations and conversion of circuits • Significant scope involves converting underground AC network	**17**	**170**
4.8kV Conversion	• Conversion of all 4.8kV substations outside of the CODI scope • Includes construction of new substations, conversion of circuits	**~260**	**~11,000**
ISO Area Conversion	• Rebuild ISO down areas – portions of circuit which are fed from a 13.2kV substation and 'stepped down' to 4.8kV through a transformer on the circuit • Does not require new substation	**0**	**5,556**

4.8kV conversion projects have a broad scope and allow us to reduce the number of substations to operate and maintain

Substation Consolidation



Due to the higher capacity of 13.2kV equipment, a conversion project will reduce the overall number of substations and circuits on the system:

- Replacing multiple (2-3) 4.8kV substations with a single new 13.2kV substation
- Reconfiguring circuits, combining multiple 4.8kV circuits (~3MVA of load each) to a 13.2kV with a design limit of 8MVA

Scope – 4.8kV Conversion

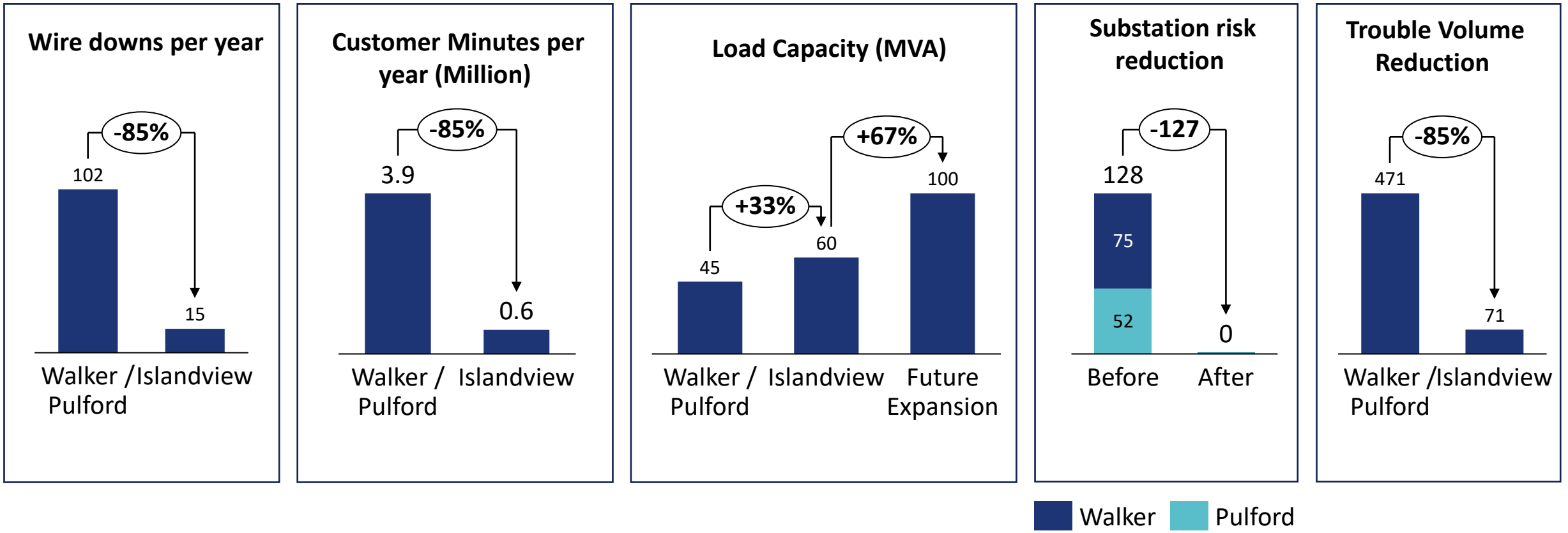
- **Substation construction:** Build new 120kV-13.2kV substation (or in some cases an existing 13.2kV substation can be expanded)
- **Cable and conduit**: Construct underground conduit and cable exits to feed the 13.2kV circuits from the new substation
- **Overhead construction**: Rebuild overhead equipment to DTEE updated construction standards
- **Automate:** Establish loop schemes on 13.2kV circuits using latest DTEE standard
- **Decommission:** Remove older 4.8kV infrastructure from service

Undergrounding:

- The Company continues to evaluate opportunities to increase undergrounding of overhead circuits during conversion project development
- The Company knows benchmarking best practices from the industry and completing an undergrounding project in Detroit are key steps to develop a cost-effective strategy to underground circuits

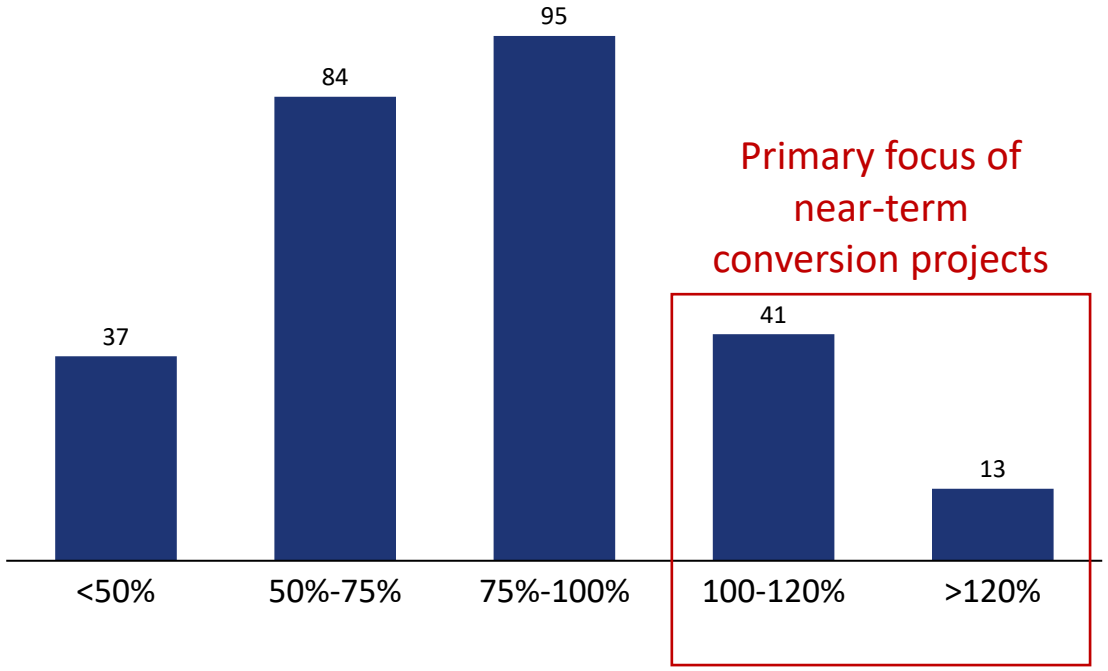
Conversion projects provide significant safety, reliability, loading, and risk reduction benefits to our customers

Projected benefits from Islandview (replacing Walker/Pulford substation and circuits) conversion project:



Load relief, including a lack of capacity at the substation and circuit level, is a major driver of our current conversion projects

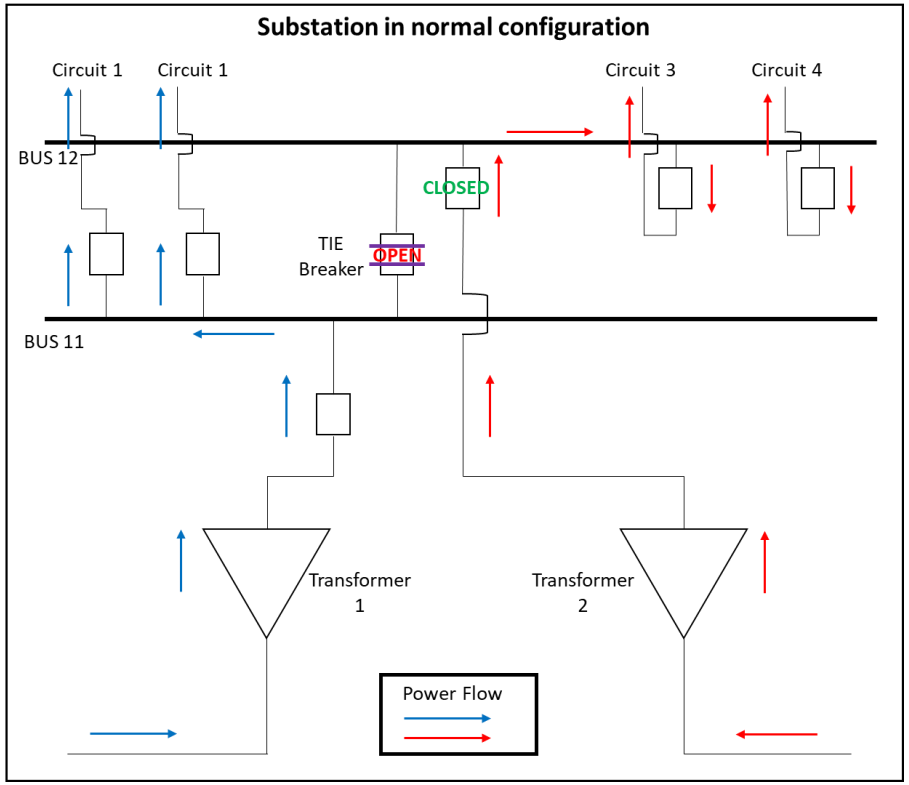
4.8kV Substations over firm rating



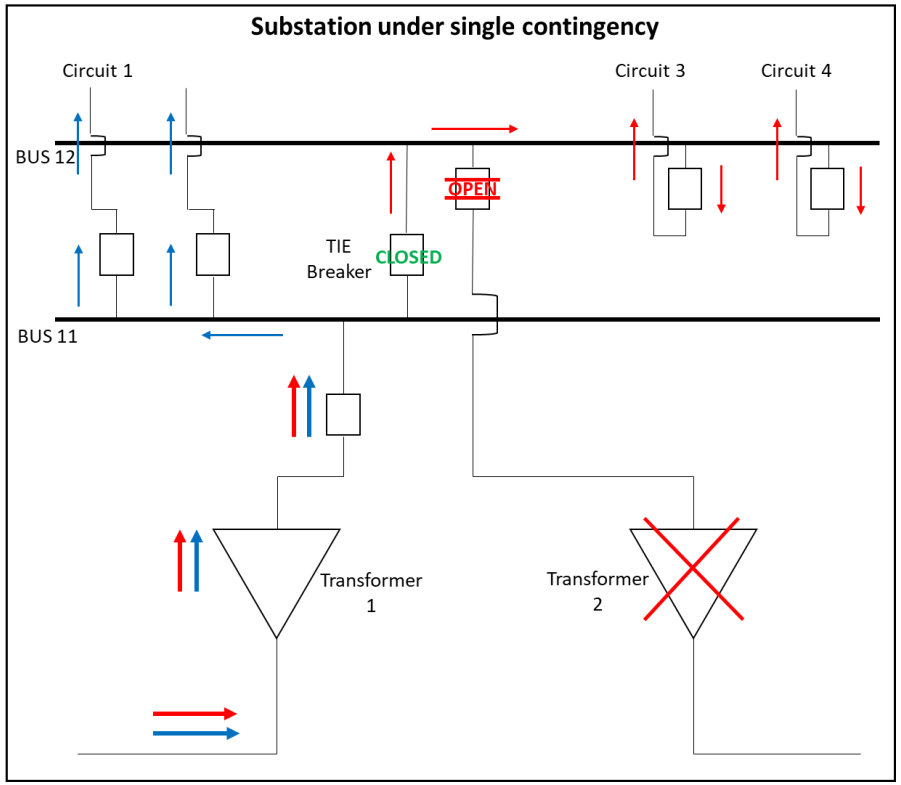
- Substation firm rating is the maximum load the substation can carry under single contingency
- Based on current loading, fifty-four 4.8kV substations exceed their firm rating
- Operating over firm limits operational flexibility as:
  - Single failures create outages
  - Lack of capacity limits flexibility to transfer load or utilize automation/loop schemes
  - Limits the ability to do maintenance and capital improvement work due to shutdown limitations
  - Addition of new load creates further constraints

Details on following slide

Large outages may occur under single contingency situations when substations operate over firm rating



- Under normal operation (left), both transformers serve customer load
- Single contingency (meaning a single failure) – would change the substation configuration
- On the right, a failure of Transformer 2 occurs[1]
- If a substation is UNDER firm rating, Transformer 1 can serve all the load on circuits 1-4
- If the substation is OVER firm rating, the extra load on transformer 1 could cause it to operate above its Emergency Rating[2]
- To operate the system safely, loading would need to be reduced to keep the equipment under emergency rating – likely by shedding load (i.e. creating an outage on one or more circuits)



1. Failure could include the transformer, the subtransmission line feeding the transformer, or other equipment such as circuit breakers connected to transformer 1
2. The emergency rating of equipment is based on manufacturer recommendations and is the loading limit equipment is rated to for a shorter period of time

In addition to load relief, near-term projects are driven by safety and reduction of substation risk (risk of a long duration outage)

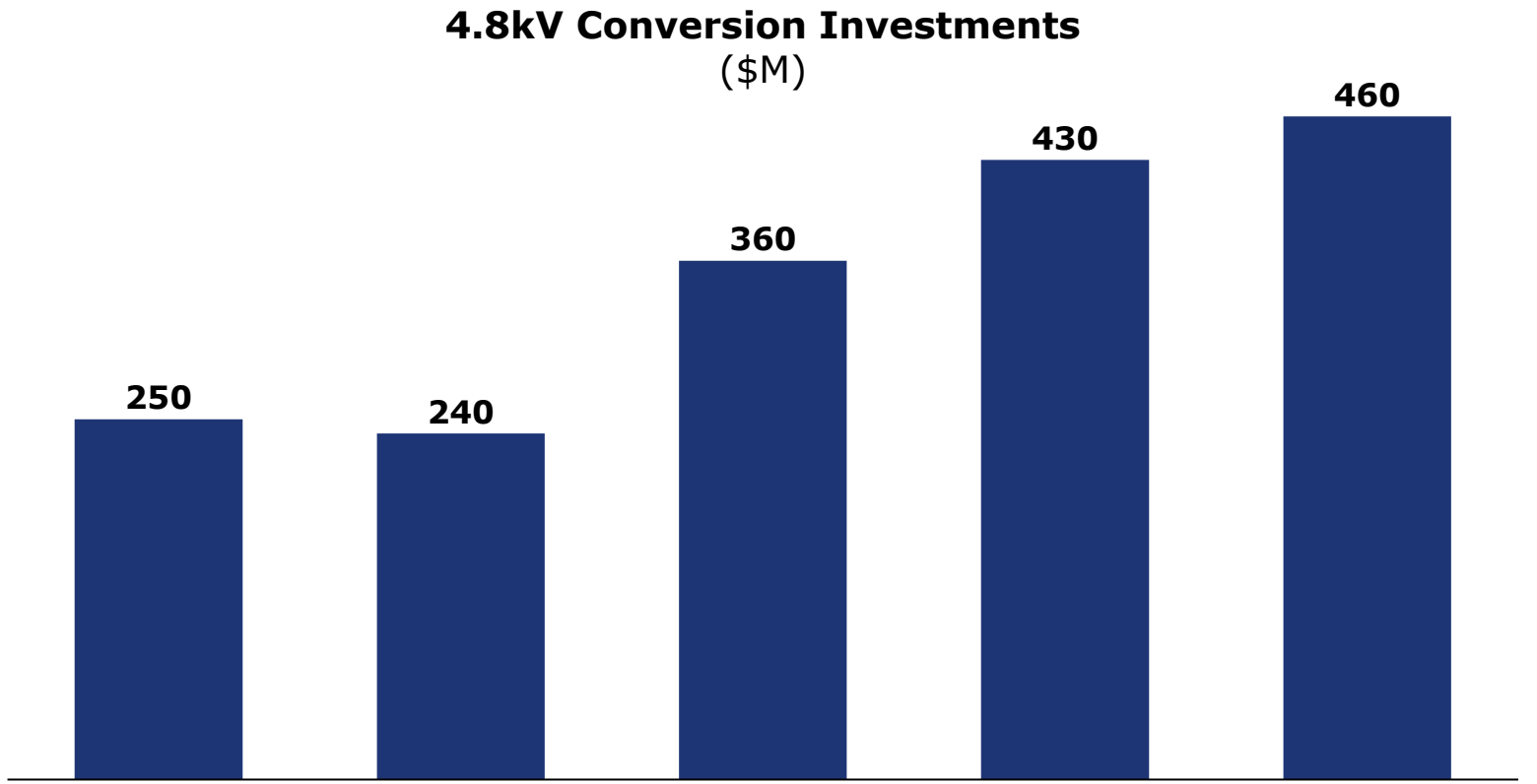
Top 10 4.8kV conversion projects account for $1.3B in investments 2024-2028

Project	Substation Loading	Substation Risk	Safety
CODI: Islandview	✓	✓	✓
CODI: Kent/Gibson	✓	✓	✓
CODI: Garfield	✓	✓	✓
CODI: Howard	✓	✓	✓
Promenade	✓	✓	✓
Hawthorne	✓	✓	✓
Zenon		✓	✓
Grosse Pointe	✓	✓	✓
Yale/Slater	✓	✓	✓
ISO Program			✓

The conversion projects in the 5-year plan will add ~700 MVA of 13.2kV capacity, and provide an All-weather SAIDI improvement of 15-20 minutes

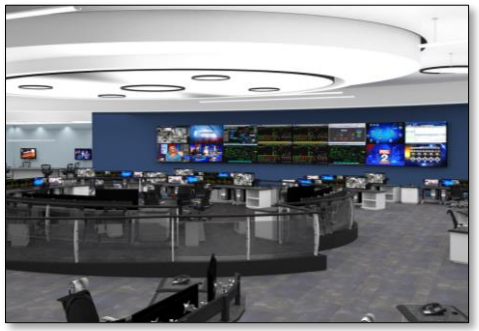
DTE

The DGP plan for 4.8kV conversion includes $1.7B of investment to convert over 800 miles of the 4.8kV system



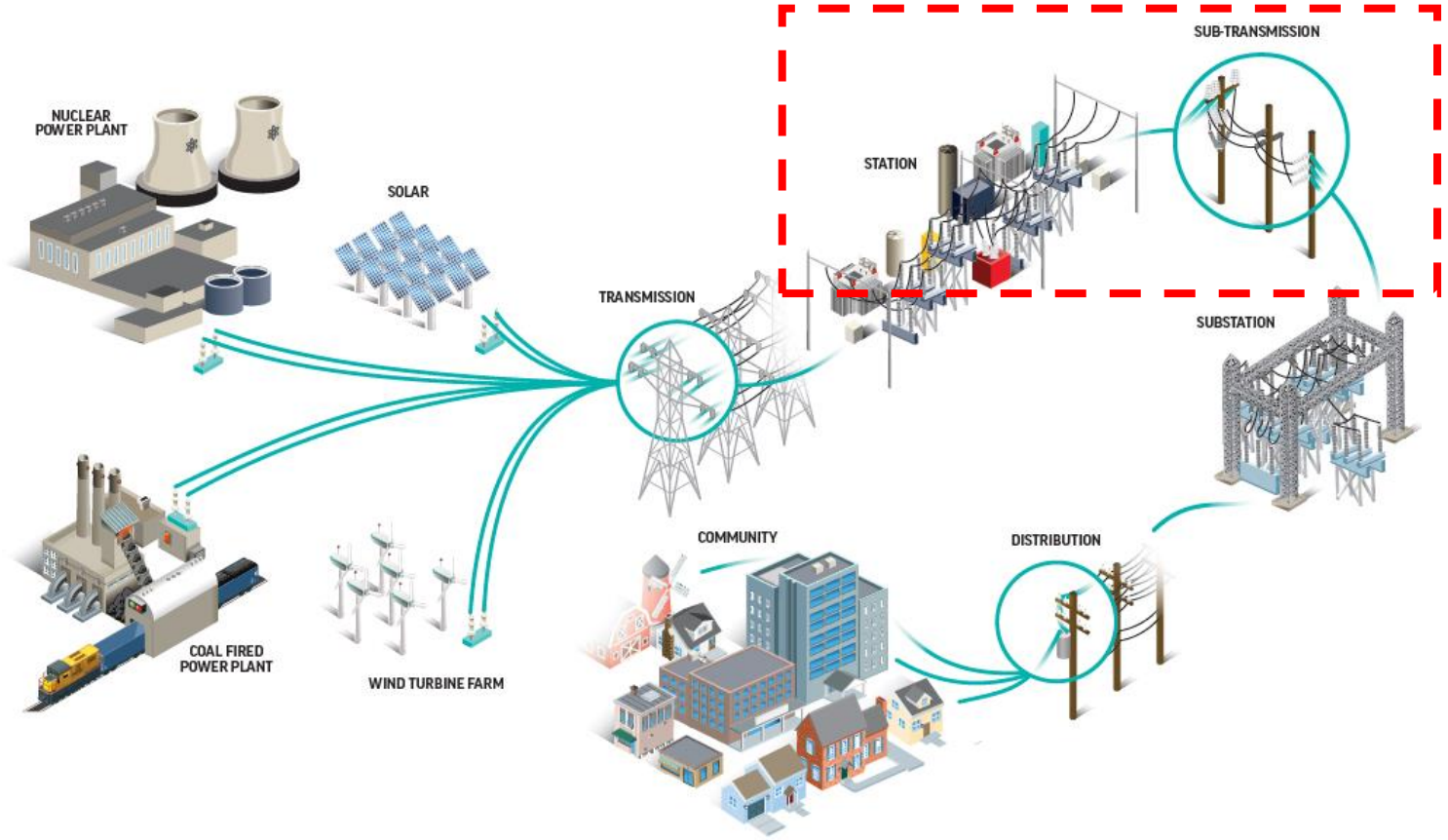
	2024	2025	2026	2027	2028
OH Miles Converted	100	100	120	220	300

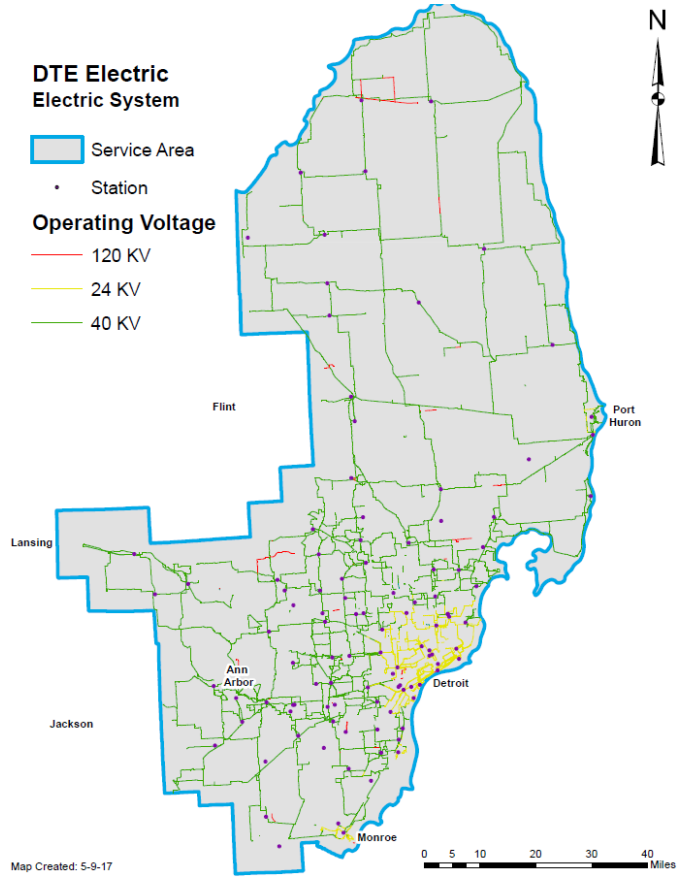
The DGP will remain rooted in the four pillars established in 2018, with the strategic focus within each pillar refined to accelerate reliability and resiliency improvements

	Infrastructure Resilience and Hardening	Tree Trimming	Technology and Automation	Infrastructure Redesign and Modernization
				
Strategic Focus	• **Ramp PTMM to 10-year pole and pole-top cycle**	• **Complete tree trim surge** • **Optimize trim cycle**	• **Fully automate system in next 5-6 years with**	• **Accelerate conversion of 4.8kV system**
Pillar Overview	• Harden system to reduce outages and increase storm resiliency • Replace aging, at-risk infrastructure	• Enhance tree trimming plan with a particular focus on specification and quality of work – to improve reliability, trouble costs and customer satisfaction	• Widely deploy remote monitoring and control • Invest in additional applications to leverage automation investments • NWAs, CVR/VVO	• Convert 4.8kV system to higher grid voltage • Eliminate loading constraints on the 13.2kV • Rebuild 40kV sub-transmission system

DTE

DTEE has ~3,700 miles of Subtransmission circuits, which transmit power from the transmission system to the distribution system



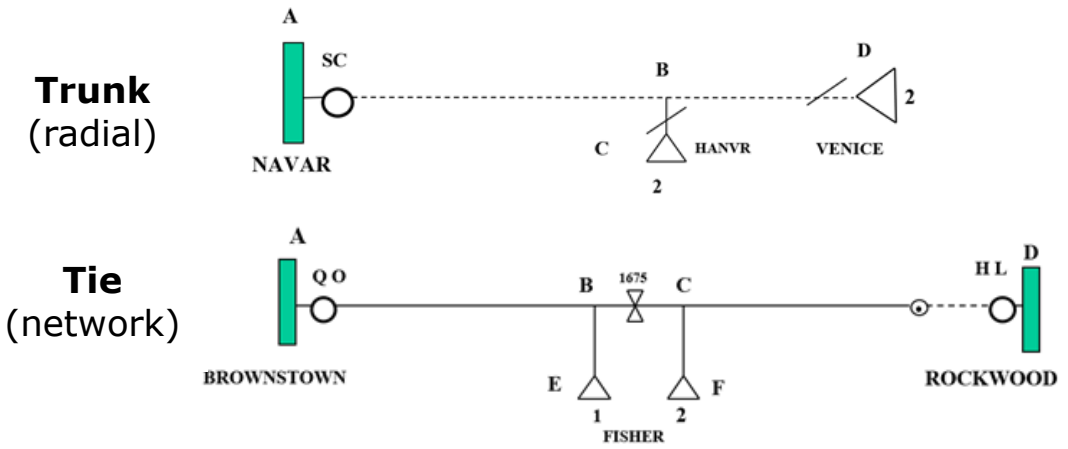


The Subtransmission system consists of stations, which convert voltage from the transmission system to 24kV or 40kV Subtransmission circuits then serve the load of the distribution substations

DTEE's Subtransmission system feeds our distribution substations and plays a critical role in delivering reliable power and providing capacity for load growth

- Subtransmission operating voltage is 24kV or 40kV
- Like the distribution system, much of the subtransmission infrastructure is near or past typical life expectancy
- Planning violations (load constraints) exist on 1/3 of circuit miles

Trunk and Tie configurations



Subtransmission OH/UG miles by voltage

	Trunks	Ties	OH Miles	UG Miles
24kV System	230	0	177	713
40kV System	244	86	2354	472
Total	474	86	2531	1185

The scope of Subtransmission redesign/rebuild projects typically includes up to three components that result in improved reliability and additional capacity for customers

Typical Project scope

(can include one or more)

Rebuild circuits: Rebuild to standards by replacing old wooden poles with new steel poles and new pole equipment relocated to truck accessible routes, install larger conductor for strength and increased capacity, replace aging cable

Expand stations: Install new station transformers and higher rated equipment in the stations to increase system capacity and operability

Reconfigure system: Add new trunk or tie lines to relieve load constraints

Customer Benefits

Improved reliability: Stronger construction materials able to withstand extreme weather, which will lead to fewer failures; additional capacity provides redundancy to serve load after single point of failure

Increased capacity: Ability to meet customer needs for new business, larger scale DER integration, support of fossil generation retirements

Wood pole construction

Steel pole construction

DTE

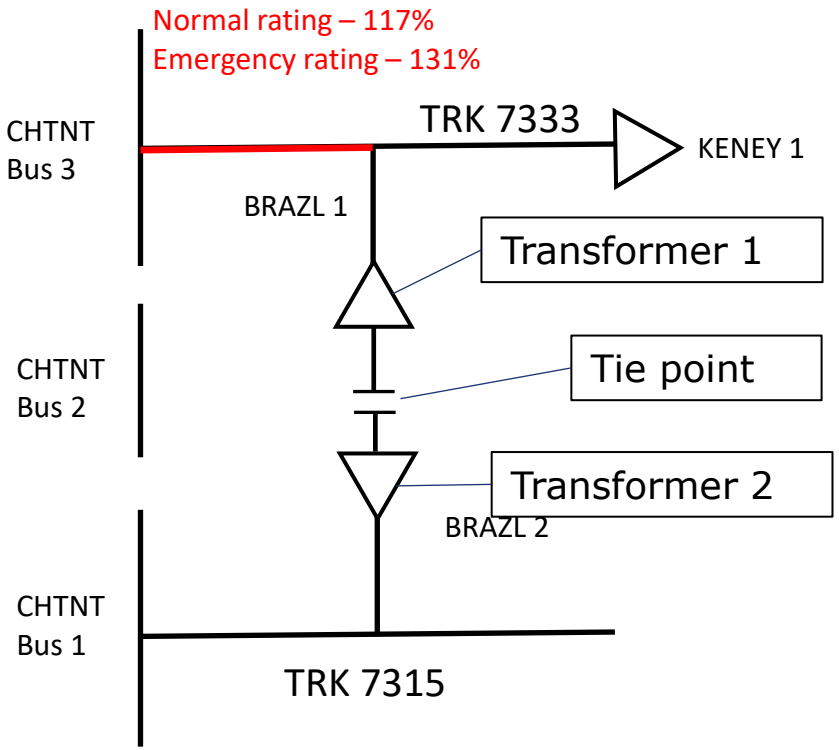
Subtransmission projects are prioritized by considering violations of the four planning criteria, reliability concerns, and near-term load growth

	Criteria for subtransmission project prioritization	Definition
Planning criteria violations	Load over day-to-day, normal conditions	Load exceeds normal rating of equipment on subtransmission line during normal condition
	Load over emergency rating for single contingency	Load exceeds emergency rating of equipment during an event
	Voltage violation	Voltage drop on a line exceeds standards during a contingency (single event)
	Load loss for single contingency	Load will be shed if subtransmission circuit cannot support substation after single failure
Other project drivers	Strong load growth	Predicted near term load growth
	Reliability	History of outages or equipment failures, known conductor issues

Areas of the system which do not have capacity to serve load under a single contingency have at least one of the four **planning criteria violations**

As an example, the TRK 7033 project relieved 3 planning criteria violations by constructing the new trunk line 7370

Previous State



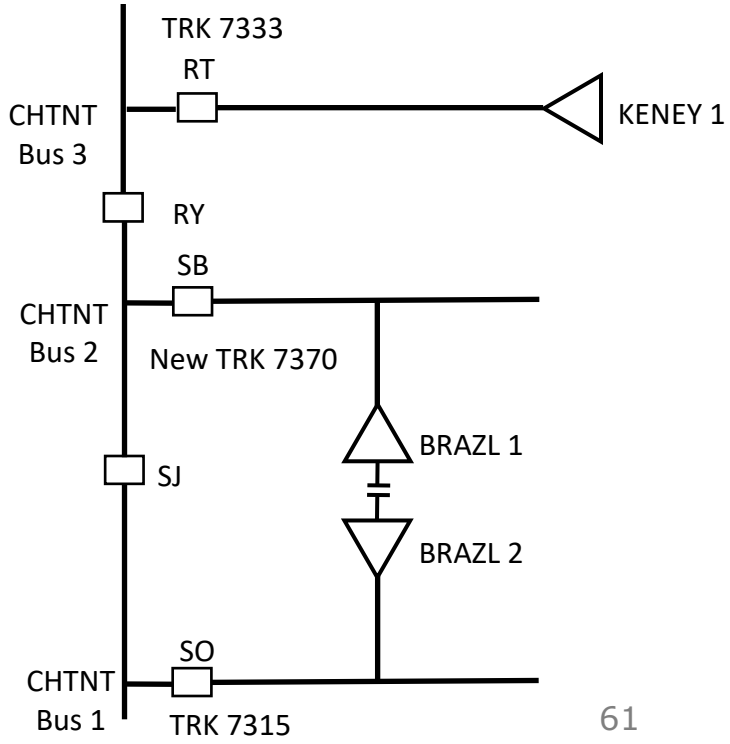
Abbreviations
CHTNT: Chestnut station
BRAZL: Brazil substation (1&2 are transformers)
KENEY: Keney substation
RT, SB, SJ, SO: breaker positions

System limitations

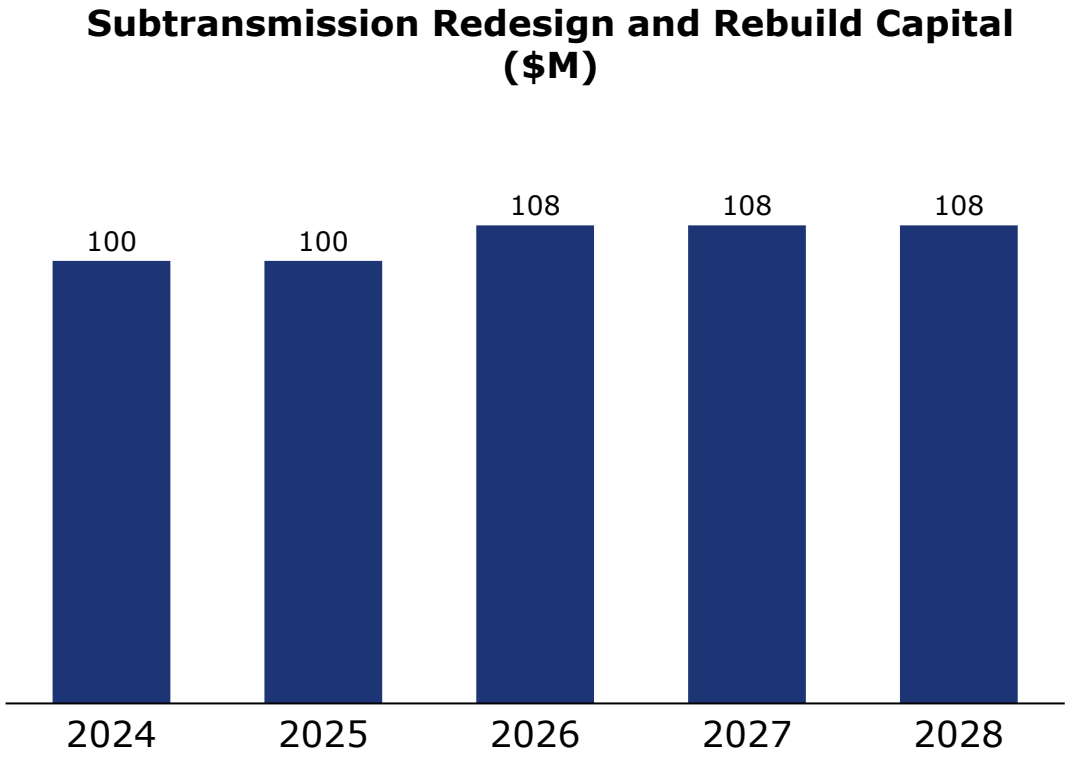
- TRK 7333 was overloaded in normal conditions **[violation 1]**, potentially shortening life of equipment during peak load
- Brazil (BRAZL) substation was fed by both 7333 and 7315
- In the event of an outage on TRK7315, the tie point should close and TRK7333 should feed both transformers, increasing load on 7333
- This would bring TRK7333 to 131% of emergency **[violation 2]**
- To prevent damage to the equipment, 12MVA of load (~2,500 customers) would be shed to limit loading **[violation 3]**

Project and current state

- A new circuit was built out of CHTNT, TRK7370, to feed BRAZL
- Both 7370 and 7315 can serve all BRAZL load if the other experiences an event

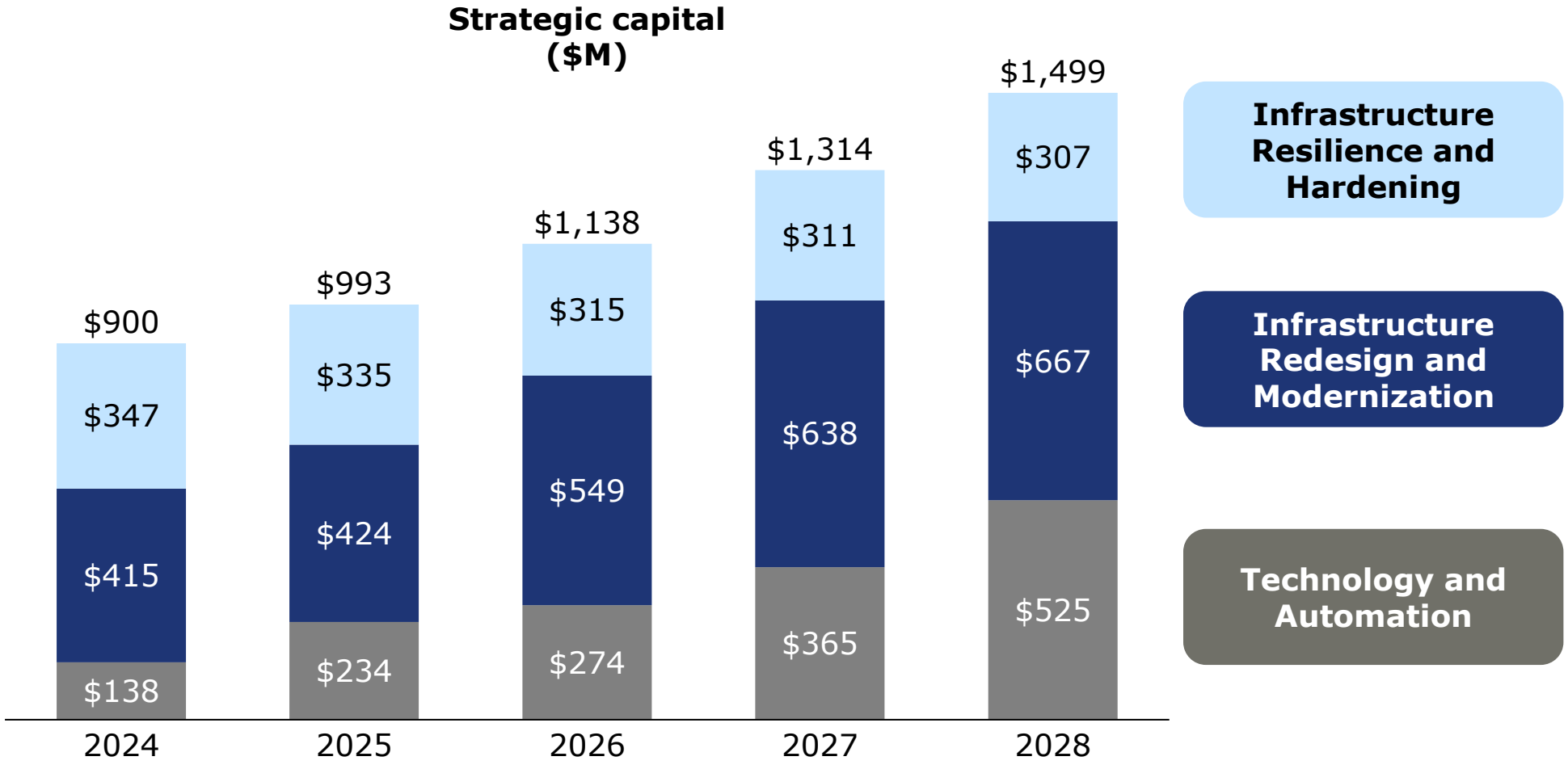


DTEE will invest over $500M to rebuild the Subtransmission system to improve reliability and relieve a majority of the loading constraints



- The projects encompassed in this investment will rebuild:
  - 190 miles of OH subtransmission
  - 35 miles of UG subtransmission
  - 77 miles of co-located distribution lines
- Planning criteria violations are projected to be reduced by 80% upon completion of the projects

DTEE will invest nearly $6B of strategic capital from 2024-2028 in order to execute the 2023 Distribution Grid Plan



Today’s Agenda

- Conference kickoff (10 minutes)
- Grid Vision (5 minutes)
- State of the Grid/Future Forces Impacting the Grid (20 minutes)
- Distribution Grid Plan Strategic Pillars:
  - Infrastructure Resilience and Hardening (PTMM) (20 minutes)
  - Tree Trimming (20 minutes)
  - Technology and Automation (30 minutes)
  - Infrastructure Redesign and Modernization (Conversion and Subtransmission) (30 minutes)
- **Global Prioritization Model (GPM) Updates (20 minutes)**
- Environmental Justice (EJ) Plan (20 minutes)
- Detroit Targeted Analysis (15 minutes)
- Open Table Discussion/Conference Feedback (20 minutes)
- Closing Remarks (5 minutes)

DTEE uses its Global Prioritization Model (GPM) to compare the relative benefits of investments in the grid to prioritize the strategic plan

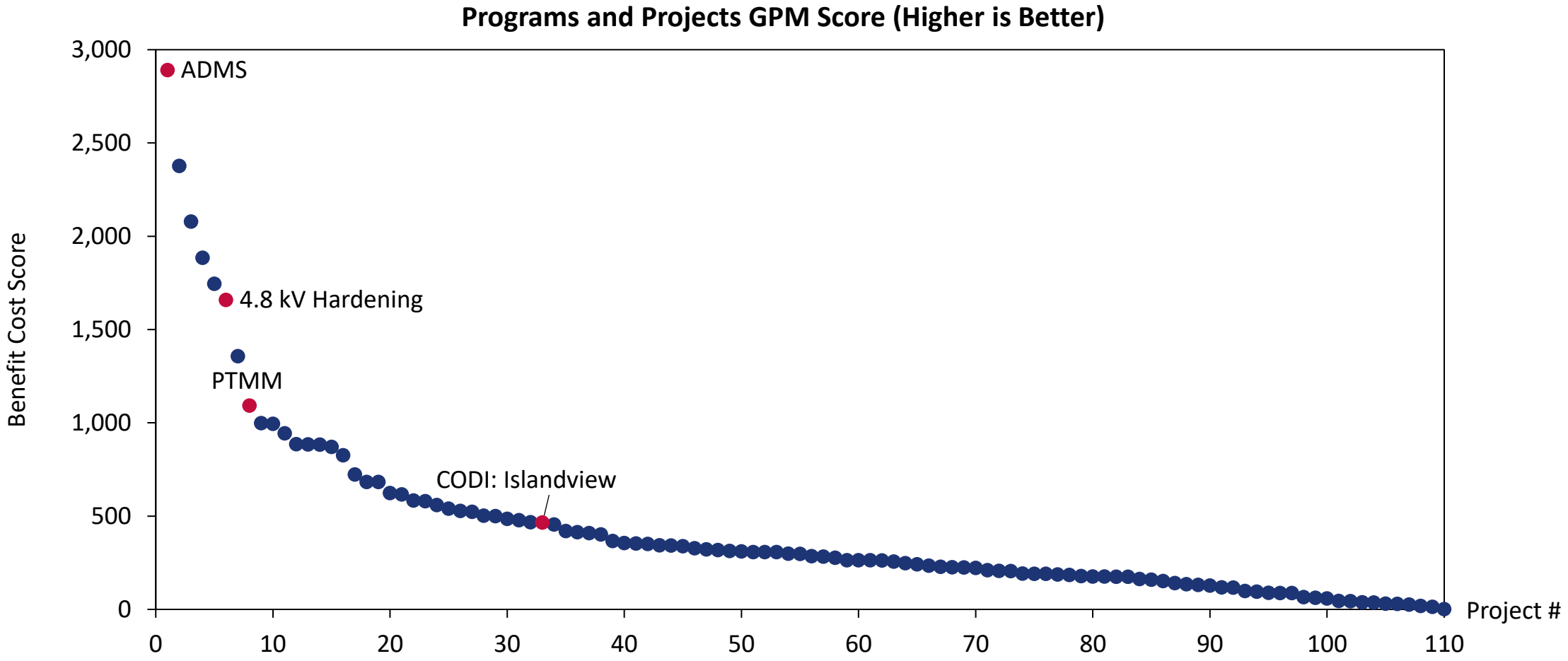
- The Global Prioritization Model (GPM) has been used in DTEE's strategic planning process since 2018 to help prioritize investments to improve the grid for our customers
- The GPM provides a relative ranking of strategic projects and programs based on the broad set of benefits they deliver
- We have developed enhancements to the GPM to respond to Commission and Stakeholder feedback, to better align with DTE Electric planning objectives, and to capture additional grid benefits

Comments regarding the GPM and other aspects of the DGP can be entered into the conference chat, or emailed after the conference to: DTE_Electric_Distribution_Grid_Plan@dteenergy.com

The GPM provides a framework to quantify and rank grid investments on their benefit to our customers

- Strategic investments in the distribution system provide multiple benefits – safety improvements, load relief, reliability improvements, cost savings, etc.
- Many benefits are **quantifiable** but not easily or appropriately translated into **monetary** terms
- The GPM is a framework to provide a ranking for each project or program which reflects the benefits a project/program brings, generally weighted by total investment, and allows projects to be compared to each other as a baseline for prioritization
- Projects/programs receive a score in each area of benefit, which we call an impact dimension, which is relative to the magnitude of the benefit (e.g. minutes of SAIDI reduced per $M invested).
- Historically, the GPM has included 7 dimensions:
  - Safety
  - Load relief
  - Regulatory Compliance
  - Substation Risk
  - Reliability
  - O&M cost avoidance
  - Capital cost avoidance

Programs and projects are ranked based on their total score – over 100 programs and projects were evaluated as part of the 2021 DGP



There are three main goals as we consider enhancements to the GPM in the 2023 DGP

1. Incorporate Environmental Justice (EJ) considerations into the decision-making process for strategic investments[1]

2. Factor into GPM the benefits projects bring to address emerging grid needs such as readying the grid for electrification

3. Look for opportunities to simplify the framework

Changes to the GPM in the 2023 DGP include 1 additional dimension and enhancements of three existing dimensions

Impact Dimension	Major Drivers	Change proposed
Safety	• Reduction in wire down events • Reduction in secondary network cable manhole events • Reduction in major substation events	**Rename to "Reduce electrical hazards"**
Load Relief	• Elimination of system capacity constraints	A **Yes**
Regulatory Compliance	• MPSC staff's recommendation on utilities' pole inspection program • Docket U-12270 – Service restoration under normal conditions and catastrophic conditions • Docket U-12270 – Same circuit repetitive interruption of less than 5 within 12-months	**No**
Major Event Risk	• Reduction in substation events that lead to large extended outages	**No**
Reliability	• Customer minutes (SAIDI) reduction	B **Yes**
O&M Cost Avoidance	• Trouble event reduction and truck roll reduction • Preventive maintenance spend reduction	**No**
Reactive Capital Avoidance	• Trouble event reduction and truck roll reduction • Reduction in capital replacement during equipment failures	C **Yes**
Investment in EJ Communities (New)	• % of EJ customers impacted by project/program investment	D **Yes**

A To better incorporate load impacts from electrification and prioritize investments which aid in automated restoration, we are adding 3 additional loading factors and splitting it into 2 dimensions

New metrics in in bold

GPM Dimensions

Overload Relief

Definition: investment addresses equipment currently operating above its designed rating

Metrics:

- Subtransmssion equipment over day-to-day
- Subtransmission equipment over emergency rating (n-1)
- Subtransmission voltage violation
- Substation equipment over day-to-day
- Circuit over day-to-day
- **Distribution transformer over day-to-day**

Capacity Relief

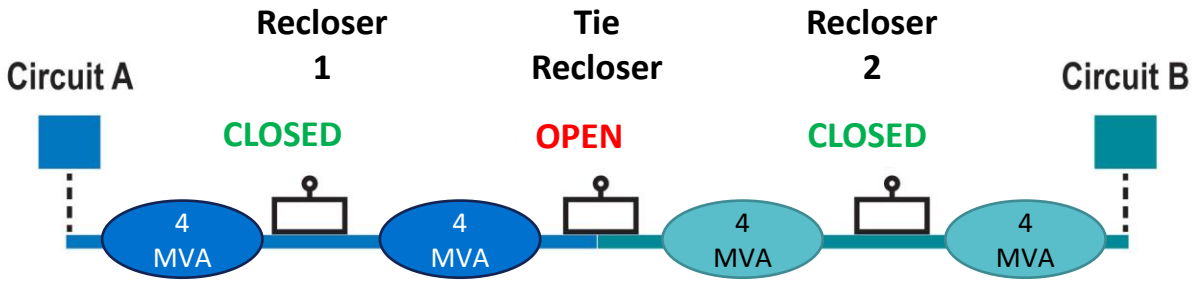
Definition: investment adds capacity to meet our design standards (firm capacity or circuit design order) which enables the system to avoid customer outages upon a single equipment failure

Metrics:

- Subtransmssion load loss (n-1)
- Substation over firm (today)
- **Substation over firm (2035)**
- Strong near-term load growth
- **Circuit over design order (DDO)**

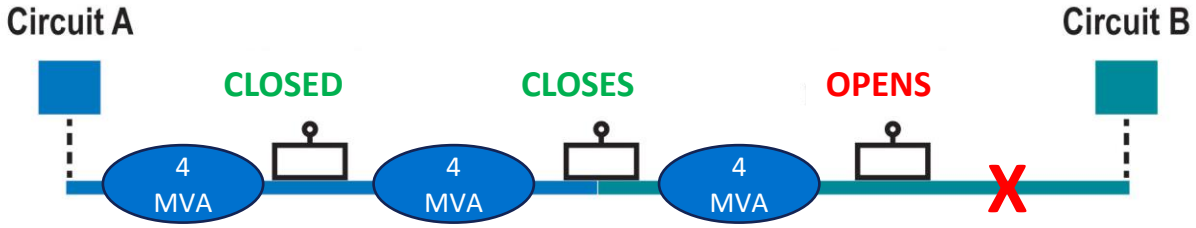
Explanation on following slide

Maintaining circuit loading below the circuit distribution design orders (DDOs) provides capacity to fully utilize automation and improve reliability



Normal Operation

- Circuit A and B have day-to-day ratings of ~12MVA, meaning the equipment is designed to operate at 12MVA for an extended period of time
- Circuit design orders (DDOs) are to load the circuit up to 8MVA
- Under normal operation, the middle recloser is open
- Each circuit has **8MVA** of load



Event near substation (breaker opens)

- Recloser 2 opens
- Tie recloser closes
- Circuit A supports **12MVA** of load until full restoration
- Because Circuit A was loaded to the DDO or below, it can support ½ of circuit B's load without bringing equipment above its day-to-day rating

B To provide a more complete view of reliability performance, a SAIFI dimension will be added to include outage frequency in addition to outage duration

New metrics in bold

GPM Dimensions	SAIDI	**SAIFI**
	Definition: reduction in customer minutes interrupted	**Definition**: reduction in customer interruptions
	Metrics: • Customer minute interruption reduction per $M	**Metrics**: • **Customer interruptions per $M**

C Capital avoidance metric would be expanded to include avoided capital replacements

New metrics in bold

GPM Dimension

Capital Avoidance

Current state

- Metric tracks reduction in trouble event volume and associated emergent capital reduction

Future metric

- Continue to track event volume reduction
- **Account for avoided future capital replacements for 4.8kV breakers, system cable, and potential subtransmission upgrades**

D We propose measuring the % of investment in EJ communities as the metric to incorporate vulnerable communities into the GPM

New metrics in bold

GPM Dimension

Invest in EJ communities

Definition: % of investment that benefits an EJ community

Metrics:

- **Customers in EJ (vulnerable) census tract / Total Customers impacted by project**

Considerations

- Would allow for measurement of % of investment in EJ communities
- Allows for projects that may cross EJ and non-EJ areas to reflect that they benefit EJ communities
- System-wide projects and programs also benefit EJ customers at a ~26% score

Given the diverse coverage of impact dimensions to planning objectives we propose simplifying dimension weightings

Current weighting of GPM dimensions

Dimension	Weight
Safety	10
Regulatory Compliance	4
Major event risk	4
Load Relief	4
Reliability	4
O&M Avoidance	3
Capital Avoidance	3

Proposed weighting of new GPM dimensions

Dimensions	Weight
Reduce electrical hazards	3
Overload relief	
SAIDI	
SAIFI	
Investment in EJ communities	2
Major event risk	
Capacity relief	
Regulatory compliance	
O&M avoidance	1
Capital avoidance	

Any additional feedback on the GPM can be sent to:
DTE_Electric_Distribution_Grid_Plan@dteenergy.com

DTE

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DTE Electric began to include Environmental Justice (EJ) in the 2021 DGP, including the use of MiEJ Screen Tool to identify potential opportunities to support our most vulnerable customers

- On November 18, 2022, the Commission issued an order in Case U-20836 requesting DTEE to include a comprehensive environmental justice plan in future rate cases and distribution plans
- In the 2023 electric rate case, the Company demonstrated how the investment programs are reaching vulnerable communities to improve electric distribution infrastructure and reliability performance
- We are improving our EJ plan in the 2023 DGP by incorporating EJ consideration into the GPM model, reliability improvements through our programs to address poor performing circuits, and storm restoration considerations in EJ communities

DTE Electric defines vulnerable communities as those with a threshold composite score at or above the 80th percentile using the State of Michigan's MiEJScreen tool

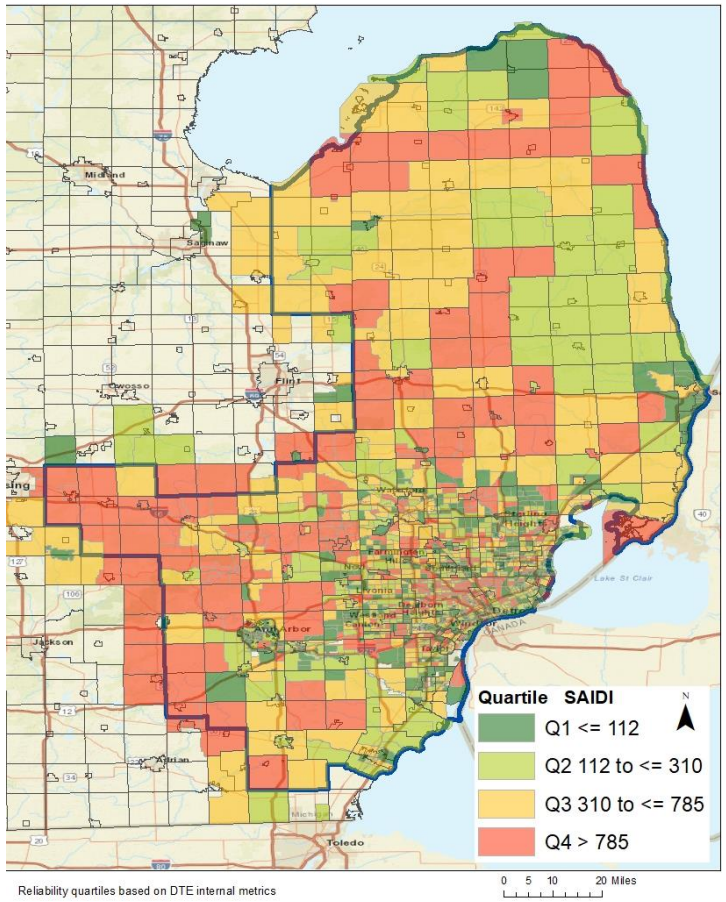
Categories	Environmental Exposure	Environmental Effects	Sensitive Populations	Socioeconomic Factors
Indicators	NATA Air Toxics Cancer Risk NATA Respiratory Hazard Index NATA Diesel Particulate Matter Particulate Matter ($PM_{2.5}$) Ozone Traffic Density	Proximity to Cleanup Sites Proximity to Hazardous Waste Facilities Impaired Water Bodies Proximity to Solid waste Sites and Facilities Lead Paint Indicator Proximity to RMP Sites Wastewater Discharge Indicator	Asthma Cardiovascular Disease Low Birth Weight Infants Blood Lead Level Life Expectancy	Low Income Population Black, Indigenous, People of Color Population Educational Attainment Linguistic Isolation Population Under Age 5 Population Over Age 64 Unemployment Housing Burden
Sub Scores	**Environmental Conditions** (Average percentile of Environmental Exposure indicators + 0.5 x average percentile of Environmental Effects indicators) / 1.5		**Population Characteristics** (Average percentile of Sensitive Population indicators + average percentile of Socioeconomic Factor indicators) / 2	
Score	Final Composite Score = Environmental Conditions score x Population Characteristics score **MiEJScreen Score**			

- The MiEJScreen overall score is made up of many factors that combine environmental conditions and population characteristics
- This combination highlights census tracts where the most vulnerable communities in Michigan are located
- Approximately 550,000 DTE Electric residential customers live within vulnerable communities (483 census tracts)

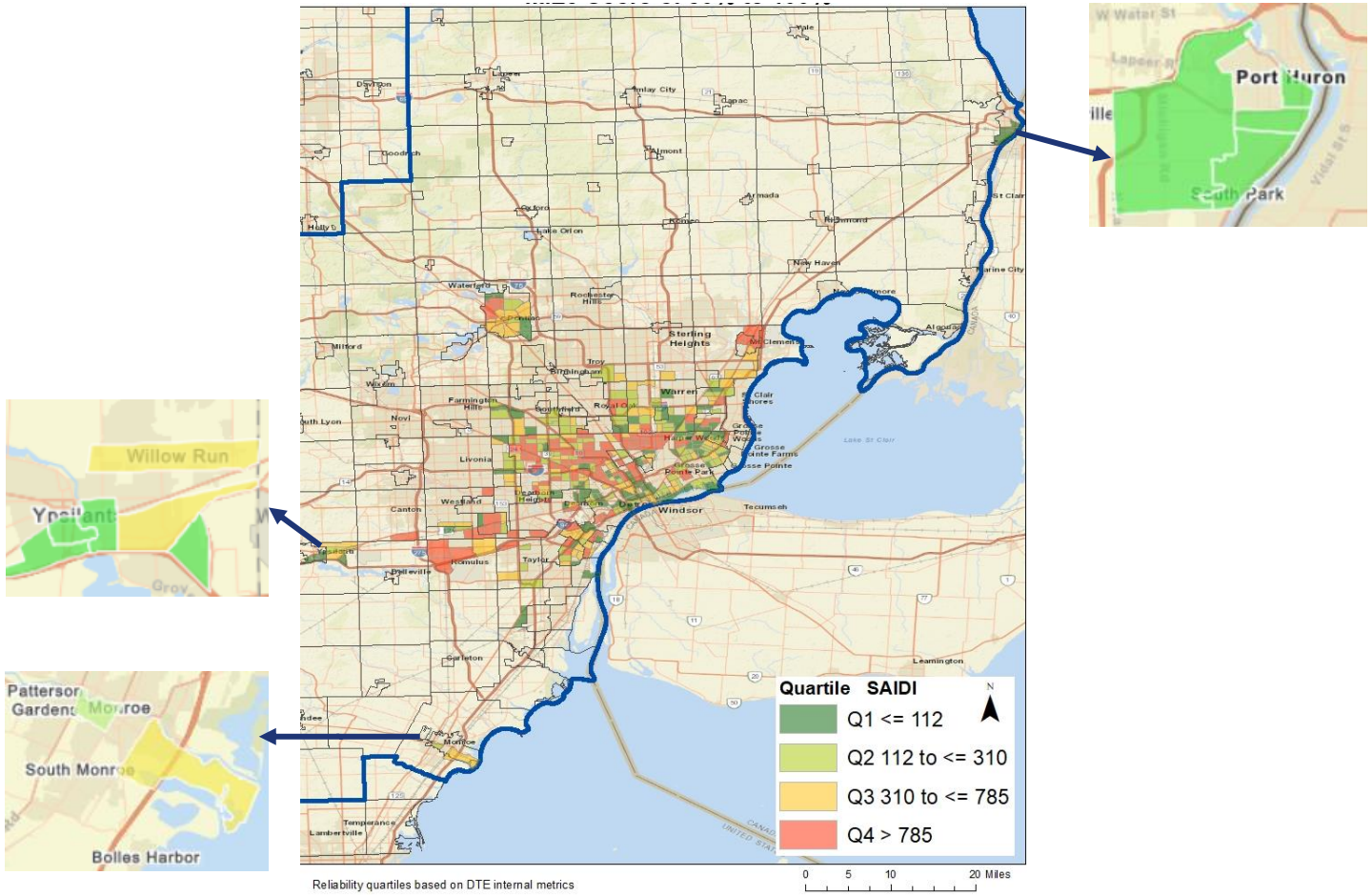
Currently, DTEE identifies **vulnerable communities** as those with a final composite score of 80% to 100%

Building on the 2021 DGP plan and utilizing the draft MiEJScreen tool, the Company is able to provide a geographic representation of electric reliability data by census tracts

2022 all weather SAIDI by census tract for DTE Electric (Full Electric Service Area)

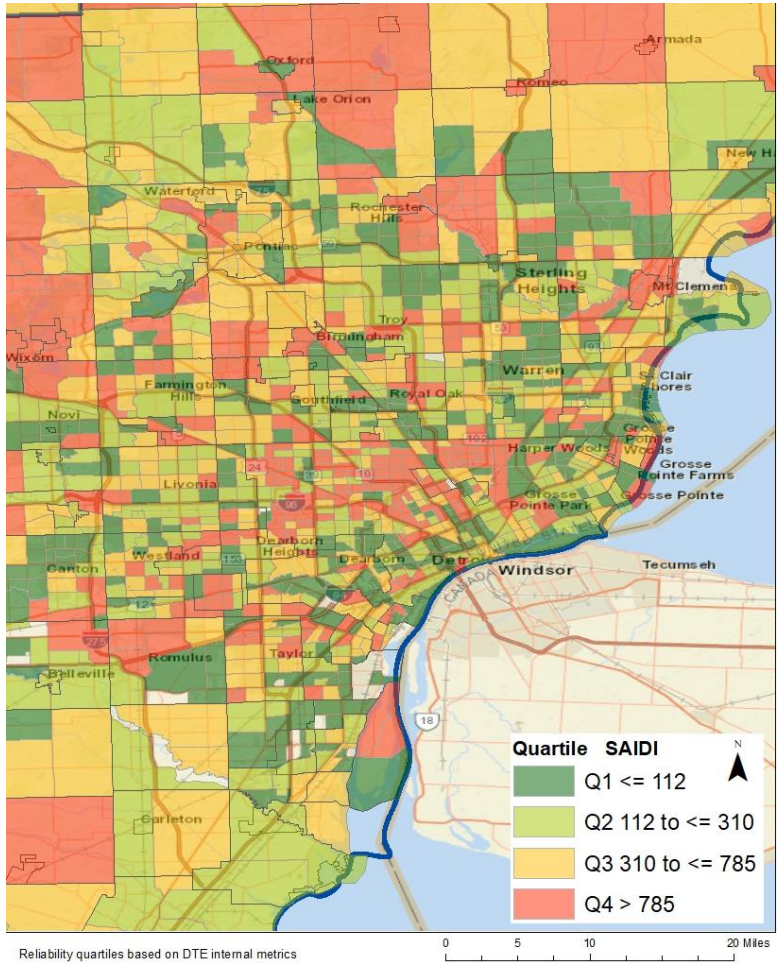


2022 all weather SAIDI for vulnerable census tracts with MiEJ score of 80% to 100%

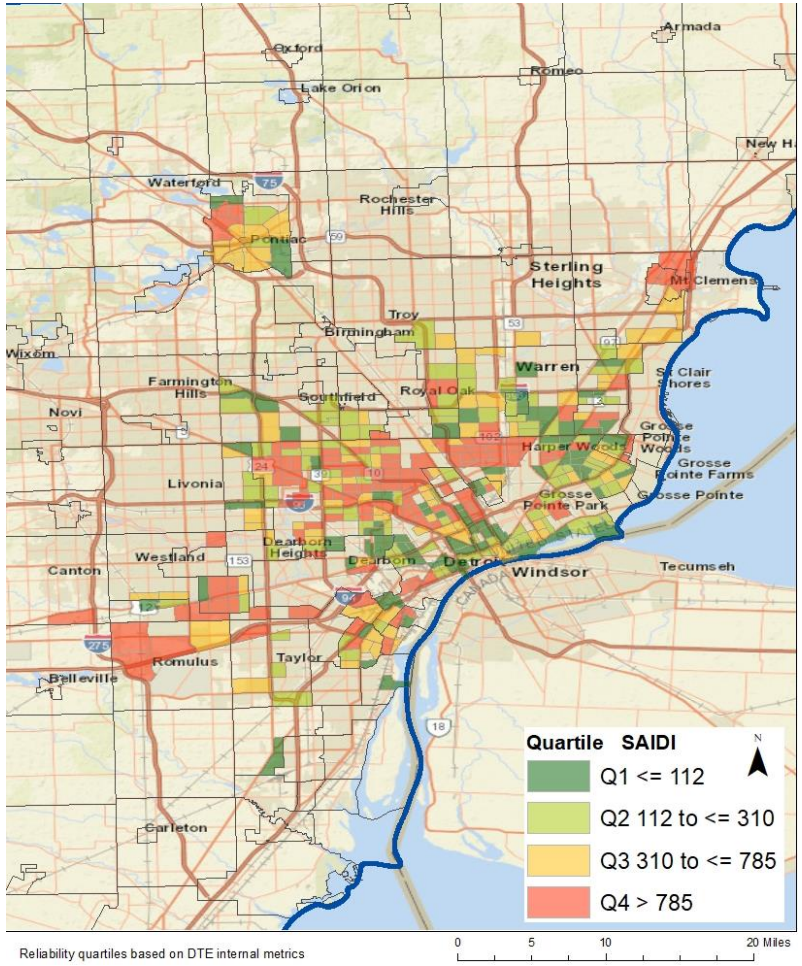


The view of reliability performance by census tracts for Metro Detroit area

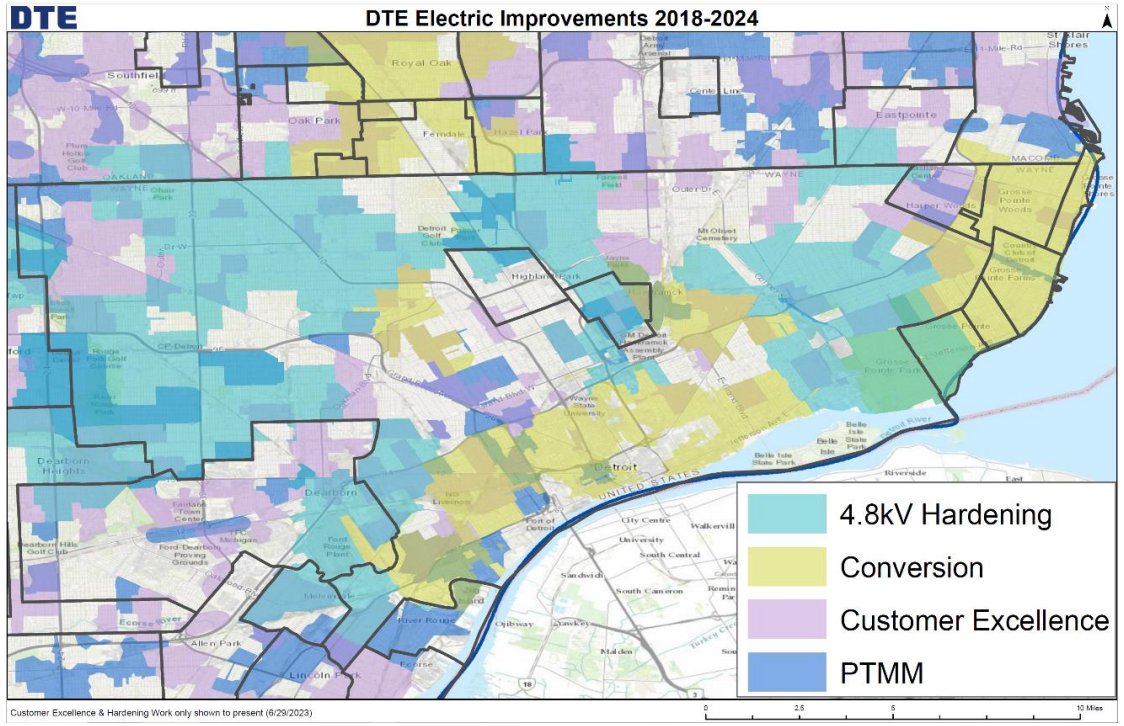
2022 all weather SAIDI by census tract for DTE Electric (Metro Detroit Area)



2022 all weather SAIDI for vulnerable census tracts with MiEJ score of 80% to 100% (Metro Detroit Area)



In addition to reliability performance evaluation, the Company conducted analysis of our investment programs to assess how they are reaching our vulnerable customers and communities



- The Company completed investment analysis in the vulnerable communities and included the results in the 2023 Electric rate case
- The analysis results demonstrated that we have made significant investments in the EJ areas through our programs

Investment Program	% of investment in Vulnerable Communities	
	(2018-2022)	(2023-2026)
Conversion	75%	86%
4.8kV Hardening	89%	93%
Tree Tim	30%	14%*

*Tree Trim has not finalized the circuits to be trimmed in 2024 and beyond

DTEE built the 2023 DGP EJ plan on the foundation developed in the 2021 plan, and focused on three key objectives

1. Incorporate EJ considerations in investment decisions by including an EJ component in the GPM model (already discussed)

2. Improve system performance for EJ communities with the worst reliability through our investment programs (Tree Trim, PTMM, Conversion, Customer Excellence, and 4.8kV Hardening)

3. Provide support to vulnerable customers experiencing outages during storm through community outreach efforts

1

The GPM supports DTEE's strategic investment prioritization, and has been updated to include an EJ dimension that incorporates vulnerable communities in our investment decisions

GPM Dimensions

Dimensions
Reduce electrical hazards
Overload relief
SAIDI
SAIFI
Investment in EJ communities
Major event risk
Capacity relief
Regulatory compliance
O&M avoidance
Capital avoidance

- Global Prioritization Model (GPM) is used to inform, support/prioritize strategic investments
- As part of the decision-making process the GPM model has been updated to include an EJ dimension
- The new GPM model calculation allows for:
  - Measurement of % of investment in EJ communities
  - Projects that may cross EJ and non-EJ geographic areas to reflect that they benefit EJ communities

2

Currently, DTEE has identified 191 circuits in EJ communities which fall in the 4th quartile for reliability over the last 5 years

Investment Category	191 total circuits in EJ communities falls within the 4th reliability quartile	
	68 circuits have work completed 2018-2022	123 circuits have work planned 2023-2026
Conversion	1	11
4.8kV Hardening	49	88
Tree Tim	12	20
Subtransmission Upgrades	1	0
CEMI Program	5	0
Technology and Automation	0	4

- About 1/3 of the 4th quartile reliability circuits have already had a recent intervention
- We have ensured that the remaining 2/3 of circuits that fall in the 4th quartile reliability (SAIDI performance) align to existing investment programs
- As the work is complete on each circuit, continue to monitor the reliability performance and evaluate if additional work is needed
- The Company will continue to monitor and identify additional work that is needed in EJ communities

3 The Company has ongoing outage response strategies that are used to support our customers, with consideration of impacts in the EJ communities

Storm Response Initiatives

Community Vans

- Deploy community vans to support the impacted customers in the vulnerable communities
- The community vans distribute bottled water, bags of ice, charged batteries for mobile phones, flashlights, blankets, and hand warmers
- Locations are identified with cross functional input from Community Engagement, Regional Relations and DO Operations

Warming/Cooling Centers

- During storms, identify warming and cooling centers in the vulnerable communities that could serve outage customers. These locations will provide targeted support during storm restoration efforts

Community Communication

- Develop storm updates and safety messaging to share with our vulnerable customers during storm restoration efforts
- Ongoing efforts to educate school children on wiredown safety focused in our oldest communities which happens to be primarily in vulnerable communities

The Company is engaging vulnerable communities to listen to their concerns and share how we are incorporating EJ into our distribution planning processes

Engagement Methods
• Direct conversations with customers via community meetings (e.g., block clubs, HOAs, resident meetings) • Conversations with community leaders from faith-based institutions, social service agencies, advocacy organizations and others

Key Themes from Community Feedback

• While talking to our most vulnerable customers, they shared with us their desire to understand:
  • Reliability performance at the local community level and how that compares to other communities
  • How the investment programs identified in the DGP will translate into investment plans at the local level, the timing of the investment, and the expected reliability improvement

Next Steps

- Continue to work on identifying projects/opportunities to improve reliability in the EJ communities
- Seek stakeholder input from the technical conference as our plan continues to evolve
- Continue to listen to our customers and stakeholders to improve our analysis and planning processes
- Collaborate with the MPSC and other stakeholders on potential IIJA grant opportunities to fund infrastructure-related programs to benefit vulnerable communities

Today’s Agenda

- Conference kickoff (10 minutes)
- Grid Vision (5 minutes)
- State of the Grid/Future Forces Impacting the Grid (20 minutes)
- Distribution Grid Plan Strategic Pillars:
  - Infrastructure Resilience and Hardening (PTMM) (20 minutes)
  - Tree Trimming (20 minutes)
  - Technology and Automation (30 minutes)
  - Infrastructure Redesign and Modernization (Conversion and Subtransmission) (30 minutes)
- Global Prioritization Model (GPM) Updates (20 minutes)
- Environmental Justice (EJ) Plan (20 minutes)
- **Detroit Targeted Analysis (15 minutes)**
- Open Table Discussion/Conference Feedback (20 minutes)
- Closing Remarks (5 minutes)

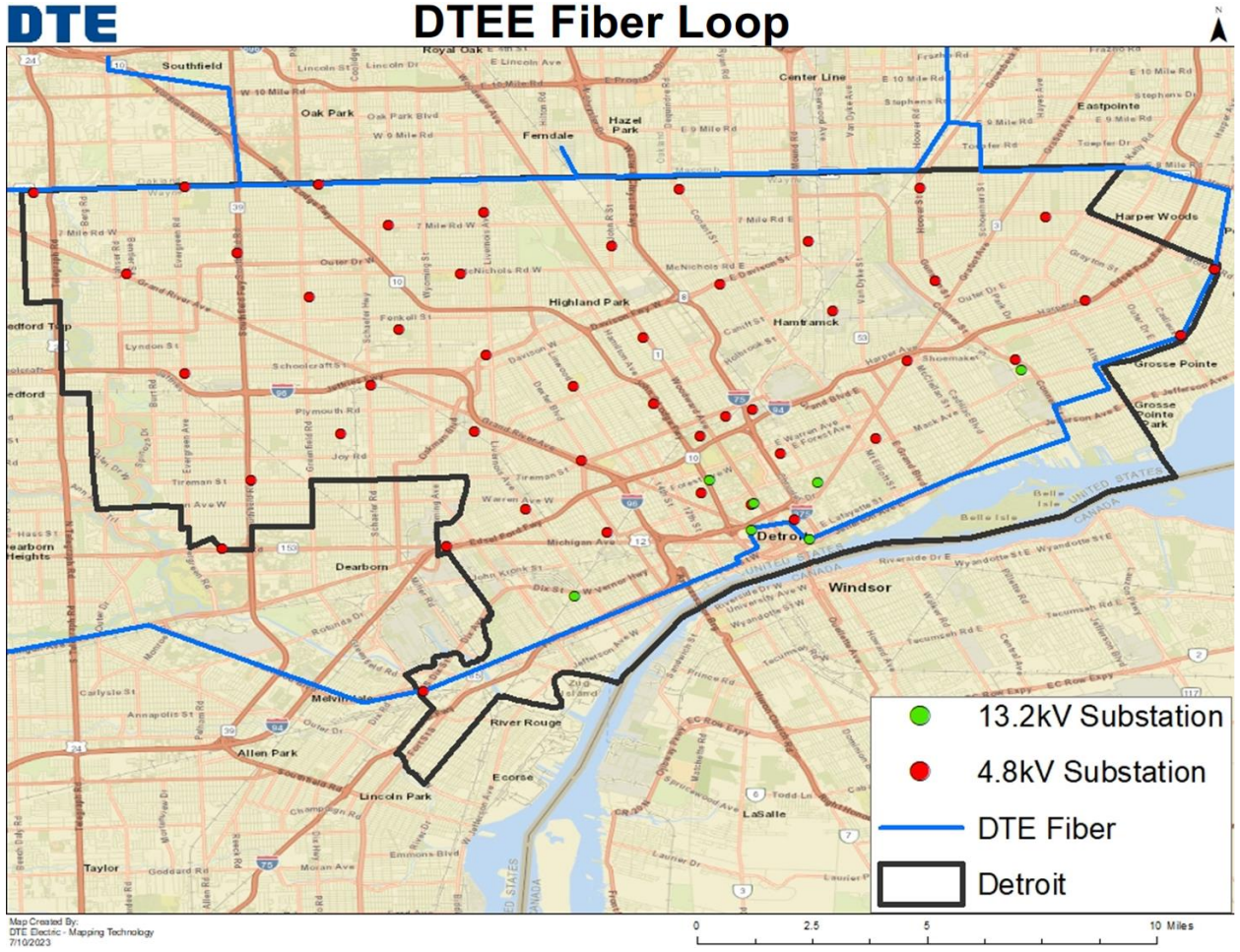
On September 18, 2022, the Commission issued an order in Case U-20836 requesting DTEE to work with Staff on the Detroit targeted study

> The Commission also finds the Staff's request for DTE Electric to work with the Staff and interested stakeholders to develop "a case study on the impact of socioeconomic data analysis and more comprehensive analysis of alternatives for the 4.8 kV system within the Company's metro Detroit fiber loop" to be reasonable. The Commission directs DTE Electric to file this study in a future rate case or distribution plan, informed by stakeholder input and reflecting the learnings derived from the technical conference(s).
>
> Page 463
> U-20836

DTEE has completed data analysis of the Detroit targeted study to include in the Distribution Grid Plan

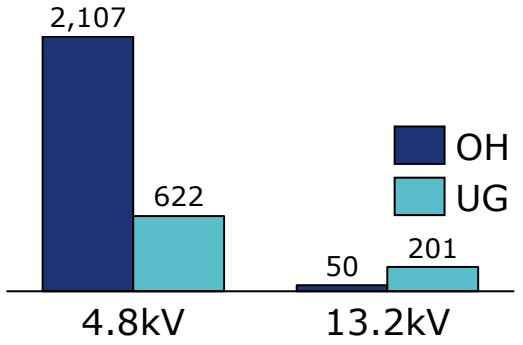
- We have completed the Detroit targeted analysis which includes forty-five 4.8kV substations
- The methodology for the study includes four metrics reflecting socioeconomic data and grid performance consolidated at a substation level
- The Detroit targeted analysis findings include potential mitigation solutions to improve wire downs, reliability, and relieve capacity

The study area included forty-five 4.8kV substations within The Company's metro Detroit area

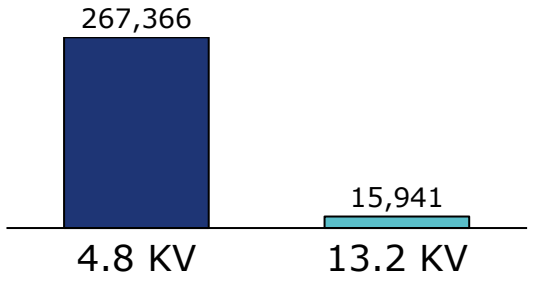


1.There are eight 13.2kV substations within the geographic area which are not included in the analysis

Circuit miles by substation voltage



Customers by substation voltage



Four metrics were used in the analysis – reflecting socioeconomic data and grid performance at a substation level

Metrics	Description	Calculation Method	Mitigation Threshold
EJ Score	Michigan Environmental Justice score of substation	Map MiEJ score to circuit and substation	-
Wire downs	Measured using 5-year average of Wire Downs	Total # of wiredowns per OH mile multiplied by # of customers	4th Quartile relative to all DTE Substations
Reliability	Measured using 5-year average of SAIDI	Customer minutes interrupted minutes per substation divided by total numbers of customers per substation	4th Quartile relative to all DTE Substations
Capacity	Electrical demand a substation can deliver	2022 Peak MVA divided by Substation Firm Rating*	>100%

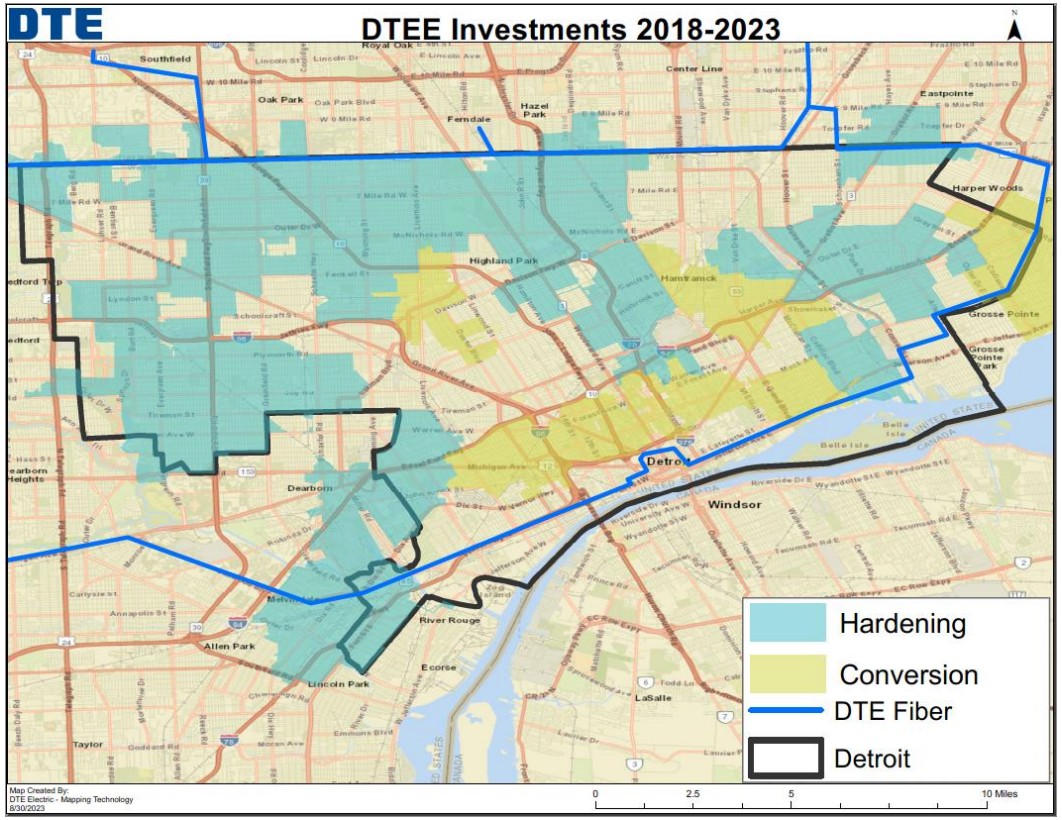
1. Substation Firm Rating is the maximum amount of electricity a station can supply under single contingency without damage to equipment

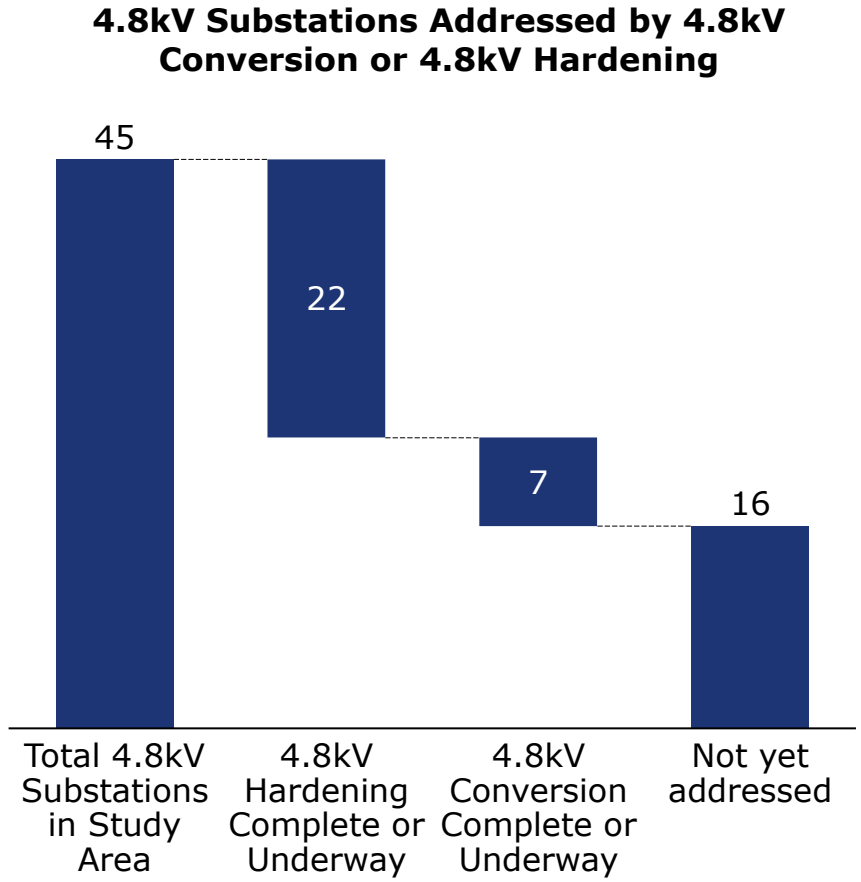
DTEE explored various mitigation solutions; while some have estimated costs, others' costs vary based on site conditions and scope of work

	Solution Description	Cost per mile[1]
Tree Trimming	Trees trimmed to enhanced specification, no arc wire removal	*
4.8kV Hardening	Arc wire removed, crossarms replaced, tree trimming	~$353K
Conversion	Fully convert circuit and substation to 13.2kV, includes automation	~$2.7M
Microgrids + Pre-conversion	Arc wire removed, rebuild wires, poles, and pole tops to 13.2kV standard and build microgrid for reliability	~$14.6M
DERs & Storage	Utility-scale or distributed solar and battery storage to improve capacity	*
Energy Efficiency	Target residential, commercial, and industrial customers for waste reduction	*

1. Tree Trimming, DERs, Storage, and Energy Efficiency costs vary significantly from site to site based on conditions and scope of work
2. The cost for Hardening, Conversion, & Microgrids + Pre-conversion is an average cost and may vary

The majority of 4.8kV substations in the Detroit targeted study have been addressed by the 4.8kV Hardening and Conversion programs; 16 substations remain





1. All substations will also be on-cycle for tree trimming as part of the ETTP surge

These solutions have varying degrees of effectiveness addressing wire downs, reliability concerns, and capacity constraints

	Improved Safety/ Wire downs	Improved Reliability	Increased Capacity	Use case	Cost Level	Execution Complexity
Tree Trimming	◔	◑	○	Improve reliability/safety if area is off-cycle	Low	Low
4.8kV Hardening	◑	◕	○	Improve reliability and safety, remove arc wire	Medium	Low
Conversion	●	●	●	Relieve capacity constraint and provide significant safety/reliability improvements	High	High
Microgrids + Pre-conversion	●	●	◑	Potential to provide highest reliability and resiliency	Very High	Very High
DERs & Storage	○	◔	◑	Small/moderate load relief	Medium	Medium
Energy Efficiency	○	○	◔	Small load relief	Low	Medium

Effectiveness	
○	0%
◔	25%
◑	50%
◕	75%
●	100%

DTE

The 16 remaining substations were selected for solutions that solve their specific challenges

	Metrics				Solutions					
Substation	EJ Score	Capacity	Reliability	Safety	Tree Trimming	4.8 KV Hardening	Conversion	Microgrids + Pre-conversion	DERs & Storage	Energy Efficiency
DENVR	◑	●	◑	●		✓	✓	✓		✓
MADSN	●	○	○	◔						
PINGR	●	○	◑	◕		✓	✓	✓		
EMPIR	●	○	◕	●	✓	✓	✓	✓		
OUTDR	●	◑	◑	●		✓	✓	✓		
REDFD	●	◔	●	●	✓	✓	✓	✓		
STOPL	●	○	●	●	✓	✓	✓	✓		
AMSTR	●	○	◔	◑						
CORTL	●	○	◑	◕		✓	✓	✓		
COOLG	●	○	◕	●	✓	✓	✓	✓		
GDRIV	●	○	◑	●		✓	✓	✓		
GRPTE	◔	◑	◔	●		✓	✓	✓		
HAYES	●	○	◑	●		✓	✓	✓		
SCOTN	●	○	◕	◕	✓	✓	✓	✓		
STLUS	●	◔	◑	●		✓	✓	✓		
FRMNT	●	◑	◑	◕		✓	✓	✓		

◕ ● Candidate for mitigation solution

Hardening planned

Conversion planned

- DERs and storage solutions are considered for substations with load relief requirement under 3 MVA
- MADSN and AMSTR are primarily underground and part of the AC network conversion (CODI), as such they are evaluated differently

DTE Distribution Grid Plan Technical Conference
August 31, 2023

Break: 12:25 – 12:35 PM

Agenda		
9:00 am	Welcome and Opening Comments	Dr. Joy Wang Manager – Distribution Planning, MPSC
9:05 am	DTEE Distribution Grid Vision	Sharon Pfeuffer Vice President – Distribution Operations Engineering, DTE
9:10 am	State of the Grid/Future forces impacting the grid	Husaninder Singh Manager – Distribution Planning, DTE
9:30 am	Strategic Pillar - Infrastructure resilience and hardening	Morgan Elliott Andahazy Director – DO Programs, DTE
10:00 am	Strategic Pillar - Tree Trim program	Brian Hill Director – Distribution Operations, DTE
10:20 am	Strategic Pillar - Technology and Automation	Joseph Jacunski Manager – Engineering Standards and Design, DTE
10:50 am	Break	All
11:00 am	Strategic Pillar - Infrastructure Redesign and Modernization	Edward Karpiel Manager – Business Performance, DTE
11:30 am	Global Prioritization Model (GPM) model updates	Edward Karpiel Manager – Business Performance, DTE
11:50 am	Environmental Justice (EJ) plan	Grace Musonera Manager – Engineering Support, DTE
12:10 pm	Detroit targeted study	Jamie Kryscynski Acting Director – Distribution Operation, DTE
12:25 pm	Break	All
12:35 pm	Open discussion and conference feedback	Moderated by Dr. Joy Wang Manager – Distribution Planning, MPSC
12:55 pm	Closing Remarks & Next Steps	Dr. Joy Wang Manager – Distribution Planning, MPSC
1:00 pm	Adjourn	

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

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DTE Distribution Grid Plan Technical Conference

Closing Comments

August 31, 2023

Thank You and Next Steps

- Thank you to participants and presenters!
  - If any additional thoughts to share, please email Joy Wang at wangj3@michigan.gov.

- Next Steps
  - Post recording and slides online
  - Incorporate feedback in upcoming/future distribution grid plan
  - Distribution grid plan will be filed by September 29, 2023.

Thank You!