



Traction Power System Update

October 23, 2025 | BART Board of Directors Meeting





AGENDA

Traction Power System Overview

State of Substations & 34.5kV Cable

Powering Forward



BART's Traction Power System

Vision: Modern and Reliable Traction Power System through Data-Driven, Risk-Based, Strategic Planning & Actions

The Core Challenge

Maintain and modernize a critical, aging power system while managing **service reliability**, **limited funding** and **escalating costs**.

The Strategic Shift

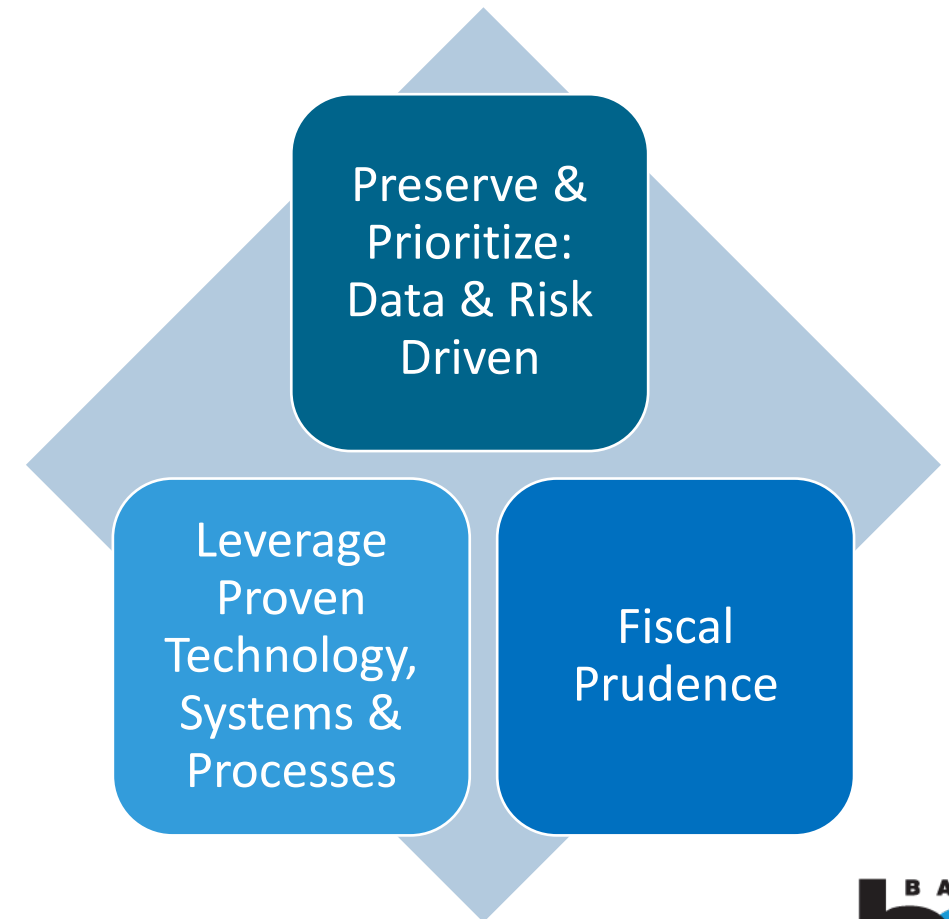
Moving from a traditional "replace-on-age" model to a **data-driven**, **risk-based approach**.

Key Benefit

Building a **modern infrastructure** necessary for the long-term future of BART and our region.

Current Assessment

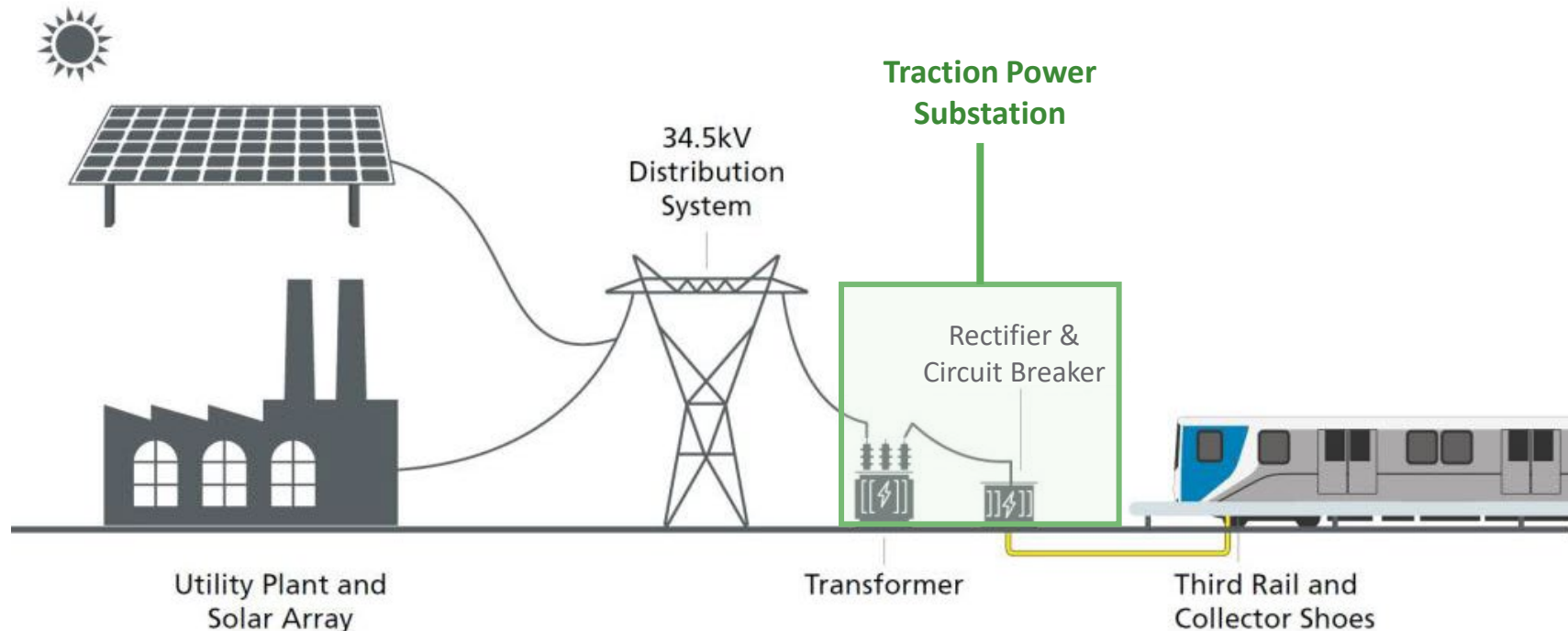
BART's system remains **resilient**, but aging infrastructure and **complex** interconnections are increasing fragility and causing more frequent, less predictable failures.



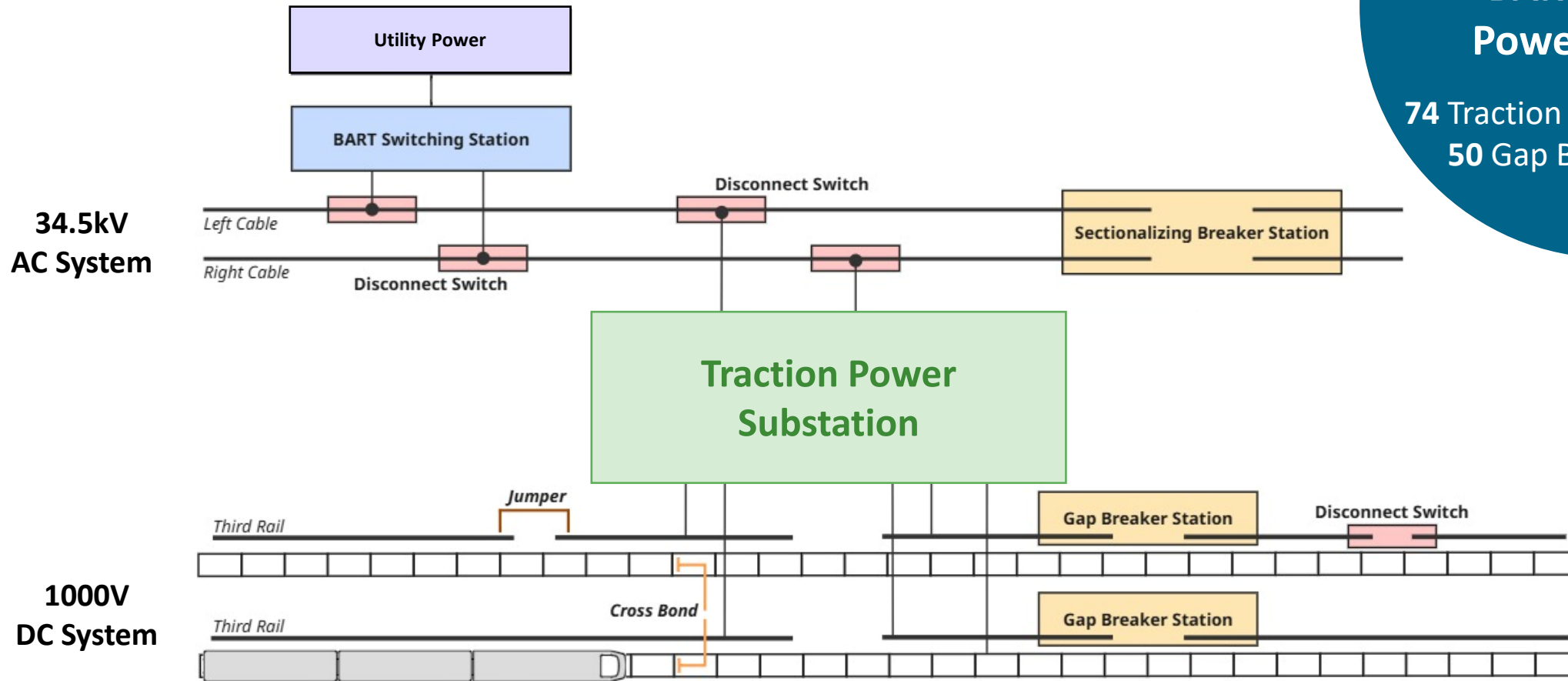
Traction Power System Overview

What is Traction Power? It is the Power that ultimately used to operate BART trains

- Takes incoming power from PG&E 34.5kV (AC) and through a series of devices converts it to 1,000 Volts (V) Direct Current (DC) power for BART's 3rd rail system
- Provides stable and constant power to operate trains
- Traction Power Substations are spaced approximately two miles apart



Traction Power System Overview



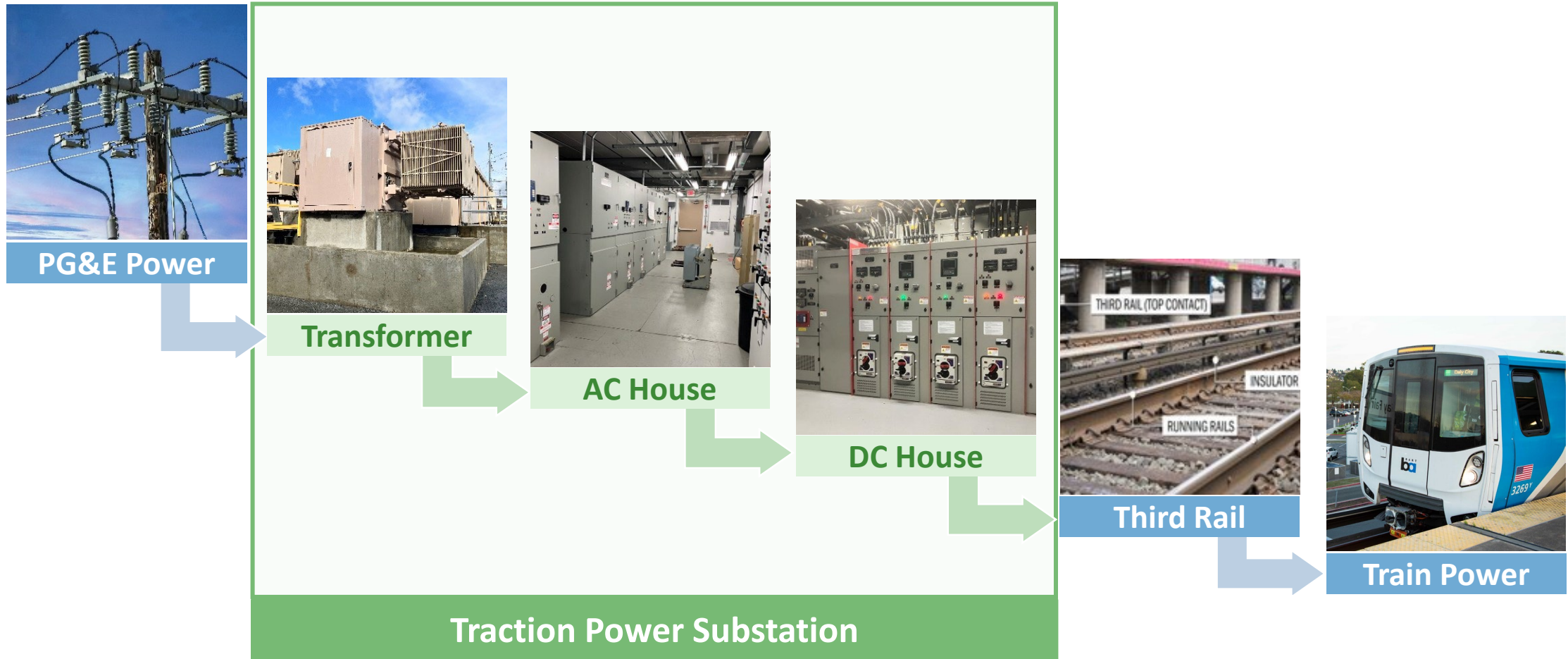
BART Traction Power Facilities

74 Traction Power Substations
50 Gap Breaker Stations

Glossary

- 1) **Switching Station:** Houses high voltage transformers and AC breakers to convert incoming utility power to 34.5kV voltage distribution systems and substations.
- 2) **34.5kV Power Distribution System:** Composed of approximately 225 miles of Right and Left 34.5kV cables which distribute 34.5kV AC power throughout the BART service territory to each of the 74 Traction Power Substations. Older cable types include PIPE (Paper Insulated Power Cable in Rigid Conduit) and PILC (Paper Insulated Lead Covered). New replacement cables are EPR (Ethylene Propylene Rubber) as they provide high insulation strength and durability.
- 3) **Traction Power Substation (TPSS):** An electrical facility which includes transformers, rectifiers, circuit breakers, relays, control and communication devices. TPSS converts energy from the 34.5kV AC system to 785V AC, and finally 1,000V DC to provide power to the 3rd rail in order to run trains.
- 4) **Gap Breaker Station:** Provides the ability to isolate and connect 3rd rail sections together and maximizes system redundancy and flexibility.
- 5) **Transformer:** Used by the TPSS to stepdown the 34.5kV AC to 785V AC, which lowers the voltage.
- 6) **Rectifier:** A device used by the TPSS to convert AC output power from the transformer into 1000V DC power for the trains.
- 7) **Communication, Control and Protective System Devices**
 - **Circuit Breaker:** mechanical switching device that can open and close to make or break current flow. They are relied upon to provide electrical protection and control and can be operated automatically or manually, either locally or remotely.
 - **SCADA (Supervisory Control & Data Acquisition):** A central computer system, along with communication, that allow operators to remotely monitor and control all power and circuit breakers on the rail network.
- 8) **Sectionalizing Breaker Station:** Set of circuit breakers which are utilized to isolate or align power from adjacent sections of 34.5kV distribution systems, allowing power to be quickly re-routed or restored to the healthy parts of the system.
- 9) **Negative Grounding Device:** Connects the running rails (the return path for current) to the earth.

Traction Power System Overview



Traction Power Substations (TPSS)

74 Substations Systemwide



Recent Renovations

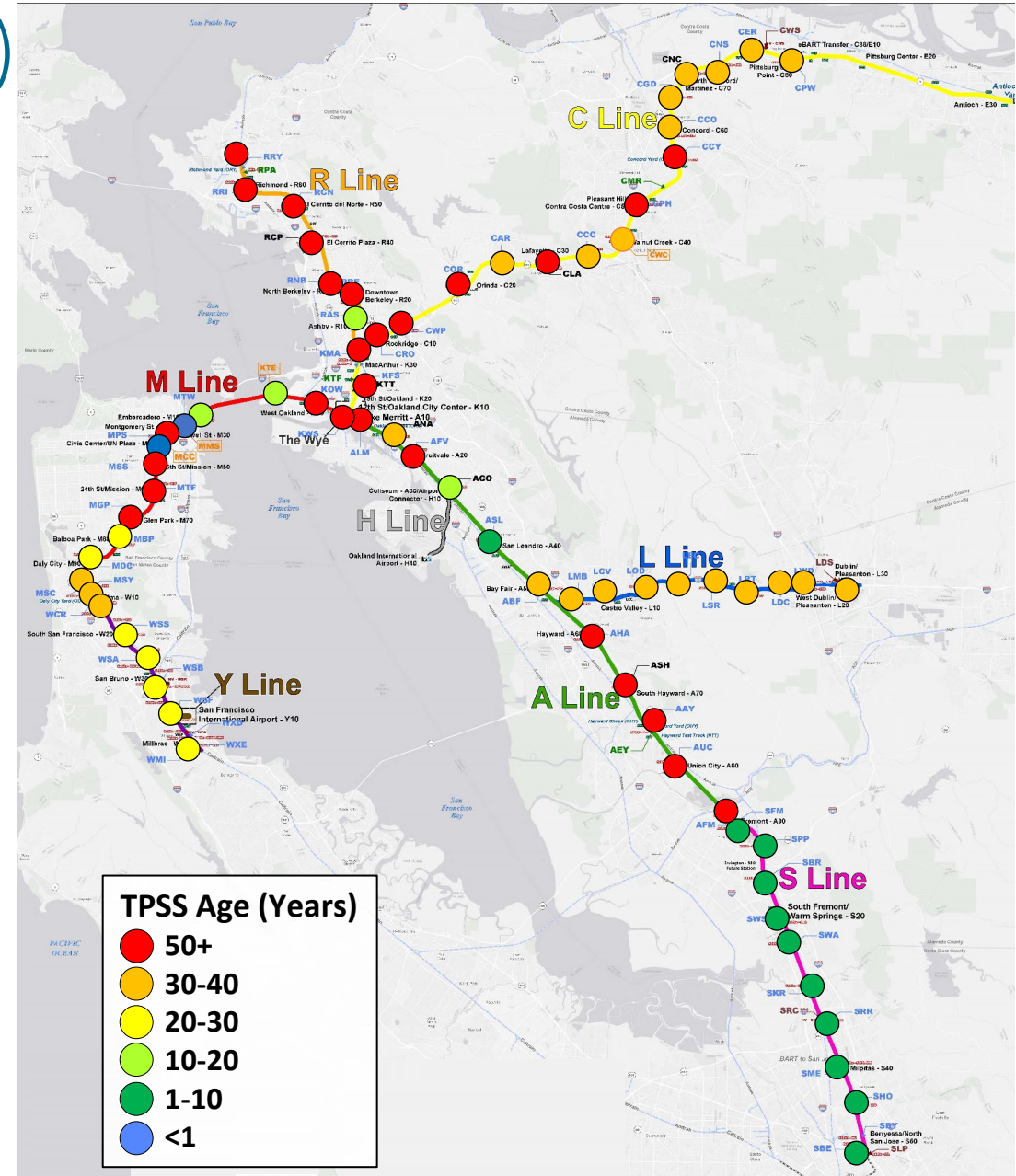
- Higher output capacity
- All new AC and DC Components



- New two **5-MW Units** Substation at Civic Center
- Montgomery, Transbay Tube East & Walnut Creek in Progress
- Approximately 20-25% increase in capacity at each location



- **70%** of TPSS are original with greater than 30 years service life
- **3** Substations are out of service
- **3** Substations are operating at 50% capacity



34.5kV AC Cable

225 Miles of Cables Systemwide



Recent Renovation Highlights

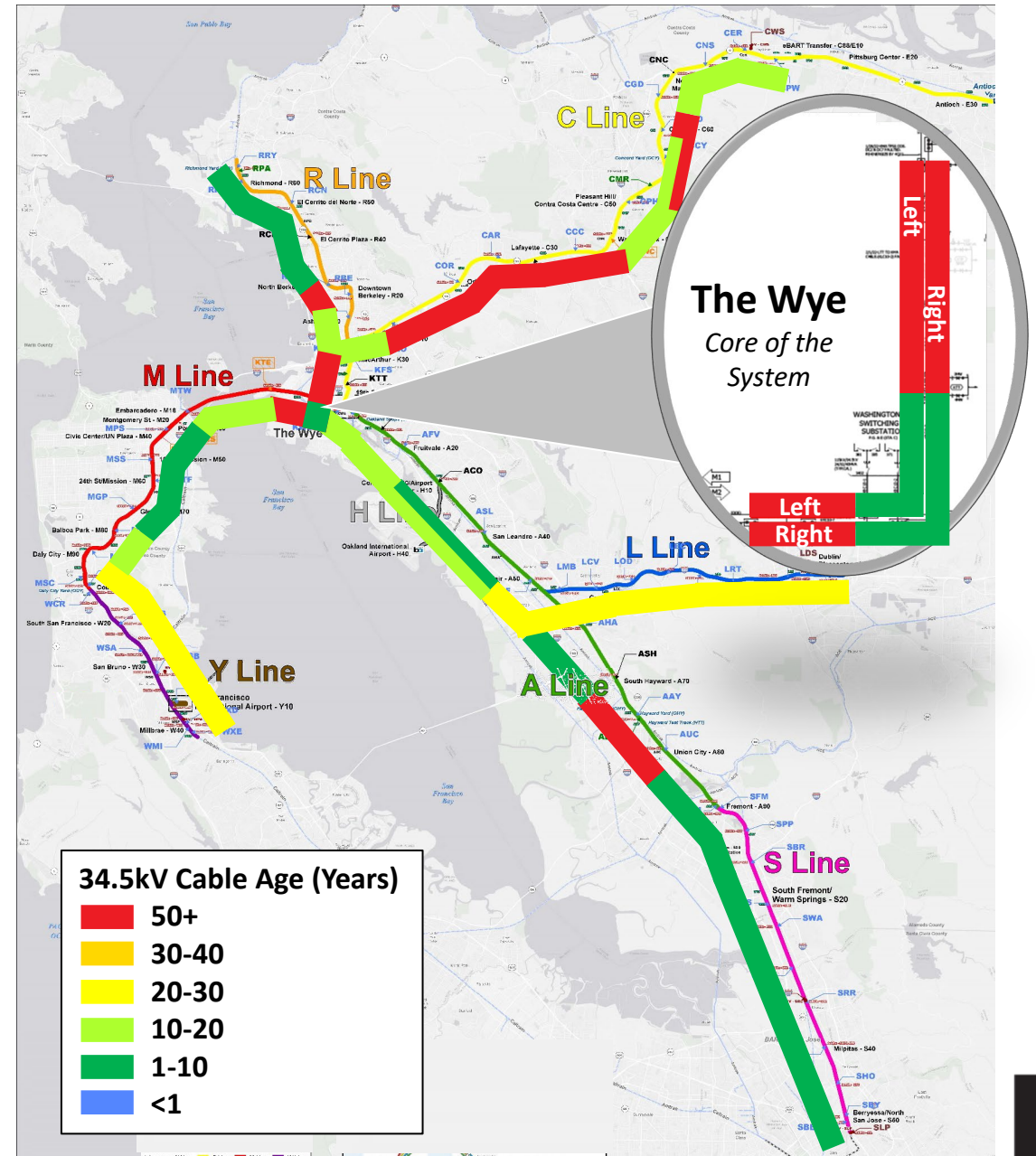
- Older PIPE & PILC Cables being replaced with modern EPR Cables
- More durable and robust cables with higher current carrying capacity (20-25% more)



- M-Line, both Left and Right circuits between Embarcadero to Balboa Park Stations Completed
- A-Line, R-Line & K-Line: In Progress

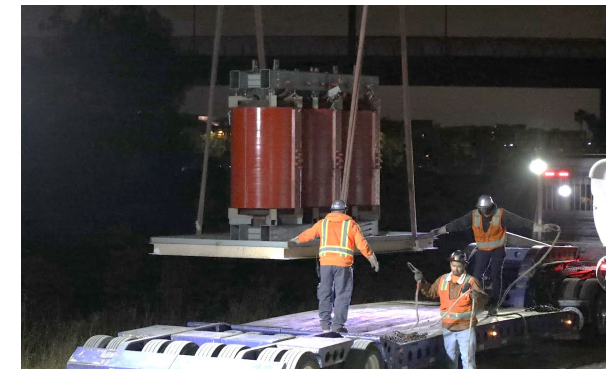


- **50%** of cables are approaching 20 years service
- Majority of Remaining PIPE/PILC Cables Need to be Replaced



Traction Power Facilities

	Out of Service	In Service	Restored (Last 5 Years)
Traction Power Substations			
Substations	6	68	9
DC Breakers	43	707	40
34.5kV Breakers	12	174	11
Transformers	8	140	7
Rectifiers	7	141	8
34.5kV AC Cable			
34.5kV Cables	10 miles	215 miles	40 miles
Wayside Traction Power Assets			
Gap Breaker Stations	2	48	0



Modernizing Our Critical Power System

A Strategic, Data Driven, Risk-Based Roadmap

PROACTIVE RELIABILITY

- Transition to Predictive Maintenance
- Remote monitoring & advanced technology and equipment
- Risk-Based Prioritization of investment based on Probability & Consequence of Failure (service, safety, financial)

STRATEGIC LEVERAGE & MODULARITY

- **Optimize Existing Systems & Processes** (Shutdowns, CNI, Asset Risk Register, Funding)
- **Leverage existing contracts and explore additional delivery methods** (partnerships/procurement with utilities or other agencies)
- **Utilize Modular Design & Pre-Fabrication** (rapid, safe deployment & minimal service impact)

FISCAL PRUDENCE

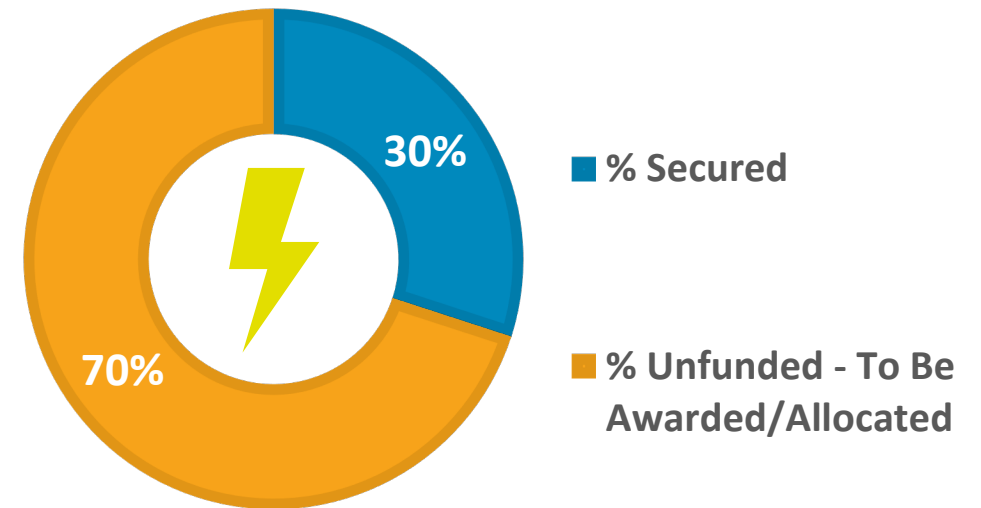
- **Capital-Efficient Phasing** (seeking funding in strategic phases, focusing on the highest-risk priorities)
- **Creative Funding** (pursuit of alternative financing & aligning with State/Federal grants)
- **Maximize Access Windows** (power upgrades with existing track/station modernizations)

Powering Forward

- Preserve and optimize existing infrastructure through targeted state-of-good-repair investments
- Complete 34.5kV AC Cable Replacements
- Traction Power Substations
 - Complete **Design** at Transbay Tube West (SF), Powell & Daly City
 - Complete **Construction** at Transbay Tube East (Oakland), Montgomery & Walnut Creek
 - Add 3 new **Substations** on K, R & C-Lines
- Install Remote Monitoring & Data Recording Devices
- Design and complete additional three to five Traction Power Substation Facilities



10 YEAR TRACTION POWER FORECAST EXPENDITURES (\$1.9B)



Thank You

