



SWITCHED SOURCE

Power Balanced. *Capacity Unlocked.*

Distributech ARPA-E

February 2024

Switched Source Solutions – Two Products, Overlapping IP

Phase-EQ

Distribution Phase Balancing



- Resolves phase imbalance
- Increases circuit capacity
- Reduce OpEx
- Improves energy efficiency
- Improves reliability



HOSTING
CAPACITY



LOAD
BALANCING



POWER FLOW
CONTROL



UPGRADE
DEFERRALS



STORAGE
ENRICHMENT



ENERGY
CONSERVATION



MICROGRID
APPLICATIONS



EMERGENCY
RESPONSE

Tie Controller

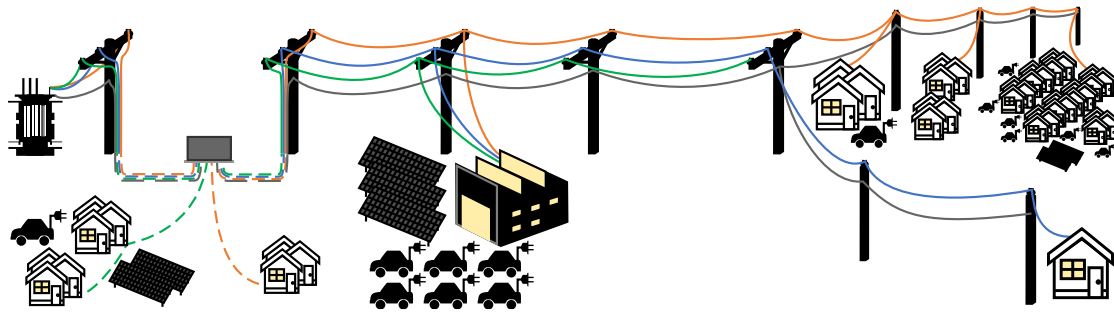
Distribution Power Flow Control



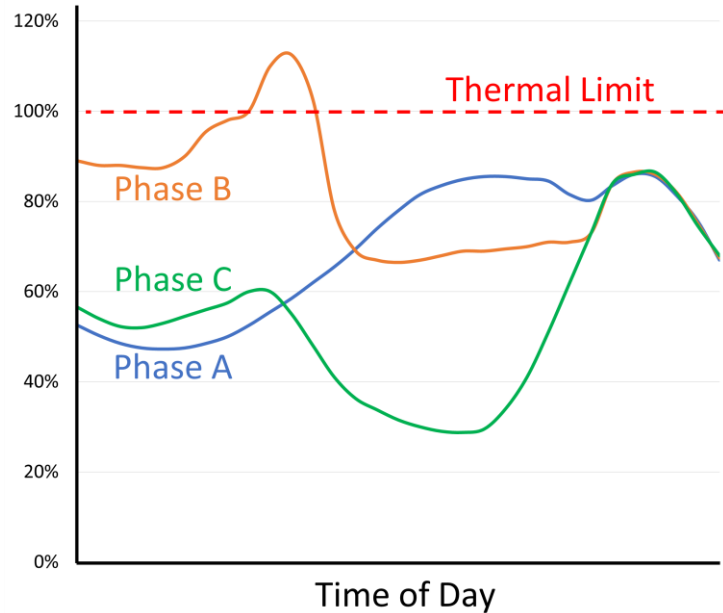
- Defers circuit upgrades
- Increases circuit capacity
- Improves energy efficiency
- Improves resiliency

Phase-EQ Impact on Distribution Systems

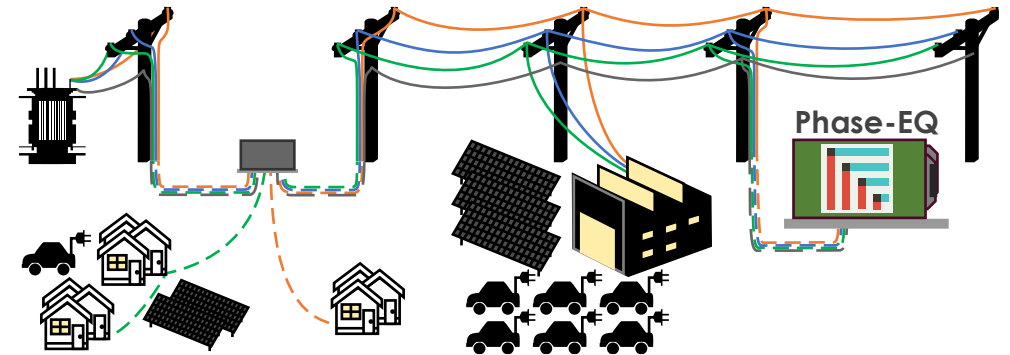
Before Phase-EQ



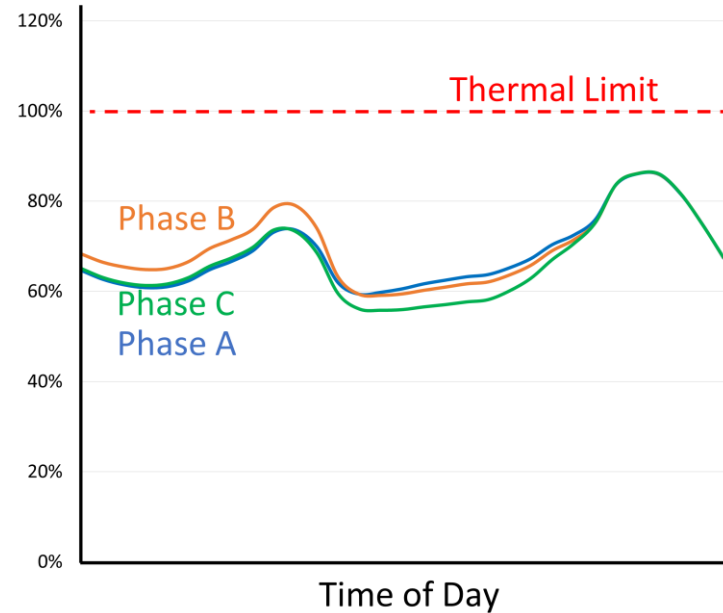
Load (MW)



After Phase-EQ



Load (MW)



What range of capacity benefits should we see?

900kW increased load serving capability on average



Feeder	Voltage Limit				Thermal Limit			
	Without Phase-EQ	With Phase-EQ	Increase (kW / %)		Without Phase-EQ	With Phase-EQ	Increase (kW / %)	
A	8,415	10,634	2,219	26%	8,990	9,691	701	8%
B	7,349	7,951	602	8%	12,689	13,276	587	5%
C	17,858	19,336	1,478	8%	13,047	14,019	972	7%
D	12,687	13,123	436	3%	11,000	11,267	267	2%

Installed Phase-EQs



“...whether we use it for solar or EV integration, curing imbalance violations, system restoration schemes – this can offer us 10-20% more circuit capacity. Get it on the system, we’ll decide later what we use the capacity for.”

- Head of Power Delivery at major IOU

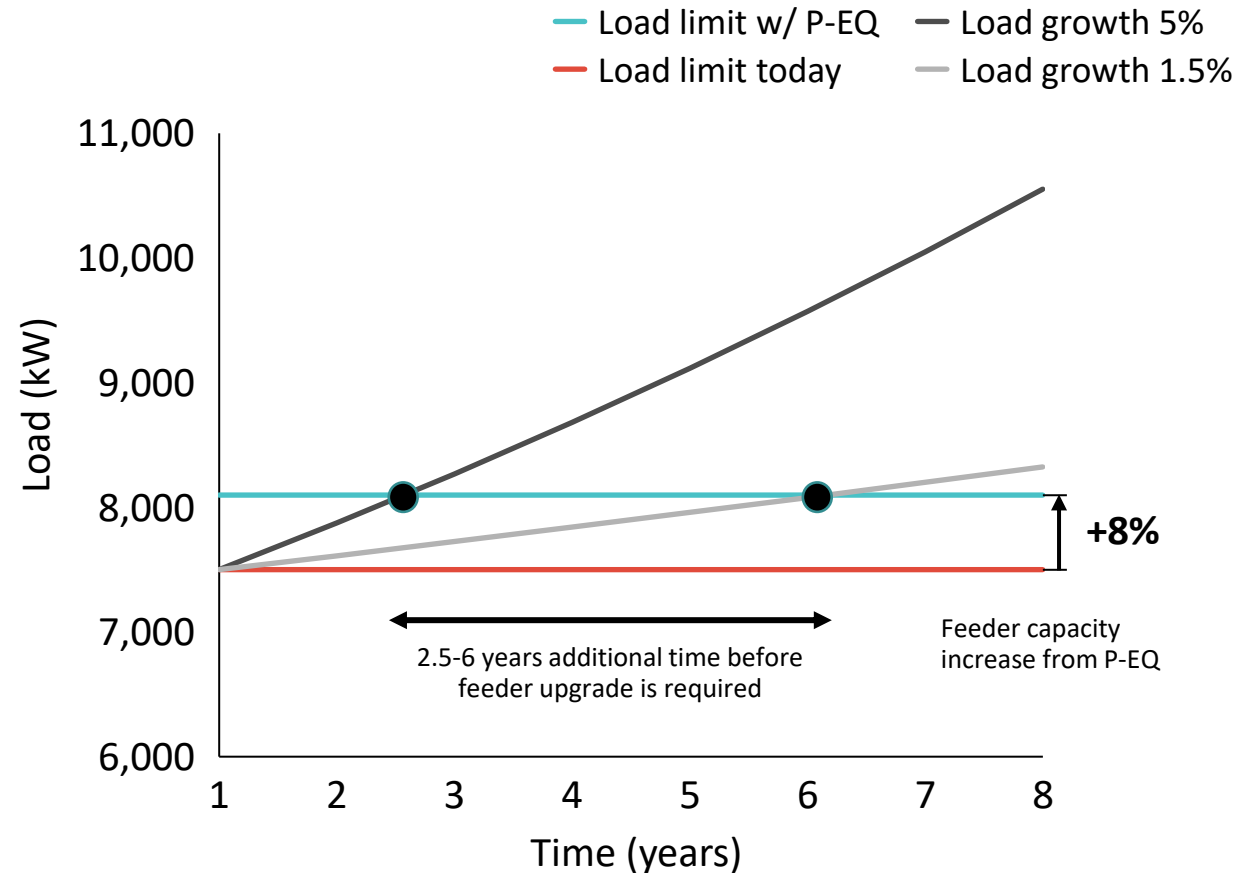
Installed Phase-EQs



50% of demo partners commit to more units within 6 months!!!

How can this help smooth capital upgrades?

By **optimizing load serving capacity**, Phase-EQ buys between **2.5-6 years** before an upgrade is required

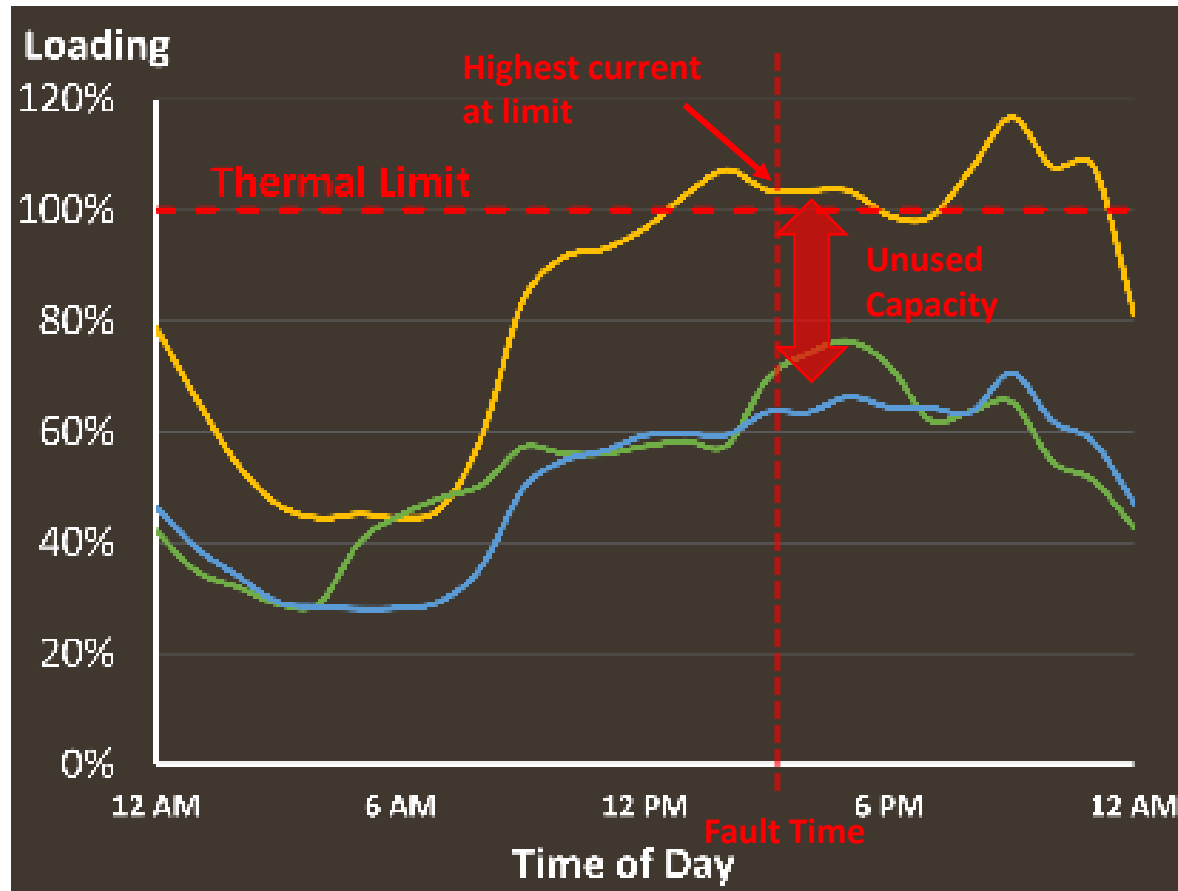


1. Assumes 25% of planned spend on distribution feeder upgrades (USD 200m) can be mitigated via Phase-EQ technology
2. Assumes USD 350k per Phase-EQ upgrade vs. USD 3M per feeder upgrade i.e., 88% savings

Confidential & Proprietary

The Reliability Benefits also justify deployment of Phase-EQ

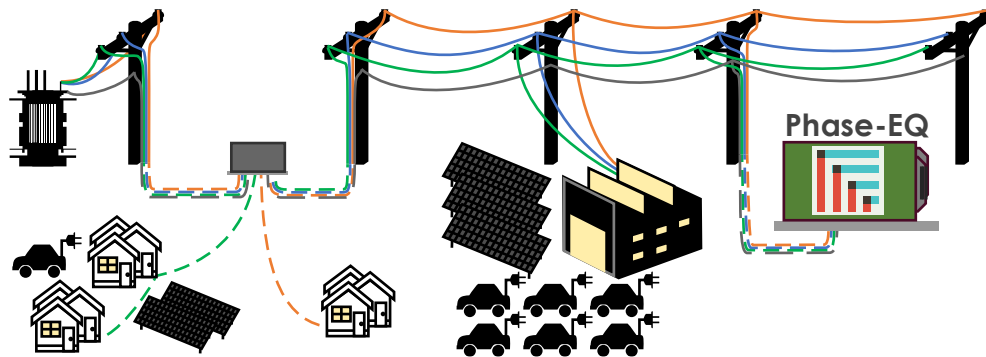
The highest single-phase current is often used to determine how much capacity is available before system switching.
(Per conversations w. control room operators)



Available capacity is untapped when operators need it most!

The Phase-EQ can “Future Proof” the System

After Phase-EQ



Solar Generation*

18,000 additional households can install DERs without triggering interconnection upgrades



EV Charging*

Enables 1,000 additional fast chargers or fleet charging stations without new, dedicated express circuit feeders.

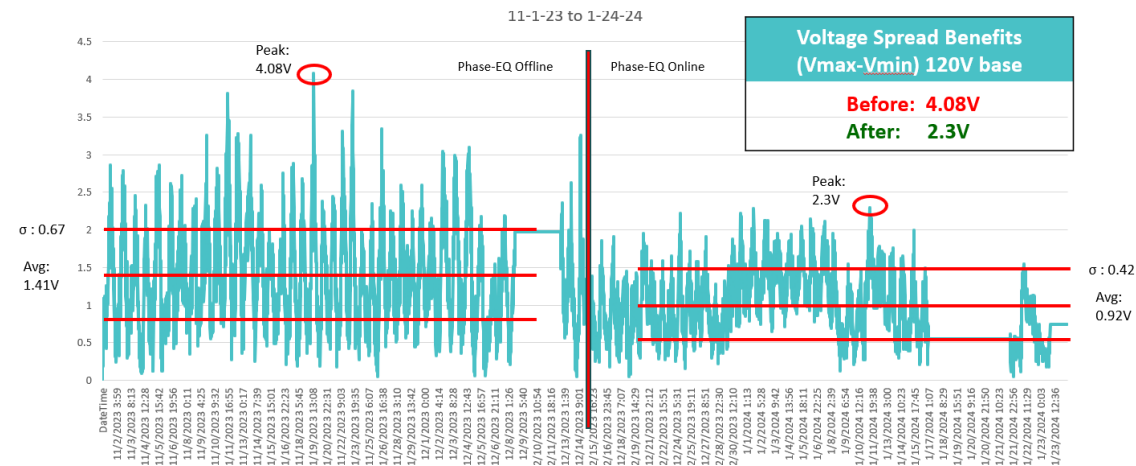


*Assumes 200 Phase-EQ deployments

Voltage and Power Quality Benefits

BEFORE

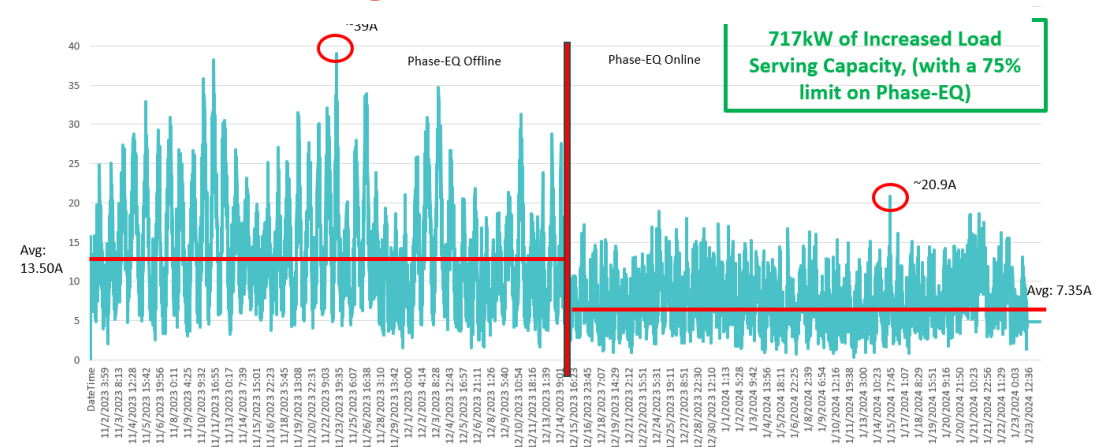
AFTER



Loading and Capacity Benefits

BEFORE

AFTER



Imbalance Criteria tells us where we can have an impact

Surveys typically show **25 – 50% of a distribution utilities circuits are a fit**. These are the circuits outside of planning criteria/rqmts, where we can have the most impact!

Summary Results of System Survey			
Criteria	Cutoff	# Circuits In Violation (Out of 229)	Percentage
Neutral Current	>100A at Feederhead	30	13%
Load Imbalance	> 20% at Feederhead	24	10%
Voltage Imbalance	>3% anywhere on cct.	28	12%
Total Circuits in Violation		55	24%



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