



Office of
ELECTRICITY

Distribution Transformer Shortage Mitigation

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License plates

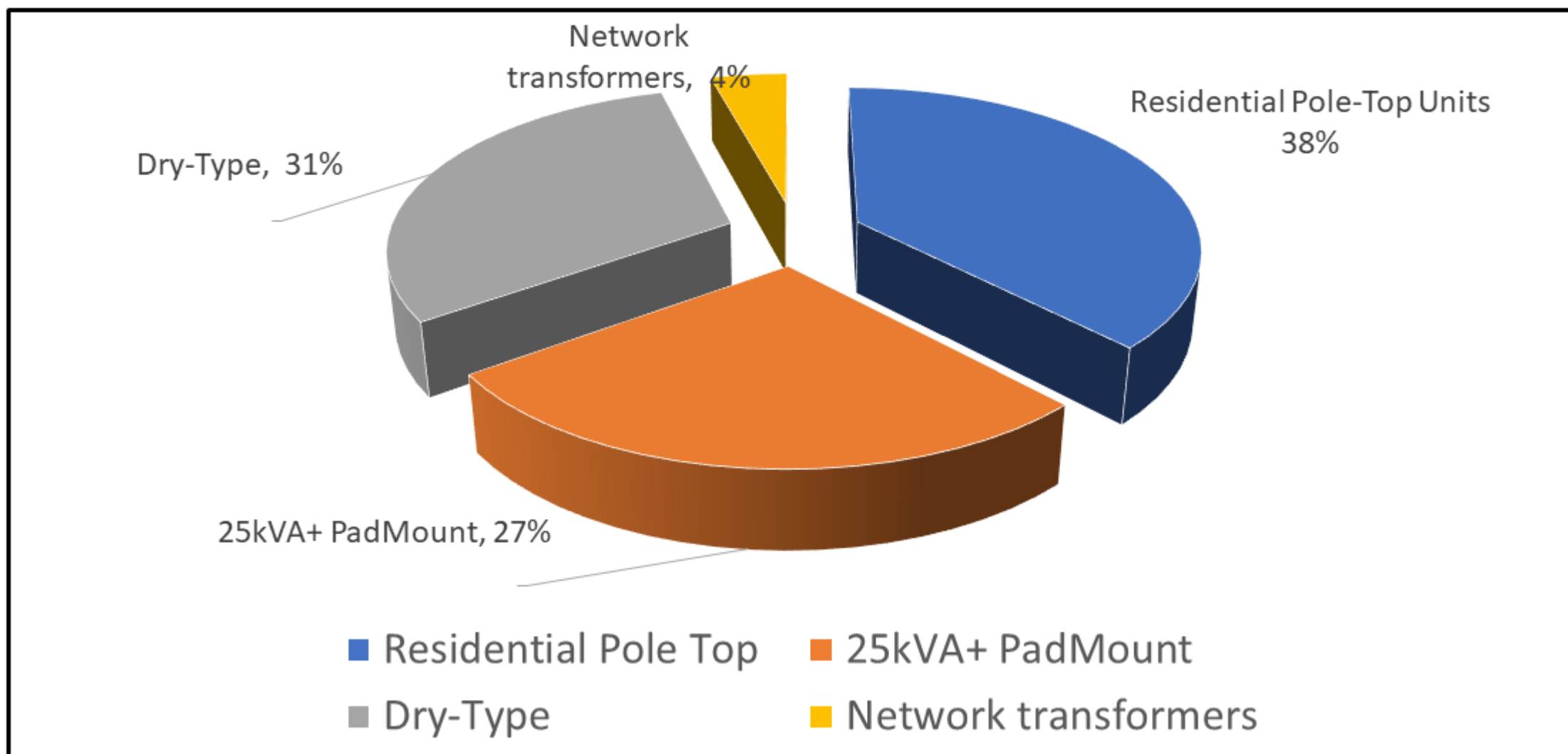
- 292 million registered vehicles in the U.S.
 - Within each state, each license plate number is unique.
- As of 2023, there are 8,331 different license plate types in the U.S.
- But each, are the same size.
- Each has the holes in the same place.
- An example of a common configuration.

Interesting, but made-up facts

- There are at least 79,421 different types of distribution transformers and an estimated 60M-80M DTs in the U.S., and 2,938 utilities – facts.
 - Garbage fact No. 1 – with 2,938 utilities $\Rightarrow \Rightarrow \Rightarrow$ ~20k-27k DTs per utility.
 - ✓ More than likely, utilities will have some standardization of DTs within their system.
 - Garbage fact No. 2 - with 2,938 utilities $\Rightarrow \Rightarrow \Rightarrow$ 27 unique types of DTs per utility.
 - ✓ Using Garbage fact No. 1, it shows there may be hundreds if not thousands of like DTs within their system.
 - ✓ The takeaway is that the opportunity for common configurations already exists.
- Why so many types?
 - Unique utility or customer circumstances.
 - Regional differences
 - DTs manufacturing has changed over time.
 - ✓ Not the capability of developing unique DTs, but the capacity has changed.

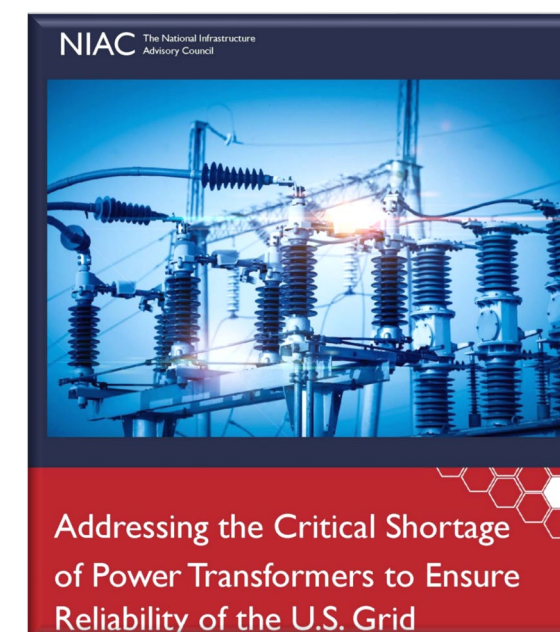


U.S. Market for Distribution Transformers (2023 Estimated Value of Unit Shipments = \$2.7-\$3.0 Billion)



Why a shortage?

- NIAC “Addressing the Critical Shortage of Power Transformers to Ensure Reliability of the U.S. Grid”
 - Post-pandemic economic growth
 - Grid modernization
 - National electrification trend
 - Renewable generation and transmission build-out
- Their recommendations:
 - Expand domestic capacity through federal policies and funding incentives
 - Increase collaboration to achieve greater accuracy in transformer demand forecasting
 - Encourage commitments between transformer suppliers and the sectors driving demand
 - Establish a reserve of transformers
 - Promote collaboration to standardize transformer design and reduce complexity



NREL “Major Drivers of Long-Term Distribution Transformer Demand”

• Forecasting:

- By 2050, 60-80% of service transformers will have been replaced through routine replacement.

- ✓ With 60M-80M DTs; this means 36M-64M nonweather-related replacements.

- Garbage fact No.3 - over 25 years need 1.44M-2.56M *per year*
 - Garbage fact No. 4 - roughly 2-3% of inventory per year.

- Extreme weather replacements:

- ✓ Hurricane Katrina and Rita – 12,600 in Louisiana, 2,300 in Mississippi.

- The takeaway is that while we often look to storms as the biggest hit to inventory.
 - It may be routine replacement that bites us as we go forward.

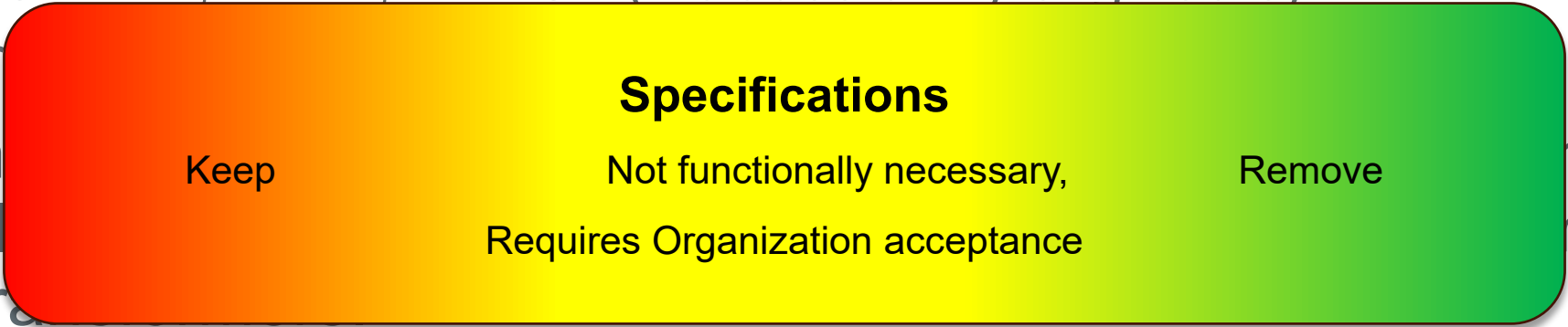
- Changing requirements:

- ✓ There is a growing shift from pole-mount to pad-mount.
 - ✓ This is consistent with the recovery we have seen this year.



Configuration Matrix

- DT working Group:
 - 24 members from EEI, APPA, NRECA (includes utility engineers)
 - 18 members from
- Goal - The Com
transformers, all
on distribution tra
 - Consolidates attributes according to:



Type: overhead, pad mount, network	Size: 0.5 kVA to 2,500 kVA
High Side Voltage: 2.4kV to 34.5kV	Low Side Voltage: 208V to 600V
Phasing: 1Ø to 3Ø	Protection: Conventional vs. CSP
Winding Configuration: Δ-Y, Y-Y, etc.	Cooling System: Oil, Dry
Basic Impulse Level (BIL): tied to voltage class	Bushing Class: # bushings, configuration, etc.

Roughly 15-40% reduction of the 79,421 unique types.

Interchangeability Matrix

- The Interchangeability Matrix - The sourcing of many of the parts and components can be difficult to understand during uncertain events that impact these supply chains. To mitigate these challenges, the Interchangeability matrix identifies alternatives that utilities and manufacturers can evaluate for their particular situation and needs.
 - Provides a listing of critical components that impact the delivery, capacity, or other supply chain impacts for Distribution Transformers.
 - Compiled from input by multiple manufacturers and utilities to provide a broad range of knowledge of standard and suitable alternative suppliers for specific components.
 - All manufacturers or utilities may not have a working relationship or have had the need to engage multiple suppliers in the past, so this consolidated listing is meant to provide a starting point for this discussion
 - This is meant to be a dynamic list to be updated as new vendors, components, or general information becomes available so the input from the broader engineering community is vital to ensure current information.

Asks for the EAC

- Currently looking for a home for the tools
 - Likely a national lab
- OE will be going to venues to inform utilities about the matrixes.
 - APPA and NRECA events.
- Looking for volunteers to implement the matrixes at a most basic/fundamental level.
 - Avoiding the expectation of the 'other 2,937 utilities' trying this out.
 - What are EAC recommendations for getting volunteers?
 - ✓ Are there members here that would be willing to try this out?
- Questions you have for me?

Thank you

