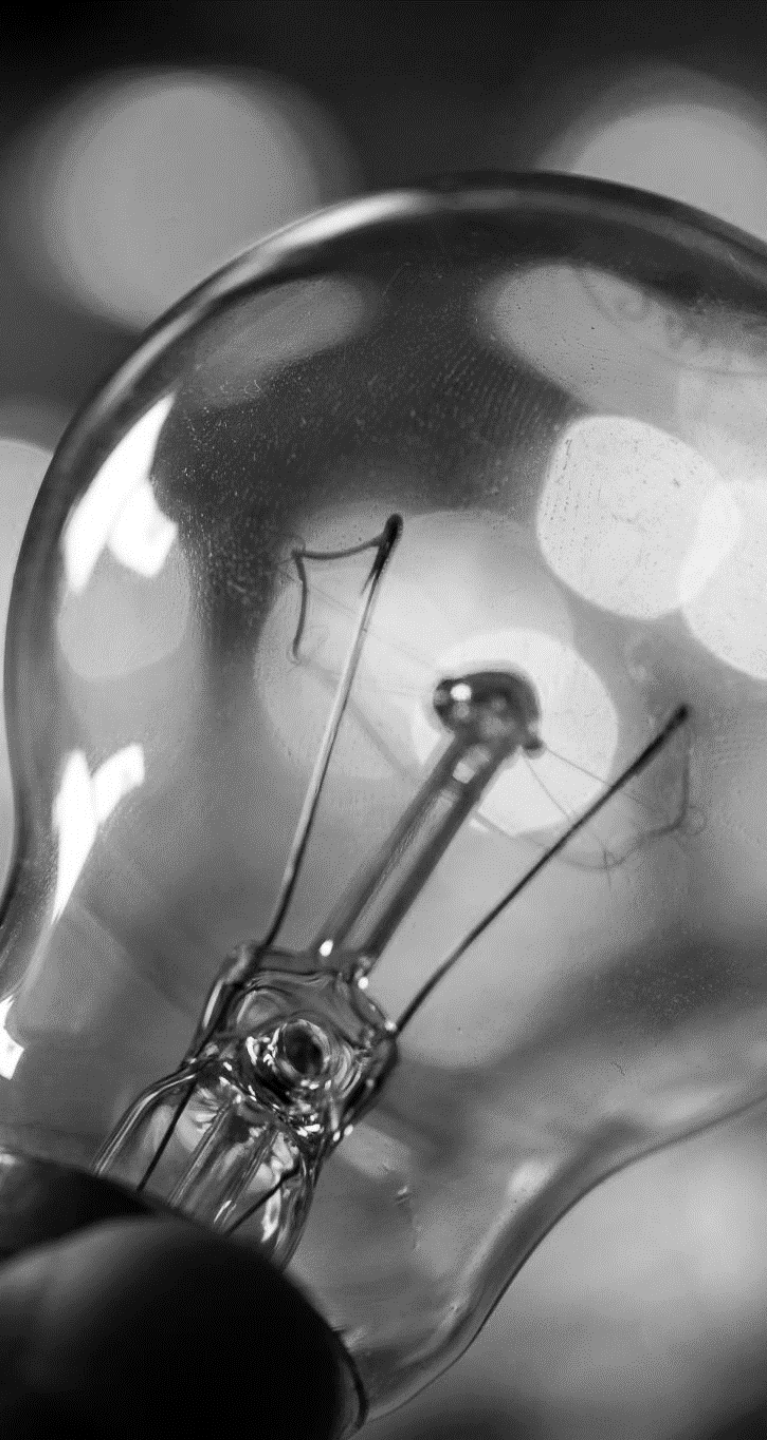
INTEGRATING AMI WITH GIS FOR ELECTRIC DISTRIBUTION TRANSFORMER LOAD MANAGEMENT

Sue Ann Panton, GISP
GIS Analyst
Kissimmee Utility Authority

Pennsylvania State University
Advisor | Pat Kennelly



AGENDA

BACKGROUND

STUDY AREA

OBJECTIVES

METHODOLOGY

RESULTS and DELIVERABLES

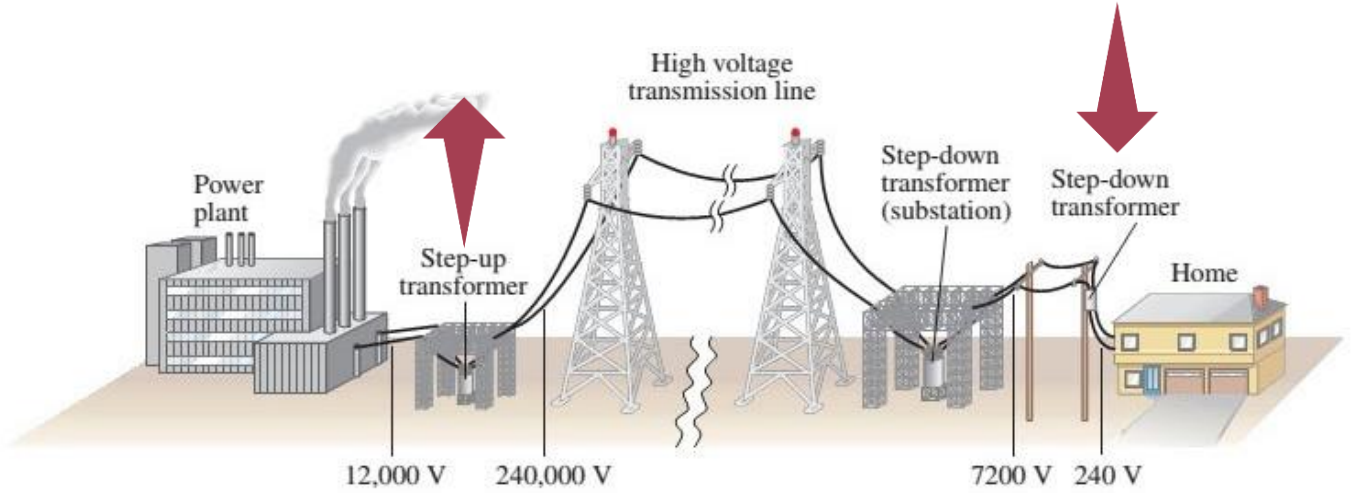
BACKGROUND

STEP-UP TRANSFORMER

Increase voltage and reduce current

STEP-DOWN TRANSFORMER

Reduces voltage before reaching end-user



Source : https://www.servostabilizer.org.in/what-is-step-down-transformer/

BACKGROUND

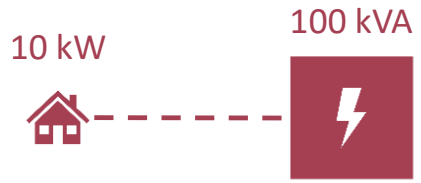
transformer load analysis

Analyze transformer consumption data against transformer capacity

BACKGROUND

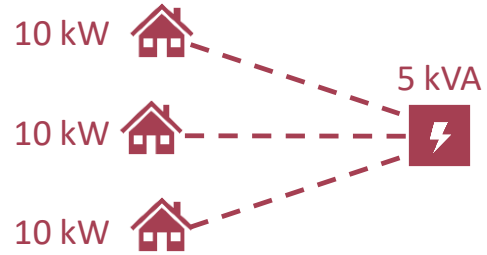
transformer load analysis

OVERSIZED TRANSFORMER



- Excess fuel costs = $$

UNDERSIZED TRANSFORMER



- Transformer life reduced
  - System outages
    - Reliability
- Requires replacement = $$$$

Source: https://articles.utegration.com/case-study-sap-ami-implementation-transforms-a-multi-service-utility-for-the-future

BACKGROUND

electric meters

ANALOG ELECTRICITY METER → SMART METER

Energy consumption is collected manually on a monthly basis by a meter reader.

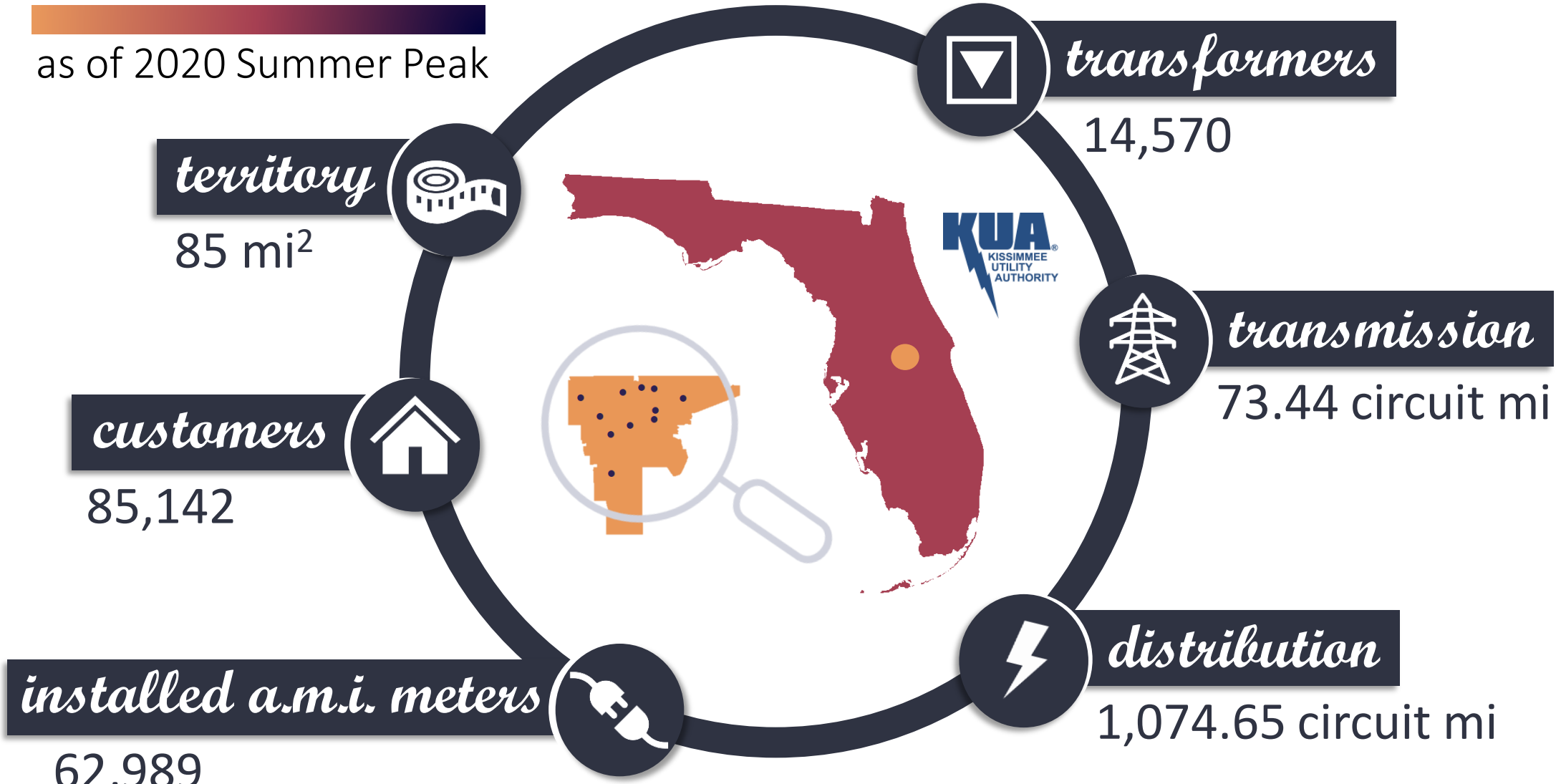
Utility can read, start, and stop services remotely.

Advanced Metering Infrastructure (AMI)

Smart meters record and transmit energy consumption to the utility throughout the day via a secure wireless network

STUDY AREA

as of 2020 Summer Peak



OBJECTIVES

comparative analysis

Determine if distribution engineering design standards used are still valid based on actual customer usage within areas of single-family residence.

spatial analysis

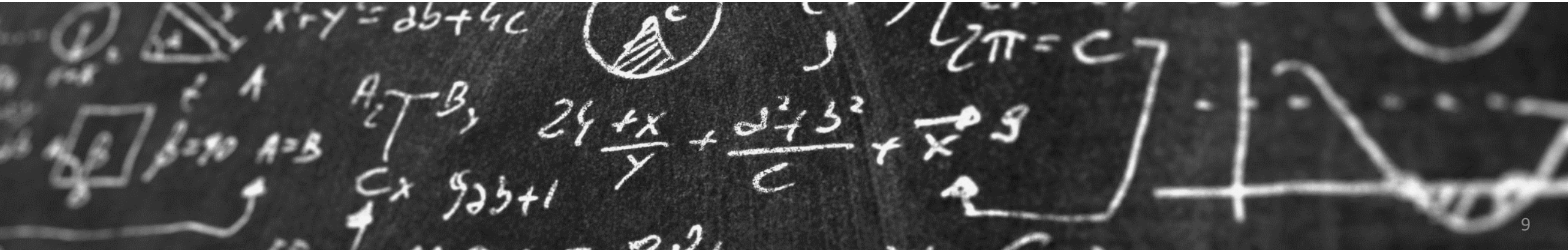
Improve criteria used when placing an appropriately sized transformer.

custom application

Aid our engineers in identifying areas which may require electric reconstruction to avoid future power-related issues.

METHODOLOGY

1. connect AMI peak data to consumer feature class in GIS
2. populate summarized AMI data within transformer feature class
3. identify undersized transformers
4. create a display of identified transformers
5. engineers to determine if current design standards require updating
6. spatial and statistical analysis to find potential patterns of under sizing

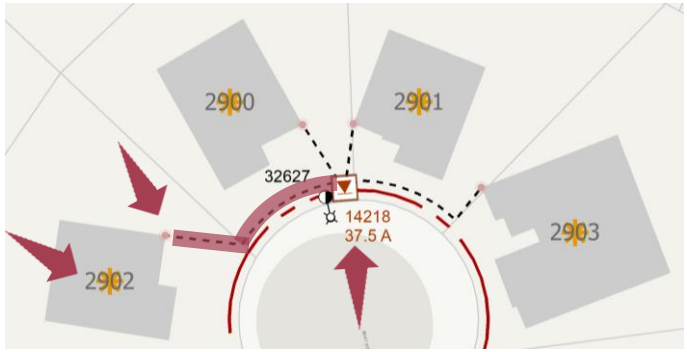


METHODOLOGY

1 connect AMI peak data to consumer feature class in GIS

```
H|4324|1.0.0
D|0149925402|123462760A|0.8.15.6.1.1.8.0.0.0.0.0.0.0.3.38.0|3.0.0|20200921062100|127.99|
D|0149925402|123462760A|0.0.0.1.1.1.12.0.0.0.0.0.0.0.3.72.0|3.0.0|20200924000000|249708|
D|0149925402|123462760A|0.0.0.1.19.1.12.0.0.0.0.0.0.0.3.72.0|3.0.0|20200924000000|162163|
D|0149925403|123461310A|0.8.15.6.1.1.8.0.0.0.0.0.0.0.3.38.0|3.0.0|20200919153700|35.77|
```

Join MDMS extract data to Consumer



Populate data from joined Consumer into Service Points

Copy Linked Record

Updates an attribute of a feature with a value from a related table.

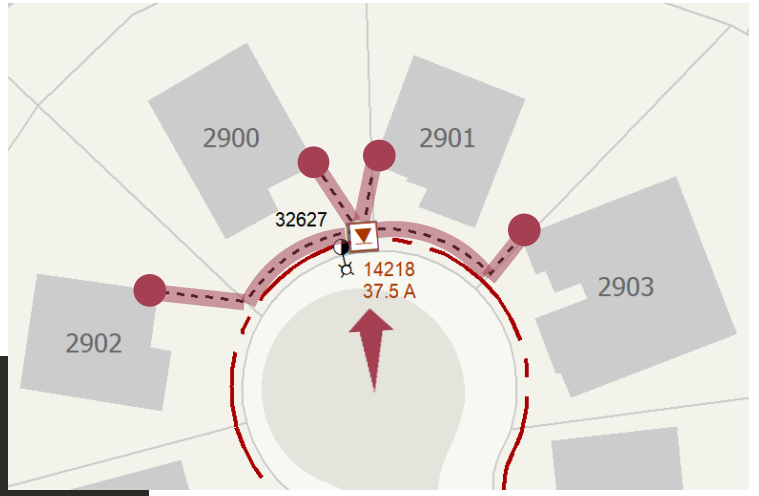
To configure this method, populate the following in the DynamicValue table:

Table Name	Field Name	Value Method	Value Info
Feature class to which value will be copied to from the source or related table	Field to store the copied value	COPY_LINKED_RECORD	Source|Source Field|Primary Key|Foreign Key

Attribute Assistant's Copy Linked Record function

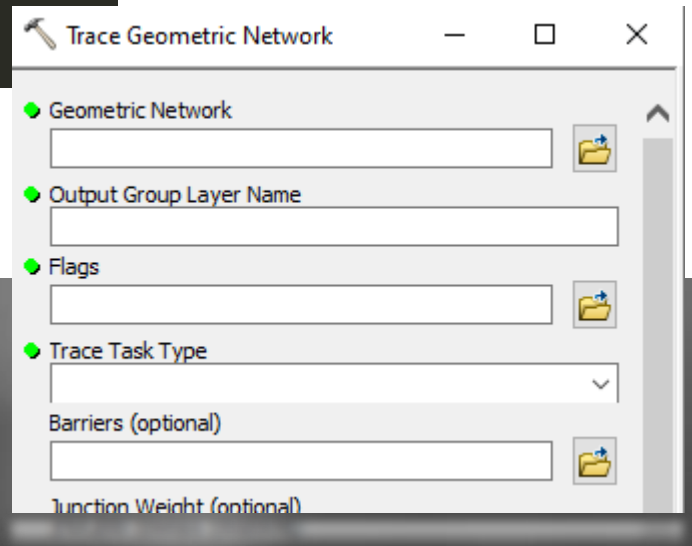
METHODOLOGY

2 populate summarized AMI data within transformer feature class



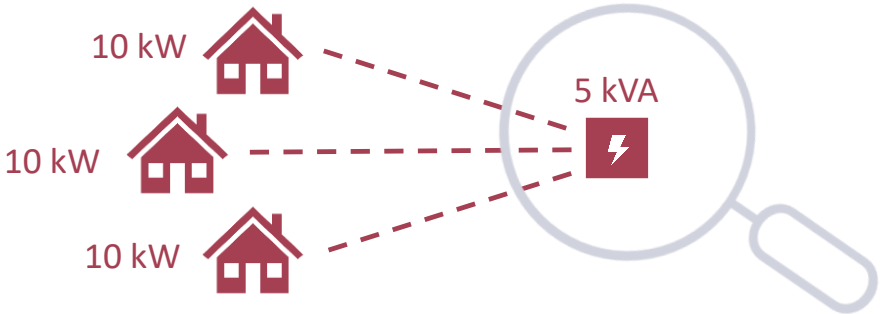

```
["List", "of", "transformers"]

Loop through list, for each transformer:
    Make Feature Layer tool of single transformer to be used as Flag
    Trace Geometric Network tool (result:  all service points downstream are selected):
        Flags - as created above | Trace Task Type - TRACE_DOWNSTREAM | Disable unneeded feature classes from trace
    Copy Features tool to create feature class of all downstream service points
    Summary Statistics tool to sum all peak data
    Insert Cursor to populate external table with peak data sum
```

Pseudocode to populate peak data within transformer feature class via an external table

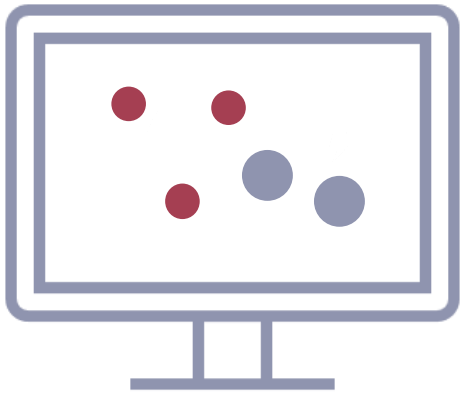


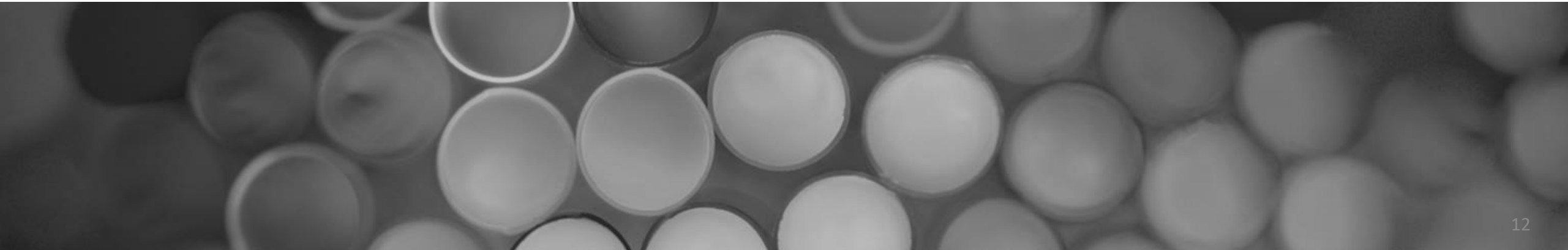
METHODOLOGY

3 identify undersized transformers



4 create a web application display of identified transformers





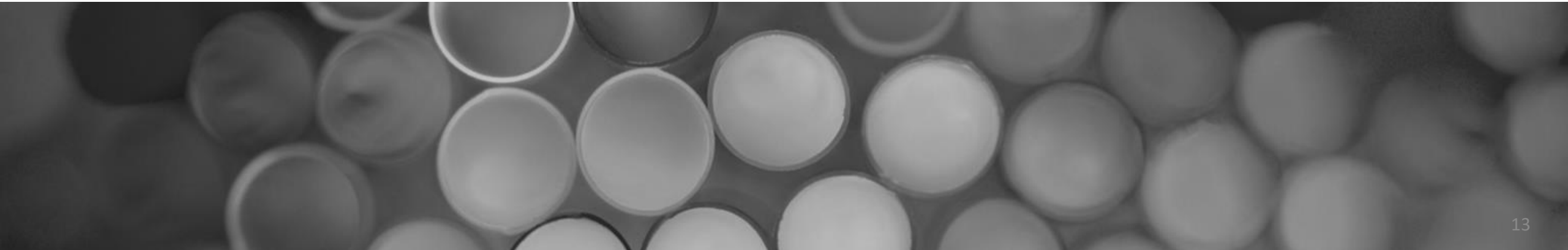
METHODOLOGY

5 engineers to determine if current design standards require updating

6 spatial and statistical analysis to find potential patterns of under sizing

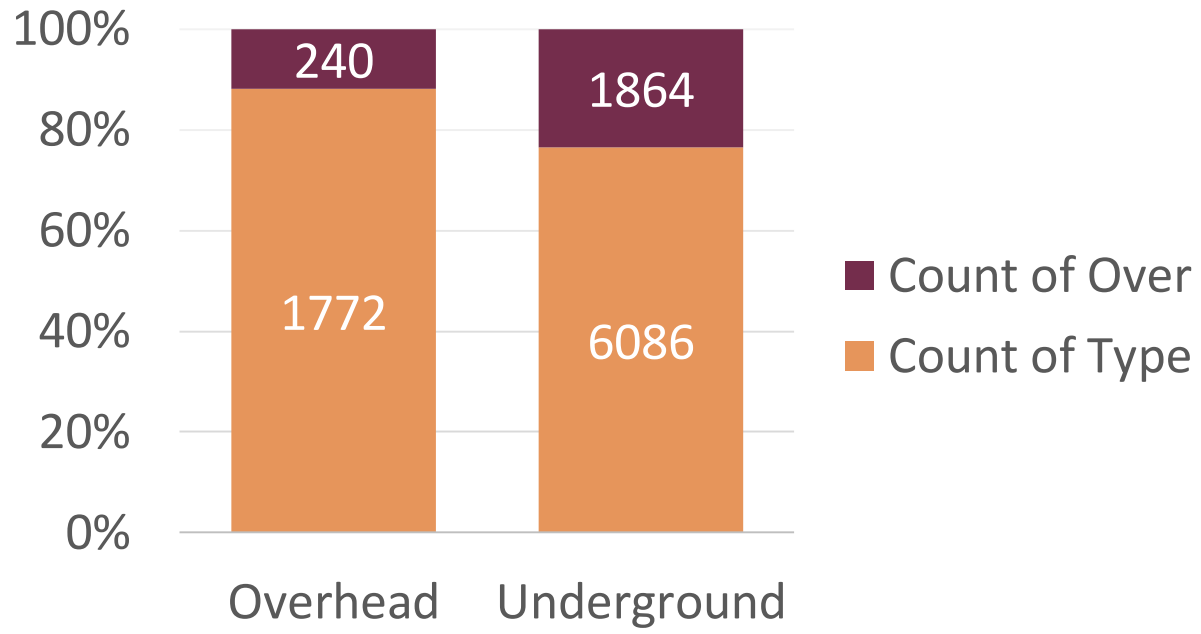
UNDER SIZED TRANSFORMERS

151% - Over	**Immediate Action**
126% - 150%	**Evaluate**
101% - 125%	
80% - 100 %	**Monitor**

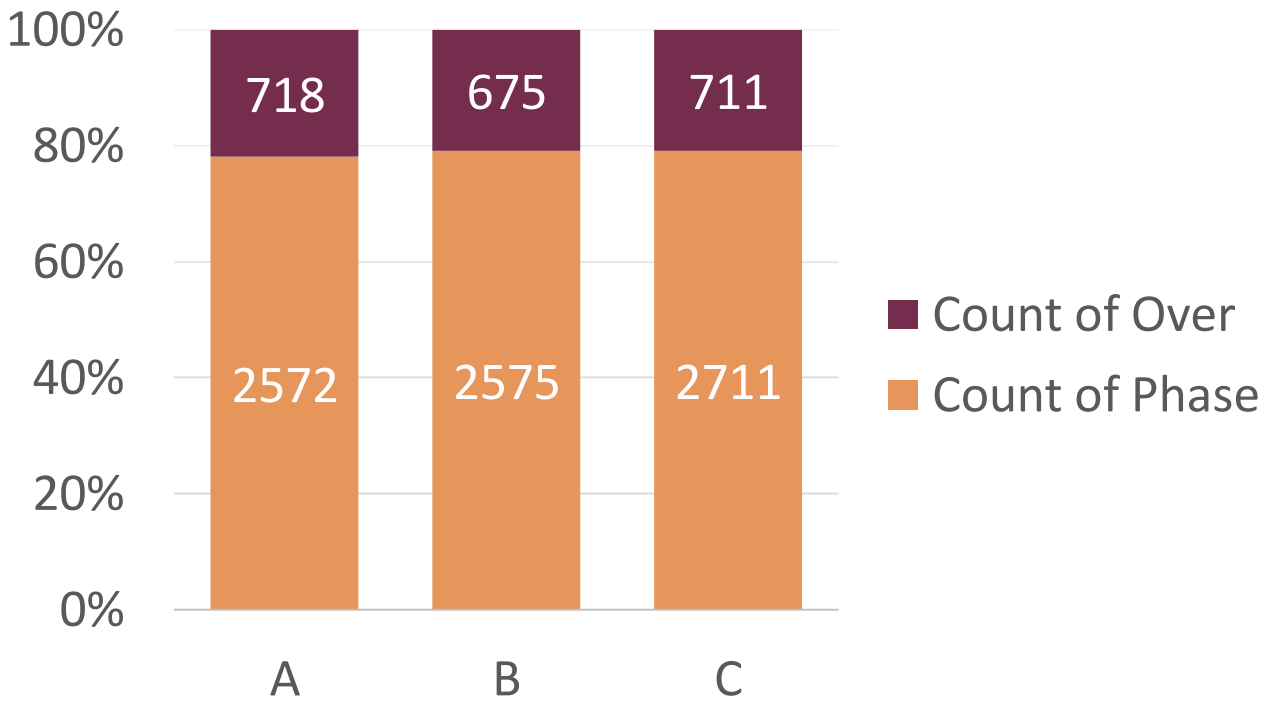


RESULTS and DELIVERABLES

Transformer Type



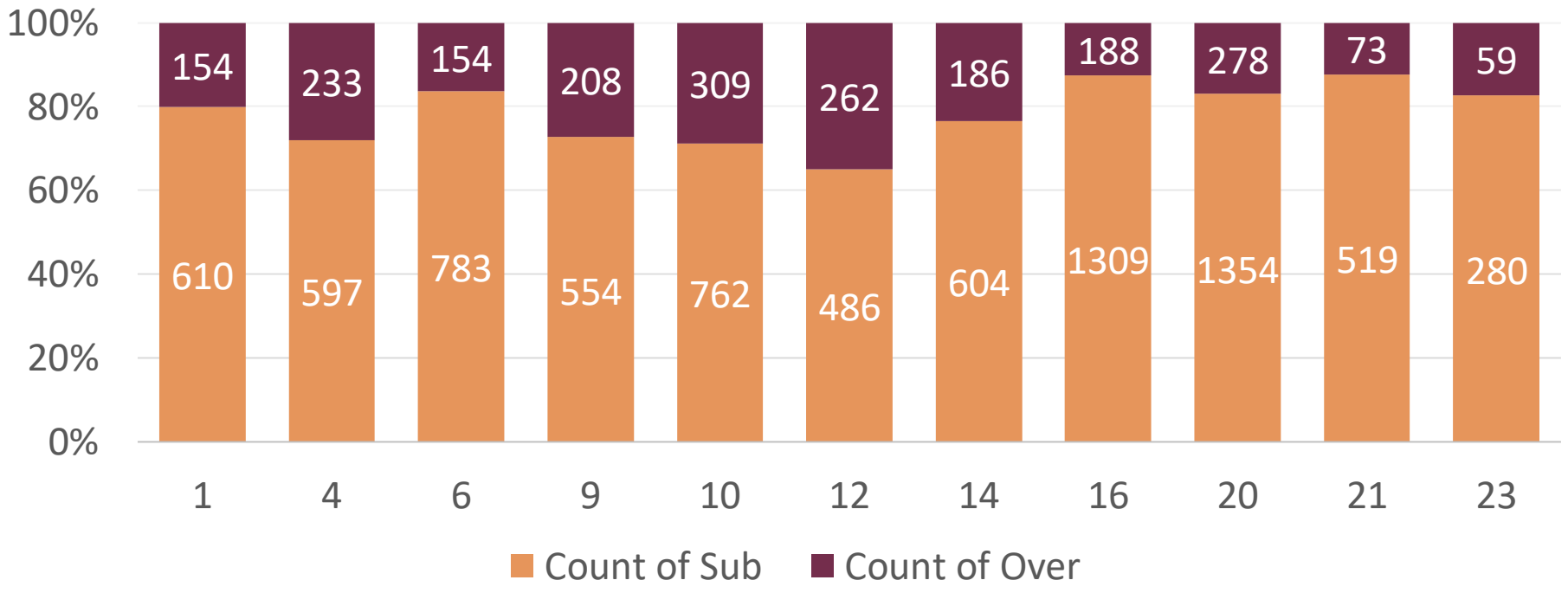
RESULTS and DELIVERABLES



Transformer Type

Phase

RESULTS and DELIVERABLES

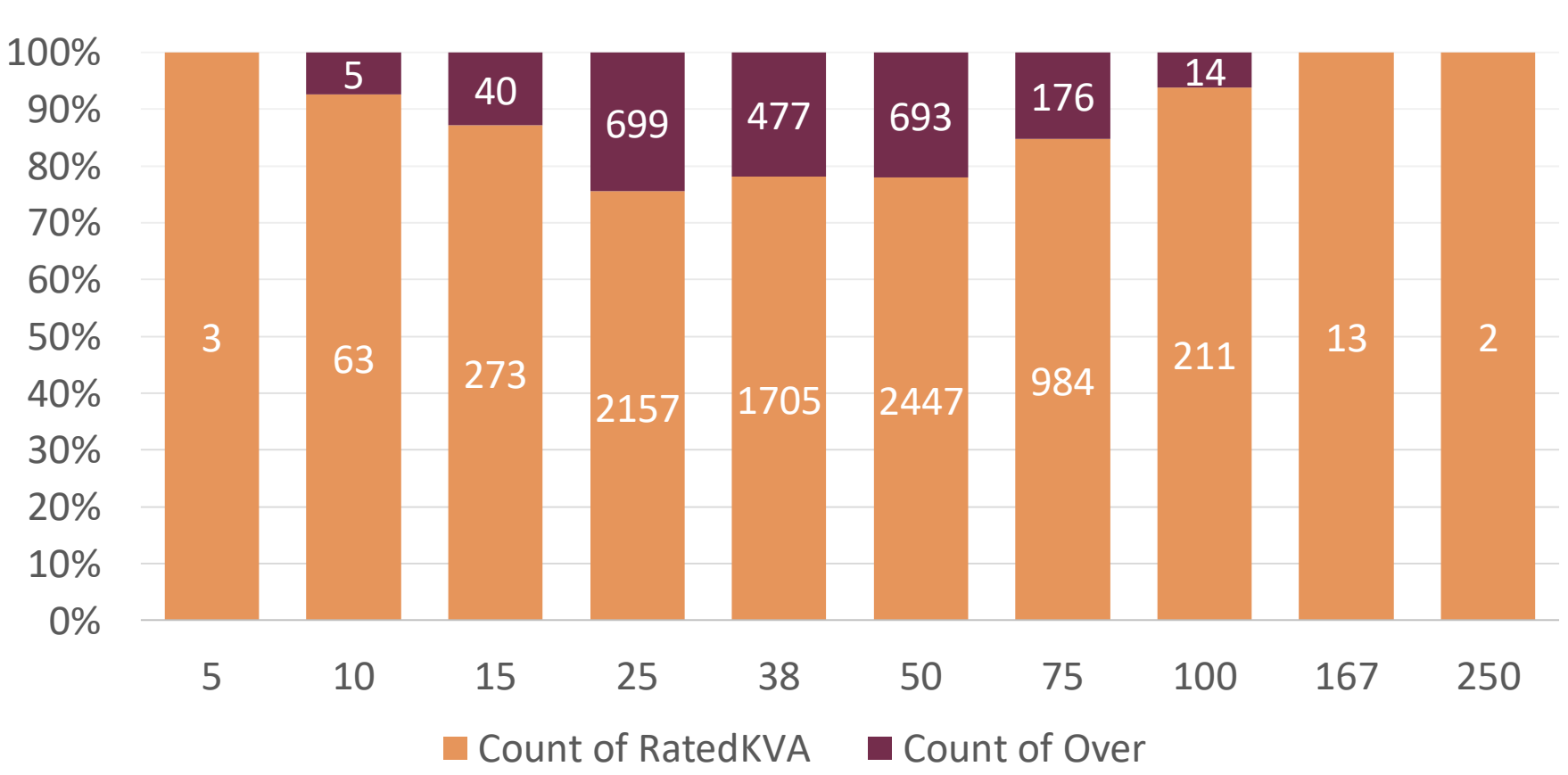


Transformer Type

Phase

Substation

RESULTS and DELIVERABLES



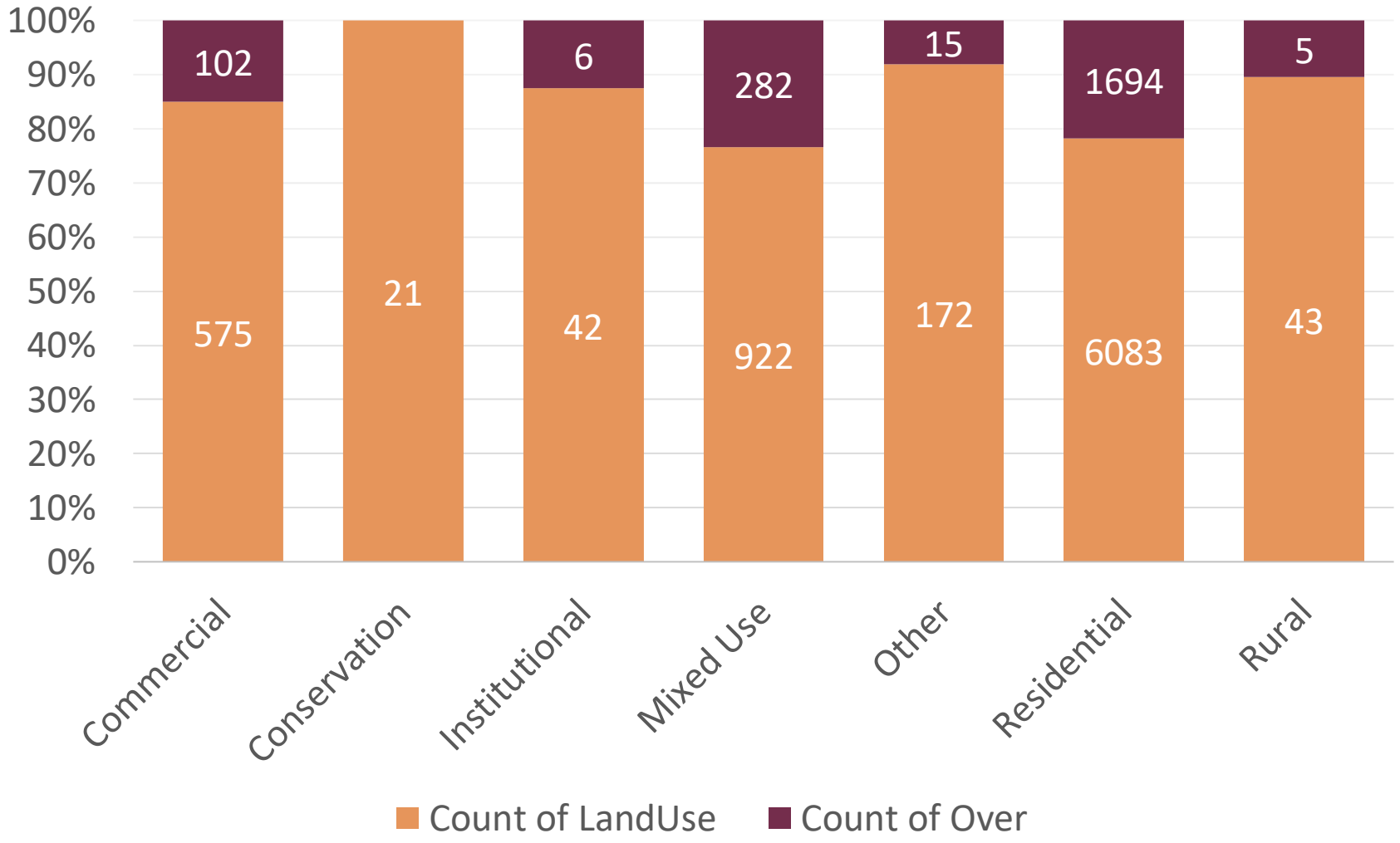
Transformer Type

Phase

Substation

Rated kVA

RESULTS and DELIVERABLES



Transformer Type

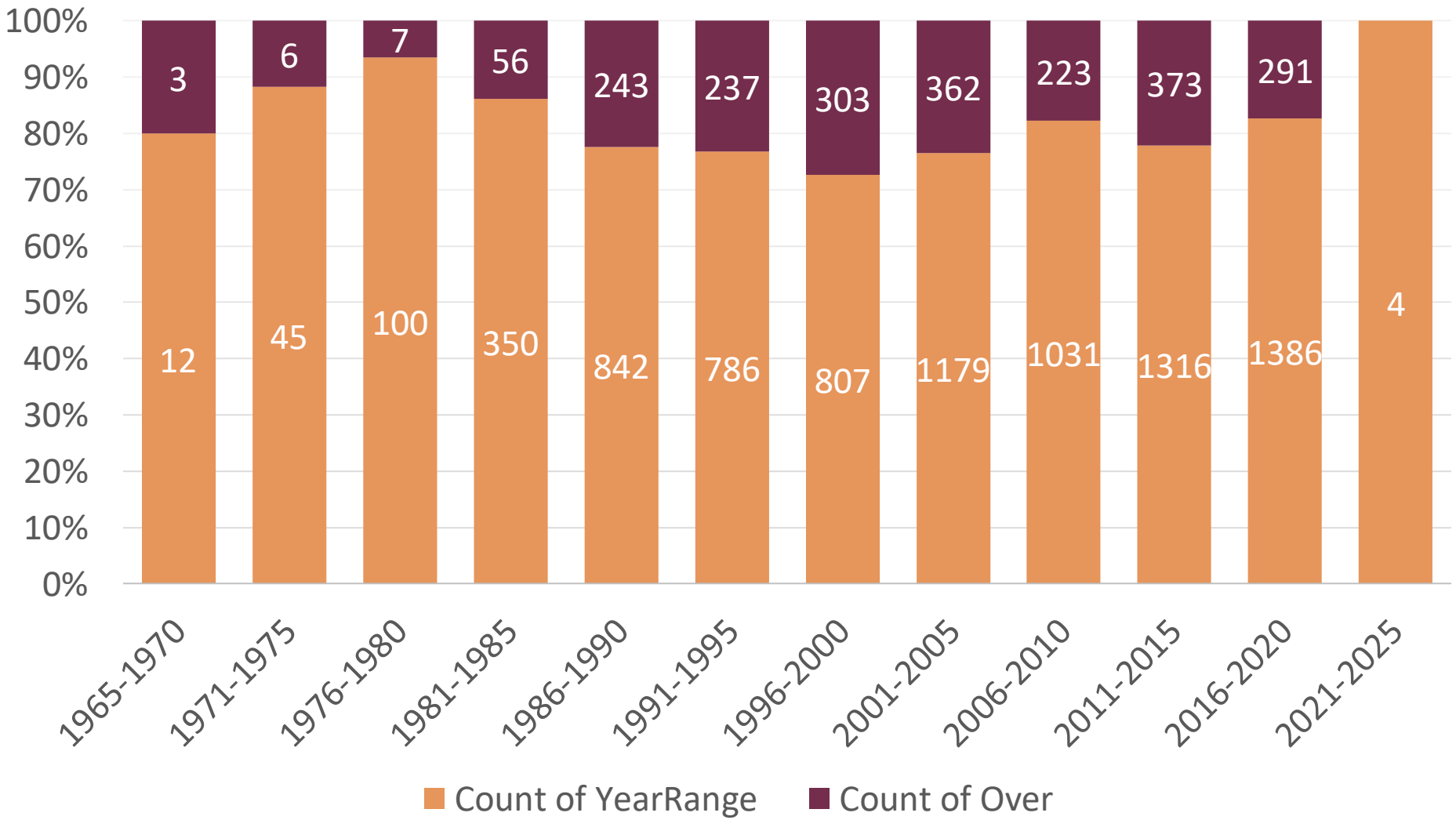
Phase

Substation

Rated kVA

Land Use

RESULTS and DELIVERABLES



Transformer Type

Phase

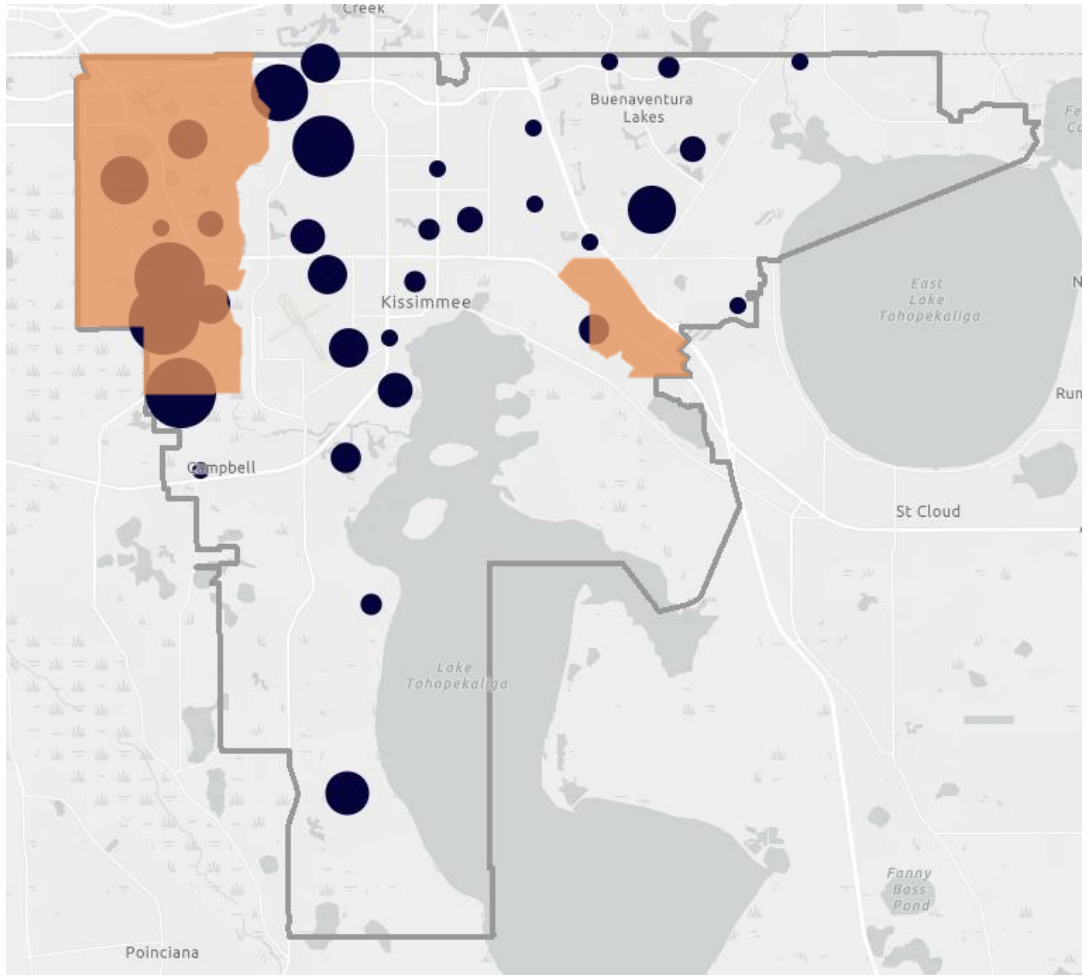
Substation

Rated kVA

Land Use

Year Installed

PRELIMINARY FINDINGS

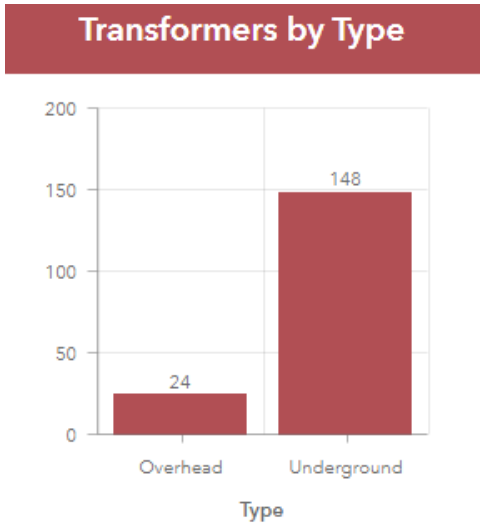


151% - Over

Immediate Action

Short Term Rentals

PRELIMINARY FINDINGS



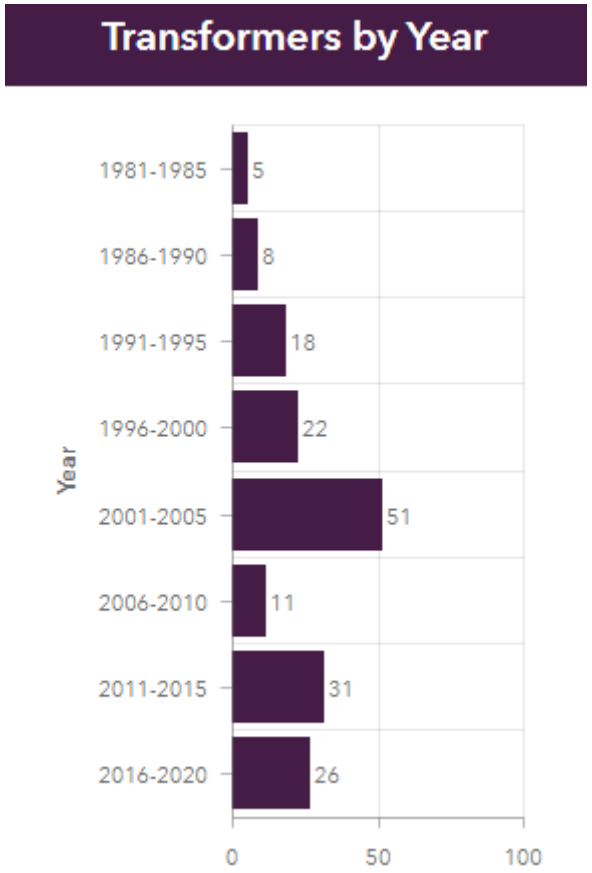
151% - Over

Immediate Action

Short Term Rentals

Underground Transformers

PRELIMINARY FINDINGS



151% - Over

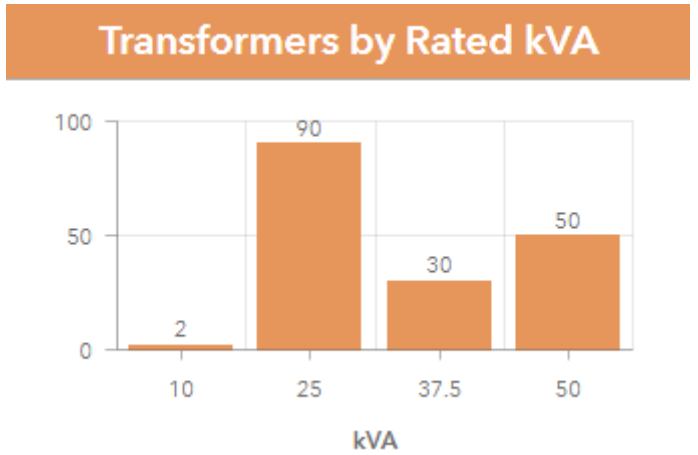
Immediate Action

Short Term Rentals

Underground Transformers

Year of Installation

PRELIMINARY FINDINGS



151% - Over

Immediate Action

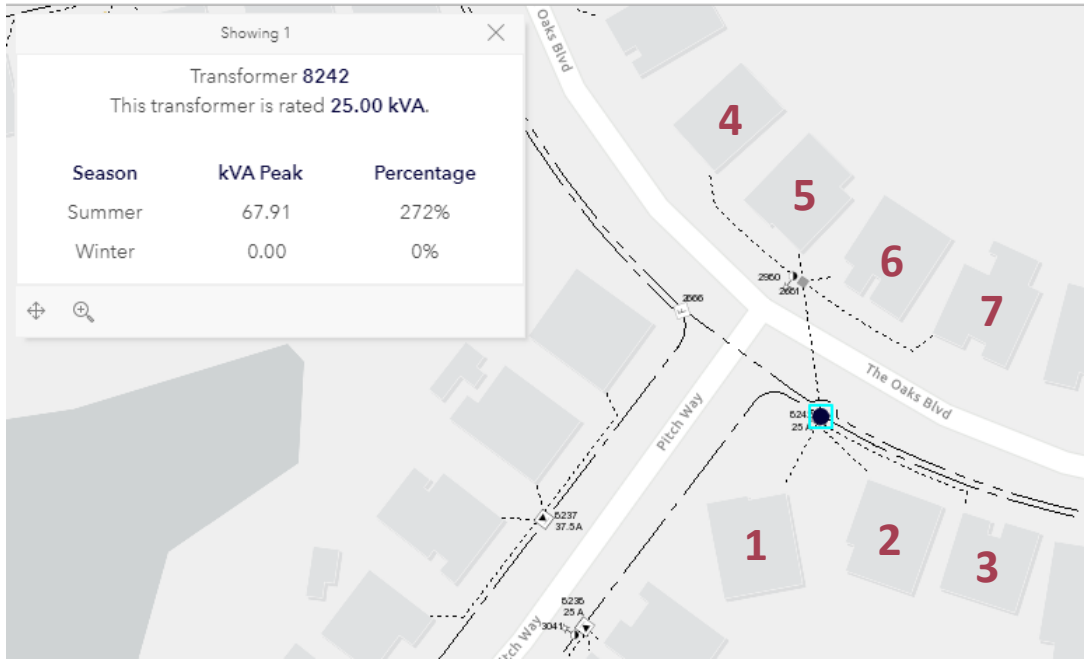
Short Term Rentals

Underground Transformers

Year of Installation

25kVA Transformers

PRELIMINARY FINDINGS



151% - Over

Immediate Action

Short Term Rentals

Underground Transformers

Year of Installation

25kVA Transformers

CHALLENGES and OPPORTUNITIES

LARGE AMOUNTS OF DATA

Multi processing

COPY LINKED RECORD

Query, calculate, populate

DYNAMIC DISPLAY

Arcade

QUESTIONS

SUE ANN PANTON

spanton@kua.com

THANK YOU