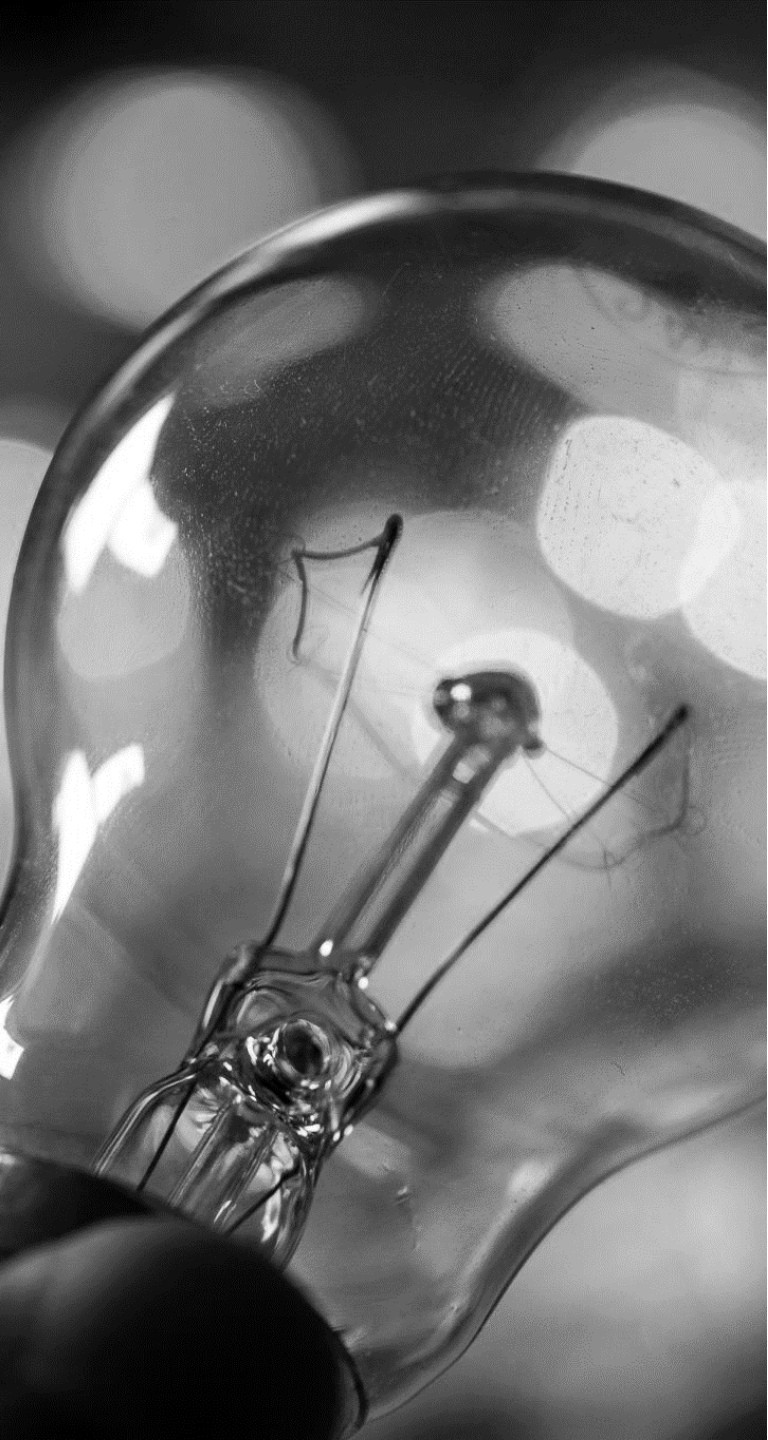


INTEGRATING AMI WITH GIS FOR ELECTRIC DISTRIBUTION TRANSFORMER LOAD MANAGEMENT

Sue Ann Panton, GISP
GIS Analyst
Kissimmee Utility Authority

Pennsylvania State University
Advisor | Pat Kennelly



AGENDA

BACKGROUND

STUDY AREA

OBJECTIVES

METHODOLOGY

RESULTS and DELIVERABLES





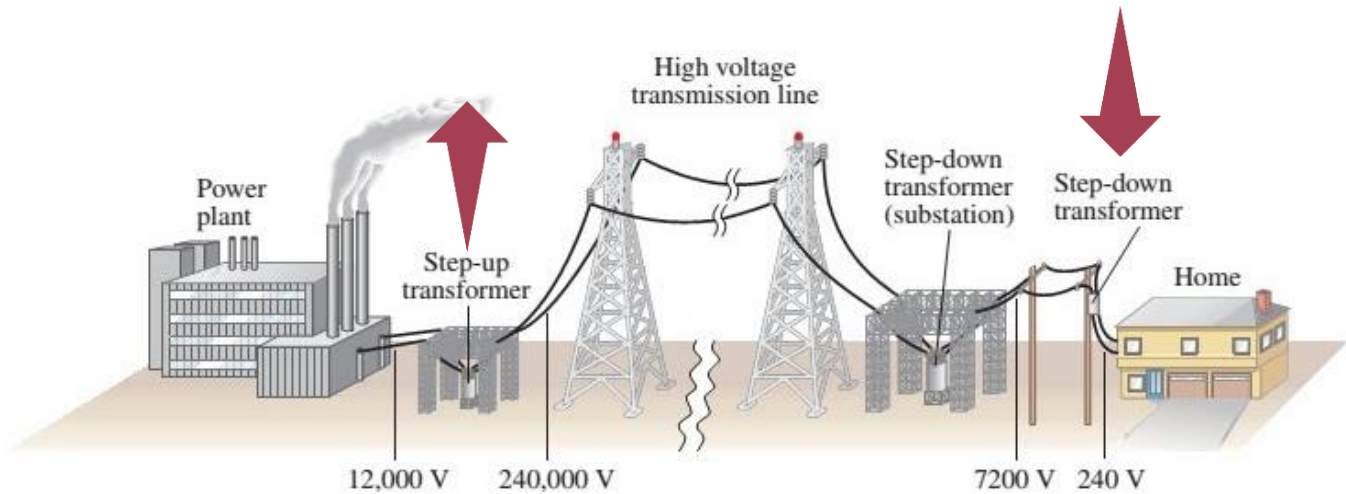
BACKGROUND

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

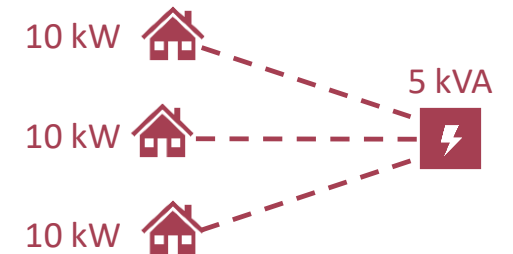
transformer load analysis

OVERSIZED TRANSFORMER



- Excess fuel costs = \$\$

UNDERSIZED TRANSFORMER



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



BACKGROUND

electric meters

ANALOG ELECTRICITY METER

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



SMART METER

Utility can read, start, and stop services remotely.

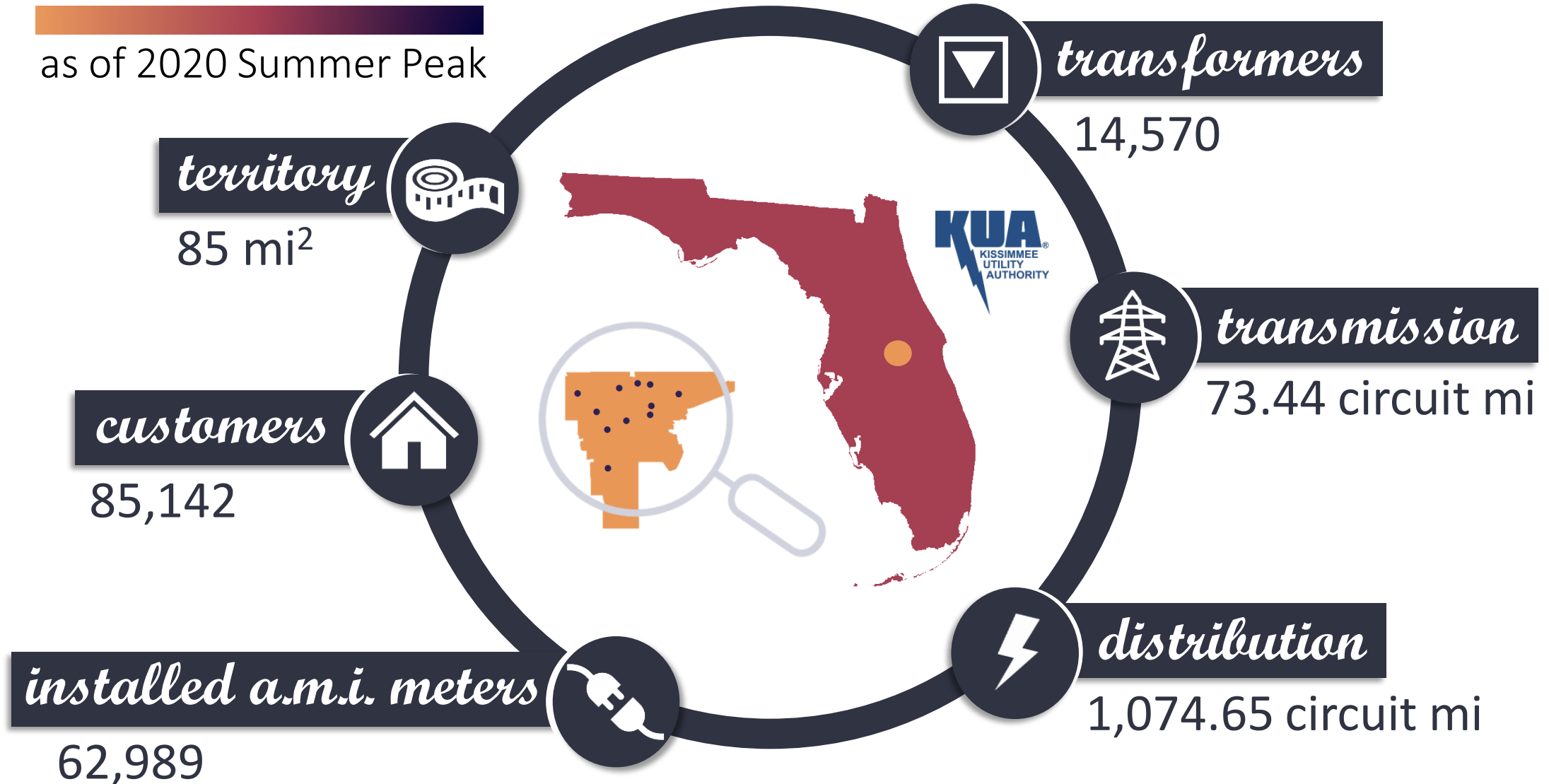
Advanced Metering Infrastructure (AMI)



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.

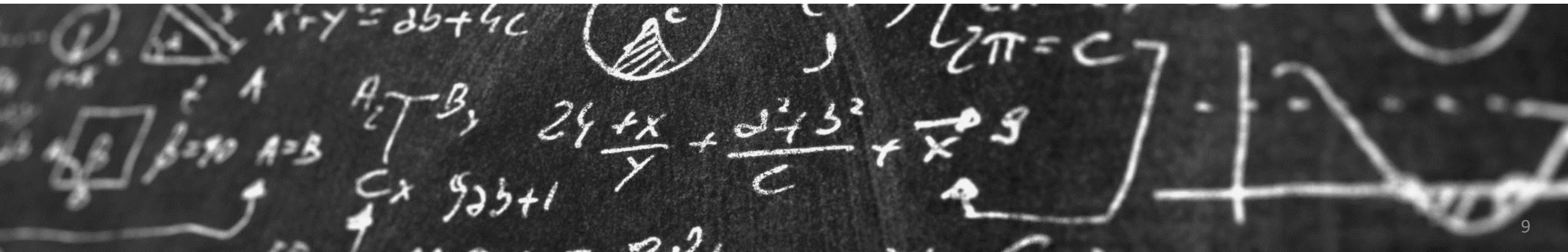
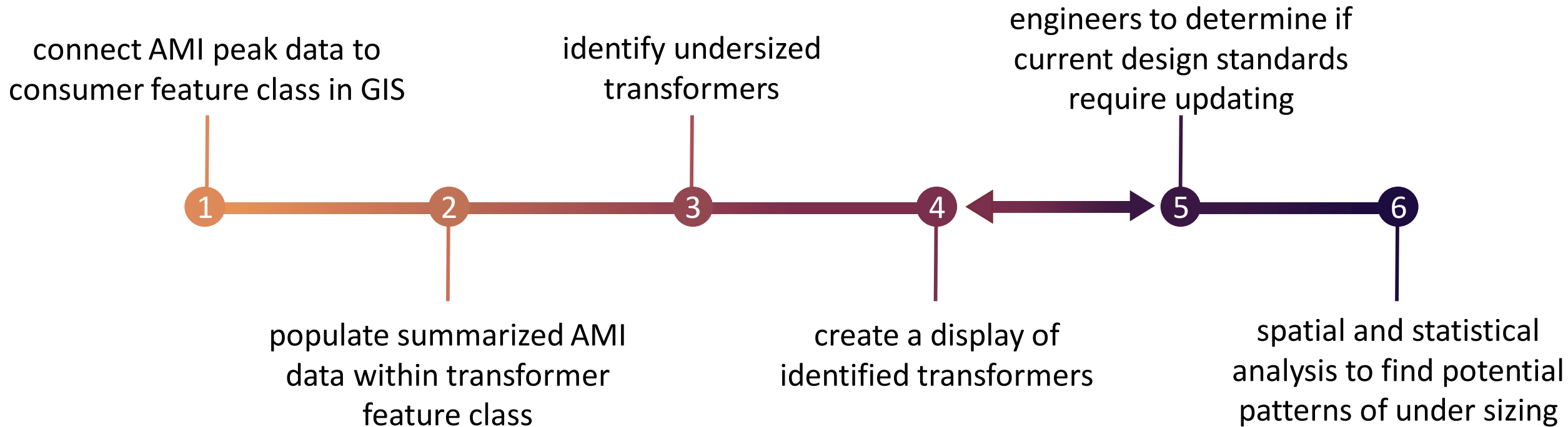
spatial analysis

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



connect

1

identify

3

determine

5

6

populate

create

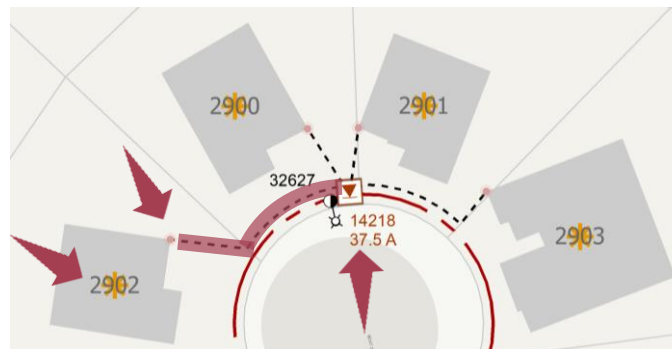
analysis

METHODOLOGY

1 connect AMI peak data to consumer feature class in GIS

```
H|4324|1.0.0  
D|0149925402|123462760A|0.8.15.6.1.1.8.0.0.0.0.0.0.0.0.0.3.38.0|3.0.0|20200921062100|127.99|  
D|0149925402|123462760A|0.0.0.1.1.1.12.0.0.0.0.0.0.0.0.0.3.72.0|3.0.0|20200924000000|249708|  
D|0149925402|123462760A|0.0.0.1.19.1.12.0.0.0.0.0.0.0.0.0.3.72.0|3.0.0|20200924000000|162163|  
D|0149925403|123461310A|0.8.15.6.1.1.8.0.0.0.0.0.0.0.0.0.3.38.0|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

connect

1

identify

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determine

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6

populate

create

analysis

METHODOLOGY

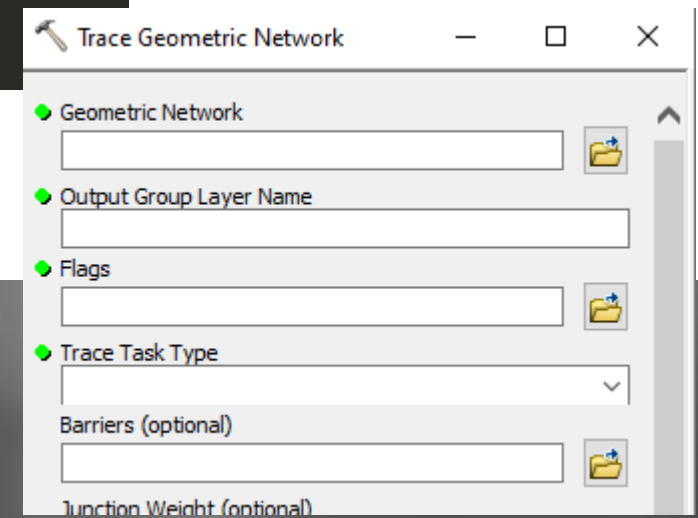
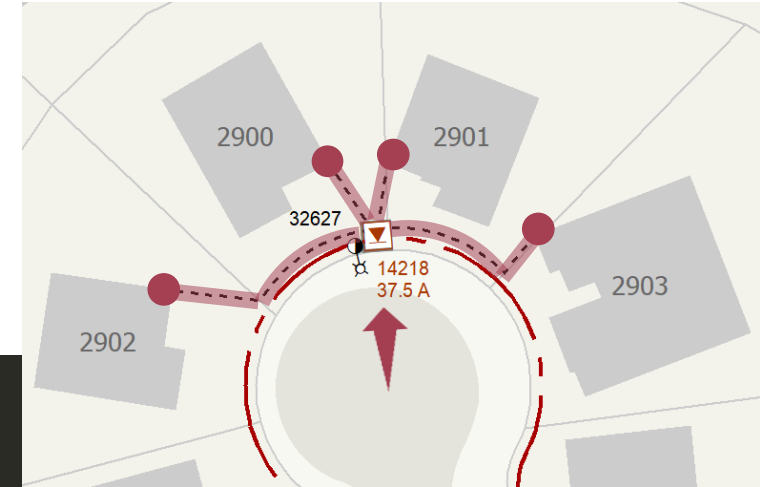
2 populate summarized AMI data within transformer feature class

```

1 ["List", "of", "transformers"]
2
3 Loop through list, for each transformer:
4   Make Feature Layer tool of single transformer to be used as Flag
5   Trace Geometric Network tool (result: all service points downstream are selected):
6     Flags - as created above | Trace Task Type - TRACE_DOWNSTREAM | Disable unused feature classes from trace
7   Copy Features tool to create feature class of all downstream service points
8   Summary Statistics tool to sum all peak data
9   Insert Cursor to populate external table with peak data sum

```

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



connect

1

2

populate

identify

3

4
create

determine

5

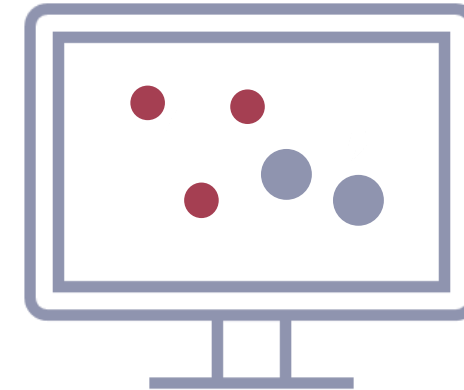
6
analysis

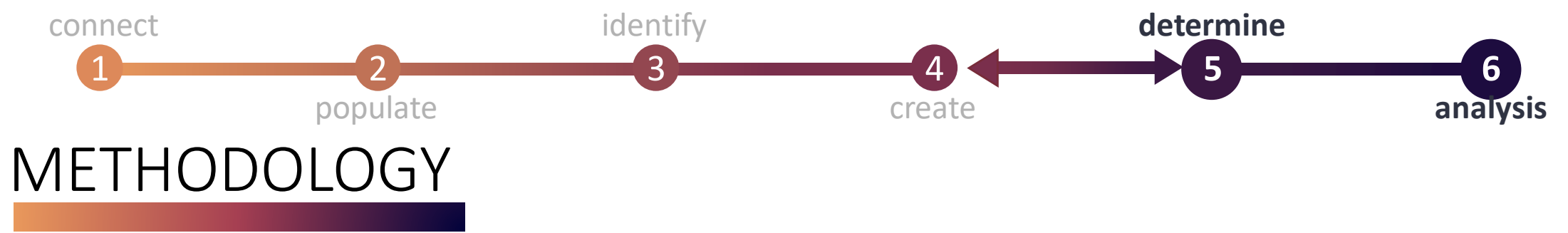
METHODOLOGY

3 identify undersized transformers



4 create a web application 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

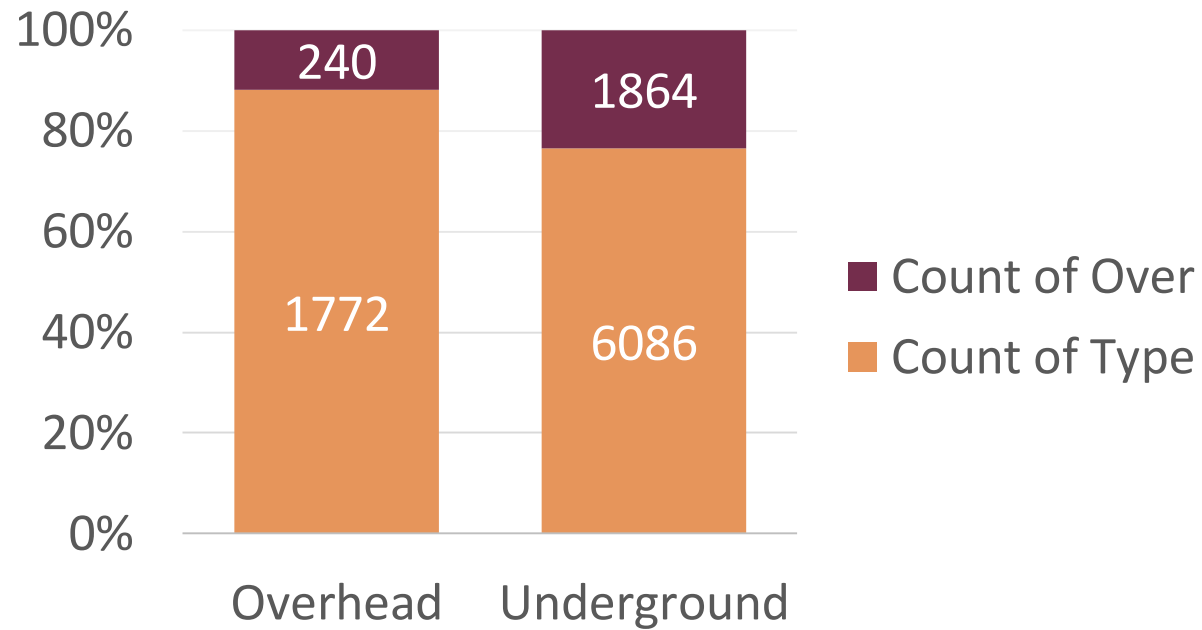
UNDER SIZED TRANSFORMERS

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

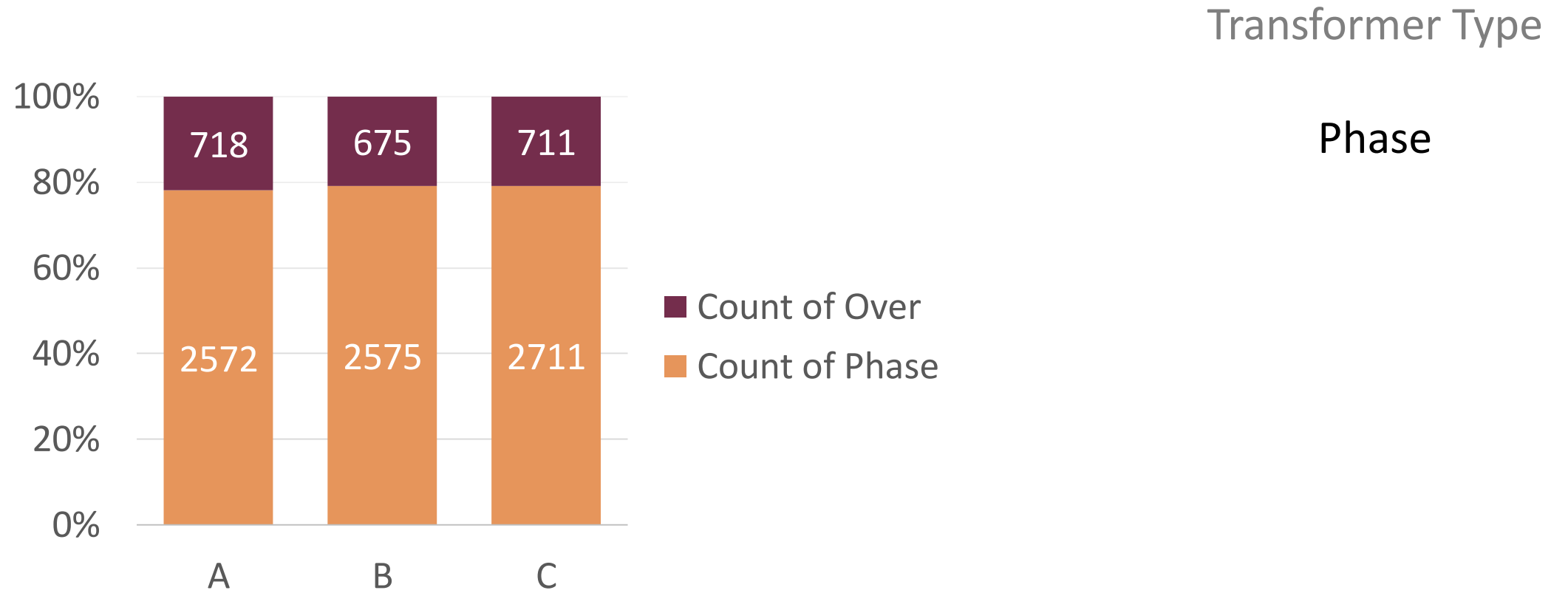
RESULTS and DELIVERABLES



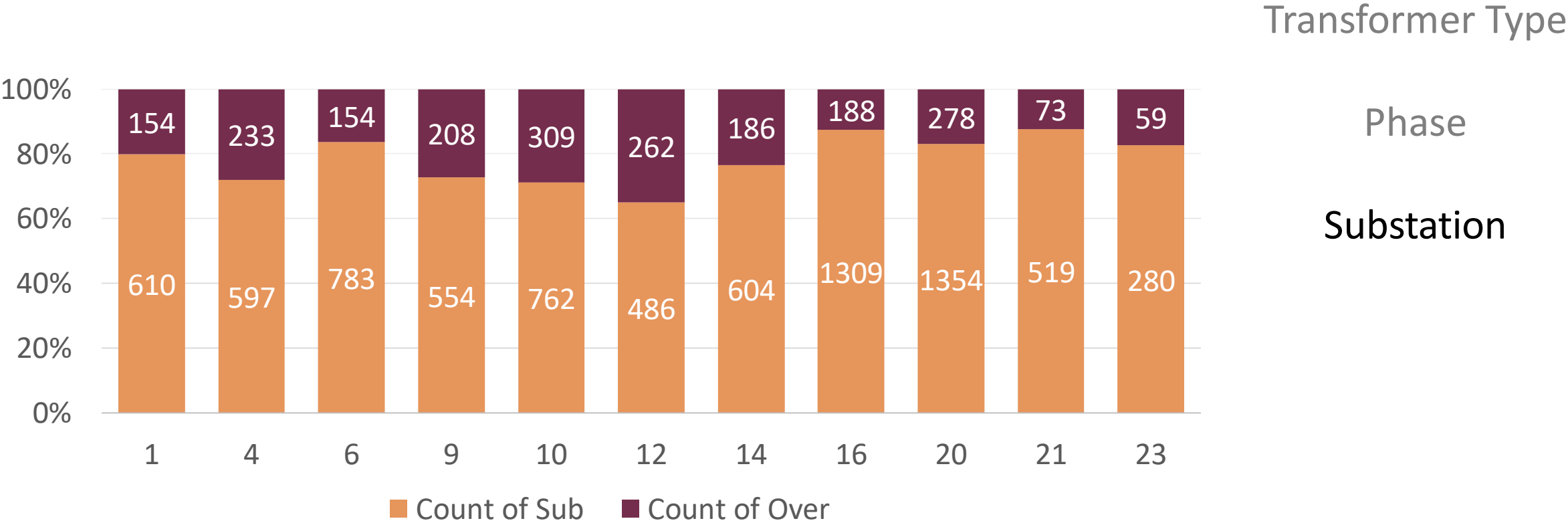
Transformer Type



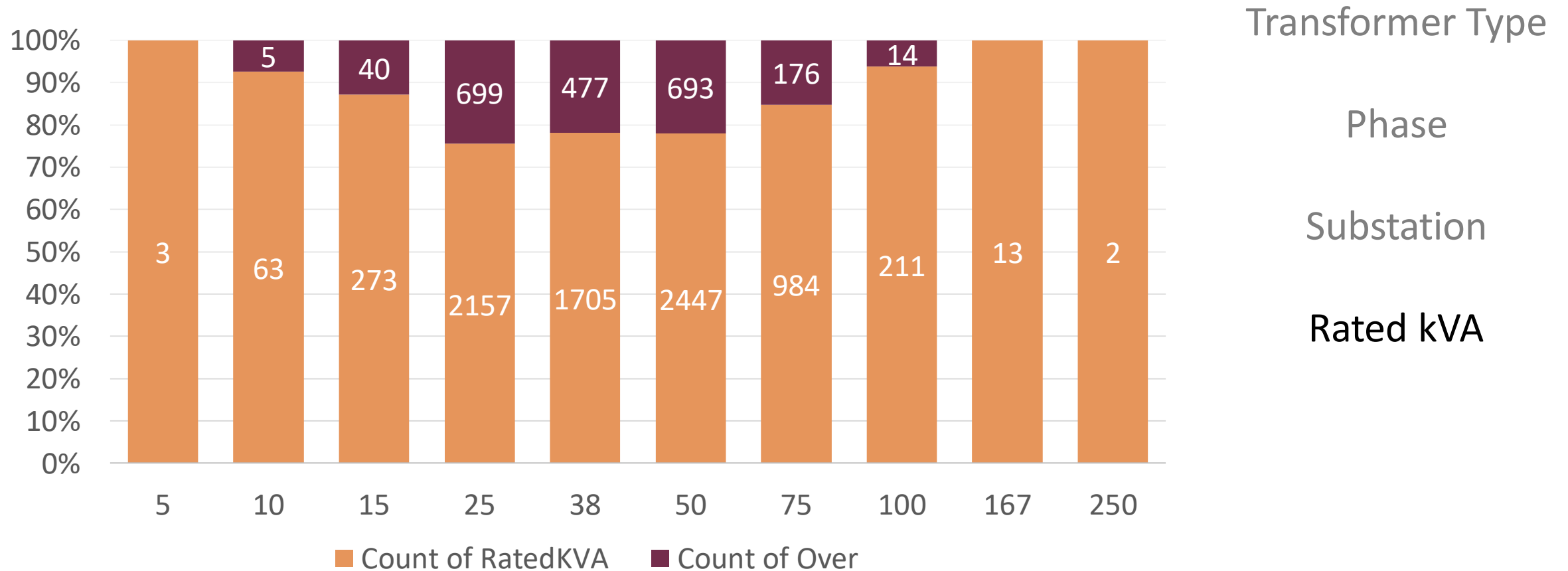
RESULTS and DELIVERABLES



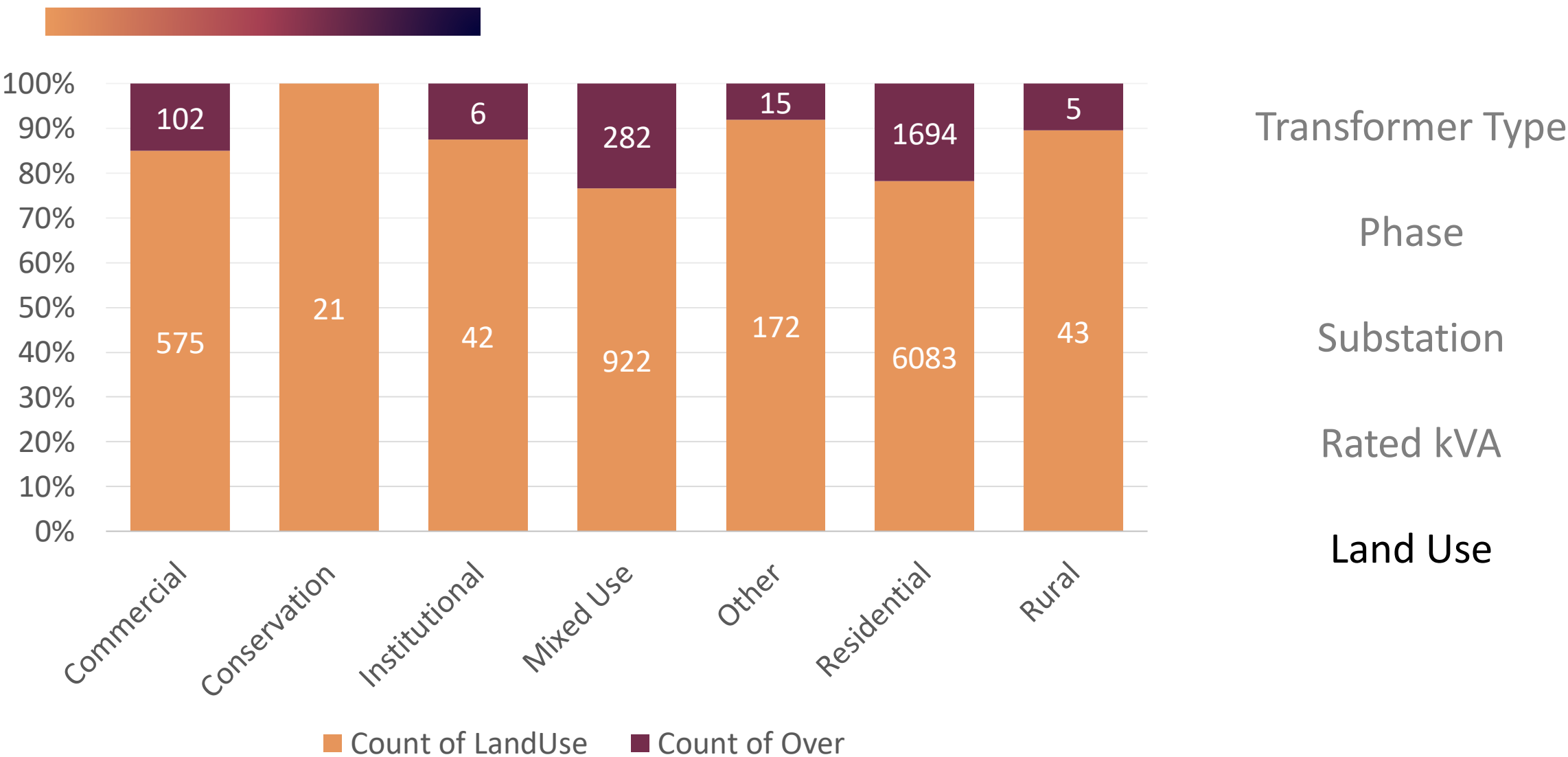
RESULTS and DELIVERABLES



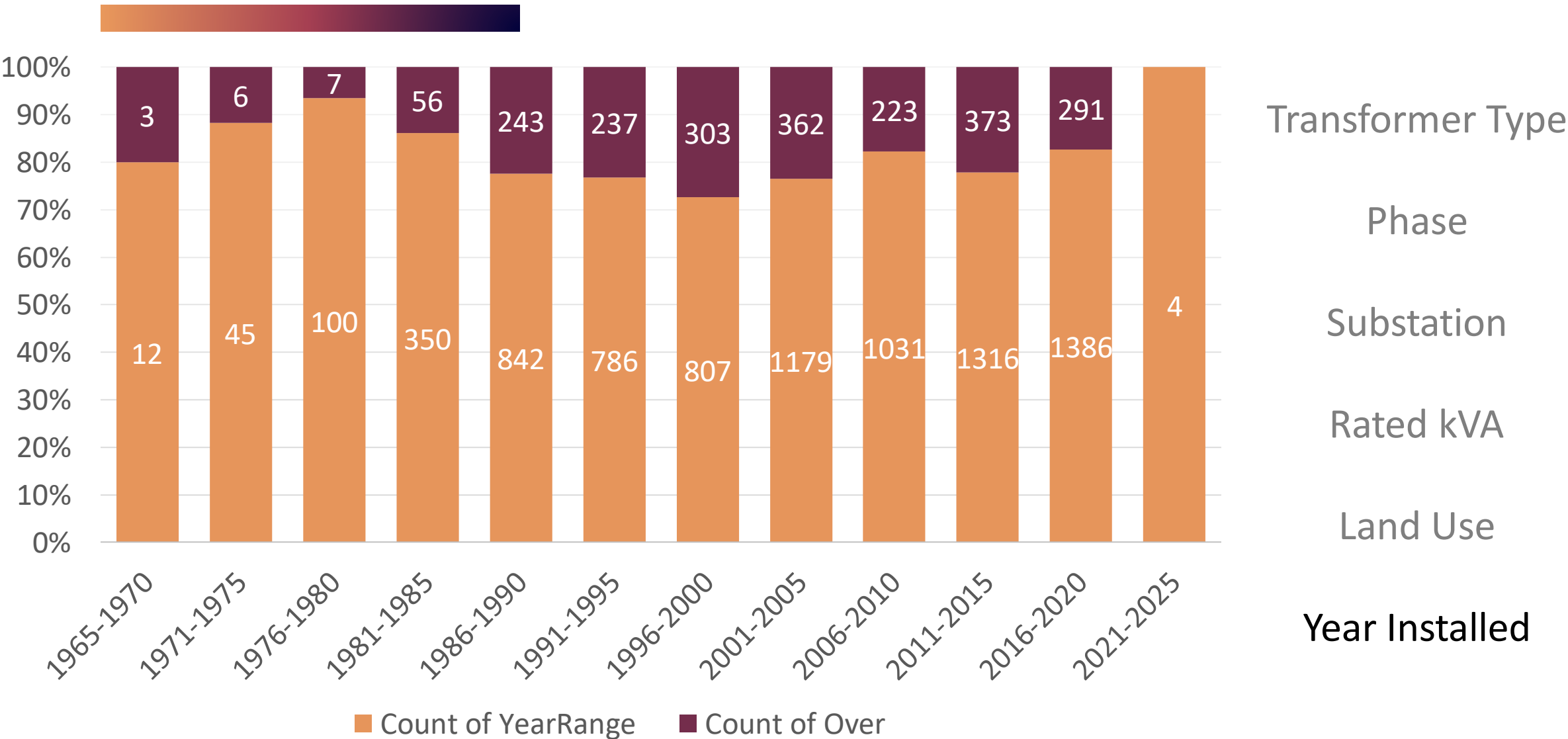
RESULTS and DELIVERABLES



RESULTS and DELIVERABLES

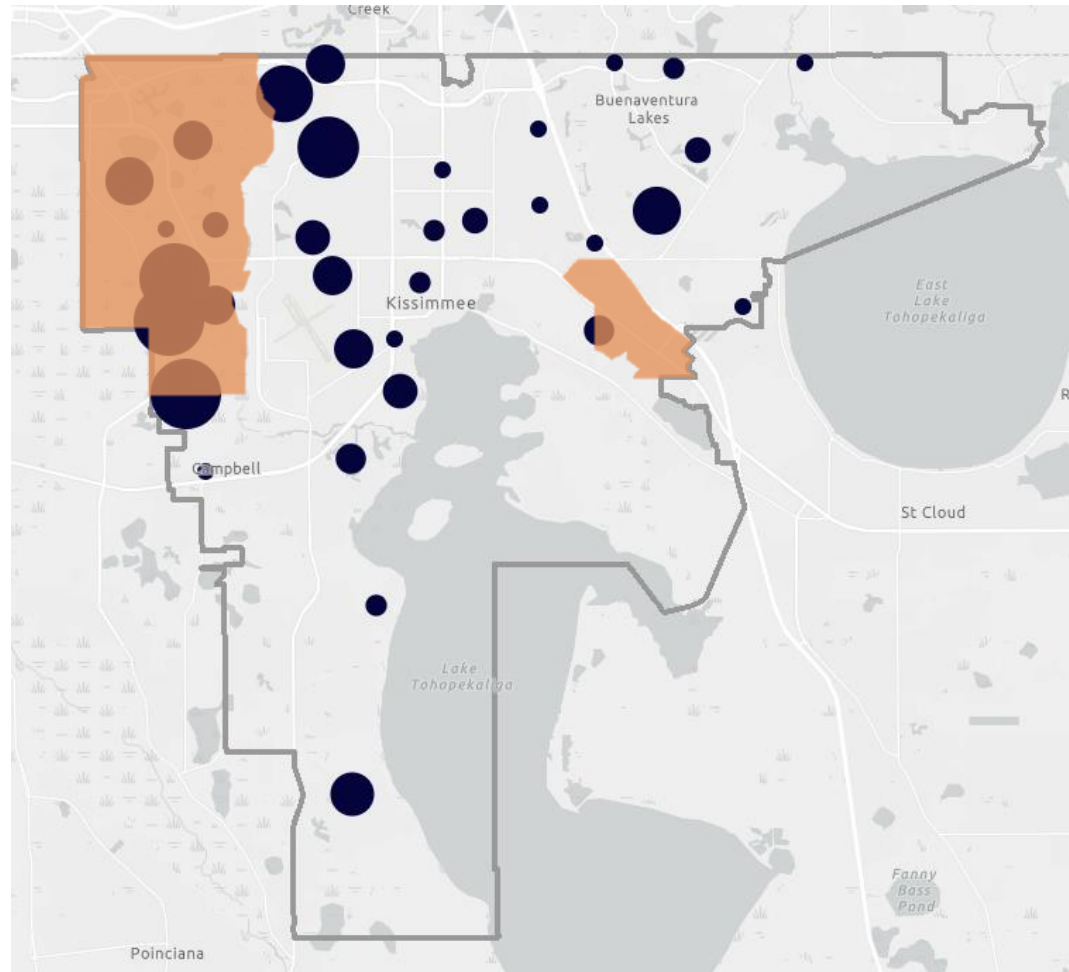


RESULTS and DELIVERABLES





PRELIMINARY FINDINGS



**151% - Over
Immediate Action**

Short Term Rentals



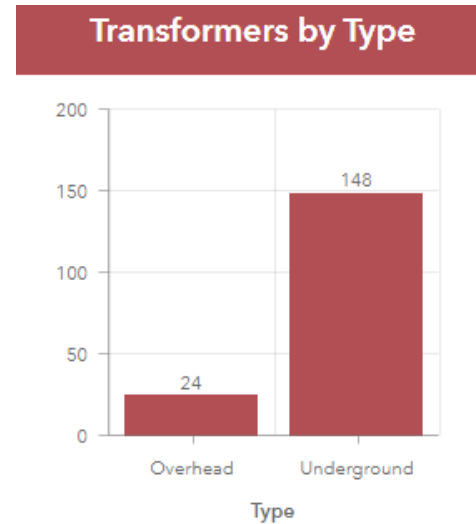
PRELIMINARY FINDINGS



**151% - Over
Immediate Action**

Short Term Rentals

Underground
Transformers

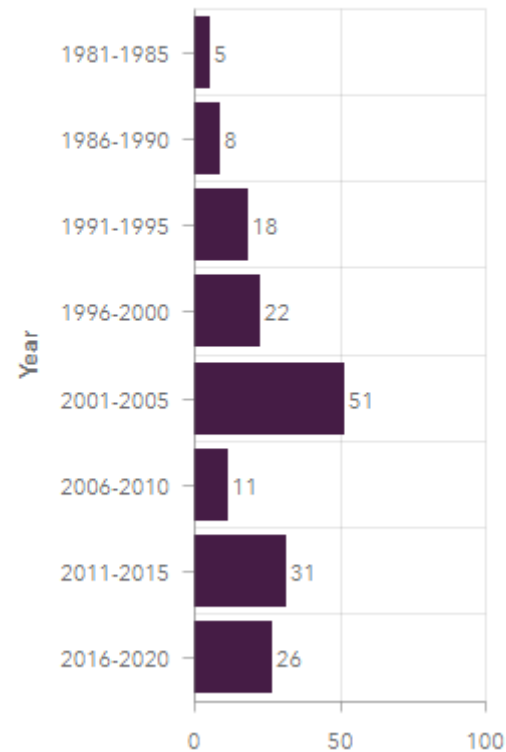




PRELIMINARY FINDINGS



Transformers by Year



**151% - Over
Immediate Action**

Short Term Rentals

Underground
Transformers

Year of
Installation



PRELIMINARY FINDINGS



**151% - Over
Immediate Action**

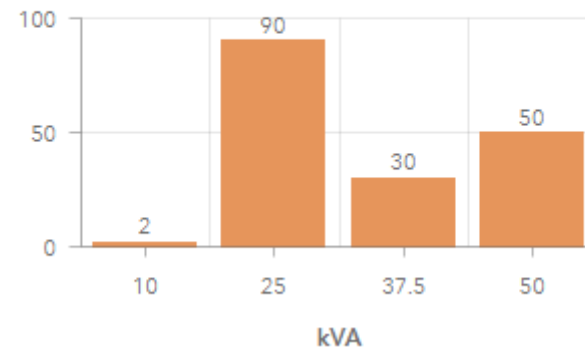
Short Term Rentals

Underground
Transformers

Year of
Installation

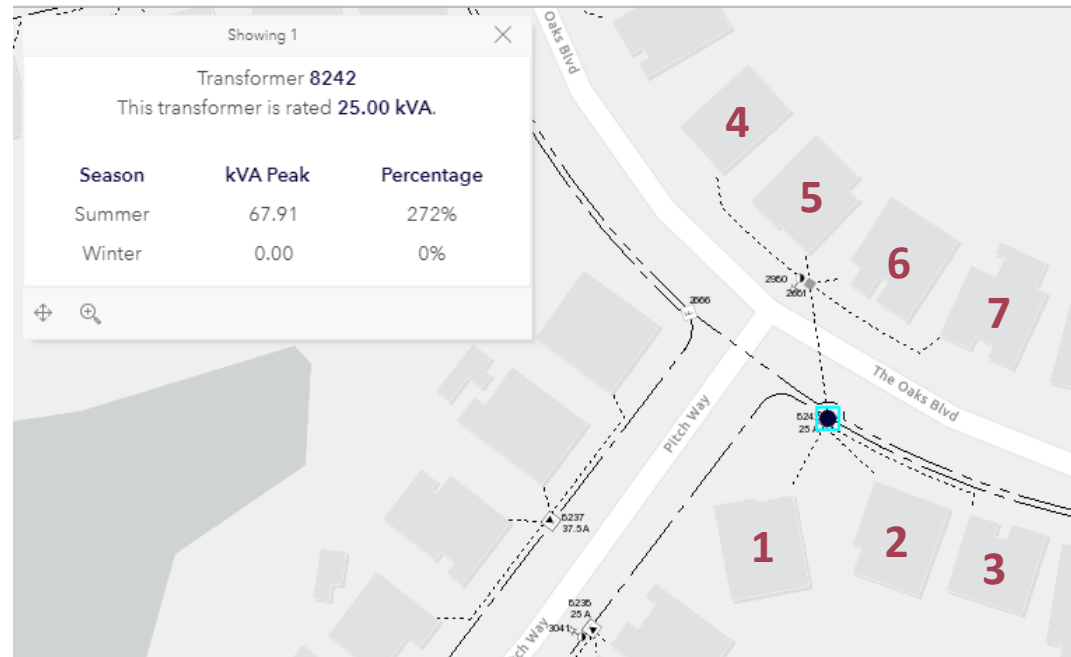
25kVA Transformers

Transformers by Rated kVA





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