Implementing Conservation Voltage Reduction

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Consumers Energy
Count on Us®

- Electric and Gas Utility in Michigan
- Geographically, covers most of the lower peninsula
- 71,039 miles of electric distribution lines
- 27,000 miles of natural gas distribution pipeline
- 5,885 Megawatts of generation capacity
- Net zero carbon emissions by 2040

PI at Consumers Energy

- Smart Meter System
- Gas AMR
- Generation
  - Solar/Winds
  - Hydro
  - Coal and Gas
- Electric SCADA

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CHALLENGES

- Need to reduce peak loads on the electrical system and reduce carbon emissions

SOLUTION

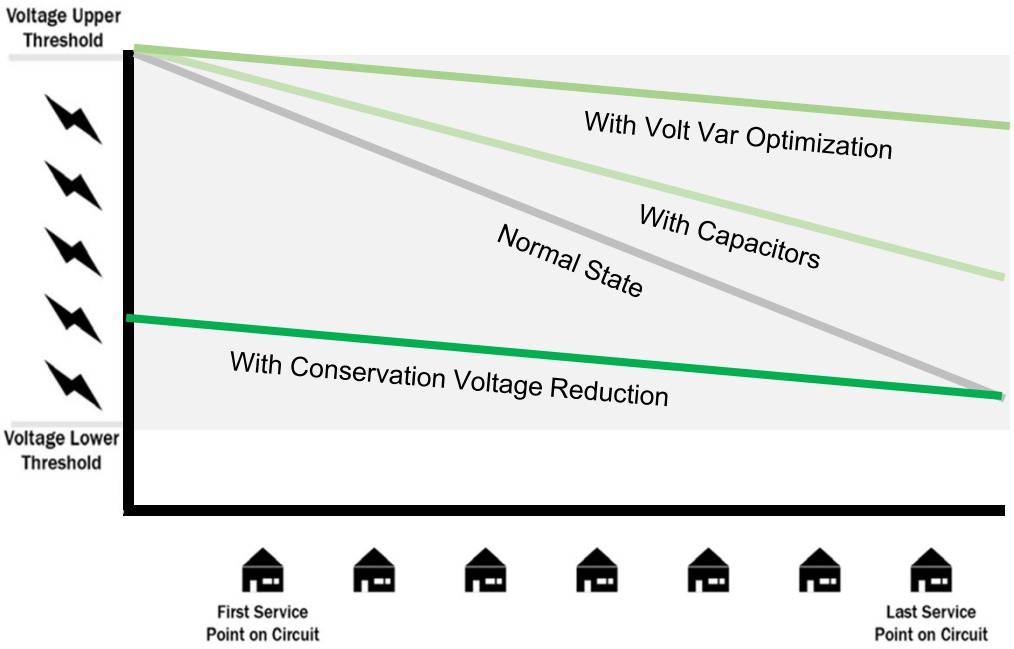
- Using the PI system, we are able to monitor circuit voltage for each customer, enabling us to improve power quality through volt/var optimization and voltage reduction

BENEFITS

- We are reducing peak load on each circuit without requiring customer participation and still providing power quality.

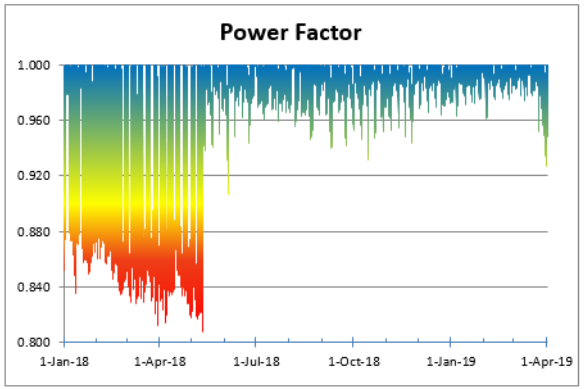
> The CVR program is one example of a new strategy being implemented to optimize electric grid performance benefitting our customers.

CVR Overview



Objective:

Optimize customer voltage to reduce energy demand on our system, without requiring customer participation



Asset Framework Hierarchy

- Headquarter
  - Substation XYZ
    - Substation Transformer Bank
      - Circuit 01
        - Circuit Regulator
        - Capacitors
        - Reclosers
        - Phases
          - Secondary Transformer
            - Service Point

Transforming the Data

Smart Meter Data

Category: Raw Measurement	
Meter Event Raw Value from meter	18916 : ERT Connection Downtime Time Exceeded
VARh Delivered Int Raw value	15.5
VARh Delivered Register Raw Measurement	2.3669E+06 VAR
Volt2hour_a	3671.9
Volt2hour_b	3690
Volt2hour_c	11031
Wh Delivered Int Raw value	174 Wh
Wh Delivered Register Raw Measurement	3.5644E+06 Wh
Wh Received Int Raw value	0 Wh
Wh Received Register Raw Measurement	0 Wh

Service End Point

Category: Meter Measurement	
kVARh Delivered Interval	0.062 KVARh
kVARh Delivered Register	2366.9 KVARh
kWh Delivered Interval	0.6975 kWh
kWh Delivered Register	3564.4 kWh
kWh Received Interval	0 kWh
Max Demand	3581.5 kW
Meter Event	18916 : ERT Connection Downtime Time Exceeded
Voltage Phase A	121.19 V
Voltage Phase B	121.49 V
Voltage Phase C	210.06 V
Voltage Quality Phase A	100.99 %
Voltage Quality Phase B	101.24 %
Voltage Quality Phase C	100.99 %

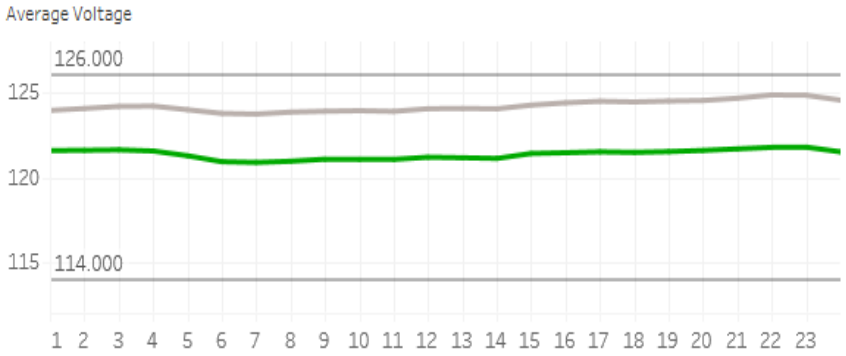
Analyses Server

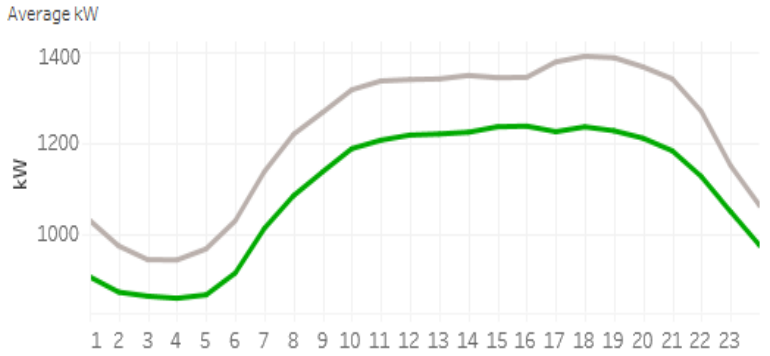
Name	Expression

Variable1	`// The purpose of this Analysis is to roll the 15 minute data up to the ordinal hour`
	`// Values are summed up to the ordinal hour so all meter have a common time stamp and we can roll up the value to the secondary`
	`// transformer`
	`// The CTPTRatio is the meter multiplier`
	`// IF the minute is not 0 then do nothing, if it is zero then it must be on the ordinal hour and we need to add the values up`
	`if Minute('*')<>0 then NoOutput()`
	`else TagMean('Wh Delivered Int Raw value', '*-45m', '*') * EventCount('Wh Delivered Int Raw value', '*-45m', '*')*'CTPTRatio'/1000`

Variable2	`if Minute('*')<>0 then NoOutput()` `else TagMean('Wh Received Int Raw value', '*-45m', '*') * EventCount('Wh Received Int Raw value', '*-45m', '*')*'CTPTRatio'/1000`

CVR Results To Date





Overall	(Data through 1/31/2020)	
	Voltage	**kW Load**
CVR Off	124.1	1248
CVR On	121.3	1228
% Reduction	2.26%	1.63%
CVRf	0.72	

Conclusion

- Build your AF to resemble real world
- Normalize the data
- Start small, validate, rebuild, repeat
  - Agile methodology works well
- Make use of the support available
  - OSIsoft
  - PI Square
  - Youtube
  - Training
- Don’t be afraid to make mistakes

What's next

- Event Frames and Notifications
- Incorporating line sensors and line regulators
- Adding condition based maintenance

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- Sith Lord
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Questions?

Please wait for
the **microphone**

State your
name & company

Save the Date...

AMSTERDAM
October 26-29, 2020

OSIsoft. PI World