BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Ohio	**:**	**Case No. 09-1820-EL-ATA**
Edison Company, The Cleveland Electric	**:**	**Case No. 09-1821-EL-GRD**
Illuminating Company, and The Toledo	**:**	**Case No. 09-1822-EL-EEC**
Edison Company for Approval of Ohio	**:**	**Case No. 09-1823-EL-AAM**
Site Deployment of the Smart Grid	**:**	
Modernization Initiative and Timely	**:**	
Recovery of Associated Costs	**:**	

REPORT

On May 28, 2015, the Commission issued a Finding and Order ("Order") granting Ohio Edison Company, The Cleveland Electric Illuminating Company and The Toledo Edison Company's (collectively, the "Companies") Application to complete studies related to the Ohio Site Deployment of the Smart Grid Program ("Smart Grid Pilot"). In that Order, the Commission ordered the Companies to file an interim report regarding the data obtained from the Volt Var Optimization and Distribution Automation studies annually. The Companies hereby submit their annual interim report for the 12-month period ending May 31, 2021.

Distribution Automation (DA)

For the 34 CEI pilot circuits with DA, the Companies analyzed the impact of DA on reliability metrics through May 31, 2021, excluding major storms, and separately analyzed major storm performance. Consistent with the tracking and reporting for the Companies' Grid Mod I project, the DA performance in the Smart Grid Pilot area was analyzed by comparing actual reliability with the smart grid investments to performance without the smart grid investments.

Non-Storm (DA)

Over the last 7 years, customers in the Smart Grid Pilot area have avoided over 70,000 power outages and saved 13.4 million customer outage minutes. Notably, customers saved over 3.5 million outage minutes in the current annual reporting period, which is the most significant annual savings in 7 years of reporting. On average, over the last 7 years, the customers in the Smart Grid Pilot area have seen a 42-minute reduction in average annual outage duration, a 6-minute improvement over the previous reporting period.

Non-Storm Reliability Saved -- Smart Grid vs. Non Smart Grid (June 2014 thru May 2021)

					SG Circuit Savings	
	Customers Interrupted Savings	% Savings	CMI Savings	% Savings	SAIFI	SAIDI
Year One (Jun '14 thru May '15)	5,425	***11%***	783,922	***15%***	0.12	17.44
Year Two (June '15 thru May '16)	4,448	***6%***	883,757	***11%***	0.10	19.65
Year Three (June '16 thru May '17)	7,207	***10%***	1,384,650	***18%***	0.16	30.51
Year Four (June '17 thru May '18)	10,814	***14%***	1,841,098	***25%***	0.24	40.28
Year Five (June '18 thru May '19)	23,502	***22%***	3,315,636	***29%***	0.51	71.68
Year Six (June '19 thru May '20)	6,198	***10%***	1,689,989	***25%***	0.13	36.51
Year Seven (June '20 thru May '21)	12,634	***13%***	3,506,419	***31%***	0.28	76.36
Grand Total	**70,228**	***13%***	**13,405,471**	***23%***	**0.22**	**41.96**

Notes
1. Outages include, Distribution, Substation, and Transmission, excludes major storms
2. Includes tap outages that would not have been affected by Smart Grid facilities

Storm (DA)

Over the last 7 years, during major storms customers in the Smart Grid Pilot area have avoided over 17,000 power outages, a reduction of 8%, and saved 8.1 million customer outage minutes representing a 7% improvement. On average, the customers in the Smart Grid Pilot area have seen a 25-minute reduction in average annual outage duration during major storms.

Major Storm Reliability Saved -- Smart Grid vs. Non Smart Grid (June 2014 thru May 2021)

					SG Circuit Savings	
	Customers Interrupted Savings	% Savings	CMI Savings	% Savings	SAIFI	SAIDI
Year One (Jun '14 thru May '15)	3,469	***18%***	631,594	***11%***	0.08	14.06
Year Two (June '15 thru May '16)	0	***0%***	13,520	***1%***	0.00	0.30
Year Three (June '16 thru May '17)	2,440	***9%***	2,070,046	***21%***	0.05	45.61
Year Four (June '17 thru May '18)	1,899	***15%***	614,638	***8%***	0.04	13.45
Year Five (June '18 thru May '19)	4,075	***12%***	2,374,258	***24%***	0.09	51.33
Year Six (June '19 thru May '20)	4,693	***14%***	1,876,616	***15%***	0.10	40.54
Year Seven (June '20 thru May '21)	715	***5%***	535,963	***6%***	0.02	11.67
Grand Total	**17,291**	***8%***	**8,116,635**	***7%***	**0.05**	**25.41**

Notes
1. Outages include, Distribution, Substation, and Transmission, includes major storm only
2. Includes tap outages that would not have been affected by Smart Grid facilities
3. Catastrophic events on 11-15-2020 and 12-1-2020 are excluded. Basis for this exclusion explained in the paper titled "Analysis of Catastrophic Events Using Statistical Outlier Method" published by IEEE.
4. Customer outages for major storms capped at 24 hours

For purposes of this analysis, the Companies excluded events on November 15, 2020 and December 1, 2020. This is based on a methodology described in the paper entitled "Analysis of Catastrophic Events Using Statistical Outlier Method" published by IEEE. While the events on these days were major storms, they would also be considered catastrophic events that are outside the normal distribution of storm days for the five-year period. Therefore, these catastrophic events were excluded from the analysis as outliers.

Integrated Volt Var Control (IVVC)

During this reporting period (June 1, 2020 through May 31, 2021), the Companies continued to operate and monitor the performance of the IVVC equipment in the Smart Grid Pilot area. The Companies analyzed 6 core substations and 18 circuits deployed with IVVC during the 12-month period. During this period, two primary operational modes for the IVVC were used:

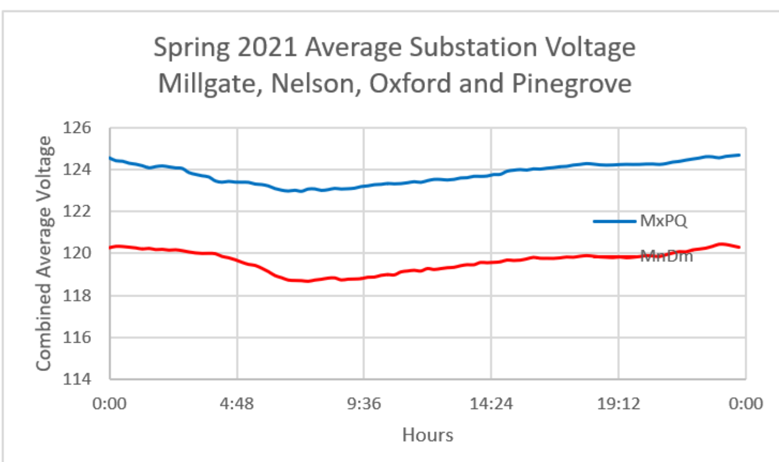
1. Minimize Demand (MnDm): This operational setting is used to reduce customer usage and to minimize peak demand, both on a circuit and substation level. This setting will lower circuit voltages to the lower end of the allowable range and could impact power quality. The target voltage range for MnDm is 117 to 120 volts.
2. Maximum Power Quality (MxPQ): This operational setting is used to mitigate power quality issues that may be created following operational switching to restore customers or by one customer that impacts other customers on the circuit. This setting typically causes voltage to increase. The target voltage range for MxPQ is 123 to 125 volts.

The Companies evaluated operation of the IVVC system in two areas of performance: voltage separation and Conservation Voltage Reduction (CVR). In addition, the Companies separately analyzed the performance of Varantec Edge of Network Optimization devices. The results of these evaluations are summarized below.

Voltage Separation

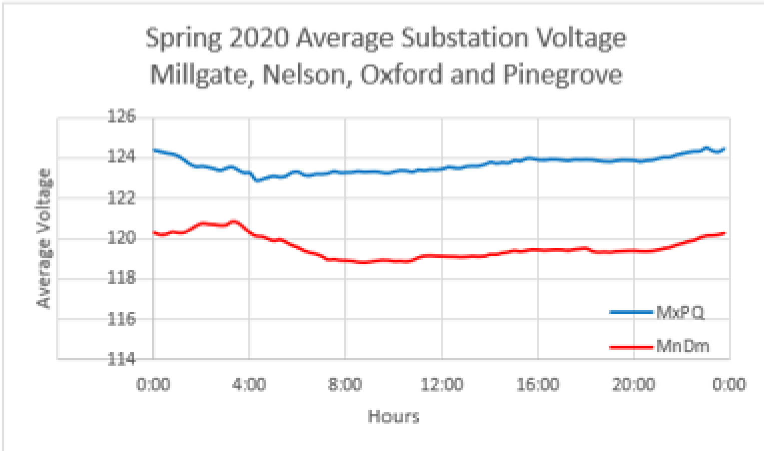
Voltage separation represents the system’s ability to respond to operational commands to lower voltage. The greater the operator’s ability to intentionally lower distribution voltage while still maintaining compliance within the ANSI range, the greater the potential performance in terms of demand and energy consumption (i.e. Conservation Voltage Reduction or CVR).

The graph below shows the combined average circuit phase voltage for four of the IVVC core substations (14 circuits) during the Spring 2021 evaluation period (March 14 through May 31, 2021): Millgate, Nelson, Oxford, and Pinegrove. Because the Norway Substation was undergoing Varentec Edge Network Grid Optimization (ENGO) device testing during the evaluation period, its voltage graphs are included in a separate section, below. Also, the Newport Substation has been excluded from this particular analysis due to the installation of a mobile substation. The blue lines represent the average circuit phase voltage of the combined core substations when the operating mode was set to Maximize Power Quality (MxPQ). The red lines represent the Average Circuit Phase Voltage when the operating mode was set to Minimize Demand (MnDM). Overall, for all hours of operation during the study period, the average voltage separation between MxPQ and MnDm operating modes across these core substations was approximately 4 volts, a difference of 3.4%.

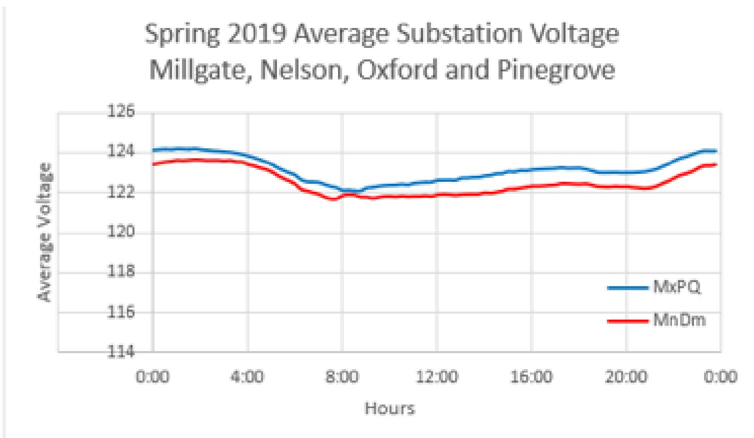


Average Voltage March 14 - May 31, 2021	
MxPQ	123.82
MnDm	119.61
Voltage Δ	4.21
%	3.40%

Similar results for these same four core substations from the prior two reporting periods for Spring 2020 and Spring 2019 are provided below. The results for Spring 2021 are consistent with last year and show significant improvement over Spring 2019.



Average VoltageSpring 2020	
MxPQ	123.68
MnDm	119.57
Voltage Δ	4.11
%	3.32%



Average Voltage Spring 2019	
MxPQ	123.12
MnDm	122.51
Voltage Δ	0.62
%	0.50%

Conservation Voltage Reduction (CVR)

Conservation Voltage Reduction (CVR) is the long-term practice of controlling distribution voltage levels within the lower range of ANSI standard acceptable service entrance voltage levels in order to reduce demand and energy consumption.

The results from the Spring 2021 evaluation period were impacted by a couple of factors that were not present in last year's analysis. First, many of the Covid-19 restrictions were still in place during this period, thereby reducing commercial loads, school loads and load patterns which in turn had a tendency to reduce overall loading and reducing overall energy conservation results. Second, Newport substation TR71 was out of service and required switching affecting various circuits at Millgate, Nelson, and Pinegrove. The switching required during this period reduced some of the testing time available for certain circuits and likely reduced IVVC performance on those circuits.

The table below shows the combined results of the Companies' CVR analysis for all core substations during the Spring 2021 period. Overall, the average voltage reduction of approximately 4 volts from the voltage separation discussed above led to kWh savings of approximately 2.1% while maintaining voltage well within the expected range.

CVR March 14 - May 31, 2021

Substation	Temp Avg (Degrees F)		Problem Formulation Days		Average Voltage (Volts)		Average Real Load to Voltage Ratio (LtVR)	Weighted Average Real LtVR (CVRf)	**Voltage Reduction (Volts)**	Voltage Reduction (Per Unit)	**Average kWh/day Reduction**	**Average kWh Savings %**	2 hr Peak kW Reduction %	4 hr Peak kW Reduction %
	PF(A)	PF(B)	PF(A)	PF(B)	PF(A)	PF(B)								
MG Roll-Up	50.9	53.2	25.0	18.7	119.0	123.1	0.46	0.49	**4.09**	0.0341	**2,394**	**1.7%**	1.8%	1.6%
NL Roll-Up	52.0	52.2	31.1	21.6	120.4	123.4	0.60	0.56	**2.96**	0.0247	**2,280**	**1.3%**	0.5%	0.2%
OX Roll-Up	51.6	53.1	30.7	22.5	119.0	124.0	1.41	1.35	**4.99**	0.0416	**5,863**	**5.0%**	4.6%	4.5%
PG Roll-Up	52.1	52.2	25.8	28.2	120.0	123.9	0.51	0.47	**3.91**	0.0325	**4,767**	**1.5%**	-0.4%	-0.3%
Roll-up	51.7	52.6	28.2	22.7	119.6	123.8	0.66	0.64	**4.21**	0.0351	**15,304**	**2.1%**	0.9%	1.0%

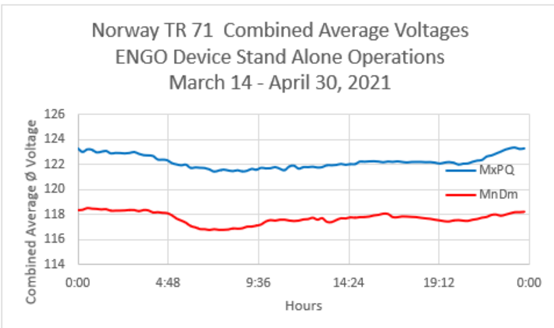
Varentec[1] Performance Evaluation

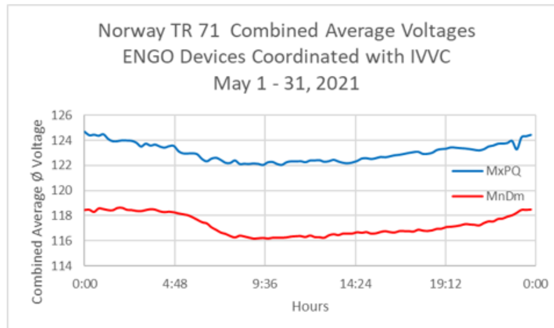
Beginning October 2019, the Companies installed 53 Varentec ENGO (Edge Network Grid Optimization) devices on the two Norway substations (four circuits). Device installations were completed in May of 2020. ENGO devices are usually mounted on poles where distribution transformers are located. The units are a single-phase mechanism connected to the low voltage secondary side of the transformer.

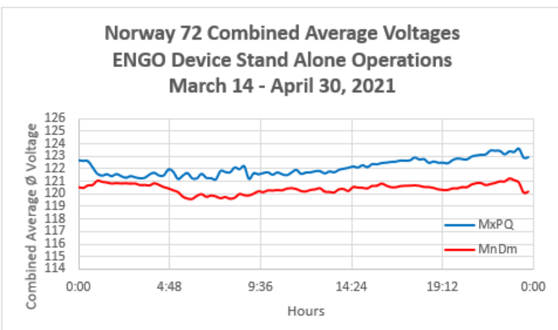
The evaluation test period, March 14, 2021 through May 31, 2021, was divided into two different test setup periods. During the period March 14 through April 30 the ENGO units were operating with the ENGO setpoints at the same value as the Load Tap Changer (LTC) setpoints, usually 120volts for MnDm and 123 volts for MxPQ. These were the original setpoints and the term "Stand Alone" is used for this test mode in the tables below. Beginning May 1st, ENGO Unit setpoints were set at 115 volts for MnDm days and were effectively turned off on MxPQ days. This essentially coordinated ENGO units with the IVVC system and is referred to as "Coordinated with IVVC."

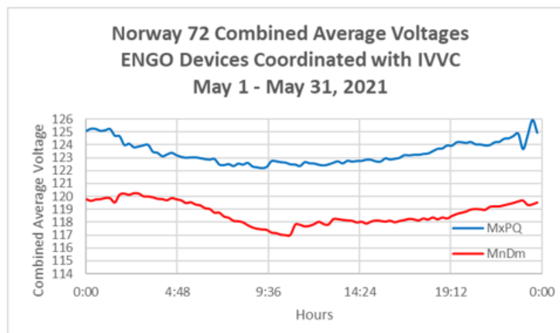
[1] Varantec is now Sentient Energy.

The following four graphs show the combined substation voltages for two circuits for the same two test periods in Spring 2021. The graphs on the left side of the pages show the voltage separation with Stand Alone ENGO devices and the graphs on the right show voltage separation with ENGO devices Coordinated with IVVC.









As demonstrated on the above graphs, utilizing Sentient Energy (Varentec) ENGO devices Coordinated with IVVC appears to provide improvement in terms of voltage separation and consequently CVR, especially for underperforming circuits. Further testing and study to determine optimum placement and application is required.

Summary

The investments in the Smart Grid Pilot area have produced solid results and benefits for customers. The Companies continue to explore ways to further enhance both the software and the reliability and power quality performance of field devices. This includes increasing the application of single-phase trip, where possible, to lower the number of customer interruptions caused by single-phase faults, working with the Companies' DA/IVVC vendor to customize software to receive better system performance, and leveraging worst performing circuit mitigation to improve the performance of the 34 circuits with DA and IVVC, where applicable.

In 7 years of operation in the Smart Grid Pilot area, the Companies have gained significant knowledge and lessons learned on how DA and IVVC can be deployed to benefit customers. The Companies have identified improvements to construction practices and analytics which include, but are not limited to, grounding improvements with smart devices, device control settings, conducting real time analysis of circuits to gain better CVR, and implementing DA and IVVC along with associated software systems together in an integrated fashion to drive benefits for customers.

The Companies will continue analyzing the performance of the DA and IVVC investments in the Smart Grid Pilot area.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that the foregoing Report was filed electronically through the Docketing Information System of the Public Utilities Commission of Ohio on this 3rd day of September 2021. The PUCO's e-filing system will electronically serve notice of the filing of this document on counsel for all parties, and the undersigned has served electronic copies to the following parties:

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