BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of Duke Energy Ohio, Inc.'s	)	
Application for Approval of	)	09-757-EL-ESS
Proposed Reliability Standards	)	

APPLICATION OF DUKE ENERGY OHIO, INC. FOR APPROVAL OF PROPOSED RELIABILITY STANDARDS

Duke Energy Ohio, Inc. (Duke Energy Ohio or Company) is an Ohio Corporation engaged in the business of supplying electric generation, transmission and distribution service to approximately 660,000 customers in southwestern Ohio. Duke Energy Ohio is a public utility as defined by R.C. 4905.02 and R.C. 4905.03.

In May of 2008, the Governor of Ohio signed into law, Amended Substitute Senate Bill No. 221 (SB 221) which amended Substitute Senate Bill 3 (SB 3) and altered various provisions of the Ohio Revised Code relating to energy and regulatory policy. Subsequent to SB 221, the Public Utilities Commission of Ohio (Commission) issued a finding and order modifying chapters of the Ohio Administrative Code (O.A.C.) including O.A.C. 4901:1-10. In its Finding and Order, the Commission's changes to Rule 4901:1-10, O.A.C., created new reliability standards as opposed to targets, and ordered the electric utilities to file proposed new standards within sixty days of the effective date of the new rules in chapter 4901:1-10, O.A.C.

Duke Energy Ohio submits this Application pursuant to the Commission's Order. In Duke Energy Ohio's Electric Security Plan case, *In re Duke Energy Ohio's ESP*, Case No. 08-920-EL-SSO *et al.*, (ESP case) Duke Energy Ohio requested the Commission's approval of its deployment of a SmartGrid across its service territory. The Parties to the ESP case submitted a Stipulation agreeing to the Company's SmartGrid plan and that Stipulation was approved by the Commission in its entirety. As part of the SmartGrid deployment plan, Duke Energy Ohio agreed to certain performance standards to be met over the years of the deployment of SmartGrid metering and distribution automation. The Commission's order approving the Stipulation is effective for the deployment period. As a result, Duke Energy Ohio is submitting herein, performance standards consistent with those standards set forth in the ESP case. Duke Energy Ohio does not propose any alternatives to these performance standards at this time.

Attached at Duke Energy Exhibit 1 on page 4 are the proposed reliability standards consistent with the standards set forth in the ESP case and filed pursuant to Rule 4901:1-10-10 (B)(2)(a). The proposed standards include calculations for SAIFI and CAIDI. Additionally, Duke Energy Ohio has included a narrative explanation with demonstrative illustrations of how CAIDI can be negatively impacted by improvements in reliability.

Also included in the attachment is information concerning historical system performance including at least five years of reliability performance data, excluding major events and transmission outages.

Duke Energy Exhibit 2, submitted pursuant to Rule 4901:1-10-27(E)(1) consists of narrative descriptions of all distribution and transmission inspection programs, in response to the Commission's order in Case No. 06-653-EL-ORD which directed utilities to file their inspection programs in an ESS extension docket.

Respectfully submitted,

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DUKE ENERGY EXHIBIT 1.

4901:1-10-10 Distribution System Reliability

Proposed Reliability Standards for ESSS Rule 10

SAIFI - The proposed standard for SAIFI is already established by the stipulation agreement with a scheduled reduction from 1.5 outages per year in 2009 down to 1.1 outages per year by 2015 and beyond.

Year	2009	2010	2011	2012	2013	2014	2015	2016 forward
Reliability Standard	1.50	1.44	1.38	1.31	1.24	1.17	1.10	1.10

CAIDI - The proposed standard for CAIDI is 127.8 minutes per outage, identical to the existing Duke Energy Ohio target.

Analysis

In considering DEO's current reported reliability indices relative to the proposed standards, the major factor considered was the implementation of Smart Grid technology, including automatic sectionalization, breaker automation & fault current intelligence and self-healing circuits.

Over the next few years, Smart Grid will be implemented on the DEO distribution system. The first phases of the system are being installed now, and work will continue for several years to come.

The effects of increasing degrees of Smart Grid automation are explained and illustrated by the following examples.

Effect of Smart Grid on Reliability

Installation of Smart Grid Distribution Automation on the Duke Energy Ohio system is expected to have favorable effects on the reliability experienced by customers, but measured CAIDI will almost certainly increase.

The three major elements of Smart Grid Distribution Automation are Sectionalization, Breaker Automation & Fault Current Intelligence, and Automatic Self Healing. See exhibit A for definitions of these terms.

Sectionalization

Refer to Exhibit A, examples 1a and 1b

With Automatic Sectionalization, a typical line fault on a circuit backbone that previously locked out the entire circuit, as in exhibit A, example 1a, may now cause an outage to only half the customers. In this case, the circuit SAIFI for that outage is reduced from 1.0 to 0.5 since only half the customers experience an outage as in exhibit A, example 1b.

The CAIDI, however, increases because due to the fact that the number of customers interrupted was cut in half while the actual outage duration remained flat. This scenario is illustrated in example 1b. The net result is that automatic sectionalization lowers SAIFI, but CAIDI goes up.

Scenario	Description	Event SAIFI	Event CAIDI
Example 1a	Before Automatic Sectionalizing	1.00	75
Example 1b	After Automatic Sectionalizing	0.50	120

Breaker Automation & Fault Current Intelligence With Automatic Sectionalization

Refer to Exhibit A, examples 2a and 2b.

When fault current intelligence is added to automatic sectionalization, as in example 2b, the number of customers interrupted is cut in half compared to example 2a. This time, however, the fault current intelligence directs the repair crew directly to the fault location, reducing the time spent locating the faulted line.

SAIFI is reduced and the actual outage duration is reduced from 2a, yet CAIDI still goes up.

Scenario	Description	Event SAIFI	Event CAIDI
Example 2a	Before Automatic Sectionalizing and Fault Current Intelligence	1.00	75
Example 2b	After Automatic Sectionalizing and Fault Current Intelligence	0.50	90

Automatic Self Healing

Refer to Exhibit A, examples 3a and 3b.

In the ultimate implementation of Smart Grid, self-healing capabilities are added to the system. The result is that in example 3b, for any given circuit fault, only the circuit customers in the faulted section are out, thereby reducing the number of customers who are inconvenienced.

This principle is illustrated in examples 3a and 3b. Once again, SAIFI is reduced while CAIDI increases.

Scenario	Description	Event SAIFI	Event CAIDI
Example 3a	Before Automatic Self Healing	0.50	75
Example 3b	After Automatic Self Healing	0.25	120

Summary

Accelerated implementation of Smart Grid Automation decreases the number of customers affected by faults on the automated circuit.

In these three examples, the actual repair and restoration times for unplanned outages after Smart Grid has been fully implemented will be the same or less, but the nature of the CAIDI calculation results in a higher reported level.

Scenario	Description	Event SAIFI	Event CAIDI
Example 1a	Before Automatic Sectionalization	1.00	75
Example 1b	After Automatic Sectionalization	0.50	120
Example 2a	Before Automatic Sectionalization and Fault Current Intelligence	1.00	75
Example 2b	After Automatic Sectionalization and Fault Current Intelligence	0.50	90
Example 3a	Before Automatic Self Healing	0.50	75
Example 3b	After Automatic Self Healing	0.25	120

In all three examples, the number of customers experiencing a sustained outage decreased, no customer experienced an outage duration increase, but CAIDI went up.

In example 2, the number of customers experiencing a sustained outage decreased, the duration for affected customers actually decreased, and CAIDI still went up.

The bottom line is that fewer customers are affected by line faults after Smart Grid automation is installed. Also, the customers who do have an outage experience one that is typically no longer, and usually shorter, than they would have without automation.

Conclusion

The expected results of implementing Smart Grid on the DEO system will be an improvement of SAIFI.

As Smart Grid implementation progresses, CAIDI will almost certainly increase over recent levels. Since the ultimate impact on overall system CAIDI is difficult to accurately project, Duke Energy Ohio proposes to keep the present CAIDI target of 127.8 minutes as the new standard.

Customer survey results on the Duke Energy System in states other than Ohio have found that SAIFI, not CAIDI, is the main driver of customer satisfaction.

Example 1a: Before Automatic Sectionalizing

- Restoration Sequence
  - Step 1 - Permanent fault occurs interrupting service to all 2,000 customers
  - Step 2 - Crew dispatched, troubleshoots line, manually opens NC switch, then closes station breaker re-energizing first line segment
    - 1000 customers experience a 30 minute outage equal to crew travel time, troubleshooting time and manual switch time
  - Step 3 - Crew repairs fault, closes N.C. switch, and restores service to downstream customers
    - Downstream 1000 customers experience a 120 minute outage equal to crew travel time, initial manual switch time, plus repair and final manual switch time

- SAIFI = (1000cu+1000cu) / (1000cu+1000cu) = 1
- SAIDI = [(1000cu*30min) + (1000cu*120min)] / (1000cu+1000cu) = 75 min
- CAIDI = [(1000cu*30min) + (1000cu*120min)] / (1000cu+1000cu) = 75 min

Example 1b: After Automatic Sectionalizing

- Restoration Sequence
  - Step 1 - Permanent fault occurs
  - Step 2 - Recloser operates and attempts to clear the fault, but remains open after unsuccessful attempts; fault is automatically isolated
    - 1000 customers in first line segment do not experience an outage (recloser opens while Bker remains closed)
  - Step 3 - Dispatched crew troubleshoots line, locates, and repairs fault
  - Step 4 - Once fault is located and repaired, recloser is closed restoring downstream customers
    - Downstream 1000 customers experience a 120 minute outage equal to crew travel time plus repair and reset times

- SAIFI = 1000cu/(1000cu+1000cu) = 0.5
- SAIDI = (1000cu*120min)/(1000cu+1000cu) = 60 min
- CAIDI = [(1000cu*0min) + (1000cu*120min)]/1000cu = 120 min

Example 2a: Before Breaker Automation/Fault Current Intelligence and Automatic Sectionalization

- Restoration Sequence
  - Step 1 - Permanent fault occurs interrupting service to all 2,000 customers
  - Step 2 - Crew dispatched, troubleshoots line, manually opens NC switch, then closes station breaker re energizing first line segment
    - 1000 customers experience a 30 minute outage equal to crew travel time, trouble shooting time and manual switch time
  - Step 3 - Crew repairs fault, closes N.C. switch, and restores service to downstream customers
    - Downstream 1000 customers experience a 120 minute outage equal to crew travel time, initial manual switch time, plus repair and final manual switch time

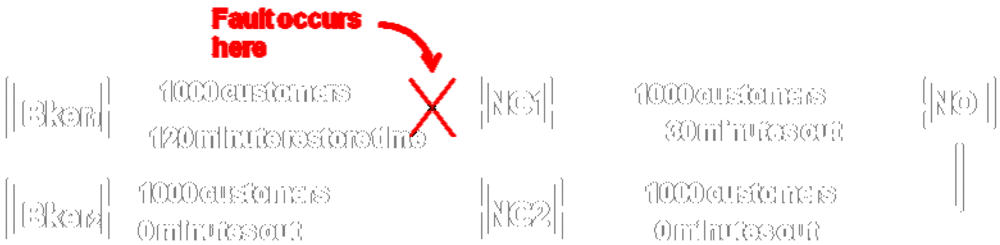
- SAIFI = (1000cu+1000cu) / (1000cu+1000cu) = 1
- SAIDI = [(1000cu*30min) + (1000cu*120min)] / (1000cu+1000cu) = 75 min
- CAIDI = [(1000cu*30min) + (1000cu*120min)] / (1000cu+1000cu) = 75 min

Example 2b: After Automatic Sectionalizing & Fault Current Intelligence

- Restoration Sequence
  - Step 1 - Permanent fault occurs
  - Step 2 - Recloser (RC) operates and attempts to clear the fault, but remains open after unsuccessful attempts; fault is automatically isolated.
    - 1000 customers in first line segment do not experience an outage (recloser opens while Bker remains closed)
  - Step 3 - Crew dispatched directly to fault location.
  - Step 4 - Dispatched crew repairs fault.
  - Step 5 - Once fault is repaired, RC is closed restoring downstream custs.
    - Downstream 1000 customers experience a 90 minute outage equal to crew travel time plus repair and reset times

- SAIFI = 1000cu/(1000cu+1000cu) = 0.5
- SAIDI = (1000cu*90min)/(1000cu+1000cu) = 45 min
- CAIDI = (1000cu*90min)/1000cu = 90 min

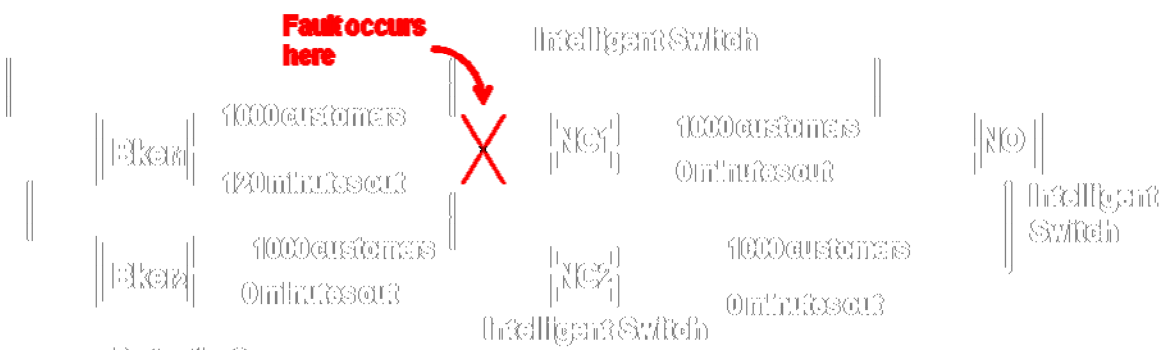
Example 3a: Before Automatic Self Healing



- Restoration Sequence
  - Step 1 – Permanent fault occurs in Bker 1 feeder line, Bker 1 opens interrupting service to 2,000 customers
  - Step 2 – Crew dispatched, troubleshoots line, manually opens NC1 sw., manually closes NO sw.
    - 1000 customers downstream of NC 1 experience a 30 minute outage equal to crew travel time and trouble shooting time, plus manual switching time
  - Step 3 – Crew repairs fault, closes Bker 1 to restore remaining customers, closes NC 1 and restores 'NO' switch to normally open position
    - Second group of 1000 customers experience a 120 minute outage equal to crew travel time, initial manual switching time, plus repair and final manual switching time

- SAIFI = (1000cu+1000cu) / (1000cu+1000cu+1000cu+1000cu) = 0.5
- SAIDI = [(1000cu*30min)+(1000cu*120min)] / (1000cu+1000cu+1000cu+1000cu) = 37.5 min
- CAIDI = [(1000cu*30min)+(1000cu*120min)] / (1000cu+1000cu) = 75 min

Example 3b: After Automatic Self Healing



- Restoration Sequence
  - Step 1 – Permanent fault occurs in Bker 1 feeder line
  - Step 2 – Communication occurs between breakers and Intelligent Switches, Bker 1 Opens, Normally Closed intelligent switch NC1 on Bker 1 feeder line also opens to isolate permanent fault
  - Step 3 – NO intelligent switch closes to transfer and restore 1,000 customers downstream of NC 1 to Bker 2 feeder
    - Only 1000 customers in the first line segment experience an outage
  - Step 4 – Dispatched crew troubleshoots line, locates and repairs fault
  - Step 5 – Once fault is repaired, Bker 1 is closed restoring service to 1,000 customers in the first line segment, NC 1 is closed and NO intelligent switch is opened to return to normal state (normal open point restored)
    - Affected 1000 customers experience a 120 minute outage equal to crew travel time plus repair time

- SAIFI = 1000cu / (1000cu+1000cu+1000cu+ 1000cu) = 0.25
- SAIDI = (1000cu*120min) / (1000cu+1000cu+1000cu + 1000cu) = 30 min
- CAIDI = [(1000cu*120min)/1000cu = 120 min

SMART GRID DEFINITIONS, KEY TO SCHEMATICS, ACRONYMS

SECTIONALIZATION

Sectionalization is a term used to describe the utilization of protective devices such as electronic, hydraulic, and vacuum reclosers to reduce the number of consumers interrupted during an outage event. Reclosers are installed in strategic points where major load divisions occur.

CIRCUIT BREAKER AND RECLOSER AUTOMATION WITH FAULT CURRENT INTELLIGENCE

Automating circuit breakers and reclosers will allow the Company to conduct operations from a remote location such as a control center that would normally require an onsite visit. This will allow DE-Ohio to obtain real time operating data, reduce truck rolls, improve operating efficiency, reduce O&M cost, and reduce outage duration. For example, with this new equipment we will be better able to determine actual line fault locations and dispatch crews closer to the actual location needing repair, thereby reducing restoration time.

SELF HEALING TECHNOLOGY

Self healing technology refers to the utilization of intelligent distribution line power devices such as switches, programmable reclosers and circuit breakers that communicate via a local area communication network to locate and isolate a fault via automated on site switching thereby reducing the number of consumers affected during an outage event.

KEY TO SCHEMATICS

- Bker – circuit breaker
- NC – normally close (describes switch position)
- NO – normally open (describes switch position)
- RC – recloser
- X – fault location
- Cu – customers
- Min – minute(s)

ACRONYMS

- SAIFI – *system average interruption frequency index*

  SAIFI = (total # of customers interrupted)/(total # of customers served)
- SAIDI – *system average interruption duration index*

  *SAIDI = ((total # of customers interrupted)*duration in minutes)/(total # of customers served)*
- CAIDI – *customer average interruption duration index*

  *CAIDI = ((total # of customers interrupted)*duration in minutes)/(total # of customers interrupted)= SAIDI/SAIFI*

Duke Energy Ohio Exhibit B

Historical Reliability Performance Data

	Past Five Years Indices Reported to PUCO					
	2004	2005	2006	2007	2008	Mean
CAIDI	84.01	82.2	87.81	97.07	98.31	89.88
SAIFI	1.35	1.49	1.48	1.33	1.33	1.396

The reliability indices listed above were calculated using sustained outage events having greater than five minutes duration. Outage event data from major events (MEDs) and from transmission outages was excluded from the calculation.

Exclusion of Major Events

Duke Energy Ohio excludes major event days (MEDs) from reliability reporting using IEEE Std. 1366-2003 methodology. The methodology involves the calculation of a threshold (in terms of daily SAIDI minutes) such that on any day that exceeds that threshold, a major event day is declared. The SAIDI threshold is based upon collecting values of daily SAIDI for five sequential years ending on the last day of the most recent complete calendar year.

Major event thresholds have been calculated using outage data as described in IEEE Std. 1366-2003. No adjustments or exclusions, beyond omitting transmission outages, have been made to the data used to arrive at the event day threshold presently in use or those used in past years.

Duke Energy Exhibit 2.

ESSS Rule 4901:1-10-27 (E) (1)

a) Poles and Towers

Inspect all Duke Energy Ohio owned poles on a 10 year schedule and treat, repair or replace as needed. Poles and towers also receive an additional visual inspection in compliance with inspection program 4901:1-10-27 (D)(1),(2). The goal is to maintain adequate strength and integrity of poles and towers per the National Electrical Safety Code. Based on the inspection results, repair work orders are prepared as needed and tracked until complete.

b) Conductors

The distribution inspection program consists of a driving or walking visual inspection. All distribution circuits are inspected on a 5-year schedule as part of the distribution inspection program 4901:1-10-27(D)(1),(2). Inspectors document physical defects or other potential hazards to the safe and reliable operation of the circuits. Based on the inspection results, repair work orders are prepared as needed and tracked until complete.

c) Pad mounted transformers

The distribution inspection program consists of a visual inspection. All pad-mounted transformers are inspected on a 5-year schedule as part of the distribution inspection program 4901:1-10-27(D)(1). Inspectors document physical defects or other potential hazards to the operations of the transformers. This inspection identifies physical defects in equipment or potential hazards such as transformers that are rusted, leaking, oil-stained, have broken hinges, missing locks. Based on the inspection results, repair work orders are prepared as needed and tracked until complete.

d) Line reclosers

Line reclosers, sectionalizers and OVR devices receive an annual visual inspection. Line workers inspect the units for signs of damage or deterioration and record the operations-counter readings. Based on the inspection results, repair work orders are prepared as needed and tracked until complete.

e) Line capacitors

Line capacitors receive an annual visual and operational inspection. Technicians inspect the units for signs of damage or deterioration and perform an operational test to verify proper function. Based on the inspection results, repair work orders are prepared as needed and tracked in until complete.

f) <u>Right-of-way vegetation control</u>

Distribution Vegetation Management – achieve 4-year cycle for vegetation line clearing on distribution circuits. The goal is to help provide safe and reliable electric service by limiting contact between vegetation and power lines.

Transmission Vegetation Management – achieve 6-year cycle for vegetation line clearing on transmission circuits. The goal is to help provide safe and reliable electric service by limiting contact between vegetation and power lines.

g) <u>Substations</u>

Station Visual Inspection

All transmission and distribution substations are visually inspected monthly. Visual inspections and documented readings taken during the inspection help determine the need for equipment maintenance and locate potentially unsafe situations or issues that could cause unplanned outages. Based on the inspection results and the tests below, repair work orders are prepared as needed and tracked until complete.

Infrared Scan

An infrared scan of substation equipment is performed annually. Any abnormal heating is recorded and the thermography analyzed to determine repairs.

Power Factor Testing

Power factor tests are performed on a time period from 2 – 9 years based on station equipment type/size/condition/criticality. Power factor tests establish baseline readings on new equipment for future reference when tests are performed to evaluate the integrity of equipment at later date.

Dissolved Gas Analysis Testing – Transformer Oil Sampling

A dissolved gas analysis test is performed on transformers with a 3-phase rating above 7.5 MVA 1 – 2 times per year depending on the transformer's MVA rating. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the transformer.

Dissolved Gas Analysis Testing – Transformer Load Tap Changer

A dissolved gas analysis test is performed on transformer load tap changers 1 – 3 times per year depending on the type/make/model of equipment. The dissolved gas analysis determines the gas levels within the insulating oil and overall health of the load tap changer.

Circuit Breaker Test

The circuit breaker tests are performed every 3 – 9 years depending on the type of circuit breaker. The purpose of this test is to provide a non-intrusive method of evaluating the circuit breaker to ensure its integrity.

Metal Enclosed Capacitor Assemblies

Internal inspection is performed annually for metal enclosed capacitor assemblies without unbalance protection and every 3 years for metal enclosed capacitor assemblies with unbalance protection. The capacitors within the enclosure are inspected to ensure equipment is functioning properly.

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Case No(s). 09-0757-EL-ESS

Summary: Application Application of Duke Energy Ohio, Inc. for Approval of Proposed Reliability Standards electronically filed by Ms. Elizabeth H Watts on behalf of Duke Energy Ohio, Inc.