STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF DUKE ENERGY INDIANA, LLC PURSUANT TO IND. CODE §§ 8-1-2-42.7 AND 8-1-2-61, FOR (1) AUTHORITY TO MODIFY ITS RATES AND CHARGES FOR ELECTRIC UTILITY SERVICE THROUGH A STEP-IN OF NEW RATES AND CHARGES USING A FORECASTED TEST PERIOD; (2) APPROVAL OF NEW SCHEDULES OF RATES AND CHARGES, GENERAL RULES AND REGULATIONS, AND RIDERS; (3) APPROVAL OF A FEDERAL MANDATE CERTIFICATE UNDER IND. CODE § 8-1-8.4-1; (4) APPROVAL OF REVISED ELECTRIC DEPRECIATION RATES APPLICABLE TO ITS ELECTRIC PLANT IN SERVICE; (5) APPROVAL OF NECESSARY AND APPROPRIATE ACCOUNTING DEFERRAL RELIEF; AND (6) APPROVAL OF A REVENUE DECOUPLING MECHANISM FOR CERTAIN CUSTOMER CLASSES	)	**CAUSE NO. 45253**

VERIFIED DIRECT TESTIMONY
OF
TIMOTHY A. ABBOTT

On Behalf of Petitioner,
DUKE ENERGY INDIANA, LLC

Petitioner's Exhibit 25

July 2, 2019

DIRECT TESTIMONY OF TIMOTHY A. ABBOTT
DIRECTOR OF SYSTEM OPERATIONS
DUKE ENERGY BUSINESS SERVICES LLC
ON BEHALF OF DUKE ENERGY INDIANA, LLC
BEFORE THE INDIANA UTILITY REGULATORY COMMISSION

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Timothy A. Abbott, and my business address is 139 East 4th Street, Cincinnati, Ohio.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed as Director of System Operations by Duke Energy Business Services LLC, a service company subsidiary of Duke Energy Corporation ("Duke Energy"), and a non-utility affiliate of Duke Energy Indiana, LLC ("Duke Energy Indiana" or "Company").

Q. PLEASE DESCRIBE YOUR RESPONSIBILITIES AS DIRECTOR OF SYSTEM OPERATIONS.

A. My primary responsibility as Director of System Operations is to provide leadership for the Transmission Control Centers of Duke Energy Indiana, and Duke Energy Ohio / Kentucky.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND.

A. I have a Bachelor of Science Degree from Miami University. I have over 28 years of experience with Duke Energy in a variety of roles of varying responsibility. I have spent the last 21 years in System Operations serving in various capacities related to control room operations, North American Electric Reliability Corporation ("NERC") Compliance, Regional Transmission Operator policy and governance, Tariff Administration, and Energy Accounting.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of this testimony is to describe the various aspects of the Duke Energy Indiana transmission system, including planning, operating, reliability, and the prudency of the related costs. I also describe and support the transmission capital and operations and maintenance ("O&M") expenditures used in the forecast.

II. <u>DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM</u>

Q. PLEASE DESCRIBE DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM.

A. Duke Energy Indiana's transmission system is jointly owned with Wabash Valley Power Alliance, and Indiana Municipal Power Agency. It consists of 723 circuit miles of 345 kV, 653 circuit miles of 230 kV, 1,391 circuit miles of 138 kV, and 2,521 circuit miles of 69 kV. The transmission system also consists of approximately 500 stations and substations, which are interconnected with a variety of transmission and distribution circuits. The transmission system, particularly at voltages greater than 100 kV, acts to transfer power from sources to loads, including the distribution system. The Duke Energy Indiana transmission system is under the functional control of the Midcontinent Independent System Operator, Inc. ("MISO"), and is part of the interconnected transmission system that safely, efficiently, and reliably transports power to customers in the Eastern United States.

Q. PLEASE EXPLAIN HOW THE TRANSMISSION SYSTEM HAS CHANGED SINCE DUKE ENERGY INDIANA'S LAST BASE RATE CASE.

A. Table 1 provides a breakdown of the changes to Duke Energy Indiana's transmission system.

Table 1:

T&D Asset	2002	2018
Number of Transmission Substations	114	106
Number of Distribution Substations	394	394
Transmission substation MVA capacity	22193	22983
Distribution substation MVA capacity	6753	9411
Number of Transmission Circuit Miles	5361	5288

As can be seen in Table 1, Duke Energy Indiana continually seeks to improve the system by identifying efficiencies and consolidating facilities, where appropriate. An example of this may be retiring a small substation and serving those circuits from a new or existing substation with consolidated functions. Additionally, since 2002 the Company replaced its engineering database with GIS data, leading to a changing in the number of transmission circuit miles.

Q. PLEASE EXPLAIN HOW DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM IS INTERCONNECTED WITH THE TRANSMISSION SYSTEM OF OTHER ELECTRIC UTILITIES.

A. Duke Energy Indiana's transmission system has a significant number of interconnections, with Ameren, Vectren, American Electric Power, LGE Energy, Hoosier Energy, NISource, Duke Energy Ohio, and Indianapolis Power & Light Company. These interconnections allow for the free flow of energy across the system, and contribute to the stability of all interconnected systems.

Q. PLEASE DESCRIBE THE OVERALL CONDITION OF DUKE ENERGY INDIANA'S TRANSMISSION PLANT.

A. The Duke Energy Indiana transmission system is comprised of a wide variety of equipment of varying vintage, as would be expected of a utility that is over 100 years old. Duke Energy Indiana maintains the transmission system utilizing good utility practice. The system operates as designed, and provides safe, reliable and efficient service for the connected customers, including the various distribution systems. Recently, considerable capital has been invested into the transmission system via the Company's Transmission, Distribution, and Storage System Improvement Charge ("TDSIC") plan, which was approved by the Indiana Utility Regulatory Commission in Cause No. 44720 ("TDSIC Plan"). These improvements consist of things such as new substation equipment, rebuilt lines, and steel poles.

III. MISO

Q. WHAT IS MISO?

A. MISO is a Regional Transmission Organization, and Market Operator, that has functional control of Duke Energy Indiana's Bulk Electric System via the MISO Open Access Transmission Tariff.

Q. HOW DOES DUKE ENERGY INDIANA PARTICIPATE IN MISO?

A. Duke Energy Indiana is a Transmission Owner and market participant in MISO. Duke Energy Indiana has transferred functional control of its Bulk Electric facilities to the MISO. Duke Energy Indiana is also a Generation Owner and Operator, and a Market Participant, and has load connected to the MISO system.

Q. DOES DUKE ENERGY INDIANA RECEIVE CHARGES FOR MISO PARTICIPATION? IF SO, PLEASE EXPLAIN.

A. Yes. Duke Energy is charged administrative fees for participating in MISO.

Q. DOES DUKE ENERGY INDIANA RECEIVE REVENUES FOR ITS MISO PARTICIPATION? IF SO, PLEASE EXPLAIN.

A. Yes. Duke Energy Indiana receives revenue associated with the use of the Duke Energy Indiana transmission system by other companies. The revenues are based on MISO tariffed rates, as approved by the Federal Energy Regulatory Commission ("FERC").

Q. HOW IS DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM PLANNED AND OPERATED?

A. Duke Energy Indiana is a transmission owning member of MISO. MISO is largely responsible for planning the Duke Energy Indiana transmission system using processes that are compliant with FERC Order 890. As a matter of compliance with FERC order 890, Duke Energy Indiana participates in MISO stakeholder forums that provide transparency and facilitate customer feedback as a normal part of planning. Duke Energy Indiana also provides for stakeholder feedback in the development of supplemental projects (*i.e.* those not assigned by MISO), such as those being undertaken as part of the Company's TDSIC Plan.

Duke Energy Indiana, in conjunction with MISO, operates the transmission system in accordance with NERC Reliability Standards and requirements, and good utility practice. This allows us to provide all customers with safe efficient and reliable, and cost effective service.

Q. DOES DUKE ENERGY INDIANA CURRENTLY TRACK FOR RECOVERY FROM ITS RETAIL ELECTRIC CUSTOMERS CERTAIN COSTS AND TRANSMISSION REVENUES RELATED TO MISO?

A. Yes. These costs are tracked through Standard Contract Rider No. 68 ("RTO Rider"). Adjustments under the RTO Rider are made on an annual basis in Cause No. 42376.

Q. WHAT COSTS ARE RECOVERED THROUGH THE RTO RIDER?

A. Costs collected through the RTO Rider generally include MISO management costs, certain MISO transmission revenues, and other RTO related costs.

IV. TRANSMISSION EXPENDITURES

Q. WHAT MAJOR FACTORS DRIVE THE NEED FOR TRANSMISSION INVESTMENT?

A. Transmission investment is needed for a variety of reasons. Baseline reliability projects allow the system to be compliant with NERC criteria. Market efficiency projects provide for a more economic delivery of energy to load. Multi-value projects in MISO allow for such things as the delivery of wind energy from remote locations to load centers. Projects for operational flexibility allow the Company to enhance reliability when certain elements are out of service. Capacity enhancement facilitates serving organic load growth and customer related projects (typically related to adding new large customers to the system) are some of the major categories. Duke Energy Indiana also undertakes projects to enhance the reliability and resiliency of the system, and increase its operational flexibility.

Q. IS THE NEED FOR TRANSMISSION INVESTMENT UNIQUE TO DUKE ENERGY INDIANA?

A. No. Virtually every region in North America, is in the process of actively investing in transmission systems for the reasons mentioned above.

Q. HOW IS DUKE ENERGY INDIANA SEEKING TO LEVERAGE TECHNOLOGY TO MORE EFFICIENTLY MANAGE TRANSMISSION SYSTEM ASSETS?

A. Duke Energy Indiana is in the early stages of implementing a Health and Risk Management ("HRM") program for its transmission system. HRM utilizes machine learning and artificial intelligence, allowing equipment to be managed based on a statistically driven program and schedule, rather than a time and failure driven schedule. HRM will allow us to more efficiently deploy financial and human resources to address equipment, while also providing a mechanism to intelligently predict and respond to probable asset end of life, rather than react to its failure.

Q. HAS DUKE ENERGY INDIANA RECENTLY REMODELED ITS TRANSMISSION CONTROL CENTER?

A. Yes, the Company upgraded the Plainfield control center in 2017.

Q. WHAT BENEFITS HAS DUKE ENERGY INDIANA DERIVED FROM THE REMODELING OF THE TRANSMISSION CONTROL CENTER AT THE INDIANA REGIONAL HEADQUARTERS IN PLAINFIELD INDIANA?

A. The new center improves the ergonomic and environmental comfort of the System Operators, enhances access to tools, and provides more situational awareness information. The simulator and training space dramatically improves the training experience for our System Operators and the support space adjacent to the control center locates key support personnel in close proximity to the control center.

Q. WHAT WAS THE AMOUNT OF INVESTMENT.

A. The capital cost of the center for 2015-2018 was $22.4 million.

Q. HAS DUKE ENERGY INDIANA INVESTED IN NEW FACILITIES FOR THEIR CONSTRUCTION AND MAINTENANCE CREWS?

A. Yes.

Q. WHAT WERE THE RESULT OF THESE FACILITY INVESTMENTS?

A. The facility investments increased the number of transmission crew headquarters from two to six. Prior to this expansion, transmission crews were headquartered in Columbus and Kokomo and all inventory was located in Plainfield. Simple logistics created challenges for responding to certain outages, as crews and materials could be located hours away. In our current, expanded configuration, we have transmission crews located in Columbus, Kokomo, Greencastle, Noblesville, Bloomington, and Vincennes. In addition to transmission crews, these locations have areas for "storm stock", such as poles, cross arms, and insulators, which will facilitate faster storm restoration times.

Q. HOW WILL THESE INVESTMENTS PROVIDE BENEFITS TO CUSTOMERS.

A. Customers benefit primarily through reduced outage times, as crews and materials are now more evenly distributed throughout the service territory.

Q. DID DUKE ENERGY INDIANA CREATE A TRAINING FACILITY FOR TRANSMISSION CONSTRUCTION AND MAINTENANCE CREWS?

A. Yes, Duke Energy Indiana constructed a training facility in Shelbyville. The Company began conducting training sessions at this location in 2017.

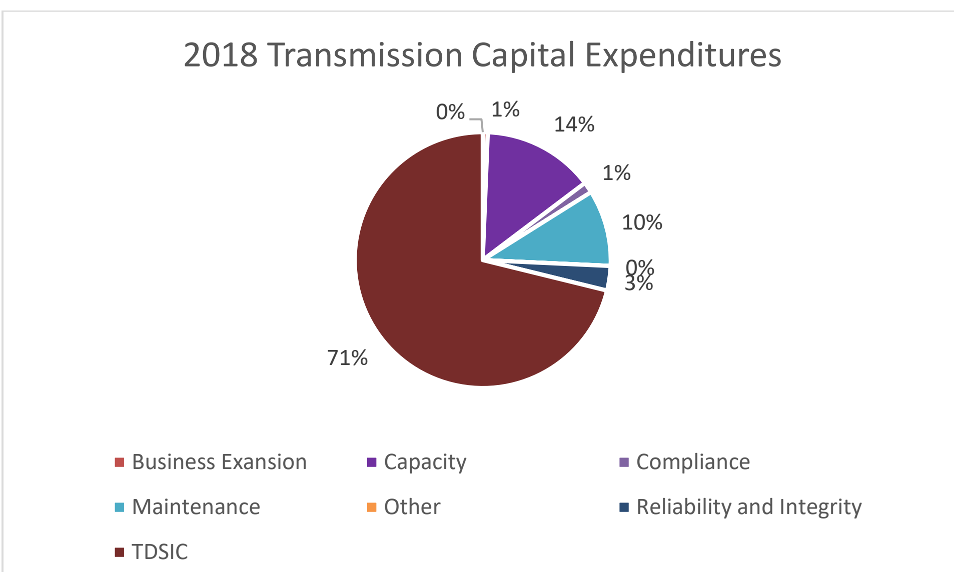
Q. WHAT ARE THE BENEFITS OF THE NEW TRAINING FACILITY?

A. The training facility in Shelbyville provides a central location where transmission resources can gather for classroom instruction and/or field training. The classroom provides computers and audiovisual equipment, with the outdoor laboratory area providing examples of substation and line equipment for the purpose of training our technicians.

Q. WHAT WAS THE AMOUNT OF TRANSMISSION EXPENSE IN 2018?

A. Total transmission Operations and Maintenance ("O&M") expenditure in 2018 was $98 million. Total capital expenditures in the transmission system totaled $174 million in 2018. The figure below provides a breakdown of Duke Energy Indiana's 2018 transmission related capital expenditures.

<u>Chart 1</u>:

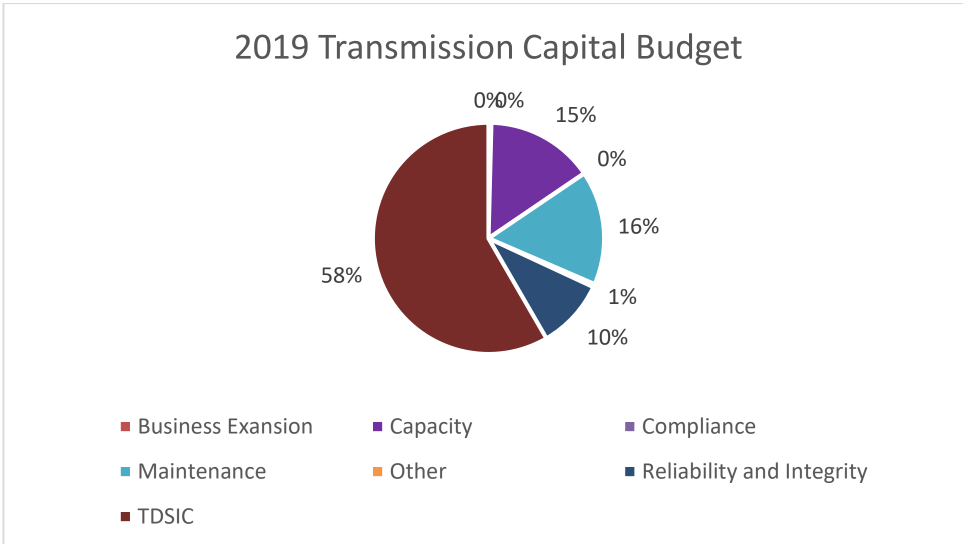


In the transmission system, approximately 71% of investment was driven by the TDSIC program, which consists of transmission substation and transmission line improvements. Examples of this investment include the replacement of deteriorated wood poles and replacement of obsolete substation and line equipment. Approximately 13% of investment was driven by reliability improvement and maintenance programs (excluding TDSIC). Examples of this type of investment include vegetation management, service restoration, line relocations and the replacement of obsolete substation and line equipment that are not part of TDSIC. The Spill Prevention, Containment and Countermeasures (“SPCC”) program is also part of this segment. Approximately 14% of investment was driven by capacity requirements to serve load and to meet the NERC Planning Standards. Approximately 1% of investment was driven by compliance projects. Examples of this type of investment include physical and cyber security projects.

Q. WHAT IS DUKE ENERGY INDIANA’S FORECASTED AMOUNT OF TRANSMISSION EXPENSE IN 2019?

A. Duke Energy Indiana forecasts $104 million in O&M transmission expense in 2019. Total capital investment in the transmission system is projected at $136 million in 2019. The figure below provides a breakdown of Duke Energy Indiana’s 2019 transmission related capital expenditures.

<u>Chart 2</u>:

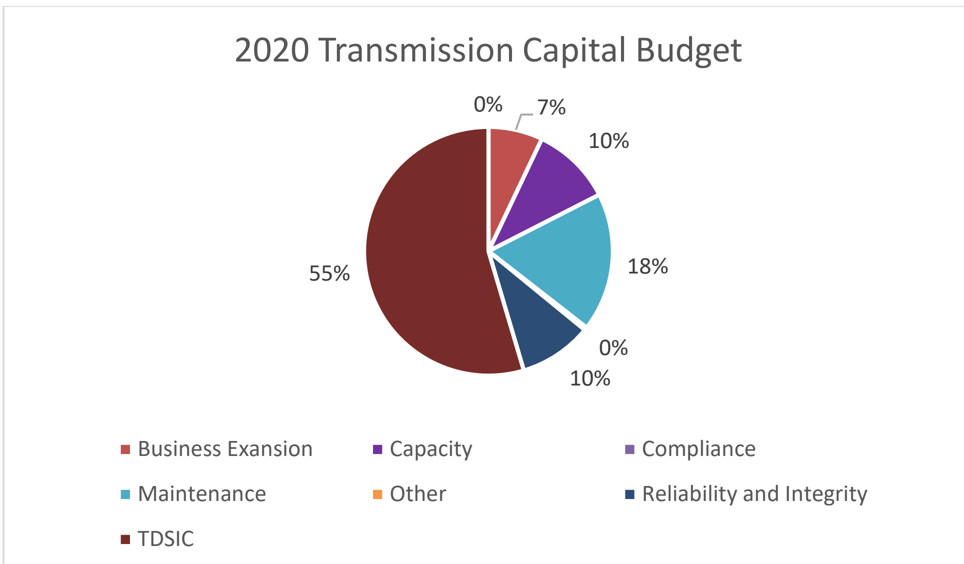


Approximately 58% of investment is driven by the TDSIC program, which consists of transmission substation and transmission line improvements. Examples of this investment include the replacement of deteriorated wood poles and replacement of obsolete substation and line equipment. Approximately 26% of investment is driven by reliability improvement and maintenance programs (excluding TDSIC). Examples of this type of investment include the vegetation management, replacement of deteriorated wood poles and replacement of obsolete substation and line equipment. Approximately 16% of investment is driven by business expansion and capacity requirements to serve load and to meet the NERC Planning Standards.

Q. WHAT IS DUKE ENERGY INDIANA’S FORECASTED AMOUNT OF TRANSMISSION EXPENSE IN 2020?

A. Duke Energy Indiana projects $99 million in O&M transmission expense in 2020. Total capital investment in the transmission system is projected at $153 million in 2020. The figure below provides a breakdown of Duke Energy Indiana's 2020 transmission related capital expenditures.

<u>Chart 3</u>:



For 2020 projection, approximately 55% of investment is driven by the TDSIC program, which consists of transmission substation and transmission line improvements. Examples of this investment include the replacement of deteriorated wood poles and replacement of obsolete substation and line equipment. Approximately 28% of investment is driven by reliability improvement and maintenance programs (excluding TDSIC). Examples of this type of investment include the vegetation management, replacement of deteriorated wood poles and replacement of obsolete substation and line equipment. Approximately 10% of investment is driven by capacity requirements to serve load and to meet the NERC Planning Standards, and approximately 7% of investment is business expansion to construct the new Mitchell Lehigh substation

Q. PLEASE EXPLAIN HOW DUKE ENERGY INDIANA'S TRANSMISSION O&M AND CAPITAL COSTS HAVE CHANGED FROM 2018-2019 AND FROM 2019-2020.

A. As can be seen in Table 2 below, there is a $6 million increase from 2018 to 2019. This was caused by lower than anticipated spend for MISO Schedule 17 and 2. The $5 million decrease between 2019 and 2020 is the result of decreased funding for MISO Schedule 2 to align with projected spend level.

Table 2:

$ in Millions	2018 A	2019 B	2020 F
Transmission O&M	$98	$104	$99
Increase / (Decrease)		$6	($5)

The difference in transmission capital expenditures between 2018, 2019, and 2020, as can be seen in Table 3, is the result of project timing in the Company's TDSIC plan.

Table 3:

$ in Millions	2018 A	2019 B	2020 F
Transmission Capital Expenditures	$236	$136	$153
Increase / (Decrease)		($100)	$17

Q. DID YOU PROVIDE THE 2020 TRANSMISSION O&M AND CAPITAL EXPENDITURES REFLECTED ABOVE TO WITNESS MR.

CHRISTOPHER M. JACOBI FOR INCLUSION IN THE DUKE ENERGY INDIANA FORECASTED TEST PERIOD PROPOSED IN THIS CASE?

A. Yes, I did.

Q. PLEASE BRIEFLY EXPLAIN ANY COST SAVING EFFORTS UNDERTAKEN TO MANAGE COSTS.

A. Duke Energy Indiana seeks to control costs on a continuing basis. This includes more focused deployment of resources, such as the methods described in the EAB program. Utilization of HRM technology will help drive efficient deployment of resources, while reducing the potential for outages to our customers. Consistently managing project scope and properly scheduling work to maximize outage opportunities all contribute to more efficient use of capital and O&M dollars. Duke Energy Indiana has maintained essentially flat O&M expenditures over the years 2018 through 2020, even though certain fees, such as those due MISO and NERC have increased.

V. VEGETATION MANAGEMENT

Q. PLEASE EXPLAIN DUKE ENERGY INDIANA'S TRANSMISSION VEGETATION MANAGEMENT PLAN?

A. Duke Energy Indiana's transmission vegetation management plan is designed to eliminate vegetation on right-of-way caused outages on circuits with voltages of 200 kV and above, in compliance with NERC Reliability Standard FAC-003. For circuits with lower voltages, Duke Energy Indiana seeks to minimize vegetation related outages. In all cases, Duke Energy Indiana seeks to utilize the most cost effective means to control vegetation. This includes aggressively leveraging new technologies and reclaiming transmission rights-of-way to utilize a preventive approach, rather than only reactive.

Q. DOES DUKE ENERGY INDIANA ANTICIPATE AN INCREASE IN COSTS RELATED TO ITS TRANSMISSION VEGETATION MANAGEMENT PLAN? IF YES, PLEASE EXPLAIN.

A. Yes. Duke Energy Indiana anticipates unit costs related to transmission vegetation management will continue to increase. The O&M for transmission vegetation management in 2018 was $5.62 million, the projected 2019 O&M is $7.65 million, and the projected 2020 O&M is $7.61 million. The 2018 capital spend was $4.3 million and of that $1.7 million was for the emerald ash borer program ("EAB Program"). The 2019 capital budget spend is $11.6 million of which $7.1 million is designated for the EAB Program. The 2020 capital budget spend is $13.3 million of which $6.7 million is designated for the EAB Program. These costs are included in the capital and O&M expenditures described above.

Q. HAS DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM BEEN IMPACTED BY THE EMERALD ASH BORER? IF YES, PLEASE EXPLAIN.

A. Yes. The emerald ash borer is a beetle native to north-eastern Asia that feeds on ash species. It has killed millions of ash trees in North America and is present in all 92 Indiana counties. It is estimated that there are approximately 18,000 dead, dying and living ash tree within striking distance of Duke Energy Indiana's 69 kV and 138 kV transmission lines.

Q. IS THIS UNIQUE TO DUKE ENERGY INDIANA?

A. No. Many areas of the midwest and approximately 50% of North America are experiencing widespread tree mortality due to the emerald ash borer. Please see Petitioner's Exhibit 25-A (TAA) for a visual of the ash tree devastation.

Q. WHAT HAS DUKE ENERGY INDIANA DONE TO ADDRESS EMERALD ASH BORER ISSUES?

A. Duke Energy Indiana has developed and implemented a plan to address ash trees that pose a risk to our transmission system. With the use of hyperspectral imaging technology, we are identifying ash trees that pose a risk to our facilities and implementing a systematic plan to cut these trees.

Q. PLEASE DESCRIBE DUKE ENERGY INDIANA'S EMERALD ASH BORER PROGRAM.

A. The Indiana EAB Program was created in 2018 with a focus on ash trees along the 69 kV and 138 kV power lines. This program is an addition to the Company's other vegetation management programs, such as maintenance, reactive, herbicide, and mowing. Hazard tree threats, which include ash tree threats, along high voltage lines are addressed through the routine maintenance program. The low-voltage transmission circuits are first aerial surveyed with fixed wing Light Detection and Ranging ("LiDAR") technology to capture the proximity of the tree threat to the power lines. LiDAR identifies the height, striking distance, tree segments, and proximity of the vegetation to the line. A second flight collects hyperspectral imagery that allows for identification of different tree species and tree health based on spectral signatures.

Q. PLEASE EXPLAIN BRIEFLY LIDAR AND HYPERSPECTRAL IMAGERY.

A. LiDAR is a surveying technology that measures distance to a target by illuminating the target with laser light pulses. The sensor records the return time and location of the laser pulses to create a three-dimensional ("3D") data representation of vegetation along the power lines. Hyperspectral imagery measures the reflectance of each pixel in five nanometer bandwidths across the electromagnetic spectrum. This results in over 100 bands of light in each pixel; in comparison to a standard photograph that detects three bands of light. Think of this as drawing a picture with a box of three crayons and then drawing the same picture with a box of 100 crayons (hyperspectral imagery). This allows for the identification of different tree species based on spectral signatures, which show reflectance at each of the 100+ bands. Each species has a unique spectral signature. An example of LiDAR and hyperspectral imagery can be seen in Petitioner's Exhibit 25-B (TAA).

Q. IS DUKE ENERGY INDIANA'S USE OF LIDAR AND HYPERSPECTRAL TECHNOLOGY LIMITED TO THE EMERALD ASH BORER PROGRAM? PLEASE EXPLAIN.

A. Both LiDAR and hyperspectral technology is being used for the Emerald Ash Borer Program. The hyperspectral technology is limited to the Emerald Ash

Borer Program. LiDAR technology is also being used on the transmission vegetation maintenance and reactive programs. For example, in 2019, Duke Energy Indiana will be flying to collect LiDAR data on our NERC circuits for their maintenance and reactive programs.

Q. WHAT IS DUKE ENERGY INDIANA'S GOAL FOR THE EMERALD ASH BORER PROGRAM?

A. The goal of the EAB Program is to safely reduce dying ash tree impacts to power quality and long-term outages with minimum impact to customers and/or property owners.

Q. WILL THIS PROGRAM IMPACT DUKE ENERGY INDIANA CUSTOMERS AND WHAT HAVE YOU DONE TO MINIMIZE THE IMPACT?

A. Many property owners/customers are welcoming the program, because it helps them address their dying ash trees problem. Because we are focusing on trees that are outside of Duke Energy Indiana's right-of-way, customer consent is a necessary step for this particular program. As part of the EAB Program development, Duke Energy Indiana reviewed and created internal and external communications used to educate and inform stakeholders. Petitioner's Exhibit 25-C (TAA) is the Emerald Ash Borer (EAB) Program brochure the Company used to educate external stakeholders. In addition, the Company works closely with other Duke Energy Indiana vegetation management programs to minimize the impact to customers while assisting with their problem ash trees.

VI. TDSIC PROGRAM

Q. PLEASE DESCRIBE DUKE ENERGY INDIANA'S TRANSMISSION TDSIC PLAN.

A. Duke Energy Indiana's TDSIC Plan is the result of enabling legislation passed by the Indiana Legislature, and codified at Indiana Code Ch. 8-1-39. From a transmission system standpoint, Duke Energy Indiana has invested in a variety of asset-based reliability improvements, including line rebuilds, pole replacements, breaker replacements, and certain substation reconfigurations. These investments will improve the reliability and operability of the system for years to come. Although customers benefit from all reliability improvements being pursued via the TDSIC Plan, some of the more noticeable benefits will be related to pole replacements and reconductoring of the 69 kV system, as well as the reconfiguration of certain substations to contain a "ring bus" configuration, which allows for more easily maintaining multiple energy sources into that substation.

It is important to recognize that some TDSIC Plan improvements require outages to the transmission system in order to perform the identified work. While this is normal, the scale of work being done under the TDSIC Plan is large. This means that during the period where we are executing our TDSIC Plan, an historically large number of system maintenance outages are being undertaken. This increases the risk of outages to our customers, and in some cases extends the length of the outage, due to abnormal system configurations while certain portions of the system are out-of-service for construction. We work diligently to mitigate these risks, but they do exist. The benefits, although significant, may not produce a step change in reliability statistics on a system-wide level, but may do so on a local level.

Q. WHAT TRANSMISSION LINE AND T&D SUBSTATION PROJECTS ARE INCLUDED IN THE TDSIC PLAN?

A. Duke Energy Indiana identified, scoped and estimated a total of 615 potential projects at 357 T&D substations and 87 Transmission Lines. From these, we have selected 323 projects at 280 T&D Substations and 144 projects on 81 Transmission Lines for inclusion in the T&D Plan.

Additionally, Duke Energy Indiana jointly owns its transmission system with Indiana Municipal Power Agency ("IMPA") and Wabash Valley Power Alliance ("WVPA"). Duke Energy Indiana manages and maintains the transmission system and plans to complete 46 projects at 42 T&D substations, and 8 projects on 8 transmission lines on behalf of the Joint Transmission Owners. These projects are not included for cost recovery in the TDSIC Plan, but remain an important component of continued reliability of the joint transmission system. The remaining 36 projects at 35 T&D Substation and 58 projects on 26 Transmission Lines were not included in the initial cut of the 7-year T&D Plan. Rather, we have identified these projects as "Alternate" projects, which are available to substitute into the TDSIC Plan at a later date if system conditions were to elevate these projects' priority to be higher than other work that is currently included in the plan, or if actual project costs are lower than originally estimated and would therefore allow additional work to be performed within the same approved total plan cost.

VII. RELIABILITY

Q. PLEASE GENERALLY DESCRIBE YOUR UNDERSTANDING OF THE RELIABILITY OF DUKE ENERGY INDIANA'S TRANSMISSION SYSTEM IN SERVING ITS RETAIL ELECTRIC CUSTOMERS.

A. Duke Energy Indiana's transmission system is reliable. The highest voltages (138 kV and above) would be best described as very reliable. The 69 kV system has more challenges from a reliability standpoint, and we are addressing those challenges via the TDSIC Plan reliability work and the EAB Program, which is described in this testimony.

Q. WHAT ARE THE PRIMARY CAUSES OF TRANSMISSION OUTAGES IN DUKE ENERGY INDIANA'S SERVICE TERRITORY?

A. Over the last four years, the three major causes of outages have been vegetation related outages, equipment failure, and planned outages to perform system upgrades. For example, in 2018, 10.10% of all transmission outages were related to vegetation and 42.76% to equipment failure.

Table 4:

Outage Cause	% of Total Number of Outages Excluding Planned Outages & MEDs			
	2015	2016	2017	2018
Vegetation	13.03%	11.50%	12.19%	10.10%
Wildlife	4.89%	2.88%	3.75%	4.38%
Public Accident/Damage	10.75%	10.54%	7.19%	18.18%
Unknown Cause	20.52%	17.89%	20.63%	15.49%
Equipment Failure	43.97%	43.45%	30.31%	42.76%
Other Cause	0.00%	9.90%	21.25%	5.39%
Weather	6.84%	3.83%	4.69%	3.70%

Q. WHAT IS DUKE ENERGY INDIANA'S MAIN GOAL FOR ITS TRANSMISSION SYSTEM?

A. The main goal of Duke Energy Indiana's transmission system is to provide safe, reliable, and affordable power to satisfy our customers' needs.

VIII. CONCLUSION

Q. WERE PETITIONER'S EXHIBITS 25-A (TAA) THROUGH 25-C (TAA) PREPARED BY YOU OR AT YOUR DIRECTION?

A. Yes, they were.

Q. DOES THIS CONCLUDE YOUR PREFILED DIRECT TESTIMONY?

A. Yes, it does.

USDA United States Department of Agriculture

Cooperative Emerald Ash Borer Project

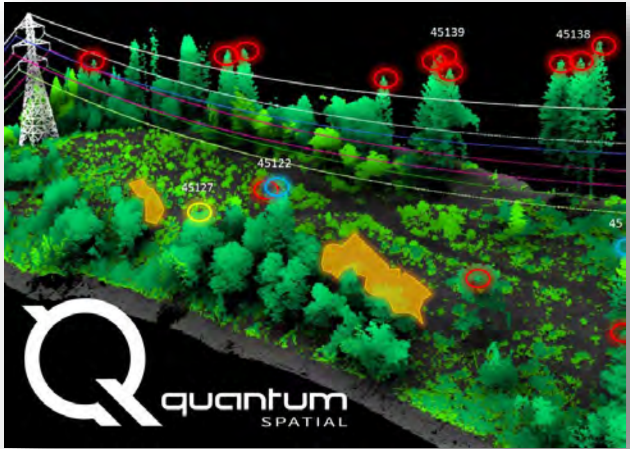
Initial county EAB detections in North America

June 3, 2019

Identifying Ash Trees Through Remote Sensing

Remote sensing technology

- LiDAR capabilities for vegetation management
  - Identify: height, striking distance, tree segments, proximity of the vegetation to the line
- Hyperspectral Imagery capabilities for vegetation management
  - Identify: tree species, relative tree health



Combined, these layers of information can tell us the threat of an ash or dead tree to nearby utility assets

How Duke Energy Is Responding

How does Duke Energy's Emerald Ash Borer Program work?

The Emerald Ash Borer Program is in addition to Duke Energy's routine Vegetation Management Program in the Midwest, which involves cutting, removing and/or preventing vegetative growth from interfering with electric lines to provide safe and reliable operation of the Duke Energy power system for our customers.

Duke Energy representatives will visit specific neighborhoods to talk with affected landowners and/or residents who may have one or more ash trees on their property that could disrupt the power system.

Our employees and contractors will carry identification and will attempt an in-person visit to schedule a time to cut the ash and/or hazard tree(s) that could disrupt the power system.

How do you determine which trees to cut down?

Once we identify an ash tree, we then assess its health and risk of disrupting the power system. After careful review, a tree is either identified for action or left untouched on the property.

Can the trees be treated instead of cut down?

Duke Energy recommends that infested trees along power lines be cut down. Once the emerald ash borer infests a tree, it is only a matter of time before the tree begins to show signs of decline. As a part of this program, Duke Energy is willing to cut down ash trees at its expense if the trees could potentially impact Duke Energy's system. However, a customer may desire to treat the trees on his/her property and not have Duke Energy cut them down. This is acceptable in areas where the trees do not have a potential impact to Duke Energy's system. Trees outside of Duke Energy's rights of way are the sole responsibility of the property owner, and therefore customers shall be solely responsible for the cost of treating any infested trees in addition to the cost and expense for the future cutting down of such trees if the customer refuses to take advantage of this program. If you desire to treat your trees, we recommend that you contact your local extension service, certified arborist or professional nursery for recommendations.

More Information

For more information about the emerald ash borer, please visit **emeraldashborer.info**.

To learn more about Duke Energy's Vegetation Management Program, visit **duke-energy.com/trees**.

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BUILDING A SMARTER ENERGY FUTURE℠

Emerald Ash Borer (EAB) Program

Proactively managing ash trees in transmission rights of way

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Dead and dying ash trees are becoming a widespread problem in the Midwest due to the emerald ash borer, a little green pest that has invaded ash trees. These dead and dying trees pose a serious danger to people, property and power lines because they are structurally unstable and may fall at any time.

Providing safe, secure and reliable energy to all our customers is at the heart of what we do at Duke Energy. Trees that grow too close or are in danger of falling onto power lines must be pruned or cut down to help prevent outages or service interruptions. To help provide reliable power to all our customers, we have implemented the Emerald Ash Borer Program in our Midwest service territory, a proactive approach to reducing the risk of trees falling onto power lines and our facilities.

Our methods are based on widely accepted standards established by the American National Standards Institute for tree care maintenance and operations.

What is an emerald ash borer?

The emerald ash borer is a beetle native to Asia that was first detected in Michigan in 2002. Researchers think it arrived several years earlier, most likely in wooden packing materials aboard a ship. Since then, the beetle has been detected in several other states. The emerald ash borer is able to kill ash trees, regardless of their health, age or size and has already killed hundreds of millions of ash trees already in the U.S.

What does an emerald ash borer look like?

Adult beetles are metallic green and about one-half inch long. When adults flare their wings, you can see their violet abdomen. Larvae are cream-colored and are approximately 1 inch long.

How do emerald ash borers kill ash trees?

Like many insects, the emerald ash borer has four life stages: adult, egg, larva and pupa. Adult beetles lay eggs on the bark of ash trees. Larvae emerging from the eggs bore into the bark and feed on the tree's trunk that lies just below. This cuts off the flow of water and nutrients and eventually kills the tree. The larvae emerge as metallic green beetles between April and June.

How can I identify an ash tree?

Ash trees can be recognized by their branches that grow directly across from one another, by the presence of five to nine leaflets, which are arranged opposite of one another on the branches and its diamond patterned bark.

Emerald Ash Borer Quick Facts

- Trees weakened by this beetle can fall and hit power lines, resulting in power outages.
- In the United States, only ash trees are at risk for infestation.
- Signs of infestation include:
  - Dead tree branches near the top of a tree
  - Bark splitting
  - Zigzag tunnels under the bark
  - D-shaped exit holes
  - Extensive woodpecker activity
  - Leafy shoots sprouting from the trunk

VERIFICATION

I hereby verify under the penalties of perjury that the foregoing representations are true to the best of my knowledge, information and belief.

Signed: Timothy A. Abbott
Timothy A. Abbott

Dated: 7/2/2019