HPP OPERATIONS PRESENTATION

August 1, 2017

DOCUMENTS INCLUDED

1. HPP – AMP Orientation Revised 2017
2. Electric Terms/Definitions & Department Background
3. 2018 Projected Power Portfolio Detail
4. Electric Service Area
5. Residential Electric Rate Summary
6. SWOT Analysis
7. Task Schedules
8. Outage Data Report & Performance Indicators

CITY OF HUDSON POWER PURCHASE RESOURCES
HUDSON PUBLIC POWER

Updated May 2017

History

Established in 1911 the mission and purpose of the Hudson Public Power Division is to provide residential, commercial and industrial electric customers with high quality, reliable electric power and associated services in an effective and efficient manner and within a fiscally responsible framework.

Electric power is supplied to the City by American Municipal Power, Inc. (AMP). AMP was founded in 1971 when a small group of municipally owned electric systems joined together to collectively work towards lowering future power costs by entering into competitive purchasing contracts and developing their own generation assets. Hudson Mayor John Rogers (1962-1980) was instrumental in getting AMP off the ground and established as a competitive force in the power industry. Today there are 135 AMP member communities across nine states. The City of Hudson has been a member since the organizations inception.

Where does Hudson's Power come from?

AMP acquires power to provide their member communities in two basic ways. First, AMP owns several power generation plants which generate electricity from different resources such as coal, natural gas, wind, solar, hydro and methane gas. Each member community has an opportunity to be a participant or invest in all of AMP's generation projects and receive a portion of the power generated from them. Like any investment individual member communities must carefully consider the benefits, risks and costs that come with being a project participant. Second, because each member community requires a certain amount of power based on their unique needs or demand, and because not all the demand can be satisfied by AMP owned generation resources, additional power requirements are purchased off the market on behalf of the member community based on AMP recommendations and member approval. Each member community then has a unique mix of these resources which make up their power portfolio. The portfolio is often a reflection of what a community believes their power resources should be, balanced with reasonable costs and diverse resources. Hudson City Council currently maintains a policy for approximately 20%-25% of the City's power supply to come from sustainable energy resources.

How much power is required and used and what is the cost?

The pie chart below shows the most up to date distribution of Hudson's power portfolio. It is a 2018 resource projection. The City of Hudson requires approximately 42-46 MW of power annually. As a comparison most average cities with populations up to 50,000 can meet demand with approximately 45 MW. Average monthly electric usage for a Hudson residential account is approximately 1075 Kwh. The average monthly commercial/industrial use is approximately 10,000 Kwh. This equates to approximately 2 hundred million Kwh's used on an annually basis. The City's cost of power projections for 2017 at an average rate of 81.73 per Mwh and based on projected usage of 190,843 Mwh is 15.5 Million. 2017 projected sales revenue is 20 million.

CITY OF HUDSON POWER PURCHASE RESOURCES
HUDSON PUBLIC POWER

How does the power get to the City of Hudson?

The transmission of electric power is an industry in and of itself. Regional Transmission Organizations (RTOs) exist in several locations and service predetermined zones across country. It is the function of these RTOs to operate the transmission grid and move power across it in the most reliable and efficient manner possible. More importantly, the RTOs must ensure there is adequate power to meet peak demands. The City of Hudson is within the Pennsylvania, New Jersey, Maryland (PJM) RTO. As such, the City is invoiced for transmission services as a portion of its power costs. Transmission costs are directly related to how much electricity is being moved and the distance its being moved. Transmission charges are calculated through formulas from the RTO's and is regulated by the Public Utilities Commission of Ohio (PUCO). Transmission costs have been increasing for many years and accounts for approximately one third of the City's power costs.

The City's power comes across high voltage transmission lines owned by First Energy and connects to the City system at two connection points. The eastside substation located on Stow Road at the Ohio Turnpike Bridge and at the south main substation located on east side of South Main Street adjacent to the railroad tracks. Power is then stepped down through transformers at five system substations that send power out to the City's distribution system for residential and commercial use.

What are Hudson's specific power portfolio resources?

Generation Resources (2018 Projections)

- The Amp Freemont Energy Center (AFEC) is a natural gas generation plant located in Freemont Ohio. Power from the AFEC plant makes up 8.78% of Hudson's energy portfolio. Hudson is a participant in this resource
- The New York Power Authority (NYPA) is power generated from federal hydro plants located in the state of New York. This resource accounts for 3.11% of the City's power. This is a contract purchase agreement.
- Prairie State generation is a newly constructed coal generation plant located in southern Illinois. It generates 42.42% of Hudson's power. This power is through a long term participant contract agreement.
- Joint Venture 5 is a hydroelectric plant located in Belleview, Ohio. It accounts for 10.97% of the City's power portfolio.
- Greenup and Meldahl are new hydroelectric generation plants on the Ohio River that went on line in 2016. They are "run of the river" facilities, no dams. They represent about 2.08% of the portfolio.
- EDI Landfill Gas is power generated by methane gas from capped landfills. This resource is generated from three different landfill sites and makes up 3.72% of the portfolio.
- AMP Solar Phase II is a new resource of what will be several solar sites. The first of which came on line in January 2017. This first solar array is located in Bowling Green Ohio and is the largest solar site in the State. This resource will account for 5.48% of the portfolio and will be for peak power needs.

CITY OF HUDSON POWER PURCHASE RESOURCES
HUDSON PUBLIC POWER

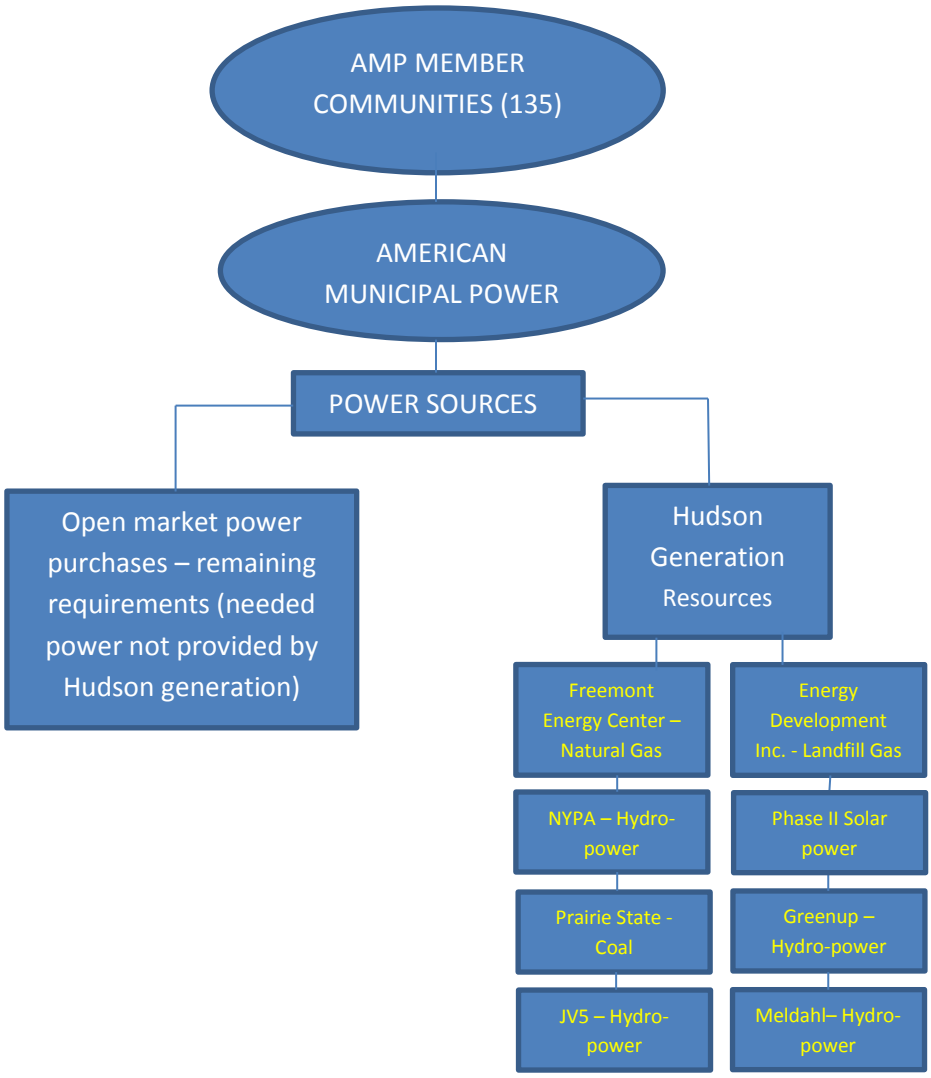
Market Resources

AMP Market Purchases

- Morgan Stanley – 7X24 power (for 24 hours a day 7 days) contract through 2020 = 4.60 %
- Barclays 5X16 power (for 6:00am –10:00pm 5 days) contract through 2017 = 6.3% (ends Dec 31)
- Remaining requirements – 2014- 2018, 2019-2020, 2021-2024 = 18.84%

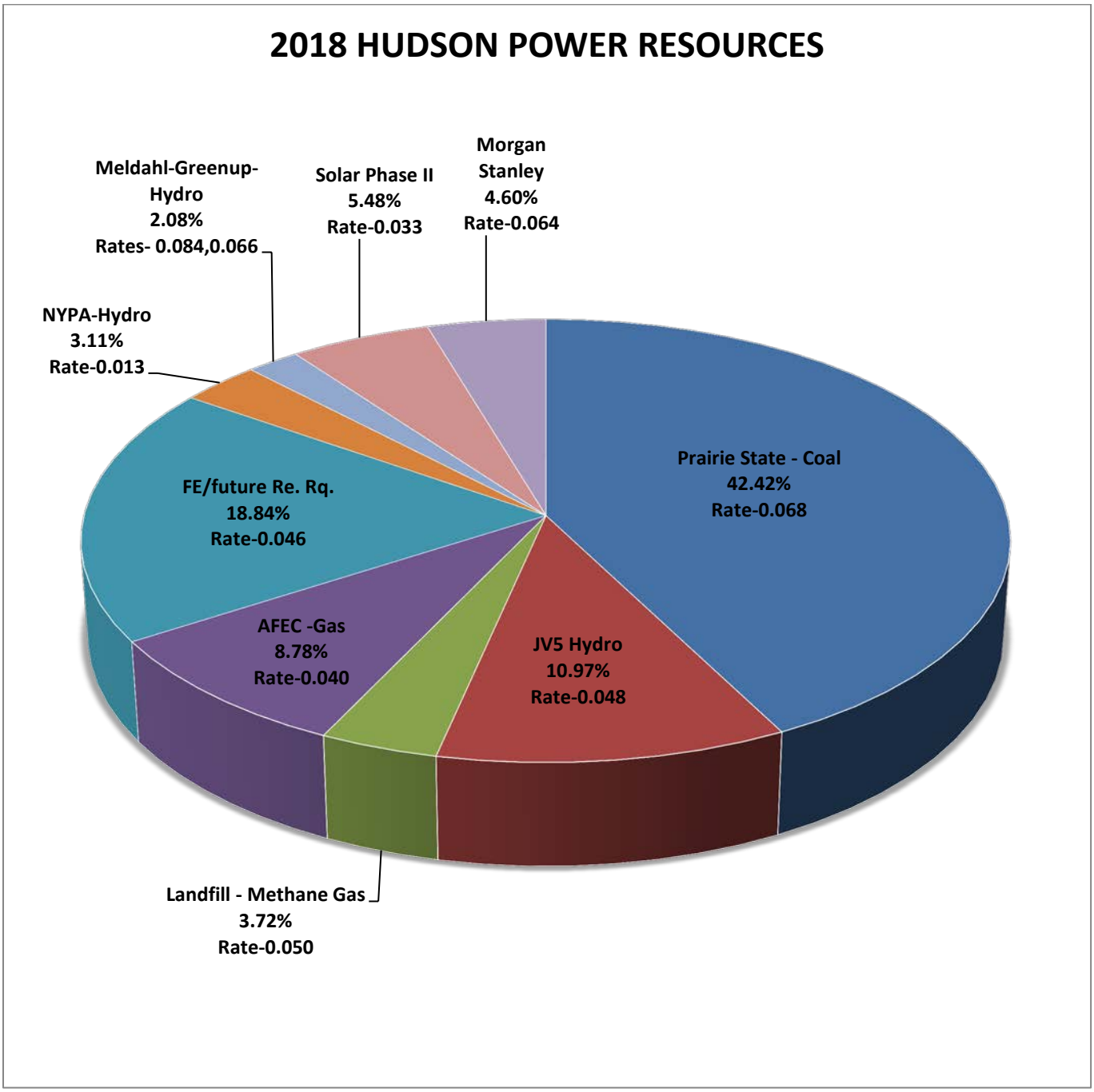
Note: AMP makes these market purchases through brokers on behalf of the City.

Amp Organization/City of Hudson relationship:



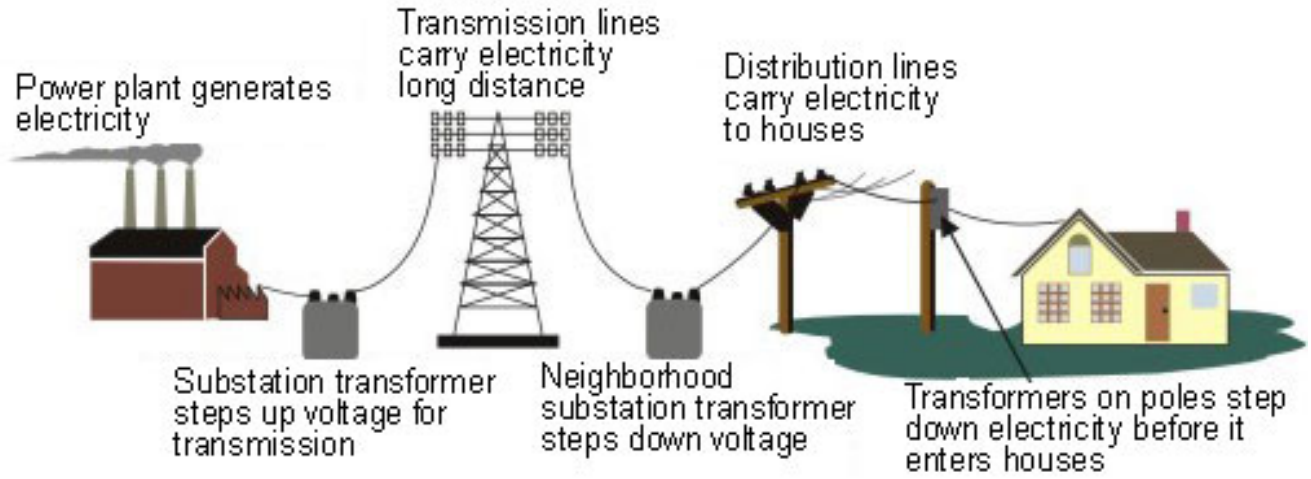
CITY OF HUDSON POWER PURCHASE RESOURCES
HUDSON PUBLIC POWER

Rates for month ending April 30, 2017



CITY OF HUDSON POWER PURCHASE RESOURCES
HUDSON PUBLIC POWER

How does the power get to the customer?



ELECTRIC TERMS/DEFINITIONS & DEPARTMENT BACKGROUND

Power charges- Hudson pays different rates for each type of power resource in its portfolio based on contractual agreements. There is a base rate for the purchases of the energy and then there are additional charges for generating the power and transmitting the power over a vast transmission system as well as other AMP administrative fees. Hudson also has certain resources in which they are direct participants/owners of the physical assets, in which case debt service is rolled into the rate to be paid over time. Due to the complexity of the many power purchase agreements and associated invoicing, each month the AMP power purchase and management invoice is thoroughly reviewed by a third party analyst to insure that there are no discrepancies in the calculations.

Transmission Charges – the operation of a nationwide electrical transmission grid to move power from generators and providers to customers realizes operation and maintenance costs as any other service provider organization. More importantly, the unavoidable limitations of the transmission system to move all the power over all of the lines all of the time is exacerbated by the following conditions:

1. Line Loss - The ratio of the power put into the grid and the power withdrawn at another point is referred to as line loss. As power travels through transmission lines and electrical equipment it losses a portion of energy as heat. This means that not all the power that enters the grid reaches the point of consumption which requires the generation of additional power which has to be paid for.
2. Transmission Constraints - The system itself must have consistent voltage across lines and equipment. To ensure this there may have to be additional points of generation installed. This is an ongoing O&M expense. The systems operation and physical condition also plays a major role in the costs to transmit power.
3. Quality of Service – The operation, age and performance of the system can lead to poor quality of the electric supply. Inefficient power supply can consist of regular drops in voltage, harmonic sounds waves and the inability to keep up with changes in demand.

Grid Congestion – congestion occurs when transmission lines and equipment are unable to carry enough power on the grid to satisfy high load demand or respond to emergency situations. Transmission congestion is actually a shortage of system capacity. Under high loads and congestion scenarios line losses increase substantially. And, the lines cannot be pushed beyond their capacity. This impacts both system reliability and efficiency. The only way that congestion can be alleviated is to adjust the system to increase its capacity. This is accomplished by a combination of adding new transmission infrastructure and reducing the end-user demand for electricity. The congestion charges are the costs of balancing out the system to meet full demand.

Capacity /Demand Charges – Capacity charges are invoiced based on the amount of power that must be made available to a customer and the amount the customer actually uses. It is the difference between a customers peak load during the billing period and the normal hour to hour usage during the same period. The capacity charge is for the power that has been made available to the customer although it may not be used, it has been generated and transmitted and therefore is an expense to the provider.

ELECTRIC TERMS/DEFINITIONS & DEPARTMENT BACKGROUND

Department Background

I. Hudson Public Power

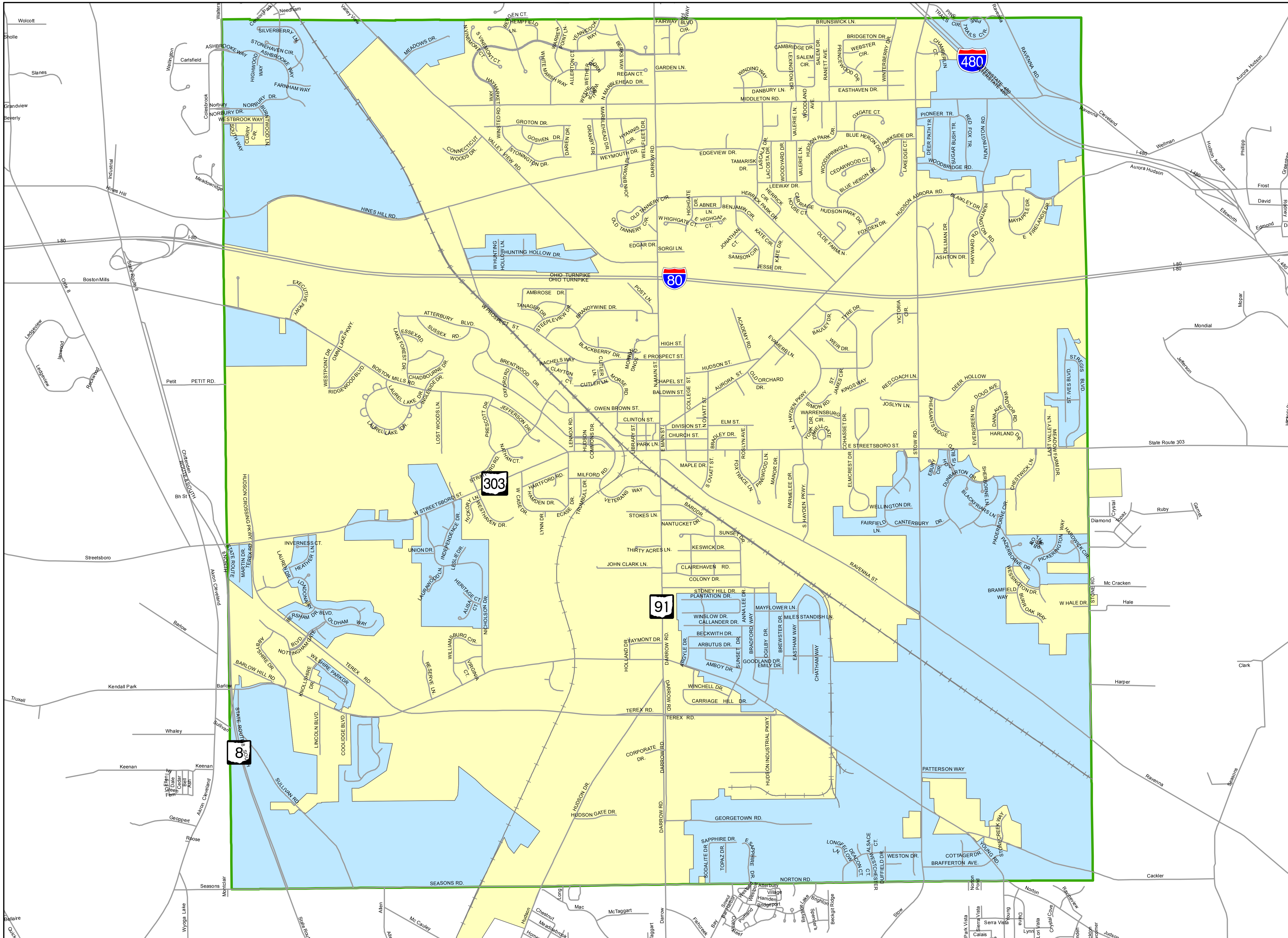
- Established in 1911 the mission and purpose of the Hudson Public Power Division is to provide residential, commercial and industrial customers with high quality, reliable electric power and associated services in an effective and efficient manner and within a fiscally responsible framework.
- Power for the City is purchased through American Municipal Power, Inc. (AMP). Long term power contracts are secured to ensure that the availability, reliability and cost effectiveness of power and services remains competitive.
- Power is delivered to the City's distribution system through two (2) points. One is a 69Kv line and one is a 138Kv line with connection points at both the south main substation and the eastside substation respectively.
- Hudson Public Power staffing is comprised of 23 fulltime positions. One (1) Assistant Director of Public Works (shared) two (2) Assistant Superintendents (Distribution and substation / Broadband operations), One (1) System Supervisor, and Fifteen (15) Linemen/Electric Techs. /Ground Techs. , One (1) Electric Operations specialist (Inventories), three (3) Substation Electricians, and one (1) Electrical Design Tech.
- The current system is comprised of five (5) Distribution Substations monitored by an integrated SCADA (supervisory control and data acquisition) system, 230 miles of conductor cable, 1200 transformers, and over 2000 overhead poles. Infrastructure also includes twenty-six (26) traffic signaled intersections.
- The system serves 6708 customers (5670 Residential, 848 Commercial/Industrial).
- The current systems annual peak load is approximately 43000 kW. Total annual energy required is approximately 200,000,000 kWh (Average home kWh per month-1100-1500).
- The average customer electric outage duration is 73.00 minutes compared to the average of 91.35 minutes for our zone.

Hudson Public Power

2018 POWER SUPPLY PORTFOLIO

Line No.	Description	Rated Capacity (MW)	Energy (MWH)	Fuel Type	Term	Resource Type*	Total Cost** ($)	Effective Rate*** ($/MWH)
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	NYPA	1.1	5,930	Hydro	Life of Unit	B/I	$ 116,459	$ 20
2	OMEGA JV5	2.4	20,919	Hydro	Life of Unit	B	977,564	47
3	EDI Landfill	0.8	7,096	Biogas	Thru 2021	B	444,444	63
4	Prairie State	10.0	80,872	Coal	Life of Unit	B	5,335,077	66
5	Amp Hydro II	0.8	3,974	Hydro	Life of Unit	B	314,381	79
6	L-T Market 7x24	1.0	8,760	Market	Thru 2020	B	557,480	64
7	AMP Solar Phase II	5.8	10,450	Solar	Thru 2041	I	344,007	33
8	AFEC	4.7	16,736	Gas	Life of Unit	I/P	824,003	49
9	OMEGA JV1	0.9	0	Diesel	Life of Unit	P	0	N/A
10	AMPCT	11.6	0	Gas/Diesel	Life of Unit	P	(534,246)	N/A
11	FE Requirements	N/A	47,735	Market	2018 Thru 2020	B	2,059,762	43
12	NP Pool	N/A	(11,845)	Market	Thru 2016		(527,400)	45
13	Sub-Total	39.0	190,627				$ 9,911,531	$ 52
14	Transmission						2,569,119	15
15	Installed Capacity (RPM)						2,683,904	14
16	AMP Fees						147,181	1
17	Totals		190,627				$ 15,311,735	$ 80

* Base (B), Intermediate (I) and Peaking (P).
** Reflects projected 2018 estimates, as provided by AMP, and transmission and installed capacity credits.
*** Column (f) divided by column (b).



City of Hudson, Ohio
Electric Ownership

Legend

- Streets
- Railroads
- Hudson Boundary

Electric Ownership

- City of Hudson
- First Energy

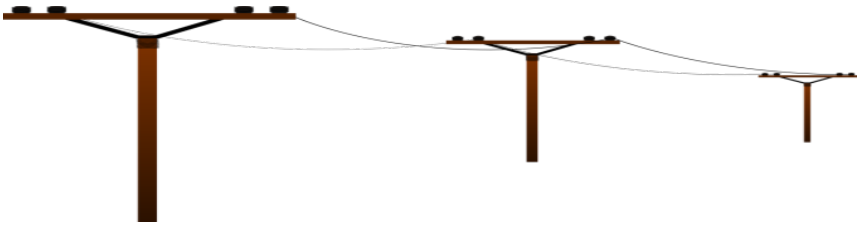
N

0 — 0.4 — 0.8
Miles

DISCLAIMER:

All data on this map were created for the City of Hudson to assist City Departments in management and planning activities. The suitability of this map for any other use is not guaranteed and the user assumes all risk for such uses. The City of Hudson, Ohio, assumes no legal responsibility for the information on this map. Users noting errors or omissions are encouraged to contact the City of Hudson Geographic Information Services at 330-342-9541.

Map Compiled: January 2011



Hudson Residential Electric Rate Summary

Residential Rate = 0.115 per KWh (Average Home uses 1000-1200 KWh per month)

Account/Meter Charge = $9.00 per month

Rate Breakdown:

Base Power = 0.0815 per KWh
Operations & Distribution = 0.0335 per KWh + $9.00 account/meter charge
PCF (Power cost factor) = $ amount over or under base power rate

June 2017 billing cycle example:

Mr. John Doe
Hudson Electric Invoice:

Total Usage----------979 KWh (6-1 to 6-31)

Account / Meter Charge----------$9.00
Base Power Charge----------$79.79
Operating & Distribution Charge-----$32.80
Power Cost Factor---------- $8.42 (June PCF=0.0086)
KWh Tax----------$4.55
Total Amount Due----------$134.56

Tax per kWh:
The first 0 – 2,000 kWh---------0.465
The next 2,001 – 15,000--------0.419
For 15,001 kWh and above----0.363

City of Hudson- Hudson Public Power

INTERNAL FACTORS

STRENGTHS (+)	WEAKNESSES (-)
• Qualified experienced staff • Ability to cross-train individuals over multiple skill sets • Ability to respond and resolve outages quickly compared to investor owned organizations • Utilizing and building on industry technologies for improved efficiencies and better system response an performance • Developing improvements and asset investments based on a comprehensive ten year system plan	• Substandard facilities and storage spaces • Lack of fully integrated control systems • Knowledge drain due to impending retirements • Aging workforce

EXTERNAL FACTORS

OPPORTUNITIES (+)	THREATS (-)
• Position HPP as a non-transmission owner to remove for FERC requirements an regulations • Develop fully integrated control system • Look at service expansion opportunities • Begin to manage system peak load utilizing solar energy resources • HPP consolidation with Service Dept. in new POW facility	• FERC and NERC requirements and regulations • Market power costs and balancing Hudson's resource portfolio • Security concerns (Physical and cyber) • Increased cost of doing business (Power, materials & labor)

ANALYSIS SUMMARY

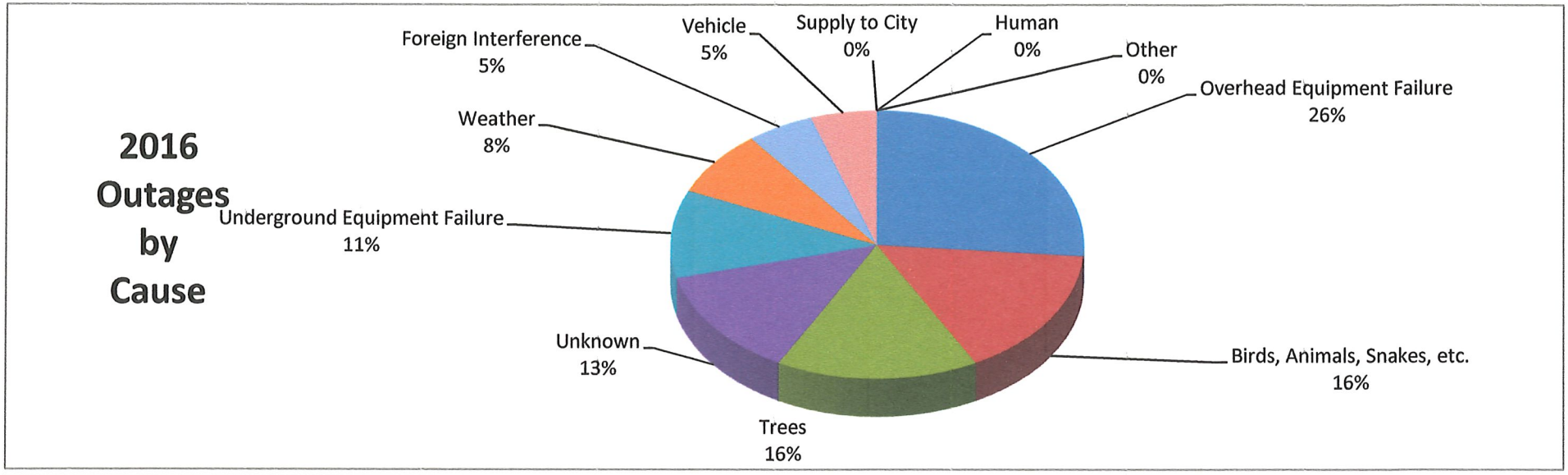
Discussion Items: Opportunities

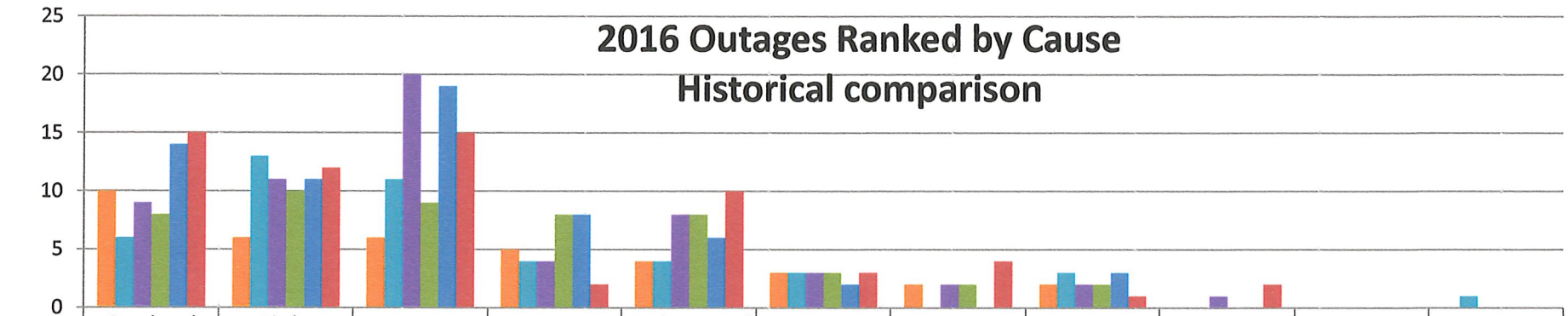
1. Sale of transmission ring bus at Eastside Sub
2. Utilization of Solar power resources
3. Continued implementation of smart grid technologies
4. Potential expansion of customer base

Discussion Items: Threats

1. Future FERC & NERC requirements (a changing industry)
2. Ongoing costs of operations and distribution system
3. Increased retirements and
4. Rising costs of transmission & capacity

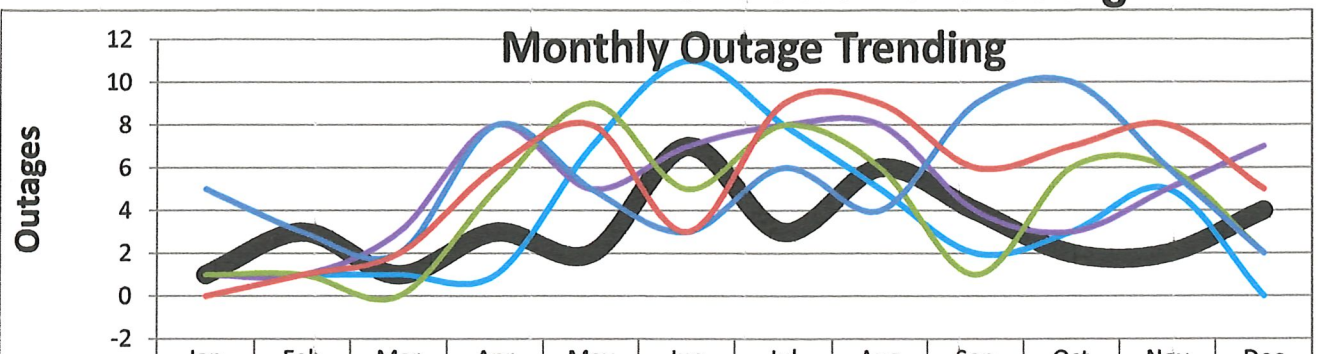
Month	HPP	
January	Schedule and coordinate projects and contracts	Removal of Holiday lights and decorations
	Opening of budget year	Equipment maintenance
February	Equipment testing	Indoor facilities maintenance
	Inventories and prep repairs	Annual reporting
March	Infrastructure inspections	Construction season starts
	Winter clean up and repairs	Substation maintenance
April	Mowing of substations and right or ways begin	Projects and construction
May	Projects and construction	Reports and data entry
June	Projects and construction	Adjusting circuit loads
July	Projects and construction	Develop and submit budgets
	Infrastructure Inspections	Adjusting circuit loads
August	Projects and construction	Reports and data entry
	Adjusting circuit loads	
September	Finalize budgets	End Projects & Construction
	Projects and construction	Adjusting circuit loads
	Fall clean ups	
October	Projects and construction	Holiday lights and decorations
November	Winter preparation of facilities	Holiday lights and decorations
	Projects and construction	Reports and data entry
December	Building maintenance	Infrastructure Inspections
Year-round tasks	Customer Service	Contract administration
	System maintenance	Maintenance & management of equipment and grounds
	Festivals and special event set-ups	Citizen requests and inquiries



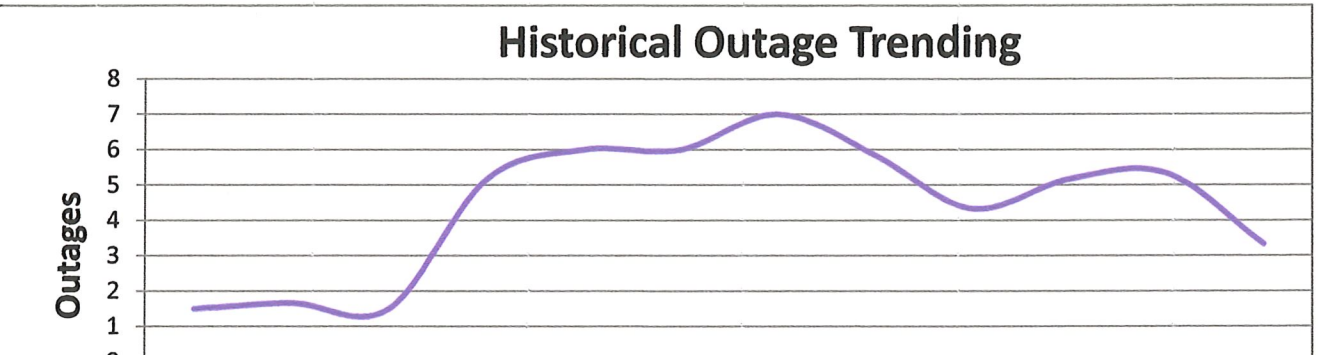


	Overhead Equipment Failure	Birds, Animals, Snakes, etc.	Trees	Unknown	Underground Equipment Failure	Weather	Foreign Interference	Vehicle	Supply to City	Human	Other
2016	10	6	6	5	4	3	2	2	0	0	0
2015	6	13	11	4	4	3	0	3	0	0	1
2014	9	11	20	4	8	3	2	2	1	0	0
2013	8	10	9	8	8	3	2	2	0	0	0
2012	14	11	19	8	6	2	0	3	0	0	0
2011	15	12	15	2	10	3	4	1	2	0	0

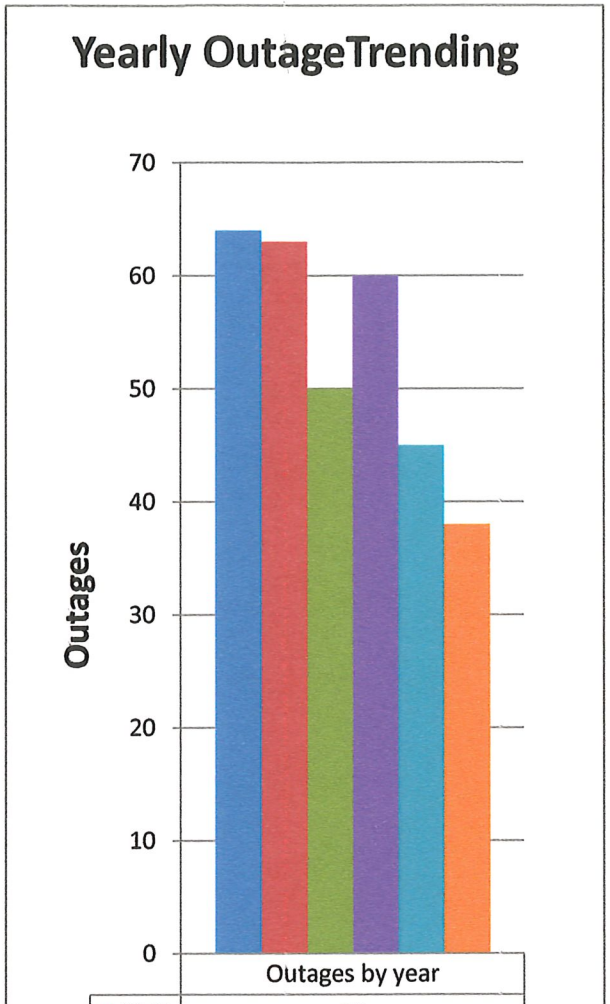
2011 thru 2016 Outage Trends



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2016	1	3	1	3	2	7	3	6	4	2	2	4
2015	1	1	1	1	7	11	8	5	2	3	5	0
2014	1	1	3	8	5	7	8	8	4	3	5	7
2013	1	1	0	5	9	5	8	6	1	6	6	2
2012	5	3	2	8	5	3	6	4	9	10	6	2
2011	0	1	2	6	8	3	9	9	6	7	8	5



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
6 yr avg	2	2	2	5	6	6	7	6	4	5	5	3



	Outages by year
2011	64
2012	63
2013	50
2014	60
2015	45
2016	38

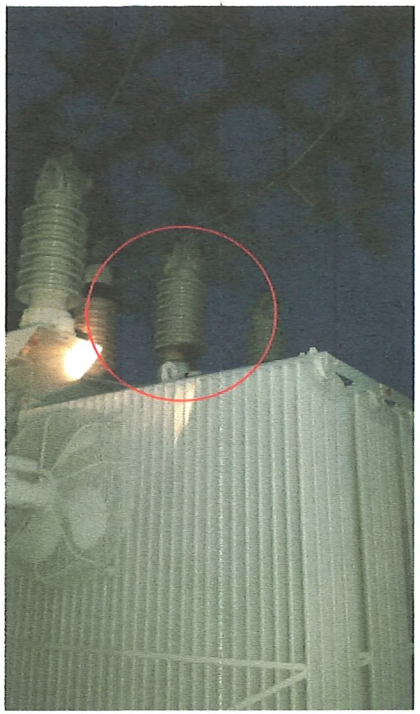
Miscellaneous Issues and Outages

2/28/16 High, sustained winds caused a transmission GOAB to unseat and burn. This caused a wide spread City outage.

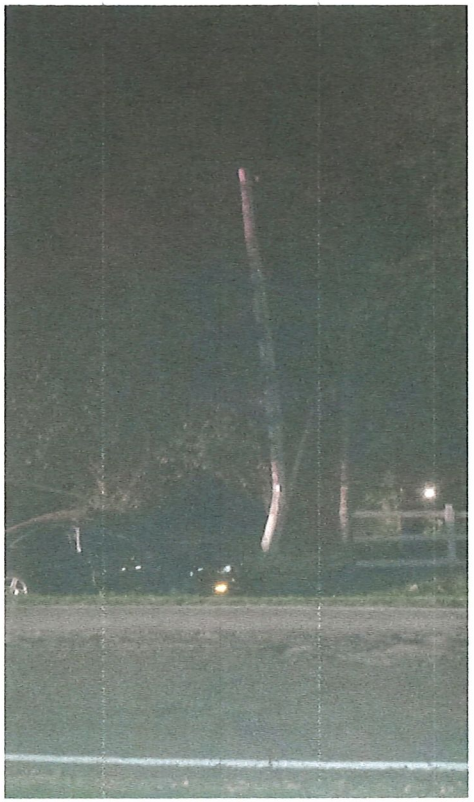
4/1/16 Tree fell on power lines rear lot of Owen Brown St. causing outage.

Miscellaneous Issues and Outages

6/8/16 Mice got into breaker cabinet at Prospect Substation and made contact with energized Main. This caused widespread outage to Northwest residents



8/23/16 Transformer arrestor bushing failed at Prospect Substation. Causing outage.

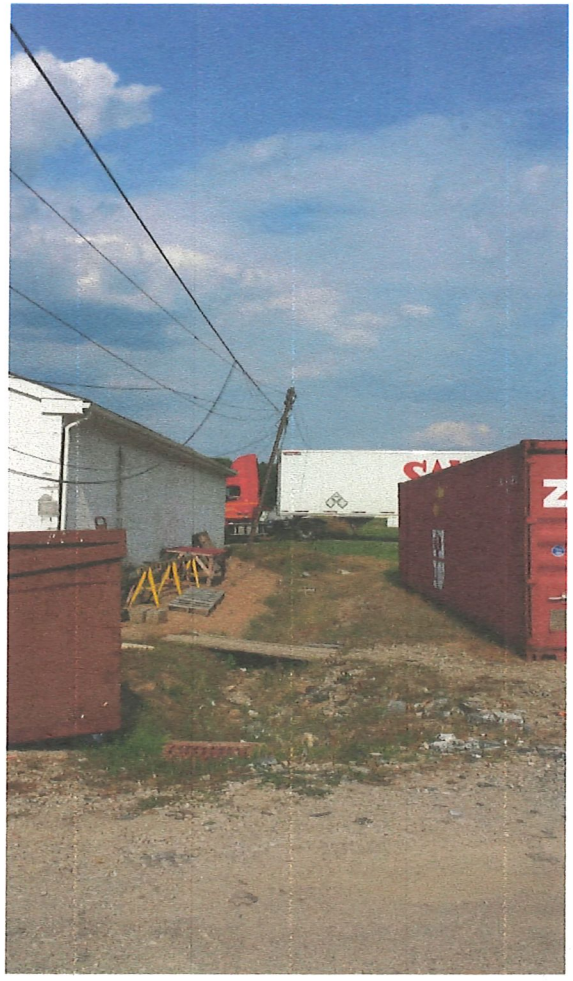


7/22/16 Car into pole on Barlow Rd.

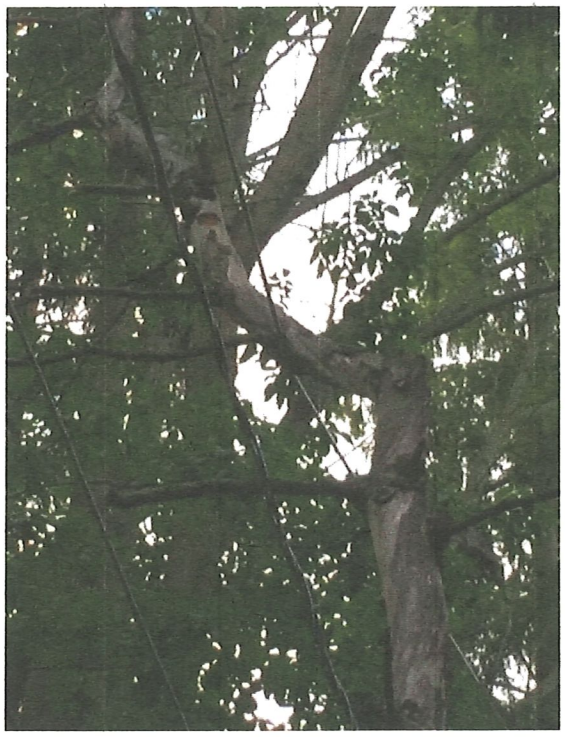
Miscellaneous Issues and Outages

9/11/16 Faulted cable on Weir Dr. caused large outage.

Miscellaneous Issues and Outages



6/30/16 Truck into private wires - American Fireworks. HPP assisted in



8/16/16 Non-outage tree on wires - Atterbbury

7/19/16 Non- outage tree on wires Darrow Rd. Protective Tree-wire is now being used in many places throughout the City to help prevent outages.