

# Fixed Cost Recovery in Rate Designs

Colorado Rural Electric Association  
February 9, 2019



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# ■ Guernsey

- Consulting, engineering & architectural firm
- Founded in 1928, Located in Oklahoma City
- 150 staff - Employee-owned firm
- Providing services to cooperatives since 1936
- Cost of Service Studies, Financial Forecasting, Management Consulting, Power Supply Planning, Power Engineering, Merger & Acquisition, Planning & Board Training, Renewable Energy
- Also provide security consulting, architecture design, and environmental services





# ■ Agenda

- ▶ Rate Design History
- ▶ Cost Allocation- Fixed vs. Variable
- ▶ Components of Expenses - How to Determine Appropriate Charges
- ▶ Demand Rate Options
- ▶ Demand Rate Trends
- ▶ Member Impacts



# ■ Rate Design History

- ▶ Residential/Small Commercial/General Service rates have traditionally been designed as “two part” rates
  - ▶ Customer charge - recovery of all or a portion of customer-related costs
  - ▶ Energy charges - recovery of the remainder costs (including margin)
- ▶ This rate design has been successful since cooperatives were formed
  - ▶ Simple to bill and easy for members to understand
  - ▶ Does not require advanced metering

# ■ Non-Demand Rate Design History

- ▶ Two-part rates have historically been used because:
  - ▶ Assumed similar average load size in a rate class
  - ▶ Therefore similar facilities required to serve the customer
  - ▶ The load profile of the customers are similar:
    - ▶ Expected energy usage given size of load served (consistent load factor)
    - ▶ Load shape and time of the peak energy usage; i.e., the hourly demand profile
  - ▶ Power flow was one-way

# ■ Three-Part Rates

- ▶ What are we talking about?
  - ▶ Customer charge
    - ▶ Recovery of all or a portion of customer-related costs
  - ▶ Demand charge or other fixed charge component
    - ▶ Recovery of all or a portion of capacity-related costs
    - ▶ Purchased power capacity and/or distribution capacity costs
  - ▶ Energy charge
    - ▶ Recovery of purchased power energy costs and remainder costs not recovered in other rate components
- ▶ Three-part rates are not a new concept
  - ▶ Historically used primarily for large power/industrial rates

# ■ What is Changing?

- ▶ Technology is driving changes for utilities and consumers
- ▶ AMI allows detailed usage information and two-way communication
- ▶ DER provides economical energy alternatives (battery storage, affordable access to rooftop solar, electric vehicles, etc.)
- ▶ Home energy management systems (AC, heat, water heat, etc.)
- ▶ Multi-speak protocols allow devices to actively communicate with each other



# ■ What Does This Mean for Cooperatives?

- ▶ Customer changes from passive to active agent
  - ▶ DER, battery storage, home management systems give consumer the opportunity to change load profiles
- ▶ Reduces homogeneity of usage profiles within the class
- ▶ Customers expect a share of economic benefits from using new technologies
- ▶ Increased inter-class and intra class subsidies
- ▶ Energy service pricings become increasingly complex to accommodate new technology

# Cost Allocation

Identifying Fixed vs. Variable Costs



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# ■ Cost of Service Process

## 1. Define System Revenue Requirement

Do we need a rate increase and, if so, how much?

## 2. Define Class Revenue Requirement

How are each of the rate classes performing?

## 3. Define Customer Revenue Requirement

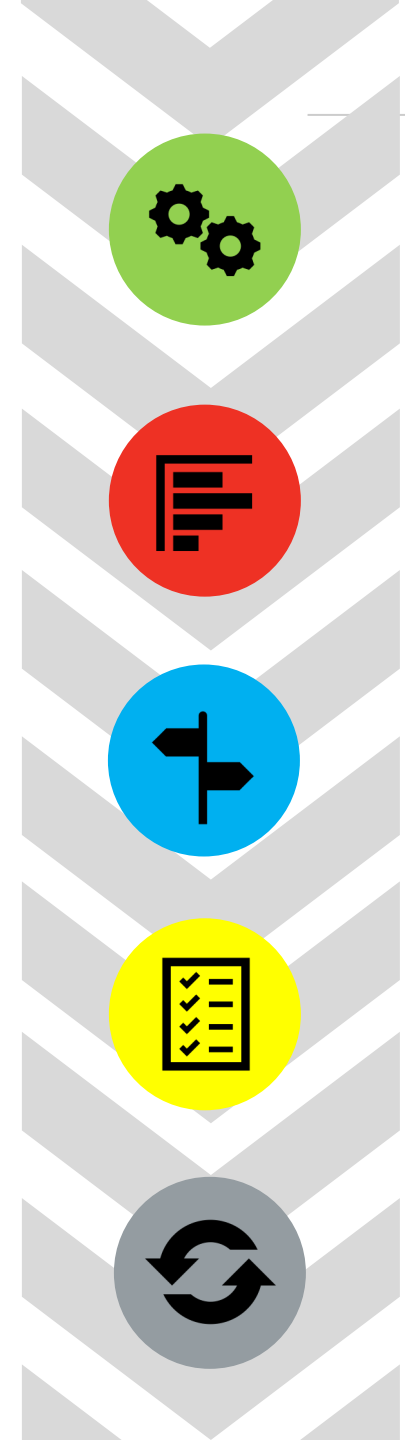
How do we recover our costs through rates and from whom?

## 4. Coordinate Rate Design & Line Extension

Do we need a rate increase and, if so, how much?

## 5. Monitor & Analyze System Performance

Do we need a rate increase and, if so, how much?



# ■ How Do We Think About Costs?

- ▶ What cooperative function do the costs support?
- ▶ Income Statement or Chart of Accounts:
  - ▶ Purchased Power
    - ▶ Capacity
    - ▶ Energy
  - ▶ Transmission
  - ▶ Distribution
  - ▶ Substation
  - ▶ Overhead
  - ▶ Underground
  - ▶ Customer Service, Accounting and A&G

# ■ Classify Costs

## ▶ Classification of costs:

### ▶ Purchased Power

- ▶ Fixed - Capacity (demand)

- ▶ Variable (energy)

### ▶ Distribution Wires

- ▶ Fixed - Capacity (demand)

- ▶ Customer

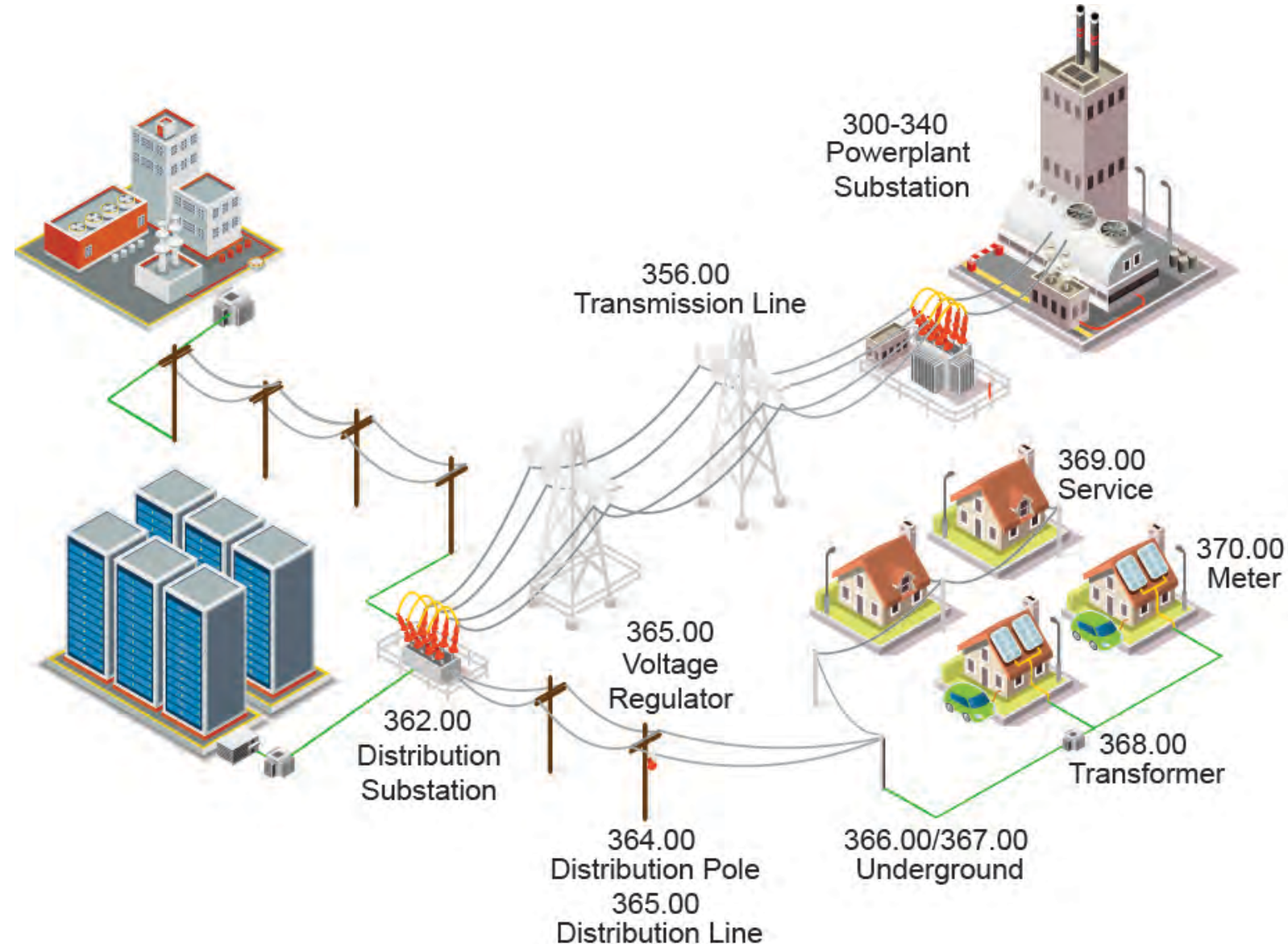
- ▶ Direct

## ■ Classify Costs - Concept

- ▶ System is designed to serve customer load
- ▶ Load is defined in terms of:
  - ▶ Peak demand (fixed)
  - ▶ Energy requirement (variable)
  - ▶ Number of customers served (fixed)

# Typical Distribution System

- ▶ Allocate plant investment to each rate class
  - ▶ Based upon their use of the system and the facilities required to serve them
  - ▶ Use Load Data (Sum of Delivery Point NCP)
- ▶ Expenses follow the plant allocation
- ▶ Identify Minimum System Cost



# ■ Distribution Plant Classification

	Wires Demand	Energy	Customer
Transmission Plant	X		
Distribution Plant			
360 Land	X		
361 Structures	X		
362 Station Equipment	X		
364/365 Overhead Lines	X		X
366/367 Underground Lines	X		X
368 Transformers	X		X
369 Services			X
370 Meters			X
371 Installations on Customer's Premises			X
372 Leased Property			X
373 Street Lights			X
General Plant	X		X

NOTE: None of our Distribution Plant is based on Energy.



# ■ Distribution Cost Classification

	Demand		Energy	Customer
	Purchased Power	Wires		
Purchased Power	X		X	
Transmission O&M		X		
Distribution O&M		X		X
Consumer Accounting/Sales/Customer Service				X
Administrative and General		X		X
Depreciation		X		X
Taxes		X		X
Interest		X		X
Margin		X		X

NOTE: None of our Distribution Expense cost recovery is based on Energy - except Purchased Power Energy & Fuel.

# ■ Classification of Costs

- ▶ Objective is to classify costs in a manner that reflects the cost drivers
  - ▶ Fixed cost recovered in the Demand Component of the rate
  - ▶ Variable cost recovered in the Energy Component of the rate
  - ▶ Customer cost recovered in the Customer Component of the rate
- ▶ Conceptually - Increasing or decreasing the billing units would reflect the increase or decrease in cost associated with the change in usage



# Cost Components



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# ■ Components of Expenses → Rate Design

- Purchased Power
  - Purchased Power Demand-Related
    - Delivery
    - Capacity
  - Purchased Power Energy
- Distribution Wires
  - Capacity-Related
    - Transmission (if any)
    - Substation (if any)
    - Backbone
    - General Demand
  - Customer-Related
    - Distribution Wires Customer
    - Metering
    - Meter Reading
    - Billing and Records
    - Customer Services
    - Revenue

# Summary of Components of Expenses

<u>Accounts</u>	<u>Total</u>	<u>Residential</u>	<u>COMMERCIAL</u>	<u>IRRIGATION</u>	<u>LARGE POWER</u>	<u>Industrial</u>	<u>Security Lts</u>	<u>Street Lts</u>
Average Consumers	88,163	81,525	4,827	1,244	565	2	47,504	4,664
kWh Sold	1,830,775,494	1,151,165,422	97,806,128	55,350,845	189,686,899	299,314,241	34,581,451	2,870,508
Metered kW		0	0	285,952	580,553	469,043	0	0
Billing kW		0	0	285,952	580,553	481,549	0	0
<b>PUR PWR DEMAND</b>	<b>64,248,681</b>	<b>45,701,556</b>	<b>3,517,154</b>	<b>2,302,715</b>	<b>6,020,746</b>	<b>6,054,182</b>	<b>602,464</b>	<b>49,865</b>
Monthly Cost per Cons	60.73	46.72	60.72	154.25	888.02	252,257.58	1.06	0.89
Average Cost per kWh	0.035094	0.039700	0.035960	0.041602	0.031740	0.020227	0.017422	0.017371
Cost per Metered kW		0.00	0.00	8.05	10.37	12.91	0.00	0.00
Cost per Billing kW		0.00	0.00	8.05	10.37	12.57	0.00	0.00
<b>PUR PWR ENERGY</b>	<b>63,473,629</b>	<b>40,472,271</b>	<b>3,438,634</b>	<b>1,946,006</b>	<b>6,597,534</b>	<b>9,702,462</b>	<b>1,215,803</b>	<b>100,920</b>
Monthly Cost per Cons	60.00	41.37	59.36	130.36	973.09	404,269.25	2.13	1.80
Average Cost per kWh	0.034670	0.035158	0.035158	0.035158	0.034781	0.032416	0.035158	0.035158
Cost per Metered kW		0.00	0.00	6.81	11.36	20.69	0.00	0.00
Cost per Billing kW		0.00	0.00	6.81	11.36	20.15	0.00	0.00
<b>WIRES DEMAND</b>	<b>41,944,802</b>	<b>33,056,114</b>	<b>2,770,133</b>	<b>1,891,473</b>	<b>3,118,892</b>	<b>744,254</b>	<b>328,699</b>	<b>35,239</b>
Monthly Cost per Cons	39.65	33.79	47.82	126.71	460.01	31,010.56	0.58	0.63
Average Cost per kWh	0.022911	0.028715	0.028323	0.034172	0.016442	0.002487	0.009505	0.012276
Cost per Metered kW		0.00	0.00	6.61	5.37	1.59	0.00	0.00
Cost per Billing kW		0.00	0.00	6.61	5.37	1.55	0.00	0.00
<b>TOTAL CUSTOMER</b>	<b>36,083,787</b>	<b>29,092,073</b>	<b>2,006,810</b>	<b>1,544,575</b>	<b>730,866</b>	<b>80,242</b>	<b>2,311,641</b>	<b>317,580</b>
Monthly Cost per Cons	34.11	29.74	34.65	103.47	107.80	3,343.41	4.06	5.67
Average Cost per kWh	0.019710	0.025272	0.020518	0.027905	0.003853	0.000268	0.066846	0.110636
Cost per Metered kW		0.00	0.00	5.40	1.26	0.17	0.00	0.00
Cost per Billing kW		0.00	0.00	5.40	1.26	0.17	0.00	0.00

# Summary of Components of Expenses

<u>Accounts</u>	<u>Total</u>	<u>Residential</u>	<u>COMMERCIAL</u>
Average Consumers	88,163	81,525	4,827
kWh Sold	1,830,775,494	1,151,165,422	97,806,128
Metered kW		7,826,400	1,555,728
Billing kW		8,021,190	462,713
<b>PUR PWR DEMAND</b>	<b>64,248,681</b>	<b>45,701,556</b>	<b>3,517,154</b>
Monthly Cost per Cons	60.73	46.72	60.72
Average Cost per kWh	0.035094	0.039700	0.035960
Cost per Metered kW		5.84	2.26
Cost per Billing kW		5.70	7.60
<b>PUR PWR ENERGY</b>	<b>63,473,629</b>	<b>40,472,271</b>	<b>3,438,634</b>
Monthly Cost per Cons	60.00	41.37	59.36
Average Cost per kWh	0.034670	0.035158	0.035158
Cost per Metered kW		5.17	2.21
Cost per Billing kW		5.05	7.43
<b>WIRES DEMAND</b>	<b>41,944,802</b>	<b>33,056,114</b>	<b>2,770,133</b>
Monthly Cost per Cons	39.65	33.79	47.82
Average Cost per kWh	0.022911	0.028715	0.028323
Cost per Metered kW		4.22	1.78
Cost per Billing kW		4.12	5.99
<b>TOTAL CUSTOMER</b>	<b>36,083,787</b>	<b>29,092,073</b>	<b>2,006,810</b>
Monthly Cost per Cons	34.11	29.74	34.65
Average Cost per kWh	0.019710	0.025272	0.020518
Cost per Metered kW		3.72	1.29
Cost per Billing kW		3.63	4.34

# Why Cost Allocation and Cost Recovery Matters

House A  
Family of 4  
Occupied full time



Cost of Service  
\$29.74 per month  
\$0.024478 per kWh  
*Excludes power cost*

Wires Rate  
\$17.50 per month  
\$0.034880 per kWh  
*Excludes power cost*

House B  
Family of 2  
Occupied part time



## Questions:

1. Excluding power cost, which house costs more to serve?
2. Which house provides more revenue?
3. Which house receives more patronage capital?
4. Who is being subsidized?

# Demand Rate Design Options





# ■ Rate Design Cost Recovery Objectives

- ▶ Recover distribution system fixed costs?
- ▶ Recover purchased power fixed costs?
- ▶ Recover both distribution fixed capacity costs and purchased power capacity costs?

# ■ Recover Distribution System Capacity Costs

- ▶ Demand component of rate billed on a non-coincident peak demand
- ▶ Consumer cannot avoid this charge
- ▶ Consumer still has the ability to manage peak demand
  - ▶ Consumer education is key
- ▶ Ensures recovery of costs regardless of kWh consumed
  - ▶ Addresses concerns caused by DER, energy efficiencies, etc.

# ■ Recover Purchased Power Capacity Costs

- ▶ Demand component billed on avoidable demand charge:
  - ▶ Coincident peak demand (requires interval data), or
  - ▶ Non-coincident peak demand within a window
- ▶ Pass through savings in purchased power capacity costs only
- ▶ Does NOT provide recovery of distribution system fixed costs
- ▶ Wholesale power supplier rate structure will dictate the best rate options
  - ▶ Billing determinants (member CP or power supplier's CP)
  - ▶ Seasonal demand charges or ratchet billing

# ■ Recover Both Distribution System Capacity Costs and Purchased Power Capacity Costs

- ▶ “Four part” rate
  - ▶ Customer charge
  - ▶ Energy charge
  - ▶ Non-avoidable demand charge - recovery of distribution costs
  - ▶ CP demand or on-peak demand - recovery of purchased power capacity
    - ▶ May use time of use energy windows instead of on-peak kW

# Unbundled Rate Design Options

	Billing Units	Unbundled Rate			Total Revenue
		Power Supply	Wires Demand	Wires Customer	
<b>6. Four Part Rate</b>					
Customer Charge	978,300			27.72	27,118,476
CP Demand Charge	2,980,736	15.33		15.33	45,694,682
NCP Demand Charge	8,804,700	0.00000	3.38	3.38	29,759,886
Energy Charge	1,151,165,422	0.03516		0.03516	40,474,976
Total	1,151,165,422				143,048,020
<b>7. Three Part Rate - Wires Demand</b>					
Customer Charge	978,300			27.72	27,118,476
NCP Demand Charge	8,804,700		3.38	3.38	29,759,886
Energy Charge	1,151,165,422	0.07486		0.07486	86,176,243
Total	1,151,165,422				143,054,605
<b>8. Three Part Rate - Power Cost Demand</b>					
Customer Charge	978,300			27.72	27,118,476
CP Demand Charge	2,980,736	15.33		15.33	45,694,682
Energy Charge	1,151,165,422	0.03516	0.02588	0.06104	70,267,137
Total	1,151,165,422				143,080,295
<b>9. Three Part Rate - Hybrid Demand</b>					
Customer Charge	978,300			27.72	27,118,476
NCP Demand Charge	8,804,700	3.12	3.38	6.50	57,230,550
Energy Charge	1,151,165,422	0.05100		0.05100	58,709,436
Total	1,151,165,422				143,058,462

# ■ Proxy Demand Rates

- ▶ Rate components designed to recover capacity costs
  - ▶ Additional kVA Charges
  - ▶ Customer charges that differentiate between single phase/three phase
  - ▶ Customer charges that differentiate between service size, i.e., greater than 200 amp
  - ▶ Horsepower charges
  - ▶ Increased minimum monthly bill
  - ▶ Time of use rates

# Demand Rate Trends



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# ■ Considering Transitioning to Demand Rates?

- ▶ Is good data available?
  - ▶ Do you have access to interval data or peak demands only?
  - ▶ Is the data being stored?
  - ▶ Are the demands being reviewed for accuracy?
  - ▶ Is the demand history being retrieved from MDM or billing software?
- ▶ Recommend good historical data rather than projected



## ■ Considering Transitioning to Demand Rates?

- ▶ Is the existing customer charge recovering all customer-related costs?
- ▶ Education process will take time
- ▶ Some cooperatives are showing kW on customer bills at \$0 charge
- ▶ Gradual process - start with small charges
- ▶ Make rate structure changes when additional revenue is not needed

## ■ Converting Horsepower Rates to Demand Rates

- ▶ Horsepower rates most common for irrigation or oil well classes
- ▶ Increased interest in converting existing horsepower rates to demand rates
- ▶ Demand data is available
- ▶ Administrative challenges for HP rates
  - ▶ Inaccurate HP records
  - ▶ Demand data can be used to check reasonableness of HP records

# ■ Converting Horsepower Rates to Demand Rates

- ▶ Should you consider converting your horsepower rate to a demand rate?
  - ▶ Demand readings do provide a more accurate measure of the load
  - ▶ Using demand eliminates need to maintain accurate horsepower records
  - ▶ However, there is nothing wrong with using installed horsepower for recovery of costs
    - ▶ Appropriate pricing signal
    - ▶ Recovery of fixed cost
    - ▶ Provides stability in revenue regardless of consumption that may be effected by weather or cyclical industries
  - ▶ Mange member impacts

# Member Impacts



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# Comparison of Proposed Rate Options

kWh Usage	L.F.	NCP kW	CP kW	Proposed	Proposed Demand Rate			Change \$		
					NCP All	NCP Wires	CP Pur Pwr	NCP All	NCP Wires	CP Pur Pwr
Customer Charge				\$32.95	\$32.95	\$32.50	\$32.50	\$0.00	(\$0.45)	(\$0.45)
Demand Charge CP kW			7.36	\$0.00			\$6.98	\$0.00	\$0.00	\$6.98
Demand Charge NCP kW		9.20		\$0.00	\$8.78	\$3.20		\$8.78	\$3.20	\$0.00
Energy Charge, per kWh				\$0.100050	\$0.034519	\$0.076195	\$0.058374	(\$0.065531)	(\$0.023855)	(\$0.041676)
PCA Factor, per kWh				\$0.000000	\$0.000000	\$0.000000	\$0.000000	\$0.000000	\$0.000000	\$0.000000
168	2.5%	9.20	7.36	\$49.75	\$119.52	\$74.73	\$93.67	\$69.77	\$24.98	\$43.93
336	5.0%	9.20	7.36	\$66.55	\$125.32	\$87.53	\$103.47	\$58.77	\$20.98	\$36.93
504	7.5%	9.20	7.36	\$83.35	\$131.11	\$100.32	\$113.28	\$47.77	\$16.97	\$29.93
672	10.0%	9.20	7.36	\$100.14	\$136.91	\$113.11	\$123.08	\$36.77	\$12.97	\$22.93
1,343	20.0%	9.20	7.36	\$167.34	\$160.09	\$164.29	\$162.28	(\$7.25)	(\$3.05)	(\$5.06)
2,015	30.0%	9.20	7.36	\$234.53	\$183.27	\$215.46	\$201.48	(\$51.26)	(\$19.07)	(\$33.05)
2,686	40.0%	9.20	7.36	\$301.72	\$206.46	\$266.63	\$240.69	(\$95.27)	(\$35.09)	(\$61.04)
3,358	50.0%	9.20	7.36	\$368.92	\$229.64	\$317.80	\$279.89	(\$139.28)	(\$51.12)	(\$89.03)
4,030	60.0%	9.20	7.36	\$436.11	\$252.82	\$368.98	\$319.10	(\$183.29)	(\$67.14)	(\$117.01)
<b>1,232</b>	<b>18.3%</b>	<b>9.20</b>	<b>7.36</b>	<b>\$156.24</b>	<b>\$156.26</b>	<b>\$155.84</b>	<b>\$155.81</b>	<b>\$0.02</b>	<b>(\$0.41)</b>	<b>(\$0.44)</b>



- Billing Comparison with actual individual customer data
- Revenue neutral rate change

kWh	All kW	> 10 kW	Load Factor	Existing Billing	Proposed Billing		
					Rate	\$ Change	% Change
Distribution Charge				\$35.00	\$37.00	\$2.00	5.71%
Demand Charge							
First	10 kW per month			\$0.00	\$7.20	\$7.20	
Over	10 kW per month			\$0.00	\$7.20	\$7.20	
Energy Charge, per kWh							
	June - September			\$0.098300	\$0.054178	(\$0.044122)	-44.89%
	October - May			\$0.077500	\$0.054178	(\$0.023322)	-30.09%
28,855	272.24	162.24	14.52%	\$2,755	\$3,930	\$1,176	42.67%
66,800	151.04	36.80	60.58%	\$5,994	\$5,151	(\$843)	-14.07%
56,274	146.54	37.71	52.61%	\$5,071	\$4,548	(\$523)	-10.31%
72,441	184.04	65.66	53.92%	\$6,358	\$5,694	(\$664)	-10.44%
59,880	134.71	20.65	60.89%	\$5,501	\$4,658	(\$843)	-15.32%
57,617	308.21	188.21	25.61%	\$5,046	\$5,785	\$739	14.64%
13,692	110.44	4.88	16.98%	\$1,541	\$1,981	\$440	28.56%
10,006	35.67	0.00	38.43%	\$1,234	\$1,243	\$9	0.71%
20,307	134.01	17.43	20.76%	\$2,095	\$2,509	\$414	19.74%
28,952	169.12	49.44	23.45%	\$2,865	\$3,230	\$365	12.74%
35,229	205.41	86.53	23.49%	\$3,328	\$3,832	\$504	15.14%
1,712	21.90	0.00	10.71%	\$569	\$694	\$126	22.14%
14,657	71.95	0.00	27.91%	\$1,621	\$1,756	\$135	8.35%
110,280	332.00	212.00	45.50%	\$9,554	\$8,809	(\$745)	-7.80%
73,520	470.76	350.76	21.39%	\$6,565	\$7,817	\$1,252	19.07%
47,250	264.25	144.25	24.49%	\$4,334	\$4,907	\$573	13.22%
27,958	212.83	95.10	17.99%	\$2,692	\$3,491	\$799	29.66%
42,680	261.36	141.36	22.37%	\$3,957	\$4,638	\$682	17.23%
28,042	115.89	4.98	33.15%	\$2,717	\$2,798	\$80	2.96%
343,260	721.42	601.42	65.18%	\$29,660	\$24,235	(\$5,424)	-18.29%
47,129	258.91	138.91	24.94%	\$4,347	\$4,862	\$514	11.83%
56,920	292.36	172.36	26.67%	\$5,070	\$5,633	\$563	11.10%
7,084	82.35	0.00	11.78%	\$1,015	\$1,421	\$405	39.94%
45,372	235.38	115.38	26.41%	\$4,037	\$4,597	\$560	13.86%
51,552	248.30	128.30	28.44%	\$4,609	\$5,025	\$415	9.01%
150,680	520.28	400.28	39.67%	\$13,245	\$12,354	(\$891)	-6.73%

## ■ Summary

- ▶ Demand rates provide a more appropriate matching of costs and cost recovery
- ▶ This does not mean that two part rates don't work
- ▶ “Three part” rates can mean many different things - be aware of which design and objective is being discussed
- ▶ Member education will be a key component of the transition process

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