ATTACHMENT 9: RES RETAIL RATE IMPACT

The Empire District Electric Company 2017 RES Filing

The Empire District Electric Company ("Empire") requested that ABB perform modeling for their Electric Utility Renewable Energy Standard (RES) Requirements. The modeling included calculating the retail rate impact per section 5 of Missouri 4 CSR 240-20.100 (the "Rule").

Assumptions:

Rule 5 (B) 1 states that the non-renewable gneration and purchase power portfolio shall be determined by adding, to the utility's existing generation and purchased power resource portfolio excluding all renewable resources, additional non-renewable resources sufficient to meet the utility's needs on a least-cost basis for the next ten (10) years. To achieve this portfolio, ABB removed the following renewables from the 2016 IRP resources; 1) Elk River and Meridian Way Wind – 36 MWs of Accredited Capacity, Ozark Beach Hydro – 16 MWs of Accredited Capacity, 2029 Future Wind – 15 MWs of Accredited Capacity and 2031 Future wind – 22.5 MWs of Accredited Capacity . In addition, the impact of the residential and commercial solar additions that were removed from the load forecast by Itron were added back. To account for the loss of capacity, the 2029 combined cycle was brought on in 2026 and an additional 100 MW combined cycle was added in 2033 in order to maintain a minimum capacity margin of 12%.

Rule 5 (B) 2 states that the RES-compliant portfolio shall be determined by adding to the utility's existing generation and purchased power resource portfolio an amount of least cost renewable resources sufficient to achieve the portfolio requirements set forth in section (2) of this rule and an amount of least-cost non-renewable resources, the combination of which is sufficient to meet the utility's needs for the next ten (10) years. ABB is using the preferred plan (Plan 5) from Empire's latest IRP filing. Plan 5 included renewable resources that meet the RES requirements set forth in section (2). As required by rule 5 (C), rebates made during each calendar year were also included in the cost of generation from renewable energy resouces. 2015-2017 budgeted solar capacity was updated with actual solar rebated operational capacity. The difference between actual and budget was added as a solar resource in order to offset the impact on the load forecast. 2015-2017 budgeted solar rebates paid were also updated for actuals.

Rule 5 (B) 4 states that the assumptions regarding projected renewable energy resource additions will utilize the most recent electric utility resóuce planning analysis. Weighting of the greenhouse gas emissions and market prices were developed using ABB's 2017 Fall Midwest Power Reference Case. A 70% weighting was given to the no-carbon tax scenario and 30% to the carbon tax scenario.

Table 1 includes the expected value of costs associated with greenhouse gas emissions used in this analysis. Weighted market prices were developed in ABB's 2017 Fall Reference Case database with modifications that included a weighted carbon tax. Figure 1 includes market prices for the SPP-KSMO market area with the impact of a carbon tax begining in 2021.

Table 1 Expected Value Carbon Tax

Year	70% No Carbon	30% Fall 2017 Ref Case	Expected Value
2017	-		
2018	-		
2019	-		
2020	-		
2021	-		
2022	-		
2023	-		
2024	-		
2025	-		
2026	-		
2027	-		
2028	-		
2029	-		
2030	-		
2031			
2032			
2033			
2034			
2035			
2036			
2037			

Figure 1 SPP-KSMO 7 x 24 Weighted Market Prices (Nominal $/MWh)

2017 Fall Ref Case - NO CO2   2017 Fall Ref Case-C02 Tax   2017 Fall Weighted CO2
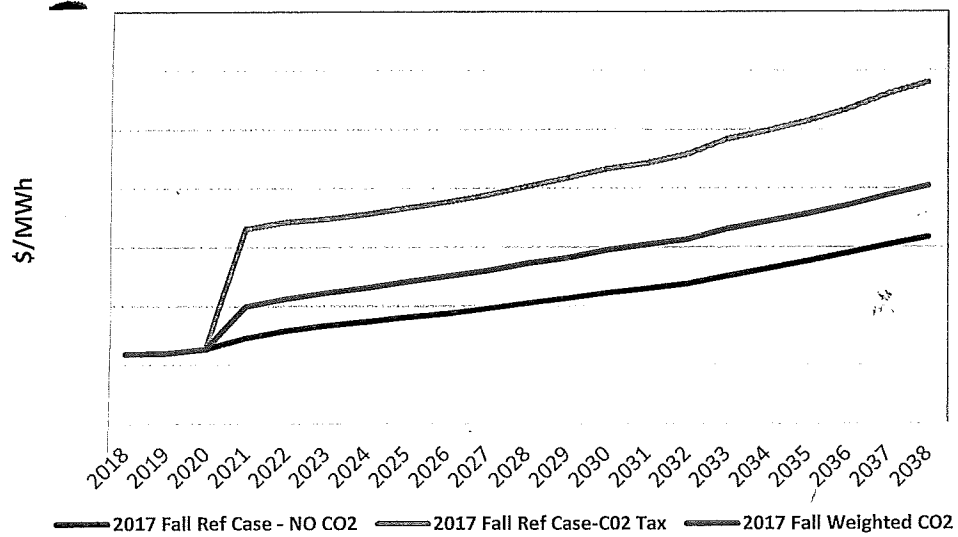
Results:

The following table shows the 1% calculation for the 10 year average over the succeeding 10-year period required by Rule 5 (B).

Table 2 Annual Revenue Requirements

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Total
Actual Spend - 2018-2027											
Budget - 2018-2027											
Revenue Requirements 2018-2027											
Budget % of Revenue Requirements											
Actual % of Revenue Requirements	2.6%	2.5%	2.2%	0.1%	-0.2%	-0.4%	-0.8%	-1.2%	-1.5%	-3.9%	-0.1%

The following tables summarize the Retail Rate Impact calculation required by Rule 5 (G).

Table 3 2018-2027 RRI Calculation Period

2018-2027 RRI Calculation Period	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Baseline Revenue Req (MM$)										
Annual 1% (MM$)										
Actual Costs										
Annual Over/(Under)										
Plus Prior Carryover	8.455									
Cumulative carryover - over/(under)	17.382	25.737	32.823	27.568	19.981	11.233	-0.261	-15.032	-31.759	-66.265

Table 4 2019-2028 RRI Calculation Period

2019-2028 RRI Calculation Period	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Cumulative
Baseline Revenue Req (MM$)											
Annual 1% (MM$)											
Actual Costs											
Annual Over/(Under)	8.356	7.085	-5.254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	
Plus Prior Carryover	17.382										
Cumulative carryover - over/(under)	25.737	32.823	27.568	19.981	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	

Table 5 2020-2029 RRI Calculation Period

2020-2029 RRI Calculation Period	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Cumulative
Baseline Revenue Req (MM$)											
Annual 1% (MM$)											
Actual Costs											
Annual Over/(Under)	7.085	-5.254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231	
Plus Prior Carryover	25.737										
Cumulative carryover - over/(under)	32.823	27.568	19.981	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	

Table 6 2021-2030 RRI Calculation Period

2021-2030 RRI Calculation Period	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	10-Year "Budget"	Cumulative "Budget"
Baseline Revenue Req (MM$)							697.706	707.576	717.009	725.249		
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)	-5.254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231	3.948		
Plus Prior Carryover	32.823											
Cumulative carryover - over/(under)	27.568	19.981	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645		

Table 7 2022-2031 RRI Calculation Period

2022-2031 RRI Calculation Period	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	10-Year "Budget"	Cumulative "Budget"
Baseline Revenue Req (MM$)								717.009	725.249	728.839		
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231	3.948	-18.097		
Plus Prior Carryover	27.568											
Cumulative carryover - over/(under)	19.981	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742		

Table 8 2023-2032 RRI Calculation Period

2023-2032 RRI Calculation Period	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032		Cumulative
Baseline Revenue Req (MM$)												
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231	3.948	-18.097	29.216		
Plus Prior Carryover	19.981											
Cumulative carryover - over/(under)	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742	-130.526		

Table 9 2024-2033 RRI Calculation Period

2024-2033 RRI Calculation Period	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033		Cumulative
Baseline Revenue Req (MM$)												
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)												
Plus Prior Carryover	11.233											
Cumulative carryover - over/(under)	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742	-130.526	-107.525		

Table 10 2025-2034 RRI Calculation Period

2025-2034 RRI Calculation Period	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	10-Year "Budget"	Cumulative "Budget"
Baseline Revenue Req (MM$)								758.224	769.474	811.113		
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)	-14.771	-16.727	-34.506	-33.097	-46.231	3.948	-18.097	29.216	23.001	-4.170		
Plus Prior Carryover	-0.261											
Cumulative carryover - over/(under)	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742	-130.526	-107.525	-111.695		

Table 11 2026-2035 RRI Calculation Period

2026-2035 RRI Calculation Period	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035		Cumulative
Baseline Revenue Req (MM$)												
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)	-16.727	-34.506	-33.097	-46.231	3.948	-18.097	-29.216	25.001	-4.170	-11.302		
Plus Prior Carryover	-15.032											
Cumulative carryover - over/(under)	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742	-130.526	-107.525	-111.695	-122.997		

Table 12 2027-2036 RRI Calculation Period

2027-2036 RRI Calculation Period	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036		Cumulative
Baseline Revenue Req (MM$)												
Annual 1% (MM$)												
Actual Costs												
Annual Over/(Under)												
Plus Prior Carryover	-31.759											
Cumulative carryover - over/(under)	-66.265	-99.361	-145.593	-141.645	-159.742	-130.526	-107.525	-111.695	-122.997	-140.017		