

**THE EMPIRE DISTRICT ELECTRIC COMPANY**

**COGENERATION RATE CALCULATION**

January 2013

|                                 | <u>SUMMER</u> | <u>WINTER</u> | <u>Source</u>         |
|---------------------------------|---------------|---------------|-----------------------|
| 1. Avoided Energy Cost          | 0.03222       | 0.02695       | Prosym Model          |
| 2. Transmission Loss Rate       | 2.336%        | 2.336%        | Loss Study 2011       |
| 3. Cogeneration Purchase Rate   | 0.0330        | 0.0276        | Line 1 *( 1 + line 2) |
| 4. Summer / Winter Differential | 19.58%        |               |                       |

The Summer period is the four months of June through September.  
The Winter period is the remaining eight months.

Costs are averaged for 2013-2014 cost years.

From Marginal Energy Costs by On-Peak & Off-Peak Periods

|                                 | 2013  | Hours        |                    | 2014  | Hours              |
|---------------------------------|-------|--------------|--------------------|-------|--------------------|
| <b>SUMMER</b>                   |       |              |                    |       |                    |
| Average Marginal Costs On-Peak  | 42.77 | 1,118        |                    | 42.86 | 1,131              |
| Average Marginal Costs Off-Peak | 25.39 | 1,810        |                    | 25.84 | 1,797              |
|                                 |       | <u>2,928</u> | total summer hours |       | <u>2,928</u>       |
|                                 |       |              |                    |       | total summer hours |
| <b>WINTER</b>                   |       |              |                    |       |                    |
| Average Marginal Costs On-Peak  | 31.26 | 2,800        |                    | 31.56 | 2,784              |
| Average Marginal Costs Off-Peak | 22.69 | 3,032        |                    | 23.00 | 3,048              |
|                                 |       | <u>5,832</u> | total winter hours |       | <u>5,832</u>       |
|                                 |       |              |                    |       | total winter hours |

AVOIDED ENERGY COST

( Marginal cost \* on/off-peak summer hours ) / total summer hour ( Marginal cost \* on/off-peak summer hours ) / total summer hours

|               |              |  |              |  |       |
|---------------|--------------|--|--------------|--|-------|
| <b>SUMMER</b> |              |  |              |  |       |
| On-Peak       | 16.33        |  | 16.56        |  |       |
| Off-Peak      | 15.70        |  | 15.86        |  |       |
|               | <u>32.03</u> |  | <u>32.41</u> |  | 32.22 |
| <b>WINTER</b> |              |  |              |  |       |
| On-Peak       | 15.01        |  | 15.07        |  |       |
| Off-Peak      | 11.80        |  | 12.02        |  |       |
|               | <u>26.80</u> |  | <u>27.09</u> |  | 26.95 |

## Empire District Electric Company 2011 Analysis of System Losses

**TABLE 1**  
**Loss Factors at Sales Level, Calendar Year 2011**

| <u>Voltage Level<br/>of Service</u>    | <u>Total EDE</u> | <u>Missouri</u> | <u>Arkansas</u> | <u>Kansas</u> | <u>Oklahoma</u> |
|--|------------------|-----------------|-----------------|---------------|-----------------|
| <u>Demand (kW)</u>                     |                  |                 |                 |               |                 |
| Transmission                           | 1.02870          | 1.02870         | 1.02870         | 1.02870       | 1.02870         |
| Substation                             | 1.03597          | 1.03624         | 1.03580         | 1.03580       | 1.03580         |
| Primary                                | 1.06298          | 1.06268         | 1.06725         | 1.06725       | 1.06725         |
| Secondary                              | 1.08725          | 1.08658         | 1.09171         | 1.09590       | 1.09137         |
| <u>Energy (kWh) *</u>                  |                  |                 |                 |               |                 |
| Transmission                           | 1.02336          | 1.02336         | 1.02336         | 1.02336       | 1.02336         |
| Substation                             | 1.03225          | 1.03275         | 1.03252         | 1.03252       | 1.03252         |
| Primary                                | 1.04914          | 1.04887         | 1.04988         | 1.04988       | 1.04988         |
| Secondary                              | 1.07636          | 1.07479         | 1.07991         | 1.07944       | 1.07583         |
| Losses – Net System Input <sup>1</sup> | 6.30             | 6.21            | 6.01            | 6.73          | 6.36            |

**TABLE 2**  
**Historical System MWH Losses**

| <u>Year</u> | <u>Firm Sales<br/>MWH</u> | <u>Total<br/>Losses</u> | <u>%<br/>Annual</u> | <u>% 5-Yr. Avg.<br/>Rolling</u> |
|-------------|---------------------------|-------------------------|---------------------|---------------------------------|
| 1998        | 4,162,607                 | 303,175                 | 7.28                |                                 |
| 1999        | 4,163,824                 | 304,747                 | 7.32                |                                 |
| 2000        | 4,424,768                 | 366,028                 | 8.27                |                                 |
| 2001        | 4,494,199                 | 304,067                 | 6.77                |                                 |
| 2002        | 4,566,262                 | 334,287                 | 7.32                | 7.39                            |
| 2003        | 4,594,856                 | 347,676                 | 7.57                | 7.45                            |
| 2004        | 4,628,759                 | 338,035                 | 7.30                | 7.45                            |
| 2005        | 4,923,486                 | 361,858                 | 7.35                | 7.26                            |
| 2006        | 5,049,599                 | 273,483                 | 5.42                | 6.99                            |
| 2007        | 5,118,460                 | 356,396                 | 6.96                | 6.92                            |
| 2018        | 5,124,277                 | 353,204                 | 6.89                | 6.78                            |
| 2009        | 4,901,435                 | 349,647                 | 7.13                | 6.75                            |
| 2010        | 5,202,277                 | 363,250                 | 6.98                | 6.68                            |
| 2011        | 5,082,772                 | 351,949                 | 6.92                | 6.98                            |

<sup>1</sup> Net System Input equals firm sales plus losses, Company use less non-requirement sales and related losses. See Appendices A and B, Exhibit 1, for their calculations.

**Time of Day Marginal Cost Summary**  
**Data From the 2013-2017 Fuel and Purchased Power Budget**  
**Average Marginal Cost \$/MWh**

2013

| Period          | Total hours | % of hours | Average Marg Cost |
|-----------------|-------------|------------|-------------------|
| Summer On-Peak  | 1,118 ✓     | 12.8%      | 42.77 ✓           |
| Summer Off-Peak | 1,810 ✓     | 20.7%      | 25.39 ✓           |
| Total Summer    | 2,928 ✓     | 33.4%      | 32.03 ✓           |
| Winter On-Peak  | 2,800 ✓     | 32.0%      | 31.26 ✓           |
| Winter Off-Peak | 3,032 ✓     | 34.6%      | 22.69 ✓           |
| Total Winter    | 5,832 ✓     | 66.6%      | 26.80 ✓           |
| Total           | 8,760       | 100.0%     | 28.55             |

2014

| Period          | Total hours | % of hours | Average Marg Cost |
|-----------------|-------------|------------|-------------------|
| Summer On-Peak  | 1,131       | 12.9%      | 42.86             |
| Summer Off-Peak | 1,797       | 20.5%      | 25.84             |
| Total Summer    | 2,928 ✓     | 33.4%      | 32.41 ✓           |
| Winter On-Peak  | 2,784       | 31.8%      | 31.56             |
| Winter Off-Peak | 3,048       | 34.8%      | 23.00             |
| Total Winter    | 5,832 ✓     | 66.6%      | 27.09 ✓           |
| Total           | 8,760       | 100.0%     | 28.87             |