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PUC PROJECT NO. 48539

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REVIEW OF THE INCLUSION OF MARGINAL LOSSES IN SECURITY-CONSTRAINED ECONOMIC DISPATCH	§ § § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

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NRG AND CALPINE CORPORATIONS' COMMENTS TO COMMISSION STAFF'S REQUEST FOR COMMENTS

Bill Barnes
Senior Director, Regulatory Affairs
NRG Energy, Inc.
1005 Congress Avenue, Suite 950
Austin, Texas 78701
Telephone: (512) 691-6137
Facsimile: (512) 691-6353
Email: bill.barnes@nrg.com

Diana Woodman Hammett
Calpine Corporation
717 Texas Avenue, Suite 1000
Houston, Texas 77002
Email: diana.woodmanhammett@calpine.com

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TO THE HONORABLE CHAIRMAN AND COMMISSIONERS OF THE PUBLIC UTILITY COMMISSION OF TEXAS:

NRG Texas Power LLC, NRG Power Marketing LLC, Reliant Energy Retail Services LLC, Green Mountain Energy Company, US Retailers LLC, and NRG Curtailment Solutions LLC – all wholly owned subsidiaries of NRG Energy, Inc. (collectively NRG) and Calpine Corporation (Calpine) appreciate the opportunity to respond to the Public Utility Commission of Texas (Commission) Staff's request for Comment filed August 9, 2018 in PUC Project No. 48539, *Review of the Inclusion of Marginal Losses in Security-Constrained Economic Dispatch.*

I. General Comments

> The ERCOT market is unique in its treatment of transmission losses. Marginal losses are not included in ERCOT real-time energy prices and the costs of losses are collected from loads on an average basis. This approach may have been reasonable at the time ERCOT was implementing its initial real-time energy markets because generators were relatively close to load centers. However, as open access transmission expansion policies and other factors have led to a wider dispersion of the generation fleet, the failure to recognize marginal losses in the real-time dispatch and pricing has led to larger dispatch inefficiencies and price distortions. Therefore, we are now recommending that the ERCOT real-time market be upgraded to recognize marginal losses in its dispatch and prices.
>
> - Independent Market Monitor (IMM) for the ERCOT Region[1]

In the Electric Reliability Council of Texas (ERCOT) energy-only market, the integrity of energy price formation is the foundation of the competitive market's success. Energy prices

[1] *2016 State of the Market Report for the ERCOT Electricity Markets*, Potomac Economics, https://www.potomaceconomics.com/wp-content/uploads/2017/06/2016-ERCOT-State-of-the-Market-Report.pdf at xxvii (May 2017). *See also 2017 State of the Market Report for the ERCOT Electricity Markets*, Potomac Economics, https://www.potomaceconomics.com/wp-content/uploads/2018/05/2017-State-of-the-Market-Report.pdf at xxix (May 2018).

are the primary source of financial incentive that drives behavior by generation, load resources, and consumers. Energy prices also provide important investment and facility siting signals. As with all other important market design changes implemented in ERCOT, the Commission has provided the leadership necessary to ensure that improvements are made to the wholesale market and that differing stakeholder interests do not impede important and necessary improvement.

The current design of the ERCOT market calculates transmission losses based on a system-wide average and allocates those losses to every load-serving entity (LSE) without incorporating those costs into energy prices. Because of this, generation resources that produce significant transmission losses have no economic incentive to behave differently, and developers or demand response providers have no economic incentive to site new resources in locations that lower the costs of losses for consumers. In contrast, by incorporating marginal losses into energy prices, the cost of transmission losses will be borne by the generator that creates them. This will more accurately express the cost of losses in each locational energy price, resulting in more accurate siting and dispatch signals, while avoiding ERCOT's highly inefficient average loss allocation mechanism. Direction from the Commission to implement marginal losses would be entirely consistent with the Commission's decision to implement the nodal market which incorporated the cost of all transmission congestion into electricity prices. Marginal-cost pricing of losses results in more competitive pricing[2] and a more efficient market. The current system of socializing transmission losses creates inefficient incentives for remote generation to produce additional output, even though the additional output increases system costs.[3] Failing to include marginal losses in ERCOT prices also creates the additional risk that there will be reduced incentives to invest in generation located more closely to load, resulting in higher costs to consumers.[4]

NRG and Calpine support the inclusion of marginal losses in ERCOT energy prices because it will improve long-term investment and retirement decisions by refining ERCOT's price signals, producing sizable benefits to the market. Additionally, it will correctly value reliability attributes of close-in resources that provide needed voltage support and frequency

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[2] Dr. Steven Stoft, *Power System Economics* at 417 (2002).

[3] Motion of the New York Independent System Operator, Inc. and the New York Transmission Owners for Leave to Supplement the Record, FERC Dockets ER97-1523-068, OA97-470-000 and ER97-4234-000, Testimony of Dr. David Patton at 14.

[4] *Id.*

response.[5] Electricity prices need to reflect the increase in transmission losses as power moves across large geographic distances, otherwise generators and consumers will not receive correct short- and long-term price signals.[6] Because the energy-only market relies on the integrity of price formation and the need for prices to reflect supply and demand fundamentals accurately, incorporating the cost of the ERCOT system's physical properties, such as transmission losses, is essential. Accuracy in energy price formation applies to system-wide scarcity prices and locational price formation that reflects the costs of delivering electricity to consumers. Therefore, the ERCOT market would benefit from the inclusion of marginal losses because it will send accurate investment siting signals for the next generation of electric production technology such as battery storage, distributed generation, residential solar, and others. Market design improvements must be made to ensure that price formation in the ERCOT energy-only market drives the right choices by market participants – to invest in generation, repowering, equipment maintenance, demand response, and innovative retail products – in the right locations. It is for these reasons that NRG and Calpine agree with the IMM and support the inclusion of marginal losses in energy prices as part of an implementation of real-time co-optimization (RTC) in the ERCOT energy-only market with the functionality to support locational reserve requirements.

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[5] William W. Hogan and Susan L. Pope, Priorities for the Evolution of an Energy-Only Electricity market Design in ERCOT at 44 (May 9, 2017) (FTI Report). Within ERCOT, under normal conditions, market prices only reflect the value of the marginal unit's cost to operate, and thus, only compensate for energy produced. This fails to compensate owners for the reliability contribution that resources provide the system. Preserving ERCOT's network reliability in real time creates costs above and beyond the pure cost of natural gas times the market-implied heat rate. Namely, the system requires voltage support and primary frequency response to function reliable, but reactive power does not travel across the ERCOT system to support voltage at distant loads. Generating resources close to the load centers are most effective at supporting distant load's voltage profile. Said another way, long energy transfers from West Texas are made possible by the reactive power created locally by generators who are not compensated for their contribution to those transfers.

[6] *See* Leslie Liu and Assef Zobian, *The Importance of Marginal Loss Pricing in an RTO Environment*, 15 The Electricity Journal 8 at 40-45 (Oct. 2002), https://www.sciencedirect.com/science/article/pii/S1040619002003706?via%3Dihub.

II. Responses to Comments Regarding Specific Questions Presented

1. What are the benefits of implementing the use of marginal transmission losses rather than average transmission losses in the Electric Reliability Council of Texas (ERCOT) Security-Constrained Economic Dispatch (SCED) over the long term?

Including transmission losses in the calculation of locational marginal prices and in the dispatch of generation resources has an extensive history of benefits as observed from its implementation in other restructured power markets. It is considered a best practice as an economic principle in power market design.[7] The benefits include, in the short-term, more efficient utilization of existing resources and over the long-term, proper alignment of investment siting and retirement incentives with improved locational electricity price signals. As explained by the Brattle Group:

> By accounting for locational differences in marginal costs, nodal prices more accurately incentivize production (or load reductions) where it is most valuable to the system. This provides improved incentives for both short-term dispatch and long-term investment purposes.[8]

The record supporting the implementation of marginal losses based on economic principles and ERCOT wholesale market design objectives in Commission rule has been established.[9] 16 Texas Administrative Code (TAC) § 25.501, relating to Wholesale Market Design for the Electric Reliability Council of Texas states in paragraph (a):

> The protocols and other rules and requirements of the Electric Reliability Council of Texas (ERCOT) that implement this section shall be developed with consideration of microeconomic principles and shall **promote economic efficiency in the production and consumption of electricity**; support wholesale

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[7] *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, Comments of Potomac Economics at 2 (Sept. 15, 2017) (IMM 47199 Comments).

[8] Johannes Pfeifenberger et al., The Brattle Group, *The Future of Ontario's Electricity Market: A Benefits Case Assessment of the Market Renewal Project* at 25 (Apr. 20, 2017), http://files.brattle.com/files/5685_benefits-case-assessment-market-renewal-project-clean-20170420.pdf (report prepared by the Brattle Group for Ontario's Independent Electricity System Operator and estimates the net benefit that Ontario could realize by reforming the wholesale electricity markets operated by the Independent Electricity System Operator (IESO)).

[9] *See generally,* IMM 47199 Comments; *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, Calpine Corporations Comments (Dec. 1, 2017) (Calpine 47199 Comments); *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, Calpine Corporation's Reply Comments (Dec. 22, 2017) (Calpine 47199 Reply Comments); *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, NRG Response to Request for Comment (Dec. 2, 1027); and, *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, NRG's Reply Comments (Dec. 22, 2017) (NRG 47199 Reply Comments).

and retail competition; support the reliability of electric service; and **reflect the physical realities of the ERCOT electric system.**[10]

Implementation of marginal losses is consistent with this market policy and adheres to economic principles that are proven to drive efficient competitive market outcomes. The implementation of marginal losses would increase the efficiency of dispatch of existing resources and the efficiency of future investment decisions, resulting in both short-term and long-term cost savings for consumers in all areas of ERCOT. The main benefits can be summarized as follows:

- Immediate production cost savings upon implementation realized through a reduction in transmission losses;
- Future production cost savings as siting decisions improve and reduce transmission losses over time;
- The distribution of surplus loss revenue to consumers (similar to the distribution of congestion rent) which exceeds any cost increases resulting from incorporating losses into prices (according to ERCOT's Marginal Loss Benefits Study);[11]
- Over time a reduction in future transmission costs as improved siting decisions reduce the need for high cost transmission infrastructure;
- Reduction in transmission congestion costs as dispatch of resources closer to load centers helps resolve transmission constraints realized when serving that load;
- Lower wholesale prices in West Texas and the Permian Basin supporting the oil and gas industry, a key economic driver for the state economy.[12]

Including transmission losses in prices has the additional benefit of simplifying hedging and settlements for Load Serving Entities (LSEs) and Retail Electric Providers (REPs). Under the current average loss system, transmission losses are uplifted to LSEs and REPs based on load ratio share after the operating day has passed. This after-the-fact settlement represents an unknown cost to serve load for LSEs and REPs, since the actual metered load served by these entities is increased by the amount of transmission loss allocation and Unaccounted for Energy (UFE). REPs attempt to quantify this uplift by using historical data, but historical data is the equivalent of a "best guess." Under a marginal loss system, the cost of losses is incorporated into the original prices and would be included in forward products, which would eliminate the

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[10] 16 Tex. Admin Code § 25.501(a) (emphasis added).

[11] *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, ERCOT Studies on Benefits of Real-Time Co-Optimization and Marginal Losses, Attachment B: Study of the System Benefits of Including Marginal Losses in Security-Constrained Economic Dispatch at 4 (Bates 16) (Jun. 29, 2018) (ERCOT Marginal Loss Study).

[12] ERCOT Marginal Loss Study at 4 (Bates 14).

loss uplift settlement and the after-the-fact price uncertainty. Therefore, if marginal losses were incorporated into energy prices, when LSEs or REPs hedge by procuring forward products, the cost of losses would be included in the hedge.

It was a critical improvement in the efficiency of the market design when ERCOT dispatching and pricing began accounting for congestion. Differences in congestion costs between locations can be significant but episodic. On the other hand, differences in marginal losses are more stable but persistent. In other electricity systems such as PJM, the cumulative impacts of congestion and marginal loss accounting have been of the same order of magnitude.[13] Hence, the long-run incentive effects on investment and location are just as important for losses as congestion.

2. Are the benefits identified in response to Question 1 sufficient to justify the near term costs to the market as a whole? Please consider individual stakeholder implementation costs as well as the costs to ERCOT identified in its study.

Yes. Only a small subset of the benefits identified in the response to Question 1 have been quantified, yet those benefits still exceeds the costs. ERCOT has estimated a cost of $10 million to implement marginal losses with an implementation time of 18 to 24 months.[14] Additionally, ERCOT has quantified the benefits of implementing marginal losses, finding a production cost savings of $11.4 million under their base case assumptions.[15] ERCOT's base case assumptions included a gas price of $3.55/MMBtu for study year 2020.[16] If gas prices were lower at $2.55/MMBtu, ERCOT has estimated a production cost savings of $13.4 million.[17] The ten-year average forward gas price strip for the Houston Ship Channel (HSC) is currently $2.76/MMBtu[18] and the ten-year average forward gas price strip for Waha index is currently

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[13] FTI Report at 44.

[14] *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, Electric Reliability Council of Texas, Inc.'s Second Report in Response to Commission Staff's Request at 6-7 (Sept. 29, 2017) (ERCOT Second Report in 47199).

[15] ERCOT Marginal Loss Study at 2 (Bates 14).

[16] *Id.* at 1 (Bates 13).

[17] *Id.* at 1-2 (Bates 13 – 14).

[18] S&P Global Market Intelligence, Natural Gas Forwards & Futures (as of Oct. 3, 2018), https://platform.mi.spglobal.com/web/client?auth=inherit#markets/energyMarketsNaturalGasSummary?key=982fafdb-b14f-4c18-b151-75be96d6c2c5.

$2.20/MMBtu.[19] Therefore, based on current gas price expectations and ERCOT's analysis, it would be reasonable to assume ERCOT consumers will realize production cost savings from marginal losses between $11.4 million and $13.4 million.[20] In other words, the implementation of marginal losses would likely pay for itself in the first year based solely on production cost savings from better utilization of existing resources.

This ERCOT analysis of production cost savings does not take into consideration other savings the implementation of marginal losses will have. Specifically it does not monetize a primary benefit of marginal losses, which is the improvement in siting signals for new resources. As more optimal locational prices attract resources to areas of the ERCOT system that lower the cost of transmission losses, the reduction in system losses will grow and accrue over time, this could potentially greatly exceed the production cost savings estimated by ERCOT. ERCOT market participants are beginning to understand the risk and increased cost of relying on remote generation for supply needs. For example, Austin Energy is pursuing a 144 MW solar project that is located in the South Zone because the "close proximity to Austin Energy's load reduces transmission losses."[21] Marginal losses will strengthen the financial incentives to locate resources in a way that lowers costs for consumers over the long term. In addition, locating more resources closer to load centers will likely reduce the need for future transmission infrastructure. The Transmission Cost of Service (TCOS) annual revenue requirement is over $3.5 billion.[22] Therefore, even a small percentage reduction in future transmission costs would result in substantial savings for consumers. Additionally, increased dispatch of resources closer to load will reduce transmission congestion and additional ERCOT costs such as Reliability Unit Commitment (RUC) used to resolve congestion related issues.

Since the cost of transmission losses is embedded into Settlement Point Prices (SPP) with marginal losses, there is no structural change to the market that would require costly stakeholder implementation costs, such as purchasing software for a new market interface. Stakeholders could easily update reporting systems to capture loss components of SPPs for settlement

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[19] *Id.*

[20] ERCOT Marginal Loss Study at 2 (Bates 14).

[21] Austin City Council Agenda: Recommendation for Austin City Council Action regarding Item No. 003 at 2 (Oct. 18, 2018), http://www.austintexas.gov/edims/document.cfm?id=307252.

[22] Commission Staff's Application to Set 2018 Wholesale Transmission Service Charges for the Electric Reliability Council of Texas, Docket No. 47777, Order at Attachment A (Bates 8) (Mar. 29, 2018).

purposes. The implementation of marginal losses would also simplify settlement of retail load by eliminating the uplift component for socialization of transmission losses.

NRG and Calpine anticipate that opponents of marginal losses will continue to argue implementation will create "winners and losers" that overshadow the clear benefits of implementation.[23] As stated in prior comments, there is no property right to an inefficient market.[24] The Commission should consider whether ignoring clear improvements in the efficiency of the market design to pacify claims of entities benefiting from inefficiencies is in the best interest of the ERCOT market over the long-term. The Commission has already established precedent to proceed with such market design improvements when the nodal market was adopted. And similar to the implementation of the nodal market, proceeding with marginal losses is not picking winners and losers but implementing a market design best practice. It is taking a principled approach to pricing electricity based on its true underlying value.

Opponents of marginal losses argue that the reduction of revenues forecasted by ERCOT causes financial harm for certain existing generation owners and that should dissuade the Commission from taking action.[25] Yet these market participants do not acknowledge that the implementation of RTC results in much lower generator revenues.[26] For generators in the North Zone, ERCOT's marginal loss study estimated that generator revenue would be reduced by $331 million under the base case scenario with a $3.55/MMBtu gas price.[27] The results of the IMM study for RTC show that generator revenue in the North Zone would be reduced by $403.3 million for the 2017 study year that had a $2.98/MMBtu average gas price.[28] A higher gas price,

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[23] *See* Project to Assess Price-Formation in ERCOT's Energy-Only Market, Project No. 47199, Vistra Energy's Comments and Alternative Proposals (Sept. 29, 2017). *See also* Project to Assess Price-Formation in ERCOT's Energy-Only Market, Project No. 47199, Vistra Energy's Reply Comments (Dec. 22, 2017).

[24] Calpine 47199 Comments at 5. NRG 47199 Reply Comments at 6-9. Calpine 47199 Reply Comments at 5. *Project to Assess Price-Formation in ERCOT's Energy-Only Market*, Project No. 47199, Workshop, Thursday, Aug. 10, 2017, Tr. At 83 ("I don't think anybody ought to have a property right to inefficient market design in general") (comment by Dr. Patton).

[25] *See Project to Assess Price-Formation Rules in ERCOT's Energy Only-Market*, Project No. 47199, Analysis of Marginal Losses Proposal (Oct. 12, 2017). *See also Project to Assess Price-Formation Rules in ERCOT's Energy Only-Market*, Project No. 47199, Informational Filing by Invenergy LLC: Report: The Long-Term Impacts of Marginal Losses on Texas Electric Retail Customers (Apr. 20, 2018).

[26] *See generally Project to Assess Price-Formation Rules in ERCOT's Energy Only-Market*, Project No. 47199, Comments submitted by various market participants (2017).

[27] ERCOT Marginal Loss Study at 3 (Bates 15).

[28] *Project to Assess Price-Formation Rules in ERCOT's Energy Only-Market*, Project No. 47199, Simulation of Real-Time Co-Optimization of Energy and Ancillary Services for Operating Year 2017 (Jun. 29,

as reflected in the marginal loss base case, would be expected to result in a larger reduction in generator revenue under RTC.

Annual Changes in Generator Revenue in ERCOT's Marginal Loss Study[29]

Annual Generator Revenue Changes by Load Zone	Low Gas Price Case	Base Case	High Gas Price Case
Houston Zone ($M)	172.00	216.40	257.60
North Zone ($M)	-222.00	-331.90	-415.30
South Zone ($M)	38.30	86.80	125.90
West Zone ($M)	-153.00	-180.70	-190.20
Total	-164.70	-209.40	-222.00

Annual Changes in Generator Revenue in IMM's RTC Study[30]

Annual Generator Revenue Changes by Load Zone	RTC
Houston Zone ($M)	-393.40
North Zone ($M)	-403.30
South Zone ($M)	-495.90
West Zone ($M)	-105.30
Total	-1,397.90

NRG and Calpine present these results for comparison to demonstrate the fact that any material change in price formation and efficiency will have an impact on market participants in different ways. The overstated arguments of harm by some opponents of marginal losses should be considered in context with RTC as a comparison. Overall, NRG and Calpine believe an efficient market will result in the best outcomes for the ERCOT market as a whole.

2018). *See also* Independent Market Monitor (IMM), Questions Regarding IMM Software to Estimate the Benefits of RTC, http://www.ercot.com/content/wcm/key_documents_lists/162135/Questions_on_IMM_RTC_study_09182018__2_.docx (revenue calculated by multiplying generator base points by Resource Node LMPs for each generator in the SCED (status quo) simulation case compared to the RTC case as advised by the IMM in IMM's response to questions regarding IMM software).

[29] ERCOT Marginal Loss Study at 3 (Bates 15).

[30] *See generally Project to Assess Price-Formation Rules in ERCOT's Energy Only-Market*, Project No. 47199, Simulation of Real-Time Co-Optimization of Energy and Ancillary Services for Operating Year 2017 (Jun. 29, 2018) (the simulation program code, data, and use instructions are published at http://www.ercot.com/mktinfo/rtm/immtool). *See also*, Independent Market Monitor (IMM), Questions Regarding IMM Software to Estimate Benefits of RTC, http://www.ercot.com/content/wcm/key_documents_lists/162135/Questions_on_IMM_RTC_study_09182018__2_.docx.

For an energy-only market to properly function, the power market must form prices based on the laws of supply and demand constrained by physics. This is what the implementation of marginal losses will do. As the ERCOT market has evolved over the past eighteen years, the Commission has improved on its design, leading to more efficient pricing outcomes and long-term savings that are expected from competitive markets. With each market design change during this evolution, some entities benefitted and some entities did not. These entities were not subjectively "picked" to "lose" or "win." The decision was to support competitive outcomes and the impacts were the natural result of moving toward efficient market pricing. Considering the present question of whether to implement marginal losses, a choice to forgo implementation and remain inefficient would be truly picking winners and losers.

3. What are the effects on retail customers and the retail market from the implementation of marginal transmission losses?

As explained above, the implementation of marginal losses will reduce the costs of delivering electricity in ERCOT. ERCOT's benefit study for marginal losses estimated that with implementation, "Total Consumer Costs" would decrease by between $76 million and $170 million per year.[31] ERCOT estimates consumers in all zones will see a reduction in costs, except for Houston in the "Low Gas Price Case."[32] However, ERCOT's analysis did not include the distribution of surplus loss revenue into the consumer cost results.[33] If surplus loss revenue was distributed to consumers (similar to the distribution of excess congestion rent), the cost for electricity would be reduced by approximately $298 million to $467 million per year.[34] Specifically, if the method used to distribute marginal loss surplus revenue was based on a system-wide load ratio share, consumers in Houston in the "Low Gas Price Case" would see a $38.9 million reduction in cost per year rather than a $21.9 million increase.[35] Consumers in Houston would see an even larger reduction in cost if the method used to distribute marginal loss

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[31] ERCOT Marginal Loss Study at 4 (Bates 16).

[32] *Id.*

[33] *See id.* at 3-4 (Bates 15-16).

[34] ERCOT, Questions Regarding ERCOT's Marginal Loss Study, at 1 (Aug. 20, 2018) http://www.ercot.com/content/wcm/key_documents_lists/160763/Questions_on_ERCOT_ML_study_08202018.dox (figured arrived at by adding surplus to the change in consumer cost).

[35] *Id. See also* ERCOT Marginal Loss Study at 4 (Bates 16) (assumes Houston load is approximately 27% of ERCOT total load given ERCOT's 2017 Demand and Energy Report).

surplus revenue was based on a zonal allocation.[36] Therefore, it is clear retail customers in all regions of ERCOT would see a reduction in their total cost of electricity when both "Total Consumer Costs" and marginal loss surplus are considered. Cost savings can be seen in the following table below.

Annual Changes in Total Consumer Costs When Considering Surplus Loss Revenue

(System-wide Distribution)

Annual Changes in Total Consumer Costs by Load Zone	Low Gas Price Case	Base Case	High Gas Price Case
Houston Zone ($M)	-38.90	-98.55	-139.85
North Zone ($M)	-141.86	-174.16	-187.88
South Zone ($M)	-74.50	-95.13	-93.32
West Zone ($M)	-43.04	-47.67	-46.56

Additionally, and as explained in the response to Question 1, the implementation of marginal losses will simplify hedging and settlement for REPs by including transmission losses in the SPPs. When a REP purchases an ERCOT futures product under a system that properly assigns marginal losses to its source, the price will include the transmission loss component of the total energy and delivery settlement. In the current system of average losses, the futures product only covers energy and congestion, causing the REP to estimate the uplift portion of transmission losses in designing retail customer pricing. This uplift is unknown in advance and will change based on dispatch patterns and ERCOT's transmission loss allocation given changes in the REP's load ratio share, and results in ultimate price uncertainty for REPs. For example, ERCOT allocated approximately 973,000 MWh of losses to NRG REPs in 2016.[37] But in 2017, ERCOT allocated over 1,200,000 MWh of losses to NRG REPs.[38]

Since marginal losses would change the value of delivered energy in prices, there should be sufficient lead time prior to the implementation of marginal losses in order to not impact existing retail contracts that were priced based on the absence of transmission losses in prices.

[36] This would be similar to the distribution of Congestion Revenue Rights (CRR) Auction revenues. *See* FTI Report at 8.

[37] ERCOT settlement data from the Market Information System (MIS) for 2016.

[38] ERCOT settlement data from the Market Information System (MIS) for 2017.

Because NRG and Calpine want to minimize contract issues, it is recommended that the Commission adopt a minimum three year lead time for the implementation of marginal losses.

4. **The ERCOT study of using marginal transmission losses instead of average transmission losses in SCED simulated one year. How would cumulative, multi-year impacts of using marginal transmission losses be different, if at all?**

By only simulating one year, the ERCOT study (and any other study utilizing the same duration published in Project 47199 – *Project to Assess Price-Formation Rules in ERCOT's Energy-Only Market*) merely estimates the immediate change in the dispatch of existing resources. While such a study is instructive to demonstrate the short-term benefits of more efficient dispatch under marginal losses, it fails to account for the greater benefit of more efficient siting of future resources that will minimize system losses and costs over time. Improved siting decisions will also reduce the need for future high cost transmission infrastructure. By excluding transmission losses from pricing, future supply resources are not encouraged to site closer to loads and future energy-intensive consumers are not encouraged to site closer to supply. This naturally results in more high cost transmission infrastructure to be borne by all consumers within ERCOT, all else being equal. By limiting the benefits analysis to one year, the true benefits of implementing marginal loss pricing are not fully quantified. Nevertheless, even this short-sighted approach makes it clear that the benefits of assigning marginal losses outweigh the costs.

5. **What costs would be incurred by market participants if marginal losses were implemented in the ERCOT market? Please provide an estimate of the costs that would be incurred by your company or companies or customers represented by your organization. Please describe the elements of those costs.**

The system implementation costs for market participants for the implementation of marginal losses would be minimal since it only impacts how prices are calculated. Market participants would likely want to update reporting systems to capture the marginal loss component of SPPs to analyze trends but these costs would be minimal. Market participants that shadow settle ERCOT would also need to remove the transmission loss uplift allocation from their settlement systems. In addition, REPs would need to remove the transmission loss uplift allocation from their pricing models since the loss component would be in forward energy prices. Both NRG and Calpine, with large generation and retail presence, expect to be on the high side

of implementation costs among ERCOT market participants, and have estimated a cost impact of less than $50,000.

6. **How would a decision to use marginal transmission losses affect your company's market systems?**

NRG and Calpine do not expect an impact to our companies' dispatch and market systems as a result of implementing marginal losses.

7. **How would a decision to use marginal transmission losses affect your company's internal operations?**

Internal processes for retail contract pricing would be simplified by removing the transmission loss uplift estimation and will result in hedged prices covering more of the costs to deliver electricity. Moreover, customers on pass through contracts would benefit by not having the risk of additional transmission loss assessments.

8. **What are the effects on reliability on the ERCOT grid of using marginal transmission losses instead of average transmission losses in SCED?**

By attracting more resources closer to load centers, implementation of marginal losses is expected to improve reliability over the long-term. Relying on resources located long distances from load centers subjects the grid to greater stress and more reliability impacts associated with transmission element outages. In addition, maintaining and attracting resources closer to load centers increases the capability of the grid to manage low voltage issues associated with load growth. More efficient locational price signals would affect entry and exit decisions by both sending signals that a resource is no longer economic but also extending the economic life of other resources in areas that add market value by supporting reliability.

9. **What effects, if any, would marginal transmission losses have on grid hardening and resilience?**

Resources sited closer to load have inherent benefits for resiliency, principally from the reduction in distance covered by the transmission lines necessary to deliver the power. The advantages of having generation closer to load include a lower risk of cascading outages due to transmission system failures and a reduction in the number of contingencies associated with the delivery of electricity over long distances. Electrically stronger systems are better able to handle

transmission emergencies than those that are weakly connected via long lines. Having generation located closer to loads provides for better voltage stability, which can be an issue in systems with remote generation. Voltage stability may also be an issue in large load pockets such as Houston, if issues occur with the North to Houston transmission lines, which could lead to localized load shedding.

10. What effects would the use of marginal transmission losses in SCED have on grid reliability in regions of the ERCOT grid where non-synchronous generation is more prevalent?

Marginal losses would expose the true costs of delivering electricity from remote locations where non-synchronous generation, such as renewable resources, have been more concentrated. The regions with large concentrations of non-synchronous generation, such as West Texas, have experienced over-building of renewables that has overwhelmed the existing CREZ transmission infrastructure and led to the need for a stability constraint to manage reliability in the region.[39] The high concentration of non-synchronous renewable generation has presented reliability concerns and caused ERCOT to adopt and alter certain processes in response, such as the procurement of ancillary services to manage frequency in a system with lower inertia and the implementation of quarterly stability studies in the interconnection process.[40] By exposing the true cost of delivering electricity from these regions, more economic siting decisions will be made that discipline the overbuild of non-synchronous generation. In addition, by directly assigning the marginal costs of transmission losses to those generators, consumers will see a benefit of lower costs in these regions, like oil and gas customers.

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[39] *See* Ehsan Rehman et al., ERCOT, Dynamic Stability Assessment of High Penetration of Renewable Generation in the ERCOT Grid, Final Report at 3 and 9-10 (Apr. 19, 2018) http://www.ercot.com/content/wcm/lists/144927/Dynamic_Stability_Assessment_of_High_Penetration_of_Renewable_Generation_in_the_ERCOT_Grid.pdf.

[40] ERCOT, ERCOT Methodology for Determining Minimum Ancillary Service Requirements, available at http://www.ercot.com/content/wcm/key_documents_lists/89135/ERCOT_Methodologies_for_Determining_Minimum_Ancillary_Service_Requirements.zip (effective Jun. 1, 2018). *See also* Planning Guide Revision Request No. 052, Stability Assessment for Interconnecting Generation, Board Report (Apr. 4, 2017) http://www.ercot.com/content/wcm/key_documents_lists/107730/052PGRR-13_Board_Report_040417.doc.

11. How would a decision to implement marginal transmission losses affect investment in new generation resources in ERCOT over the next five years, the next 10 years, and in the years beyond 10 years?

See responses to Questions 1, 2 and 4, above. One of the primary benefits of marginal losses is the improved siting incentives for new resources, which accrue benefits over time.[41] New and developing technologies of electricity supply are becoming incremental and nimble, such as batteries, small scale solar, and distributed generation. By attracting these resources closer to load centers, system costs for transmission losses, transmission congestion, and transmission infrastructure will be reduced. Over the long-term, improved pricing signals in locations with higher loads will direct investment to these areas.

12. How would the implementation of marginal transmission losses affect the composition of the generation fleet in ERCOT?

Incorporating transmission losses in prices is technology neutral, but it will change pricing for resources based on location. Therefore, resources that can site closer to load centers will receive stronger pricing signals. This is likely to favor future investment in customer driven supply, such as small scale solar, battery technology, and distributed generation.

13. Assuming the Commission decided to go forward with implementation of marginal transmission losses, what are the key issues related to determining the appropriate treatment and allocation of the marginal transmission loss surplus revenues?

Under the current average loss system, consumers pay for transmission losses based on a system-wide load ratio share allocation of losses. Under a marginal loss system, consumers will pay for losses through higher prices in regions where it costs more to deliver electricity. Therefore, as a general principle, excess loss revenue should be distributed back to consumers to offset the cost. This is analogous to the distribution of congestion rent. Consumers pay for transmission congestion through higher electricity prices and therefore are entitled to the excess congestion rent. Since consumers in some zones will see higher costs of losses than others, it makes sense to distribute excess loss revenue based on a zonal allocation in a similar way that excess congestion rent (i.e. Congestion Revenue Rights (CRR) auction revenue) is distributed.

[41] FTI Report at 47.

Although the results of ERCOT's studies show that RTC results in lower annual generator revenues for all resources except those located in the West Zone when compared to the implementation of marginal losses; some owners of existing remote thermal generation have claimed that the implementation of marginal losses will cause financial harm due to their contribution to system transmission losses. Therefore, the Commission may also choose to distribute excess loss revenue on a temporary basis to existing remote thermal generation in order to address concerns about lower prices for these resources, but this should only be done on a temporary basis during a transition period.

14. Does the ERCOT analysis of the benefits of including marginal transmission losses in SCED accurately measure such benefits? Are potential costs to the market or to market participants adequately accounted for?

As explained in the responses to Questions 2 and 4 above, the ERCOT study was focused on only a subset of benefits and only for a single year. Therefore, the results of the ERCOT study will understate the benefits of implementing marginal losses, perhaps significantly, over many years, because benefits are expected to grow over time. Additionally, while not considered in the ERCOT analysis, long-run benefits such as the accrual of transmission loss reduction due to more efficient siting decisions and avoidance of high cost transmission infrastructure should be considered for a complete evaluation. The ERCOT study also failed to include the distribution of excess loss revenue to consumers when determining changes in "Total Consumer Costs" and therefore did not accurately portray the consumer benefits.

Since the implementation of marginal losses has a negligible impact on market and dispatch systems, the cost of implementation for market participants is minimal and would not impact the benefits in a meaningful way.

15. What ERCOT operational changes would need to be made that are not considered in ERCOT's studies?

No changes to ERCOT operations are expected in order to implement marginal losses. However, ERCOT will have to change the software that calculates prices and dispatch instructions. While it does not appear that ERCOT operational changes will be required, NRG and Calpine ultimately defer to ERCOT to address this question.

16. Would the use of marginal transmission losses in SCED change the ERCOT transmission planning process and transmission build-out?

Yes, incorporating transmission losses in prices will alter the dispatch pattern of generation resources in the model ERCOT uses in the economic transmission planning process because resources closer to loads will be utilized more. This is expected to reduce the need for economic transmission projects. In addition, higher prices in load pockets are likely to attract resource investment in these areas, resulting in the avoidance of additional transmission build.

For the years 2007 through 2017, over $15 billion of transmission projects were approved through the ERCOT planning process.[42] Approximately $6 billion were related to CREZ projects.[43] ERCOT reports that for the years 2018 through 2024 an additional $7 billion of transmission projects are proposed.[44] Consumers pay for the costs to upgrade, maintain, and operate the transmission system through the annual TCOS requirement, which in 2018 totaled $3.5 billion.[45] Therefore, even a small percentage reduction in future transmission infrastructure needs as a result of marginal losses would result in significant savings for consumers.

17. Assuming that the implementation of marginal transmission losses results in the location of generation closer to load, what advantages and disadvantages would there be during an emergency event or a market restart to having generation located closer to load?

As explained in the response to Questions 8 and 9 above, there are several advantages of having generation site closer to load, including a lower risk of cascading outages due to transmission system failures, voltage management, and system stability. During a system restoration event, the proximity of generation closer to loads allows for quicker restoration due to having multiple generators available, which allows for a stronger system with better voltage and frequency control. During system restoration, electrically weak systems with remote generation

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[42] ERCOT, Report on Existing and Potential Electric System Constraints and Needs at 3 (Dec. 2017), http://www.ercot.com/content/wcm/lists/114740/2017_Constraints_and_Needs_Report.pdf.

[43] *Id.*

[44] ERCOT, ERCOT Transmission Project and Information Tracking report (Feb. 2018), http://www.ercot.com/content/wcm/key_documents_lists/89026/ERCOT_February_TPIT_No_Cost_020118.xlsx.

[45] Commission Staff's Application to Set 2018 Wholesale Transmission Service Charges for the Electric Reliability Council of Texas, Docket No. 47777, Order at Attachment A (Bates 8) (Mar. 29, 2018).

lead to large spikes in system voltage because of the Ferranti effect,[46] which can be difficult to manage with limited dynamic reactive resources in the early stages of a restoration event.[47]

18. What effects, if any, would the implementation of marginal transmission losses have on the Congestion Revenue Rights (CRR) market?

The CRR product is a financial instrument that allows market participants to hedge congestion costs. As ERCOT concluded in its cost estimate, since CRRs only consider transmission congestion, there should be no change to the structure of the CRR market.[48] However, the implementation of marginal losses will reduce the amount of system congestion, since resources closer to loads often help relieve transmission congestion. This will change the value of existing CRR products. Therefore, a minimum implementation date of three years in the future would eliminate the impact as new CRRs auctioned would incorporate the inclusion of losses in their valuation.

Point-to-Point (PTP) Obligations that are purchased in ERCOT's Day-Ahead Market (DAM) cover any difference between a source and sink SPP in the Real-Time Market (RTM). Therefore, after marginal losses is implemented, PTPs purchased in the DAM will cover both congestion and transmission losses. The PJM market offers Up-to-Congestion (UTC) products in the DAM that function in the exact same way and have done so for over 11 years.[49]

19. How should the commission direct ERCOT to implement marginal transmission losses in a way that mitigates any deleterious effects on the CRR market?

Marginal losses should be adopted at least three years in advance of implementation to eliminate any impact on the value of existing CRRs that have already been purchased. An implementation date at least three years in the future will also alleviate impacts to the retail

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[46] *See* EEEGuide.com, Ferranti Effect, http://www.eeeguide.com/ferranti-effect/ (occurs when the voltage effect on the collecting end of the transmission line is higher than the transmitting end).

[47] *Id.*

[48] ERCOT Second Report in 47199 at 5.

[49] PJM Interconnection, Virtual Transactions in the PJM Energy Markets at 5 (Oct. 12, 2015), https://www.pjm.com/-/media/committees-groups/committees/mc/20151019-webinar/20151019-item-02-virtual-transactions-in-the-pjm-energy-markets-whitepaper.ashx ("[t]he UTC bid consists of a specified source and sink location and a 'bid spread' that identifies how much the market participant is willing to pay for a congestion and loss position between the source and the sink").

market through existing retail contracts. The Commission should therefore direct ERCOT to provide for implementation by 01/01/2022.

20. Does your assessment of the incorporation of marginal transmission losses change based on the timeline of implementation?

No. The benefits of marginal losses will accrue meaningfully over the long-term. While there will be immediate cost savings from more efficient dispatch of existing resources, the benefits of more efficient siting decisions will develop over time.

21. What are the effects of implementing both Real Time Co-optimization (RTC) and marginal transmission losses on reliability and price formation?

RTC and marginal losses both provide improvements in the efficiency of utilization of existing resources through more accurate price formation. It is unlikely that RTC will provide improved siting decisions like marginal losses without the inclusion of a locational reserve component. However, both marginal losses and RTC are expected to improve reliability and reduce production costs over the long-term. It is not clear that implementing both RTC and marginal losses together would yield additional benefits in reliability or price formation than if implemented individually but both will improve price formation and the efficiency of the ERCOT energy-only market.

22. Are there any synergies that may result from contemporaneous adoption of both RTC and marginal transmission losses?

Yes. Given that ERCOT would likely utilize shared IT resources and testing efforts for a contemporaneous implementation of both RTC and marginal losses, it is expected that implementation synergies would result and lower the cost relative to implementing both individually. However, ERCOT is best suited to estimate any cost and time reduction of a joint implementation.

Since the implementation of marginal losses is expected to have a minimal impact on market participant systems, there is not likely to be much synergy from a joint implementation from a market participant cost perspective.

23. What are the effects on retail customers and the retail market from the implementation of both RTC and marginal transmission losses?

Any reduction in the implementation cost for ERCOT would also reduce the costs for consumers that are likely to fund the projects. A combined implementation would introduce the changes together, which may be preferred compared to implementing them separately at different times due to the extent of the combined changes. A future implementation date of at least three years is recommended for both RTC and marginal losses to prevent any impact to existing retail contracts, CRRs, and forward ancillary service purchases.

III. Conclusion

NRG and Calpine appreciate the opportunity the Commission has provided to respond to Commission Staff's request for comments. It is important that the Commission direct ERCOT to implement marginal losses into ERCOT electricity prices, and to collaborate with stakeholders to address the necessary implementation details through a Nodal Protocol Revision Request (NPRR) and any other appropriate standards and procedures changes. NRG and Calpine recommend the Commission set a goal to have marginal losses implemented before 1/1/2022 to provide certainty to market participants. The Commission's leadership and clear direction is needed on this issue to set forth a path forward for market design enhancements and to strengthen the performance of the ERCOT market through improved price formation – the foundation of the ERCOT energy-only market design. If left unaddressed, market inefficiencies will compound and result in uneconomic decisions that ultimately prove costly for consumers, such as increased cost of transmission losses and excessive transmission infrastructure costs.

Respectfully submitted,

By: Bill Barnes w/permission M. Jacoroti

Bill Barnes
Senior Director, Regulatory Affairs
NRG Energy, Inc.
1005 Congress Avenue, Suite 950
Austin, Texas 78701
Telephone: (512) 691-6137
Facsimile: (512) 691-6353
Email: bill.barnes@nrg.com

By: Diana Woodman Hammett w/permission M. Jacoroti

Diana Woodman Hammett
Calpine Corporation
717 Texas Avenue, Suite 1000
Houston, Texas 77002
Email: diana.woodmanhammett@calpine.com