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Memorandum

TO: Chairman Thomas J. Gleeson
Commissioner Lori Cobos
Commissioner Jimmy Glotfelty
Commissioner Kathleen Jackson
Commissioner Courtney K. Hjaltman

FROM: Werner Roth, Market Analysis
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DATE: December 13, 2024

RE: December 19, 2024 Open Meeting – Item No. 17

Project No. 55000 – Performance Credit Mechanism (PCM)
Staff's Review of the ERCOT and E3 PCM Assessments and Staff's Final Recommendation on the PCM

On February 29, 2024, ERCOT and its consultant, Energy and Environmental Economics, Inc. (E3), filed a draft strawman design with the Commission that identified 37 Performance Credit Mechanism (PCM) design parameter decisions that the Commission would need to make before the PCM design could be finalized.[1] After several months of discussion and engagement, including multiple rounds of public comment and workshops, the Commission selected the final PCM design parameters at its August 29, 2024 open meeting. These aligned with the Staff recommendations described in an August 22, 2024 memo,[2] with Staff capturing Commission decisions on the final PCM design parameters and on other relevant policy parameters, including the Value of Lost Load (VOLL), the Cost of New Entry (CONE), and the reliability standard, in an August 30, 2024 memo.[3]

For the next step in the process to evaluate the PCM, the PUCT required ERCOT and the IMM to "complete an updated assessment on the cost to and effects on the ERCOT market of the proposed reliability program and submit to the commission and the legislature a report on the costs and benefits of continuing the program."[4] The PUCT received the updated assessments from both ERCOT[5] and the IMM[6] on December 6, 2024. The IMM subsequently filed a revised version of its assessment to reflect the updated CONE value on December 10, 2024.[7]

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[1] Project No. 55000, Item 4, PCM Draft Design Parameters Options Memorandum.

[2] Project No. 55000, Item 42, Staff PCM Design Recommendations.

[3] Project No. 55000, Item 43, Staff Memo to IMM and EROCT for PCM Cost/Benefit Analysis Policy Parameters.

[4] *See* PURA § 39.1594(d).

[5] Project No. 55000, Item 45, ERCOT and E3 PCM Cost-Benefit Assessment (ERCOT/E3 Assessment).

[6] Project No. 55000, Item 44, IMM Evaluation of the PCM.

[7] Project No. 55000, Item 46, Revised IMM Evaluation of PCM (IMM Assessment).

Staff's Final Recommendation

Staff appreciates the work of ERCOT, E3, the IMM, and the entire stakeholder community for their work on the PCM over the past couple of years. After reviewing the ERCOT/E3 and IMM assessments, Staff recommends not moving forward with the PCM as currently designed.

Using the chosen design parameters, the PCM results in minimal additional resource adequacy value.

The ERCOT/E3 assessment showed that, while the PCM would improve the resource adequacy picture in ERCOT, the additional capacity that would be incentivized is minimal.

- The PCM, as designed, is anticipated to incentivize 780 MW of additional dispatchable generation relative to the energy-only market design, which would reduce the projected long-term equilibrium Loss of Load Expectation (LOLE) from 2.67 days per year to 2.18 days per year.
    - However, an additional 10,388 MW (beyond that incentivized by the current PCM design) would be needed to meet the LOLE criteria of 0.1 days per year in the reliability standard.
- Under the "Low Cost of Retention" sensitivity, which provides more insight into the short-term equilibrium, the PCM would retain 1,340 MW of dispatchable capacity, relative to the energy-only market design. However, this would only lower the equilibrium LOLE of the system from 0.67 days per year to 0.52 days per year.
- The IMM stated that the capacity margin impact from the chosen PCM market design would be less than three percent over the long-term.

Alternative design choices would result in the PCM not complying with statute.

In its cover memo, ERCOT recommended that the Commission consider additional refinements to the PCM's design that could allow it to have a more substantive impact on reliability before eliminating the PCM as a potential option. Throughout the ERCOT/E3 assessment, the specific design parameter that most significantly limits the effectiveness of the PCM is the $1 billion gross cost cap. The decision to use a gross cap, as opposed to a more flexible net cost cap calculation, was thoroughly debated and discussed before the final design parameters were decided. Comparing the ERCOT/E3 and IMM assessments makes it clear why using a gross cap was the only viable path forward to ensure compliance with statute.

The ERCOT/E3 analysis found that the $1 billion of PCM costs would almost be offset by a reduction in energy and ancillary service costs, resulting in the net cost of the PCM coming out to approximately $12 million. This is well below the $1 billion net cost cap imposed by statute. However, the IMM stated that the reduction in energy and ancillary service costs are unlikely to offset the PCM costs to the degree that ERCOT/E3 indicated. In its assessment, the IMM stated that, while higher capacity margins induced by the PCM will reduce the frequency of shortage pricing, the long-term net costs of PCM with the gross cap in place may be in the range of $350 million to $725 million.

This discrepancy demonstrates the difficulty in crafting a net cost cap: the calculation of net cost is extremely dependent upon the assumptions used to create the base case. We only have two assessments of the PCM with the gross cost cap in place, yet their estimates on the net cost implications of PCM differ by an order of magnitude. Other parties, conducting their own independent assessment, would likely come to different conclusions about the net cost impacts. Thus, any proceeding to determine if a PCM utilizing a net cost cap is compliant with statute would likely be contentious. As Staff has previously stated, the only way to ensure compliance with the statute's language around a net cost cap is to utilize a gross cost cap on the PCM.

Current analyses indicate that market modifications will likely be needed to achieve the Commission's chosen reliability standard long-term.

As Staff has previously noted[8] (and E3 mentioned several times throughout its assessment), the chosen PCM design parameters would limit its ability to achieve the reliability standard on its own. Whether the Commission moves forward with the PCM or not, additional analysis will be required to determine how much additional generation capacity is needed to achieve the Commission's chosen reliability standard.

- The long-term equilibrium of the ERCOT market design is well below the frequency criterion of the Commission's reliability standard (LOLE of 2.67 days per year in the energy-only construct, 2.18 days per year with the addition of the PCM)
- Using the "Low Cost of Retention" sensitivity, the short-term equilibrium also falls below the reliability standard (LOLE of 0.67 days per year in the energy-only construct, 0.52 days per year with the addition of the PCM)
- ERCOT indicated that its Long-Term Reliability Assessment shows a forecasted 2026 ERCOT system having an LOLE of 0.51 days per year.

ERCOT and the stakeholder community will need to continue discussions around different ways to address the resource adequacy of the system. Furthermore, the Commission may want a slate of options from which it can choose to achieve its resource adequacy target after the first resource adequacy assessment is conducted in 2026, should the analysis still show that the system is deficient.

Review of ERCOT Assessment

In its cover memo, ERCOT described the work conducted by ERCOT staff and E3. ERCOT justified the rationale to use a study system at market equilibrium rather than a forecasted year due to the fact that the analysis was conducted to evaluate the PCM as a long-term market product contributing to the overall ERCOT market design.[9] The memo also emphasized that the E3 analysis does not forecast the anticipated state of the market in 2026 or the expected reliability outcomes in that year. E3 determined that a long-term equilibrium outcome with the current energy-only market design reaches an LOLE of 2.67 days per year. ERCOT included results from its Long-Term Reliability Assessment probabilistic modeling of a forecasted 2026 ERCOT system that showed an LOLE of 0.51 days per year, which is a more likely outcome for 2026 as it is based on an evaluation of the anticipated resource portfolio and load forecast

[8] Project No. 55000, Item 42, Staff PCM Design Recommendations.
[9] ERCOT/E3 Assessment at 3.

for that year.[10] In this cover memo, ERCOT also recommended that additional refinements to the PCM's design be considered to allow for the PCM to have a more substantive impact on reliability before eliminating the PCM as a potential option.[11]

The ERCOT filing comprises two assessments:

- ERCOT's own assessment, which provides an evaluation of CONE and the planned timeline for the implementation of the Real-Time Co-optimization plus Batteries (RTC+B) initiative.
- An accompanying assessment by E3 that addresses the PCM's cost to and effects on the ERCOT market as well as the following evaluations:
    - the PCM's effects on consumer costs and the competitive retail market;
    - detailed information regarding cost offsets realized through a reduction in costs in the energy and ancillary services markets and use of Reliability Unit Commitment (RUC);
    - a set of metrics to measure the effects of the PCM on system reliability;
    - evaluation of the cost to retain existing dispatchable resources in the ERCOT Region; and
    - the anticipated market and reliability effects of new and updated ancillary service products.

ERCOT Assessment

PURA requires that this assessment include an evaluation of CONE.[12] In its assessment, ERCOT summarized the work that went into the Commission's review of CONE. Ultimately, the Commission selected a CONE of $140 per kW-year based on ERCOT's update to Brattle's sensitivity in the CONE study for a Frame CT reference technology with a 20-year economic lifetime assumption levelized in real dollars.[13] This is the value that E3 used to perform its assessment.

PURA requires that this assessment also include an evaluation of the planned timeline for implementation of real-time co-optimization of energy and ancillary services in the ERCOT region.[14] ERCOT noted that the current timeline to complete a full, simultaneous implementation of RTC+B targets a launch date of December 5, 2025. ERCOT also noted that, consistent with PURA, PCM would not be implemented until after the implementation of RTC+B.[15]

E3 Assessment

E3 continued to coordinate with Astrapé Consulting on the PCM evaluation to use Astrapé's Strategic Energy & Risk Valuation Model (SERVM) to perform the modeling for this

[10] ERCOT/E3 Assessment at 5.
[11] ERCOT/E3 Assessment at 5-6.
[12] *See* PURA § 39.1594(d)(1).
[13] ERCOT/E3 Assessment at 12.
[14] *See* PURA § 39.1594(d)(5).
[15] *See* PURA § 39.1594(a)(10).

assessment. In order to assess the impact that the PCM would have on the ERCOT market, E3 developed a theoretical study system in which the ERCOT market is in a state of equilibrium.

E3 noted several differences between this analysis and the one used in its PCM Design White Paper. The updated analysis uses:

- the Commission approved PCM design parameters;
- the multi-criteria reliability standard (frequency, duration, magnitude);
- a CONE value of $140/kW-year;
- the framework for the Dispatchable Reliability Reserve Service (DRRS) included in NPRR1235; and
- the latest SERVM model and market inputs, including updates to ERCOT forecasts for load growth, resource additions, and fuel prices.

E3 provided the following key quantitative results:

- The chosen PCM design would improve system reliability relative to the existing energy-only market design framework, decreasing the LOLE of the study system at market equilibrium from 2.67 days per year to 2.18 days per year.
- The chosen PCM design does not provide sufficient price signals for the study system to achieve the reliability standard that the PUCT adopted in 16 TAC § 25.508.
    - The PCM would incentivize an additional 780 MW of additional natural gas CT generation capacity relative to the energy-only market.
    - An additional 10,388 MW of natural gas CT capacity (beyond that incentivized by the chosen PCM design) would be needed to meet the 0.1 LOLE criteria in the reliability standard.
- The final cost impact of PCM with a $1 billion per year gross cost cap is significantly lower than the $1 billion legislative guardrail.
    - E3's analysis shows a $12 million per year increase in total net cost from PCM, as the $1 billion of PCM costs is almost entirely offset by a decrease in energy and ancillary service costs.
- PCM reduces annual total system cost variability.
    - The primary determinant of high-cost versus low-cost years is scarcity pricing.
    - The additional natural gas CT capacity that is supported with the addition of the PCM reduces energy and ancillary service market costs during the tightest years.
    - The reduction in variability is limited by the $1 billion gross cost cap.[16]
- Resource margins for various resource classes are generally similar between the energy-only and PCM market designs.
    - For dispatchable resources, the PCM revenues are largely offset by decreases in energy and ancillary service revenues.
    - The only resource classes that see a change of greater than one percent of expected revenues are battery storage and wind. Battery storage sees a 29% increase in margins under PCM while wind resources see a 1.2% reduction in margins.

[16] ERCOT/E3 Assessment at 42.

  - The selected PCM decreases the volatility of natural gas CT margins slightly relative to the energy-only equilibrium case, but this decrease is limited due to the cost limitations of the PCM design.
- The seasonal risk occurs most frequently in the winter season.
  - 90.2% of the loss of load hours occur in the winter, 8.4% in the summer, 1.4% in the fall, and zero percent in the spring.[17]
  - This impacts the PC demand curves in each of the seasons and shows how the $1 billion cost cap would be distributed across the seasons.
- E3 compared the collateral requirements under the energy-only equilibrium to the PCM equilibrium.
  - E3 determined that the collateral requirements under the energy-only and PCM system are nearly equal ($61 million vs $59 million). This is because the new collateral requirement for PCs is offset by a reduction in the collateral requirement for energy and ancillary services.[18]
- E3 also tested the system under out-of-equilibrium conditions:
  - As expected, when the system is less reliable than the equilibrium system, the expected margins increase above CONE to incent new entry, and when the system is more reliable than the equilibrium system, the margins decrease below CONE to reduce new entry and potentially induce retirements.[19]

Next, E3 provided a summary of the qualitative evaluation of the PCM:

- Market Efficiency – E3 stated that the chosen PCM design is moderately efficient. The hours of high net load do not directly reflect the hours of highest reliability risk, and this leads to increased long-term costs relative to a more efficient design. Additionally, duration-limited resources, such as batteries, have an incentive under the chosen PCM design to economically withhold discharge during PC Hours by bidding above the market clearing price to be able to retain charge and be "available" across all PC Hours, increasing costs without improving reliability.[20]
- Market Competition – E3 stated that the chosen PCM design is moderately competitive. Non-dispatchable resources can contribute to system reliability, but by excluding them from the PCM market for a value they provide to the grid, it inhibits competition and increases system costs in the long-term.
- Administrative Complexity – E3 stated that the chosen PCM design would not be complex to implement and is less complex than many other potential reliability products. The gross cost cap reduces complexity by not requiring a counterfactual scenario of the system without PCM. Additionally, the PCM does not require any forward-looking individual resource accreditation, which is a component of all other U.S. capacity markets or resource adequacy market constructs.[21]

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[17] *Id.* at 34.
[18] *Id.* at 47.
[19] *Id.* at 48.
[20] *Id.* at 51.
[21] *Id.* at 52.

- Performance Incentives and Penalties – E3 stated that the chosen PCM design has strong Performance Incentives. By definition, PCM is performance-based and does not compensate generators if they are not available during reliability hours. Loads also have strong financial incentives to shift usage outside of high net load hours. A generator that clears in the forward PCM market and then is not available in the PCM market is penalized at two percent of the forward market price, in addition to the requirement to buy back the full quantity at the actual PCM market price.
- Market Power Risk – E3 found a low level of market power risk with the chosen PCM design. PCM has low risk of supply withholding in the PCM market because PC supply is based on actual availability rather than "offers". The sloped demand curve in the PCM market also mitigates the ability of market participants to exert market power. However, E3 recommended that additional market power mitigation measures or enforcement mechanisms should be developed by ERCOT and the IMM, as the novelty of PCM might create a short-term market adjustment period during implementation.
- Effect on Competitive Retail Market – E3 found minimal impact on competition in the retail market with the chosen PCM design. PCM was intentionally designed to replicate desirable attributes of the energy market, and therefore, the impact of PCM on ERCOT's existing competitive retail market is expected to be minimal. The final PCM design applies non-performance penalties at the plant-level (PCM Design Parameter #27), which ensures that larger generators or "gentailers" do not hold an unfair advantage over smaller players due to generation portfolio effects.
- Effect on RUC – E3 stated that the chosen PCM design would have a minimal impact on RUC. PCM is designed to award PCs based on available capacity, so when deciding whether to self-commit, generators will face the same incentives they do in the current market design. Additionally, PCM will impact generator behavior during the highest net load hours of each season when many generators are already incentivized to be online due to high energy prices.

Lastly, E3 provided two additional assessments:

- It reviewed a system where resources only need to recover their going-forward cost of operation, also referred to as the cost of retention.
    - Under this alternative, the cost of retention was $75/kW-year instead of the $140/kW-year value used for CONE.[22]
    - Under the energy-only framework, the equilibrium using the cost of retention results in an additional 3.5 GW of natural gas CT capacity remaining on the system, decreasing the LOLE from 2.67 days per year to 0.67 days per year.[23]
    - Using the cost of retention results in the PCM equilibrium LOLE decreasing from 0.67 days per year to 0.52 days per year, as the PCM results in an additional 1.3 GW of natural gas CT capacity being retained.

[22] *Id.* at 55.
[23] *Id.* at 56.

  - Because of the high levels of load growth that are forecasted for the ERCOT system, E3 noted that this sensitivity may only provide insight into outcomes in the very short term.[24]
- As directed by ERCOT, E3 also reviewed the impacts of DRRS absent the PCM, as this new ancillary service would provide an additional revenue stream for ERCOT resources, which could incentivize new capacity into the market. E3 stated that, if DRRS is crafted as currently defined in NPRR1235, it would have negligible impacts on the total system capacity. Its analysis shows that DRRS would incent less than 100 MW of additional natural gas CT capacity into the market.[25]

Review of IMM Assessment

In its memo, the IMM stated that the PCM is a novel form of a capacity market because it is settled ex-post based on after-the-fact availability rather than ex-ante based on expected availability. The IMM also concluded that the PCM would provide a new source of revenue for generators that would increase ERCOT's capacity margin, increase the costs to ERCOT's customers, but reduce shortage revenues.[26] After its review and analysis of the PCM with the Commission's chosen design parameters, the IMM offered the following conclusions[27] as part of its assessment:

1. The net costs of PCM in the short term are likely to be $1 billion per year because the IMM suggested the cost cap provision is likely to bind.
   - Markets are rarely at long-run equilibrium, so it is important to understand what the expected cost of PCM implementation would be during the first few years.
   - The IMM did not find that PCM payment costs will be offset in the near-term by reductions in shortage pricing.[28]
2. Over the longer term as higher capacity margins reduce the frequency of shortage pricing, the IMM suggested that the net costs would fall in a range of $350 million to $725 million per year.
   - This amount differs significantly from the long-term net cost impact calculated by ERCOT and E3, which found the net costs of the equilibrium system to be approximately $12 million per year.[29]
   - With the gross PCM cost cap, the expected increase to ERCOT's capacity margin would be less than three percent over the long term.[30]
3. Long-term net costs would be higher if the $1 billion annual PCM cost cap were removed. The IMM estimated that these costs would range from $930 million to $2 billion per year.

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[24] *Id.* at 55.
[25] *Id.* at 57.
[26] IMM Assessment at 9.
[27] *Id.* at 1.
[28] *Id.* at 8.
[29] ERCOT/E3 Assessment at 4.
[30] IMM Assessment at 7.

- This range of net costs are associated with gross PCM payments ranging from $6 to $7 billion per year.[31]
- Without the gross PCM cost cap, the IMM stated that the increase to ERCOT's capacity margin would be six to ten percent.[32]
  - This is based on comparing markets with and without capacity markets.
  - The IMM noted that this is less than the 10 GW forecasted by ERCOT and E3.[33]

4. The trailing one-year net energy and ancillary service revenue rule for determining the PCM demand curve would likely introduce substantial year-to-year volatility in costs absent the cap.
   - The trailing 12-month energy and ancillary service offset can cause PCM settlements over time to be overstated because shortage revenues tend to occur unevenly on an annual basis—they may be low for several years and then very high in one year.
   - Low energy and ancillary service revenues cause higher PCM settlements in a number of years that are not completely offset in the smaller number of years when shortages are frequent and energy and ancillary service revenues exceed gross CONE. [34]
5. Because PCM settlements would not be as accurately focused on resources utilized during shortages to minimize the risk or magnitude of load shedding, PCM revenues will not likely be as efficient as shortage pricing in motivating investment in resources that provide the highest reliability value.
   - An advantage of the energy-only market is that the shortage revenue it provides to resources is accurately focused on resources that reduce the risk of or actual loss of load.[35]
   - While PCM provides similar incentives, it deviates in two notable ways, which could affect how effectively PCM would contribute to reliability:
     - The PC hours are a broader array of hours that exhibit high net load, which may not align with the hours that were most vital to maintain reliability.
     - PCM payments will go to resources that are deemed to be available during PC hours, which may not align with resources actually utilized to provide energy or operating reserves during shortages.[36]

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[31] *Id.* at 7.
[32] *Id.* at 7.
[33] *Id.* at 6.
[34] *Id.* at 7.
[35] *Id.* at 8.
[36] *Id.* at 9.