



# **STUDY OF UNDULY LOW OFFERS**

HITT M3

By Southwest Power Pool Market Monitoring Unit

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# EXECUTIVE SUMMARY

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Based on concerns about some extremely low energy offers setting locational prices, the Holistic Integrated Tariff Team (HITT) recommended that SPP “evaluate whether generation offer requirements, including those for renewable resources, provide adequate safeguards against uneconomic production.”<sup>1</sup> The MMU determined that the reasons for such low offers were (1) power purchase agreements (PPAs) contract limitations and (2) avoiding real-time buy back by following the day-ahead position. The purpose of these offers is to avoid being dispatched down. These unduly low offers are problematic because they do not represent any specific costs and therefore do not properly inform the market. To inform the market properly, prices should be based on actual costs.

These extremely low offers affect both the market participants who submit them and other nearby resources. Market participants submit extremely low offers so that their resources can be at the bottom of the supply stack. This makes their resources much less likely to be dispatched down but causes them to lose significant revenue when setting price. These low prices also affect other nearby resources that are undispachable because they are running at their minimums or are starting up or shutting down.

The MMU observed effects of this behavior on the market by re-solving market cases with a raised offer and comparing the results to a base case. As with any market change, there were mixed effects across the market. Most generation and load assets did not see a significant change. The analysis showed that production cost was raised, as expected, because a marginal resource’s unduly low offer was raised significantly. Overall, make-whole payments were not significantly affected. Resources that were subjected to reduced revenues, arising from unduly low offers setting price, typically have long run times with other causes of make-whole payments. With mixed results, transmission constraints were violated less. Raising the offer did not change whether the unduly low offer was setting price or whether the resource was dispatched down.

While the HITT initiative focused on uneconomic production, the MMU identified that resources capable of dispatchable withdrawal may be able to bypass the economic withholding thresholds.

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<sup>1</sup> *Holistic Integrated Tariff Team Report*, page 25, published by HITT, (July 23, 2019), (<https://www.spp.org/Documents/60372/HITT%20Report%2020190730.pdf>), (“HITT Report”).

The MMU recommends that the energy offer floor be raised to  $-\$100/\text{MWh}$ . Unduly low offers rarely set price, but when they do, other assets are unnecessarily harmed. Because the problem is not pervasive, the solution of raising the offer floor is simple and cost effective. Raising the offer floor also avoids any limitation of what costs can be included in a market offer. With the raised floor, market participants can still offer such that they are the last to be dispatched while losing much less revenue when setting price. This can also reduce losses of other nearby resources that cannot be dispatched down due to a minimum or due to a start-up or shut down process. SPP's existing offer of  $-\$500/\text{MWh}$  is on the low end compared to other ISO/RTOs. The raised offer floor will not significantly affect those offering unduly low and will improve price formation.

## BACKGROUND

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### HITT INITIATIVE

The Holistic Integrated Tariff Team (HITT) recommended that SPP "evaluate whether generation offer requirements, including those for renewable resources, provide adequate safeguards against uneconomic production."<sup>2</sup> The HITT Report notes that "stakeholders have expressed concerns about negative prices in the SPP markets."<sup>3</sup> The Market Monitoring Unit has observed resources setting price at the offer floor,  $-\$500/\text{MWh}$ . This raises concern for the need to protect market participants from unduly low offers. The market currently has protection against unduly high offers in the presence of local market power, but no such protection exists from unduly low offers. The HITT recommended that the MMU "educate the MWG on this issue and recommend a solution or set of solutions to the MWG for consideration."<sup>4</sup>

### STUDY OVERVIEW

In this study, the MMU researched how resources offered energy below their mitigated offer and how these offers affected the market. The MMU identified unduly low energy offers since the beginning of the Integrated Marketplace and contacted market participants to understand reasons behind the offers. The MMU selected periods in which unduly low offers set price.<sup>5</sup> Base cases were established by re-solving the intervals and feeding forward the solution from

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<sup>2</sup> *HITT Report*, page 25.

<sup>3</sup> *Id.*

<sup>4</sup> *Id.*

<sup>5</sup> All intervals chosen were from the real-time market. The lowest price set by an offer below a mitigated offer in the day-ahead market was well within the unduly low threshold.

the previous interval with no changes. Change cases were created by raising the unduly low offers to three values representing (1) a significantly higher offer floor that is much closer to marginal production cost, (2) a typical, grossed up production tax credit for federal and state, and (3) an offer above the production tax credit but still below \$0/MWh. With these offers, the cases were re-solved, again feeding forward the solution from the previous interval. To ensure the time periods were relevant to the current market, the re-solved cases were within the last two years. The base and change cases were compared for 129 real-time intervals to determine the effects on the market. Specifically, the MMU observed changes in objective function of the clearing engine, energy cost, congestion, violations, resource revenue, load cost, marginality, dispatch, and make-whole payments.

## STUDY RESULTS

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### DEFINITION OF “UNDULY LOW”

An unduly low energy offer was defined as an offer to inject energy that was less than its mitigated offer and less than  $-\$100/\text{MWh}$ . Offering below the mitigated offer can be a legitimate market strategy that market participants implement. Therefore, the MMU wanted to allow for some offer flexibility and not to restrict offers to cost-based only.

For unduly high offers, mitigation thresholds allow for some flexibility. The local market power test provides a clear threshold when an offer to inject energy is too high. A resource with an unduly high offer can directly benefit from the high offer. However, an injecting resource's extremely low offer is not directly beneficial but is a cost to that resource. The resultant extremely low price is also imposed on nearby injecting resources. The market clears extremely low offers because it is minimizing production cost. For economic withholding, local market power clearly identifies when unduly high offers harm other assets. However, uneconomic production does not have as clear a line where market intervention is needed to prevent unduly low offers from harming other assets.

No positive offers were considered “unduly low.” Of energy offers below the mitigated offer since the beginning of the Integrated Marketplace, about 98% of positive offers were within  $\$10/\text{MWh}$  of the mitigated offer. In contrast, only 53% of negative offers were within  $\$10/\text{MWh}$  of the mitigated offer. To represent 98% of the negative offers, the difference in the submitted and mitigated offer must be as low as  $-\$100/\text{MWh}$ .

Offers below -\$100/MWh gravitate to the offer floor. As shown in Figure 1, effectively no dispatchable real-time offers since go-live have been submitted between -\$100/MWh and -\$500/MWh.<sup>6</sup>

**Figure 1: Negative market energy offers for dispatchable resources since go-live**

<b>Offer Range</b>	-500 \$/MWh	-499 to -401 \$/MWh	-400 to -301 \$/MWh	-300 to -201 \$/MWh	-200 to -101 \$/MWh	-100 to -1 \$/MWh
<b>Hourly Offers</b>	~2%	0.02%				~98%

Market offers at -\$100/MWh or above seem to cover market participants’ specific costs. Only two dispatchable resources have ever been offered between the offer floor and -\$100/MWh. One such offer was submitted for two days at the beginning of the market, and the other was submitted for one month in 2016. Excluding these two occurrences, both resources have been offered well above -\$100/MWh. The available offer range between the offer floor and -\$100/MWh does not seem to be useful to market participants.

To define a threshold of “unduly low,” the MMU chose a value that was far less than marginal production cost while allowing flexibility. The MMU determined the lowest cost-based offer that is supported by Appendix G of the Protocols. The MMU chose a threshold that was more than double this lowest offer. For this analysis, offers that were less than the mitigated offer and less than -\$100/MWh were considered unduly low.

## REASONS FOR UNDULY LOW OFFERS

The MMU consulted with market participants who have offered unduly low to understand the reasons behind such offers. For dispatchable resources, there were two reasons given: (1) power purchase agreement (PPA) and (2) following day-ahead position.

### POWER PURCHASE AGREEMENTS

Some PPA contracts do not allow for the resource’s output to be curtailed for economic reasons. To avoid economic curtailment, some market participants offer very low or at the energy offer

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<sup>6</sup> Non-dispatchable variable energy resources were excluded from these statistics because their offer does not affect dispatch or price.

floor, -\$500/MWh. Consequently, when these resources are marginal, price is set at or near -\$500/MWh, causing the market participant to pay \$500/MWh to produce energy. For market participants with this type of PPA, setting price at -\$500/MWh causes the losses to add up quickly. These losses can be stark.

Unduly low offers setting price can also affect other resources around congestion. Due to extreme negative prices, resources stuck at their minimums can also pay even more to produce when prices are unnecessarily low. Long lead time resources occasionally have to start during these low-priced intervals, causing them to take losses that may overcome any profit gained during the commitment period. Alternatively, in some cases, resources relieving the congestion are paid more due to these unduly low offers. Regardless of whether an individual asset is winning or losing in this case, these price signals are not meaningful because they are not based on any identifiable cost.

For PPAs without an economic curtailment penalty, this low offer does not represent production cost or any cost, variable or fixed. It represents an avoidance of breach of contract. Market prices should represent cost in some form in order to inform the market. For instance, if a low energy price represents an extremely low fuel cost, such as negative gas price, then it informs the market about the price to produce the energy. Likewise, when fuel availability risk is included in an offer, it represents a cost within and pertinent to the market. However, PPAs barring economic curtailment are outside the market and even explicitly exclude the market. Because avoiding breaking a contract does not represent any particular cost, it should not inform the market via price.

Some PPAs may be written with a specified financial penalty for economic curtailment. However, it is not reasonable to expect the market to be designed around out-of-market contracts. As noted above, some nearby resources are financially harmed when these unduly low offers set price, though they are not a party to the contract. As shown in Figure 1 above, offers below -\$100/MWh have historically been at -\$500/MWh. If these penalties are in excess of \$500/MWh, then the offer floor is merely a proxy and does not represent a specific amount. Market prices should reflect meaningful costs. Below -\$100/MWh, energy offers do not seem to represent PPAs with penalties.

Because these offers do not represent a specific cost, another offer may accomplish the same goal without costing these resources as much when they set price. If resources offer at the offer floor in order to represent these types of contracts, then a higher offer floor would accomplish the same goal while still allowing the restriction to be represented in an offer and greatly reducing its effect on price for nearby resources.

## FOLLOWING DAY-AHEAD POSITION

Some resources with day-ahead positions offer unduly low in real-time to avoid buy-back.<sup>7</sup> Some resources, such as variable energy resources, are uniquely incentivized in terms of real-time buy-back. Resources participate in the day-ahead market to hedge against less predictable real-time prices. For resources with positive fuel costs, an unhedged, low real-time price can be a major concern. However, for resources with negative offers, low unhedged real-time prices are far less threatening. Real-time prices would have to be very low before they harm resources with negative offers. Furthermore, because of incentives like production tax credits, offers tend to cluster, decreasing the likelihood that prices will be far below these resources' offer. While low unhedged real-time prices cause variable energy resources to earn less revenue, these resources are much more resilient to low prices than resources with positive fuel costs.

Variable energy resources are also at an increased risk of buying back at a higher price than day-ahead. Resources that produce less in real-time than in day-ahead, buy back the difference at real-time prices. This is a disincentive to over-hedge. For resources with a less certain fuel source, the buy-back is often caused by the lack of fuel in real time. For instance, when the wind does not show up in real time as was expected in day-ahead, it may cause shortage prices. This means that the wind resources must buy back at high shortage prices. Overproducing in real time can reduce profits but not as sharply as buying back at shortage prices, so the danger of overproducing is less threatening. Because of this lopsided incentive, underproducing in real time is far more damaging than overproducing. Fuel risk causes some resources to have unique incentives in real time which can cause them to offer as low as the offer floor.

Given the ability to profit with low offers most of the time and the strong incentive to avoid buy back, some variable energy resources offer much further below their cost-based offer than their counterparts, even as low as -\$500/MWh. However, similar to the PPA scenario, these extremely low offers do not represent any specific cost. As with the PPAs, these offers need only to be lower than other offers to accomplish the goal and do not need to be at or near -\$500/MWh. A much higher offer can achieve the same result.

## MARKET ANALYSIS

### CURRENT MARKET

The MMU analyzed real-time market cases in which an unduly low energy offer was setting price for multiple intervals. These unduly low offers were replaced with an offer that was far below

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<sup>7</sup> When a resource produces more energy in the day-ahead market than it cleared in the real time market, it must buy back the difference at real-time prices. See Protocols section 4.5.9.1.

the mitigated offer while remaining the lowest offer, representing a higher offer floor. Higher offers were analyzed, but the effects had much less impact compared to the raised offer floor. The results discussed here are based on the raised offer floor.

All cases analyzed were real-time cases. In the day-ahead market, prices are very rarely set by unduly low offers. The lowest day-ahead price ever set by an offer below the mitigated offer was -\$62/MWh while in real-time it was -\$500/MWh. Because the day-ahead market has not been affected by unduly low offers to the same degree, all cases reviewed were in real time.

### *PRODUCTION COST*

One result of raising the offer floor is a higher production cost. The purpose of the market clearing engine is to minimize production cost while attempting to respect parameters. It is not surprising that when a marginal resource's offer was raised, the total energy cost, and therefore the total production cost, increased. The raised offer floor increased production cost by roughly \$1,200 in each scenario. This was equivalent to around 5 percent in most cases. In cases in which the percent was higher, the production cost was smaller in magnitude.

While cost minimization is the core objective in market clearing, higher clearing prices are not inherently bad. Accurate production costs are the cornerstone of efficient spot markets. In the base case, the total energy cost was negative for all intervals. With the raised offer floor, in all intervals, the total energy cost was still negative. Even after adding no-load costs and operating reserve costs to energy costs, the total cost for all intervals was negative. While keeping the production cost low is the goal of market clearing, it is essential that the costs represented be actual costs, even if that means higher costs.

### *MAKE-WHOLE PAYMENTS*

Make-whole payments were not significantly affected by the raised offer floor. The median revenue change per resource for the entire re-solved period was about \$3. The total change in make-whole payments for all scenarios averaged -0.16% of the total make-whole payment for the day. While this is a reduction, it is statistically insignificant.

Generally, make-whole payments are caused by prices that are too low for resources to recover their costs. It seems logical that increased production cost would reduce make-whole payments. However, during the periods in which prices were set by unduly low offers, many of the resources that received make-whole payments were not running. These periods are often in early hours when few resources are online. Resources with long run times that are often running during these hours are not affected significantly because this is a small fraction of their total commitment period. In some cases, because of congestion, a resource's revenue may have been decreased, thus increasing the make-whole payment. In these cases, the original make-

whole payment was not caused by the unduly low offer so was therefore not improved by the change in prices. In any case, there were small decreases and increases in make-whole payments, but overall, the change was negligible.

### *VIOLATION COST*

With mixed results, violation costs were reduced overall by raising the offer floor. Violations were almost exclusively transmission constraint violation relaxation limits (VRLs). For all scenarios re-solved, raising the offer floor lowered the VRL block in 32 instances but increased the VRL block in only 4 instances. When a transmission constraint is violated, the flow limitation is increased above its stated limit in steps with an increasing violation cost per VRL block.<sup>8</sup> In most intervals, the energy flow across the constraint was closer to the physical limit. In some intervals, the VRL block was reduced to zero, meaning that all limits were respected. Generally, the raised offer floor reduced violation costs and respected constraint limitations more.

### *MARGINALITY AND DISPATCH*

Though the unduly low offer was significantly raised, the raised offer still set price. Marginal resources were chosen for this analysis. Marginal resources set or directly affect price. For every interval of the base case in which an unduly low offer set price, the same resource offer set price with the raised offer floor. Raising the offer did not significantly affect whether or not the resource was dispatched down or whether or not it was marginal.

Furthermore, because the resource was marginal in the base case, it was already being dispatched down.<sup>9</sup> Significantly raising the offer floor added only one additional interval in which the resource was dispatched down. In the case of PPAs not allowing economic curtailment, since the resources are already being dispatched down in the base case, being dispatched down in the change case does not seem to worsen the contractual situation. In the case of resources avoiding expensive buy-backs, the amount the dispatch was reduced was very small, around a megawatt on average. Again, this does not seem to significantly worsen the buy-back situation, especially considering the buy-back price was reduced to one-fifth of the original buy-back price. In some cases, the raised offer floor decreased the dispatch, but it did not significantly change the contractual or financial the situation. It did, however, significantly reduce real-time losses for the resource while improving price formation.

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<sup>8</sup> VRL blocks are 101%, 102%, 103%, 104%, and greater than 104%.

<sup>9</sup> The amount a resource was dispatched down in the base case or change case was often very small as it often takes very little change to unbind the constraint or to change applicable the violation relaxation limit (VRL) block.

## *INDIVIDUAL LOCATIONAL EFFECTS*

While the MMU is concerned with the market as a whole, the MMU also observed effects to individual market participants and individual constraints. The goal of the market clearing engine is to minimize production costs, and all other outcomes are a side effect of this objective. The dispatch instructions and constraints are very important to individual market participants but do not necessarily reflect a higher quality solution.

For instance, congestion is not an indication of an improved or worsened dispatch solution. As previously stated, the objective of the market clearing engine is to minimize production cost. Congestion is caused by the market clearing engine dispatching least-cost generation while respecting transmission limits. When congestion does not allow more least-cost generation to be dispatched, more expensive generation is dispatched. This process of market clearing does not minimize congestion. Congestion indicates that the market has dispatched all the least-cost generation that transmission constraints allow.<sup>10</sup> Congestion is priced separate from marginal energy to inform the market how much congestion affects local prices. As long as there is no exercise of market power, congestion is not an indication of the quality of a dispatch solution.

With a raised offer floor, congestion patterns changed. There were nine constraints unique to the base case while only three constraints unique to the change case. Among constraints that were common to both the base case and the raised offer floor, there were 38 improved constraint states while only 10 constraint states were worse. An improved constraint state is when the flow across it goes from being over the limit to at the limit or when the flow is at the limit and drops below the limit in the change case. A constraint state is worsened when the opposite happens. Changes in congestion show that there will be differences in locational price in the market, but do not show that raising the offer would produce more or less just and reasonable patterns of congestion.

The price at resource and load settlement locations also do not indicate a higher or lower quality solution. As mentioned above, the median change in revenue for resources was about \$3 for the entire re-solved period. The 25<sup>th</sup> percentile represented about a \$10 reduction in revenue and 75<sup>th</sup> percentile represented about an \$80 increase in revenue over the re-solved period. For load settlement locations, the median change in cost was a reduction of about \$5. The 25<sup>th</sup> percentile represented about a \$70 reduction in cost and 75<sup>th</sup> percentile representing about a \$3 increase in cost over the re-solved period. On average, the changes in revenue and cost were very small.

The relatively few notable changes observed were around congestion. The direction of the change depended on whether a settlement location was on the relieving side or the loading side. The largest increase in revenue for a resource was about \$40,000, and the largest decrease

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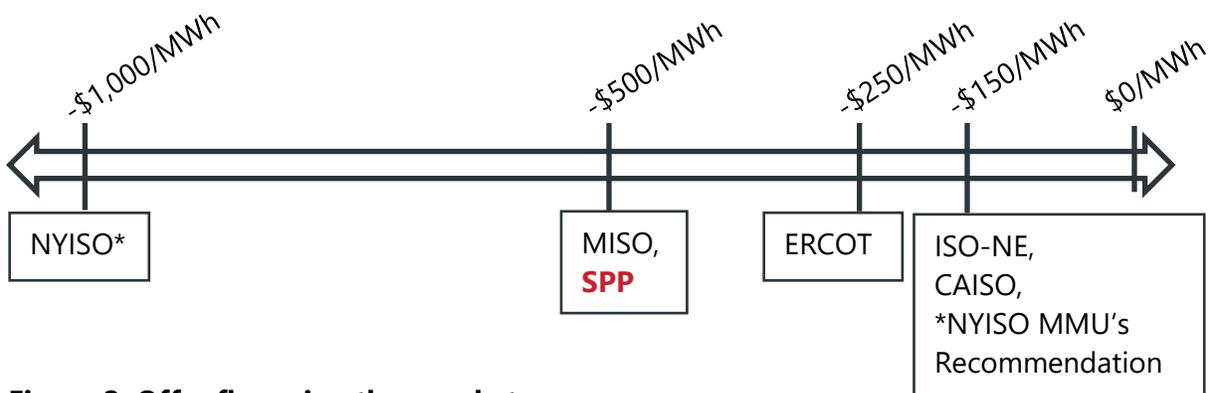
<sup>10</sup> Given no changes in topology.

in revenue was about \$4,000. The largest change in revenue was to a self-committed resource running significantly under cost. In the same interval, the resource with the unduly low offer increased its revenue about \$30,000 by raising the offer floor. The largest increase in load cost was about \$8,000 while the largest decrease in cost was about \$8,500. Regardless of whether individuals gained or lost when the offer floor was raised, an individual's change in settlement location price does not justify either changing market design or status quo.

With any market design change, there will be individual resources or loads that see benefits and detriments disproportionately. The MMU did not observe any effects at individual settlement locations that outweigh the value of meaningful price formation.

## MARKET COMPARISONS

Other ISOs/RTOs have higher offer floors. Figure 2 below compares offer floors from other ISOs/RTOs.<sup>11</sup>



**Figure 2: Offer floors in other markets**

SPP and MISO have an offer floor of  $-\$500/\text{MWh}$ . ERCOT, though it allows energy offers as high as  $\$9,000/\text{MWh}$ , does not allow offers below  $-\$250/\text{MWh}$ . ISO-NE and CAISO set their offer floors even higher at  $-\$150/\text{MWh}$ . The only offer floor below SPP's is NYISO's at  $-\$1,000/\text{MWh}$ . However, NYISO's market monitor, in its 2019 annual report, recommended that the offer floor be raised to  $-\$150/\text{MWh}$ .<sup>12</sup> If NYISO implements this recommendation, SPP and MISO will have the lowest offer floor.

<sup>11</sup> PJM has no offer floor.

<sup>12</sup> 2019 State of the Market Report for the New York ISO Markets, published by Potomac Economics, (<https://www.nyiso.com/documents/20142/2223763/NYISO-2019-SOM-Report-Full-Report-5-19-2020-final.pdf/bbe0a779-a2a8-4bf6-37bc-6a748b2d148e>), page 37.

As many decisions were being made rapidly to implement the Integrated Marketplace, SPP's current offer floor was chosen, but it appears that no analysis was performed to determine that number, and no reason was provided in FERC filings. Because the current offer floor does not seem to represent a meaningful threshold, there does not seem to be any reason to keep it unnecessarily low.

## FUTURE MARKET

The MMU analyzed "safeguards against uneconomic production" in the current market design.<sup>13</sup> The current market assumes that resources can only inject energy. However, energy storage resources (ESRs) are currently scheduled to be able to participate in the market in August 2021. ESRs have a unique ability to withdraw energy dispatchably which will affect low offers in a way that has never been possible.

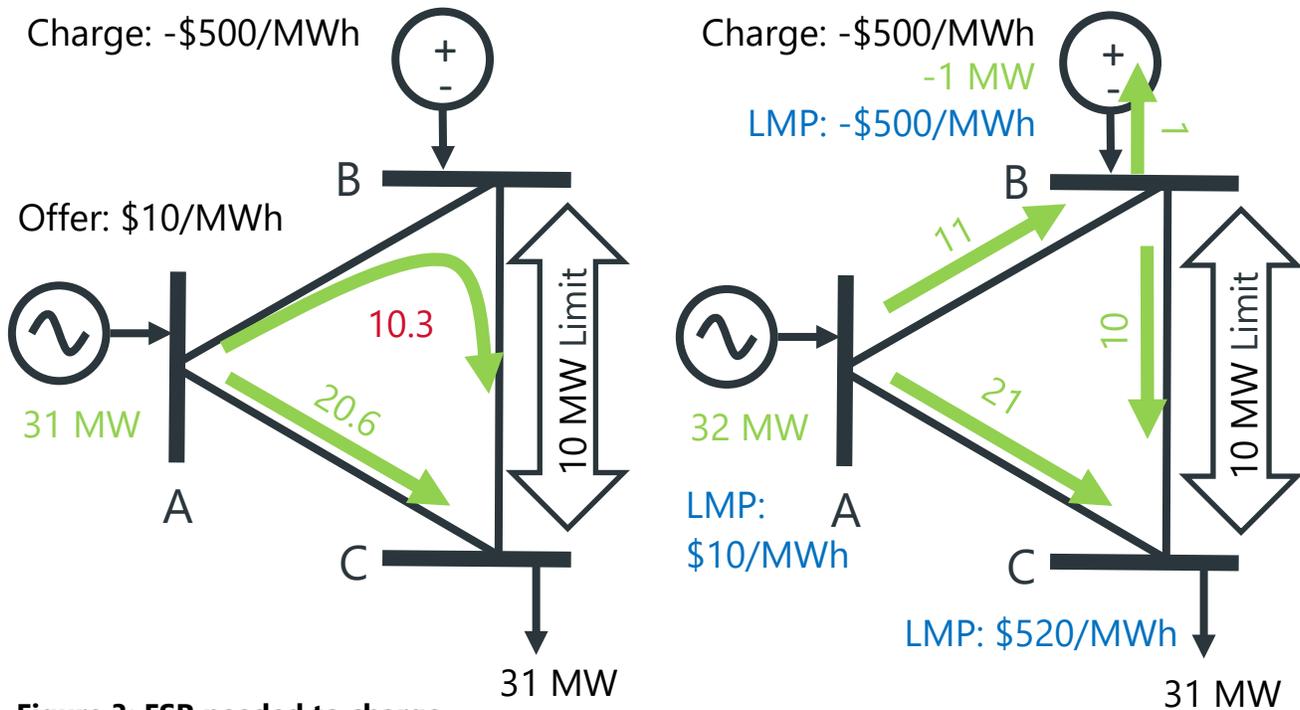
An ESR may be able to set price to charge without being identified by the current mitigation thresholds. When the ESR offers a negative price for producing a negative output, or charging, this becomes a payment to the ESR. Setting an unduly low price to charge is economic withholding of charging capability.

Consider the following three bus model, Figure 3, with an ESR at bus B.<sup>14</sup>

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<sup>13</sup> *HITT Report*, page 25, emphasis added.

<sup>14</sup> Assume equal length lines with identical impedances and no losses. This will cause 1/3 of the generation from a bus to flow on two serial lines while 2/3 flows on the other single line.



**Figure 3: ESR needed to charge**

The load is 31 MW, but there is a line limitation of 10 MW on line BC. Resource A has a positive resource-to-load distribution factor (RLDF) on this constraint, so if it produced 31 MW, it would violate the constraint, as shown on the left. The ESR at bus B is needed to charge to resolve the constraint, as shown on the right. The ESR produces -1 MW, or charges 1 MW, at a price of  $-\$500/\text{MWh}$  which results in a payment for charging.

The current mitigation thresholds will not prevent dispatchable withdrawals from exercising market power. The ESR has a positive 66 percent RLDF. However, the local market power test looks for an RLDF less than -5 percent. Because the local market power test looks for resources that can relieve congestion by injecting energy, it does not identify the ESR as having market power.

Furthermore, offers below  $\$25/\text{MWh}$  will not be mitigated, so a  $-\$500/\text{MWh}$  offer would be allowed. Again, the current thresholds are looking for resources that can relieve congestion by injecting energy.

The price impact test looks for an *increase* of  $\$25/\text{MWh}$ . In this example, the price at bus C increased beyond the threshold, but the price at bus B would not be beyond the threshold even though it results in a payment to the ESR. The current thresholds do not consider that a resource can produce negative energy, or charge. This change in direction turns what would be a credit for injecting resources into a debit for withdrawing resources.

The conduct test is also insufficient for withdrawing resources. In the same way positive offers are often above the mitigated offer, charging offers will likely be less than the mitigated offer.

Because the conduct test looks for offers *above* the mitigated offer, it will not identify an offer to withdraw that is much lower than its mitigated offer.

All of the mitigation thresholds were designed for resources that economically withhold positive megawatts, so these thresholds need to be updated to account for the new, unique capability to economically withhold negative megawatts. However, the HITT initiative was to analyze uneconomic production. SPP should give more consideration to economic withholding of charging capability.

## CONCLUSION

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Energy injection offers below  $-\$100/\text{MWh}$  do not represent a specific cost and therefore cause distorted prices. Market participants offer unduly low, as low as  $-\$500/\text{MWh}$ , the offer floor, to adhere to PPA contracts and to follow their day-ahead position. Our analysis shows that raising the offer floor to  $-\$100/\text{MWh}$  does not significantly change the outcome for market participants who offer unduly low.

Given that the current  $-\$500/\text{MWh}$  offer floor lacks analytical support, changing the limit does not seem to be problematic. Of all mitigated offers that could be supported by Appendix G, the lowest since go-live was greater than  $-\$50/\text{MWh}$ .<sup>15</sup> Because the resources offering unduly low do not have local market power, the MMU does not intend to hold them strictly to a cost-based offer. To provide ample flexibility in offer development, the MMU doubled this lowest, valid mitigated offer and rounded it to  $-\$100/\text{MWh}$ .

With this  $-\$100/\text{MWh}$  energy offer floor, market participants can still offer below other offers like they do currently. This allows market participants to include other non-short run marginal costs in their offer. All offers below the mitigated offer and below  $-\$100/\text{MWh}$  were due either to a PPA or to follow their day-ahead position. The raised offer floor will not prohibit these market participants from being the lowest on the supply curve and last to be dispatched like they are today. In fact, when a resource is setting price at the raised floor, it will lose much less revenue than it does at the current floor.

Furthermore, the market will benefit because energy prices will much more closely represent marginal production cost. These more meaningful prices will not only properly inform the market but also reduce the volatility of negative prices. Nearby resources running at their minimums during extreme negative prices will also lose less revenue during these events.

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<sup>15</sup> In other words, these offers were less negative than  $-\$50/\text{MWh}$ , or the magnitude was less than  $\$50$ .

Because the problem of unduly low offers setting price is not pervasive, the MMU's recommended solution is simple and cost effective. Prices have been set at -\$500/MWh less than one percent of all intervals since go-live. This does not mean that the distorted prices and financial harm is negligible. However, the frequency of the problem merits a simple solution that can limit the harm to the market.

More complicated solutions could be evaluated but would increase cost and complexity. For instance, low offers could be mitigated similar to the mitigation process of high offers. Alternatively, resources could be limited to offer within a certain threshold of their mitigated offer. Currently, no rules dictate what can be included in a market offer. Although the MMU unequivocally believes that large, non-specific, out-of-market costs should not be included in the market offer, the MMU does not want to create a new offer-approval process to address unduly low offers. A much simpler solution is warranted.

Raising the offer floor is a simple value change to an existing parameter. It is a simple solution that does not add new market regulations but improves price formation.

When resources capable of dispatchable withdrawal are able to participate in the market, the current thresholds will not prevent economic withholding of charging. These resources may be able to exercise market power to set price. While the HITT initiative is to evaluate "safeguards against uneconomic production," this is strongly related and should be considered.

The -\$100/MWh energy offer floor will not significantly inhibit market participants who currently offer at the offer floor but will improve price formation. The raised offer floor should reduce the unnecessary financial losses both of market participants offering unduly low and of nearby undispachable resources all while minimally affecting a resource's market offer.

## RECOMMENDATION

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The MMU recommends that SPP raise the offer floor from -\$500/MWh to -\$100/MWh for injecting resources.

Outside of this HITT initiative, the MMU recommends that SPP consider updating economic withholding rules for resources that can dispatchably withdraw. The MMU intends to provide a report on economic withholding of dispatchable withdrawal by the August 2021 MWG.