

## Response to CERC Staff Paper on Market-Based Economic Dispatch

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CERC Staff has come up with a new paper on Market Based Economic Dispatch (MBED) to help distribution companies save costs and transition to a new form of power market. For various reasons, the current market structure has not been able to ensure that the most economical set of electricity generators are dispatched first. This idea is inspired by power pool models adopted in the USA. The largest power pool in USA, Pennsylvania, New-Jersey, Maryland (PJM) has something similar to the Market Based Economic Dispatch (MBED) proposed by CERC Staff.

In the long-term vision of the paper (beyond the pilot), all the generators and discoms, who have entered/going to enter into any kind of bilateral contracts between themselves will not be settling the dispatch quantum and variable charges on a bilateral basis. The quantum and price will be decided on the basis of an Economic Dispatch solution which will run on a day ahead basis. All generators available for dispatch next day will be required to bid their variable charge on a day ahead basis and they will be dispatched as per the outcome of the Economic Dispatch algorithm. Given that most bilateral contracts are long term, with pre-specified variable charges for the duration of contracts, the staff paper mentions elaborate pricing, clearing, and settlement mechanism.

The suggested MBED mechanism is a big change in comparison to the recent order of CERC to conduct a pilot of Security Constrained Economic Dispatch (SCED) originated by POSOCO and NLDC.<sup>1</sup> Generally speaking, India's power market trajectory has followed market design principles and trajectories observed in European power markets. The MBED proposal suggests an ambitious and potentially disruptive move towards more American market design principles. As one of CERC Staff's consultants has made clear, following up on the earlier staff papers on Real-Time Markets<sup>2</sup> and Ancillary Services<sup>3</sup>, the MBED proposal is one among a series of staff papers which are likely to be issues in the near future which cover the topics of Financial Transmission Rights (FTRs), Locational Marginal Prices (LMPs) and Market Monitoring and Surveillance.<sup>4</sup>

### Power and Federalism

The proposal's long-term vision expects state discoms and generators to eventually cede many of the procurement powers they enjoy currently to a centralized market mechanism.

“The participation in the Market Based Economic Dispatch model in Day-Ahead Market (DAM) time horizon would **initially be voluntary** for the parties. **Ideally all procurement by discoms should be done through DAM.** However, the discoms may retain **some** generators on the self-schedule list and allow others, with whom they have long term PPAs to participate directly in the market (38).<sup>5</sup>” (emphasis mine)

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<sup>1</sup> <http://CERCind.gov.in/2019/orders/02-SM-2019.pdf>

<sup>2</sup> [http://www.CERCind.gov.in/2018/draft\\_reg/RTM.pdf](http://www.CERCind.gov.in/2018/draft_reg/RTM.pdf)

<sup>3</sup> [http://www.CERCind.gov.in/2018/draft\\_reg/DP.pdf](http://www.CERCind.gov.in/2018/draft_reg/DP.pdf)

<sup>4</sup> <https://www.raponline.org/blog/india-kick-starts-wholesale-market-reforms/>

<sup>5</sup> [http://www.CERCind.gov.in/2018/draft\\_reg/DP31.pdf](http://www.CERCind.gov.in/2018/draft_reg/DP31.pdf)

The ceding of certain powers by States to the Centre is a standard part of many theories of economic federalism. It is a typical compromise state's make for access to the national common market.<sup>6</sup> However usually this is the result of extended negotiations between members of the federal polity, not regulatory fiat.

In some ways, the MBED proposal is very similar to the GST mechanism implemented in India recently, where the state governments gave up their individual indirect taxation powers to pool their sovereignty to create a common market for goods and services in the country. The principal justifications for its implementation has been the efficiency gains, simplicity, and GDP growth push, not dissimilar to the MBED proposal. But GST policy implementation was the culmination of almost two decades of tax negotiations between the Centre and States. It is not clear that such a consensus has evolved for MBED, either from political authorities or from state discoms.

There are a few instructive lessons we can take from GST implementation. These are:-

- a. The GST discussions took place over two and a half decades before they reached the implementation stage.
- b. Even after these deliberations and thinking, there are still implementation challenges and teething problems
- c. After lengthy deliberations and bargaining over the structure of GST, a new decision-making authority— the GST council— was created for the implementation of this tax reform
- d. Given all the transitional pains being experienced during GST rollout, much more administrative capacity, infrastructural investment, and familiarization was required before the policy was put in place

If CERC Staff is serious about proceeding with the MBED proposal, then GST serves as an instructive example of how to reach consensus in the Indian context, but also how not to roll out a policy hastily and then suffer consequences afterwards. While CERC certainly has the responsibility of developing national power markets, it will need to take along the Forum of Regulators, State Discoms and State governments as they will be ceding control to a centralized dispatch model over the prevailing decentralized market structure.<sup>7</sup> This is a power that States have had for decades, and it is not likely something that will be ceded quickly. There will likely be a need for a GST council like body for the power sector if India does move towards a centralized dispatch model. The centralization of dispatch decisions it not solely a technocratic decision; it is also a political one which requires much broader consensus.

Embedded in the MBED proposal is a systemic critique of self-scheduling, which points out various inefficiencies in discoms' procurement practices because they do not "see" generators outside of their long-term contracts and cannot schedule them; the proposal calls it "merit order in silos." The proposal claims that this is because of lack of visibility of such generators. But there is another interpretation here, which would lead to much hairier problems; that some state discoms do not want to dispatch cheapest cost power, that they would rather dispatch in-state power and keep the money within their system than send it to out-of-state generators. This a practice which is well understood by people in the power industry. If this is the

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<sup>6</sup> See, for example

Weingast, Barry R. "The Economic Role of Political Institutions: Market-Preserving Federalism and Economic Development." *Journal of Law, Economics, & Organization*, vol. 11, no. 1, 1995, pp. 1–31. *JSTOR*, [www.jstor.org/stable/765068](http://www.jstor.org/stable/765068).

<sup>7</sup> While there is some evidence that these consultations have been happening informally over the last few years (from the earlier referenced Regulatory Assistance Project article) , this is the first time this idea has been open for any kind of public consultation.

case, even if a broader pool is created, as long as states have discretionary power of procurement, they may still choose financially inefficient but politically beneficial dispatch solutions. There needs to be much more thinking on how to address these incentives. States like Gujarat, Madhya Pradesh, West Bengal and Uttar Pradesh have definitely benefited massively from interstate power trading. But not all states have availed such opportunities, which already indicates that there is an incentive mismatch problem that needs to be addressed before universal claims of “merit orders in silos” can be made.

In fact, when power exchanges were introduced in 2008, their role was precisely to solve the “merit order in silos” problem. It is difficult to quantify how much market participants have benefited from the introduction of exchanges. But industry conversations indicate that some discoms have started optimizing their portfolios by taking into account their bilateral contracts and the forecasted prices on the power exchanges. A national merit order, like the one in the MBED proposal, will require this kind of optimizing behavior from **all** distribution companies to achieve the optimal solution and maximum cost savings. But even now we do not observe even such universal optimizing behavior on power exchanges from discoms. Then how will a spot market change behavior any differently (especially if it is voluntary)?

A central issue which emerges from the MBED proposal is the need for the discoms to optimize their electricity portfolios, by taking into account the behavior of the generators, other distribution companies, transmission constraints and prices discovered on a day ahead basis. They are often unable to do so because of their constrained capacity, lack of necessary tools (particularly software), technology availability etc. This is one reason discoms are unable to optimize their actions and engage in trading, even under the present market structure. Barring a few state discoms (mentioned earlier) who are managing their portfolios efficiently, most discoms have not made the transition to such optimizing behavior.

One of the implication of the MBED proposal is that once it is made mandatory for everyone to settle their contracts (along with safeguard mechanisms inbuilt in terms of price increases) on day ahead basis, the discom state capacity problem will go away. As long as states bid their desired quantity and price thresholds, the algorithm will determine the rest. However, discoms still have to plan for future capacity needs which requires considering the future behavior of generators, other distribution companies, transmission constraints and prices discovered on the DAM. This proposal’s principle justification comes from the observation that the discoms are not able to optimize their portfolios in the short run. What confidence do we have that the same discom with limited state capacity will be able to optimize their portfolio in the long run? Without a clear articulation of how capacity markets will work, this could simply kick the bucket down the road rather than address the fundamental, difficult issue: the ability of discoms to engage with markets in the first place.

As I discuss below, Europe, despite having larger renewable energy penetration and having political structure similar to India (federalism with limited sovereignty), has not leaned towards market designs like the one suggested in the MBED proposal. Yet, they have consistently made small incremental changes to achieve the desired efficiencies in their markets.

### International Experience

If we consider the trajectory that power markets have taken in both America and Europe, it is clear that these were gradual processes. In America, the most sophisticated bid-based power markets run by PJM started in 1997 after a series of FERC orders enabled the creation of wholesale power markets with a strong commitment to open access and competition. While PJM had been operating across states for decades, it

became the first fully-functioning Independent System Operator (ISO) in the US in 1997.<sup>8</sup> In 2002, FERC encouraged the creation of Regional Transmission Organizations (RTOs), whose responsibility extended from not only operating the transmission system, but also encouraging the development of competitive wholesale power markets by providing incentives for other utilities and transmission systems to integrate to form larger pools. Over the last twenty years, various regional utilities (American discoms) have gradually chosen to integrate with RTOs (like PJM), incentivized to do so by FERC regulations and proof of RTOs' ability to manage risks and deliver reasonable prices. As PJM's Craig Glazer puts it, **"PJM's market have developed in an evolutionary fashion, rather than 'big bang' - a deliberate risk management strategy."**<sup>9</sup> A timeline of PJM market development is given below.

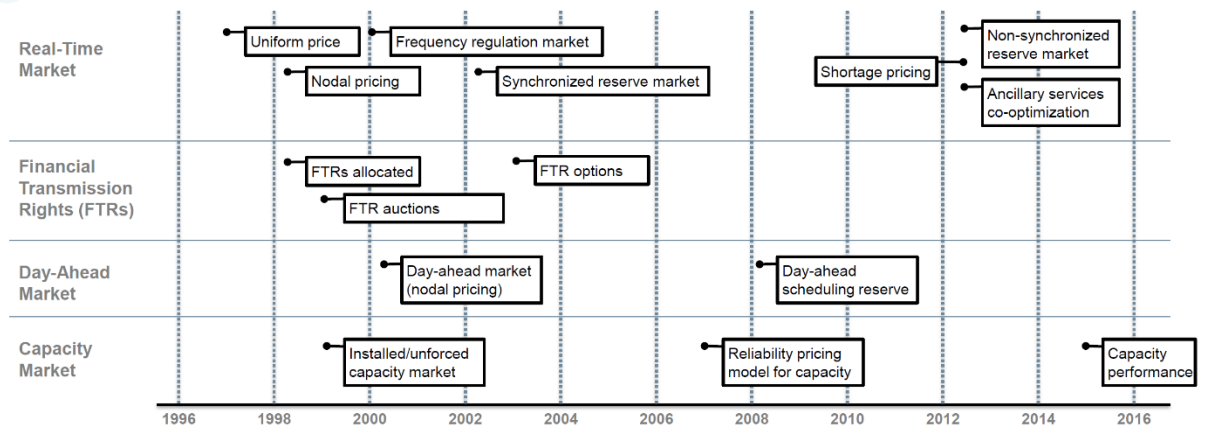


Figure 1: A Timeline of PJM's Market Development<sup>10</sup>

What is also notable is that there are various other RTOs and power pools in America. Rather than insisting on one convergent national model (as the MBED proposal does), different regions which are synchronously connected (particularly in the Eastern Interconnect) operate under different market structures, trading with each other. Western regions (particularly the Southwest Power Pool) which do not suffer the same congestion problems as the Eastern US have also slowly adopted DAM, real-time energy markets and more, but at a much slower pace than market thought-leading RTOs like PJM.

<sup>8</sup> <https://www.pjm.com/about-pjm/who-we-are/pjm-history.aspx>

<sup>9</sup> [https://csis-prod.s3.amazonaws.com/s3fs-public/event/180926\\_Glazer.pdf](https://csis-prod.s3.amazonaws.com/s3fs-public/event/180926_Glazer.pdf)

<sup>10</sup> Adapted from Craig Glazer's "The Evolution of PJM's Market in the United States: Looking Back to Look Forward" delivered September 5, 2018 in Jakarta, Indonesia. Slide 46. [https://csis-prod.s3.amazonaws.com/s3fs-public/event/180926\\_Glazer.pdf](https://csis-prod.s3.amazonaws.com/s3fs-public/event/180926_Glazer.pdf)



Figure 2: Different RTOs in America<sup>11</sup>

The MBED proposal admits that European experience is actually more similar to the Indian case. However, by focusing on the Nord Pool Elspot example, it selectively represents the European power market experience. The Nord Pool spot market is a corner case where over half of the power generated in the pool comes from hydropower, lending the market an unusual amount of predictability and stability. This makes the implementation of a spot market much easier. The broader European power market does not have a similar market structure, but rather has been going through gradual geographic integration across various markets<sup>12</sup>: Bilateral, Day Ahead, Intra-Day, Ancillary Services, derivatives like Contracts for Differences. Organizations like the European Network of Transmission System Operators - Electricity (ENTSO-E) have been working for over five years to improve data-sharing, interoperability standards, and regional cooperation to a point where these various markets can operate and clear simultaneously across countries.<sup>13</sup> But nowhere in this system are there Locational Marginal Prices (LMPs), the way there are in America. Europe is still able to run a vibrant, efficient electricity market while simultaneously scaling up RE generation in a big way. Clearly there are multiple paths to “efficient” dispatch solutions. These diverse experiences deserve serious consideration.

### Financial Benefits

Reducing prices for the end consumers is a key goal for any market design. However, it cannot be the only consideration. Savings to present consumers and static efficiency gains have to be weighed along with the potential for savings/dissavings to the consumers and the long run dynamic efficiency issues especially the effect on the electricity generators. The MBED proposal has been conveniently conceptualized during a period of relative glut or decreased demand, primarily because of various discoms’ liquidity problems.

<sup>11</sup> [https://www.ferc.gov/images/maps/rto\\_map.gif](https://www.ferc.gov/images/maps/rto_map.gif)

<sup>12</sup> [http://www.europarl.europa.eu/RegData/etudes/STUD/2016/578968/IPOL\\_STU\(2016\)578968\\_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/578968/IPOL_STU(2016)578968_EN.pdf)

<sup>13</sup> [https://docstore.entsoe.eu/Documents/Publications/vision/entsoe\\_vision04\\_regions\\_web.pdf](https://docstore.entsoe.eu/Documents/Publications/vision/entsoe_vision04_regions_web.pdf)

Because of the large amount of “excess capacity” that exists at the moment (which is likely ephemeral and transitory), it is easy to save money for the distribution companies by increasing power pool size.

However, this view is myopic, forgetting the not-so-distant realities of a decade ago when most forecasters were projecting shortage in generation capacity. Many of the PPAs which are now being labelled “inefficient” were signed in this scarcity period. Everything seems expensive now because the new price benchmarks are now being set by renewable energy sources, which appear cheap on auction tariffs and variable-cost bidding, but incur higher system costs than traditional fossil-fuel generation. But this was not always the case; in the mid-2000s discoms were scrambling to sign PPAs with generators at “acceptable” prices because as a country we could not build generation quickly enough. These actions were not irrational but borne out of economic necessity; it was better to hedge yourself with a fixed long-term price and quantity with rather than face both price and quantity risks in a small-volume, high volatility short-term market in the late 2000s. Consequently, the cost-saving opportunities through pooling suggested by the MBED proposal are a one-time simulation based arbitrage based primarily on historical price assumptions which may or may not be true in the future.

One of the factors which was not considered at depth in the MBED proposal, but will become increasingly important if all procurement is done through a DAM, is will buyers be ready to face higher prices and potential quantity curtailments induced by price increases, in case the market again becomes supply constrained? These are precisely the exceptional situations which undermine the credibility of a market design, as was observed in the California electricity crisis in the early 2000s when wholesale power prices rose an incredible 800% due to a mix of market manipulation and electricity supply shortages.

There is a passing reference to capacity markets in the proposal,

“It is **believed** that the proposed MBED framework – where the existing legacy contracts are proposed to be brought to the market only on their variable costs – will help develop the desired level of capacity market in future. The discoms will re-align their strategy about the capacity contracting in future - depending on whether and to what extent they have to bear the fixed cost of those generators (legacy contracts) which don’t get cleared in the DAM (because of high variable cost) ; or whether they have to face high price in the energy only market in the absence of hedging through capacity contracting. As a corollary, the generators will also take a considered call on the extent to which they need to hedge their revenue through capacity contract and the proportion for which they would play purely in the energy only market. Such intrinsic demand and supply is **expected** to yield a robust framework for ideal capacity market in future (56).” (emphasis mine)

Unfortunately, belief and expectation are woefully insufficient for as important an issue as future capacity growth. India’s capacity market experiments have been very mixed. The Case-I and Case-II bidding structures have gone largely unused in the last 6-7 years. The UMPP program is also in tatters. Most capacity contracts have faced long delays and litigation for one reason or another. Building new generation capacity (regardless of technology) is hard enough in India as it is; adding further price uncertainty is unlikely to inspire confidence among developers who have already been burned a few times. **A necessary and urgent follow-up to the MBED proposal must be a clear articulation of how capacity markets would interact with it to ensure that there are incentives for the construction of new generation.** Otherwise it risks alienating power developers even further.

As discussed earlier, the current market situation may be of residual surplus and therefore, the discoms may be more comfortable moving to the new mechanism as they are shown to not do worse than what they are already doing, in the prevailing market design. However, this may not be the case for electricity generators. Winners and losers will be created between them and there is a zero sum game between them, where gain

for one generator will come at the cost of the other generator. This issue has not been considered at all in the staff paper. If the timelines in the proposal are followed and the DAM becomes mandatory next year, existing NPA problems in generation will likely be exacerbated for “expensive” generators, which are concentrated in the private and state sectors. These costs could significantly offset any of the proposed gains of the MBED mechanism.

The proposal’s simulations claim Pareto efficient results for the buyer side; discoms and buyers can only gain from the proposal. But this ignores time horizons, looking only at the short-run. Dynamically (in the medium to long run), these claims may not be true as the MBED optimization may produce congestion in completely new corridors and the downstream buyers may end suffering from higher prices than expected.<sup>14</sup> Another scenario where the buyers may suffer in the long run is because of the return of the scarcity scenario which can occur for a number of reasons. Let us consider one case not too far from our current reality—investments in thermal generation continues to be stagnant; discom finances do not revive as expected; discoms start defaulting on the payments to both traditional and renewable energy generators and then any kind of generation investment comes to a standstill. Then scarcity prevails, the narrative may completely change and buyers would long for the hoary past of long term contracts catering to their individual needs.

A variable-cost bid-based DAM will inherently prefer to dispatch RE generation over traditional generation because of its negligible variable costs. While this may be a desirable system characteristic in the long run, it is also a reality that the majority of India’s power generation base is and will remain fossil-fuel based for the next decade or two. **What are the likely financial consequences of implementing a universal DAM across generators (particularly Central vs private vs state generation)?** This is a big question that looms any time there is a major transition in market structure. There need to be some clear analytical answers to who the winners and losers will be in such a transition. In the absence of detailed variable cost data, intuition would say that state fossil-fuel generators will probably have the most to lose financially in such a system. Is this a cost states are willing to bear?

In absence of the financial derivative contracts<sup>15</sup>, presently, all the price risk will be borne by generators, since they will only be informed about the price and quantum of power cleared a day before dispatch. How will the infrastructure financiers get the confidence to finance new power plants? One may speculate that the fixed charges should be sufficient for the financing needs. However, the present power sector NPA scenario clearly shows that fixed charges were not sufficient for making payments to the financiers. The only other possibility is that in future, generators will have to increase the fixed charges to cover these risks and costs.

One of the main shortcomings of the MBED proposal is that it keeps too narrow a focus. By looking primarily at cost-saving potential, rather than elaborating on how the power market interacts with other parts of the Indian power system and financial system, it proposes a solution that does not consider its larger unintended consequences. Power markets do not exist in a vacuum. Any kind of power market, regardless of its form, affects other parts of the system. When something as revolutionary as a universal DAM for power is being proposed, its first and second order effects must be closely considered and analyzed. **Market design cannot exist separately from complicated issues like federalism and the distribution of powers between Centre and States, the current NPA problem, the difficult investment environment for new generation, and the capacity of discoms to engage with**

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<sup>14</sup> It is impossible to prove or disprove this scenario because of the lack of public transmission utilization and congestion data.

<sup>15</sup> Another market which needs to be developed for the MBED proposal to be truly effective.

**sophisticated markets. Each of these issues deserves to be addressed and analyzed before proceeding with such a proposal. Any market design proposal has hard trade-offs and there are rarely free lunches available. The MBED proposal needs to go into details of such trade-offs.**

### Considering Alternatives

As mentioned earlier, the MBED proposal and its antecedents on RTMs and Ancillary Services are part of a string of likely CERC Staff proposals which would suggest a strong intellectual preference towards the creation of markets running on bid-based, security constrained economic dispatch with locational marginal prices. This is very much in the image of PJM and other power markets in America. However, this is not the only way to approach power market reforms, and there should at least be some consideration for other ways to reform Indian markets which do not necessarily lock us into a particular market design.

As the proposal clearly highlights, one of the primary preoccupations of most discoms is the reduction and hedging of costs. This problem can be addressed through approaches other than MBED. For example, right now India has fairly inflexible PPA contracts when it comes to point-to-point transmission of power. Whatever the electrical reality, the contractual assumption is that the contract path is the only way to evacuate power; contracts are not tradeable or substitutable in any meaningful way. Two discoms cannot mutually agree to partially swap parts of PPAs, even if it may lead to a more financially efficient outcome. By loosening the contract path requirements of PPAs towards a “contract network,” as suggested in William Hogan’s seminal paper, it is possible to create an environment where energy traders and brokerage companies can actually provide hedging services to discoms.<sup>16</sup> This is one way of creating a market with trading and exchanges, without all the additional machinery of a centralized spot market (which could eventually be integrated later if necessary). As long as the new solutions discovered by energy traders are dispatchable and satisfy security constraints, such a simple tweak could more easily bring about similar efficiencies as MBED.

### Transmission Planning

Arguably the biggest exclusion from the MBED proposal, but something which will largely determine its success and/or failure, is an articulation of how transmission planning and congestion management will function under this new system. Regardless of what form the final market design takes, pricing in congestion has become a cornerstone of contemporary power market design. But this is precisely the part of the Indian power system which is least understood publicly. Which corridors are most congested? How far are we from avoiding the market splitting currently seen at power exchanges? What are current line utilizations on major corridors? How will MBED possibly change dispatch and hence congestion patterns along these corridors (and across the system more generally) going forward?

Because of the federalism in transmission construction in India, interstate transmission has been largely PowerGrid’s responsibility, while intrastate transmission has been left to state government transcos. CEA has been primarily responsible for national transmission planning. Like with discoms, there are considerable non-economic incentives for prioritizing certain projects and building certain corridors before others. This proposal does not delve at all into the interaction between the transmission planning (General Network Access) and MBED.

What is required here is not just a series of piecemeal technical proposals (like MBED, RTM, DAM, FTR, LMP etc.) but also a framework document which describes the CERC Staff’s broader strategy and vision for market reform discussing:-

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<sup>16</sup> [http://salserver.org.aalto.fi/vanhat\\_sivut/Teaching/Mat-2.142/elmarket/Sem\\_S98/SESS5\\_1.PDF](http://salserver.org.aalto.fi/vanhat_sivut/Teaching/Mat-2.142/elmarket/Sem_S98/SESS5_1.PDF)  
<https://link.springer.com/article/10.1007/BF00133621>



- Interactions between the suggested changes
- Why the preference for American vs. European market design principles?
- What sequencing of reforms do they imagine taking place?
- How will these sequential changes interact with the current realities of discom finances, discom capacity, generator NPAs and more?

There is clearly a broader agenda of reform embedded in this sequence of proposals, but it has not been clearly articulated.

### Some Other Issues

The paper leaves the discussion on the price discovery platform open and suggests multiple potential options. One of the confounding factors in any design of power markets in India is the existence of two parallel power exchanges (IEX and PXIL)<sup>17</sup>. The issue of price coupling and exchange coupling has not achieved any closure in the last 10 years power exchanges operations. Now there is a discussion on incorporating engineering constraints as well in the price solution. This can only be achieved if the distinction between the market operator and the system operator is slowly done way with and either they end up sharing all the information with each other or they merge together to become one.<sup>18</sup> This is will affect the MBED proposal and there is an urgent need to give some closure on this aspect of market design before the proposal is taken forward. In Europe and USA—where price coupling between markets is prevalent, the price discovery mechanism is public and the stakeholders can verify the veracity of the price discovery solution on their own.

Another important issue not mentioned in the MBED proposal (but apparently in the pipeline) is market surveillance. FERC, PJM, and the EU have strong market monitoring and surveillance mechanisms. FERC itself has over 100 employees solely for market monitoring and surveilling purposes; CERC Staff currently dedicates less than 5 people to such operations. Monitoring and surveillance is an integral part of the power market development and this capacity needs to be developed **before** such a market is rolled out, not as an afterthought. This is necessary, irrespective of the power market design chosen. MBED, if implemented, will exponentially increase the number of transactions on exchanges and therefore the complexity of the system will increase substantially. There will be plenty of opportunities to game the system by withholding capacity. All efforts must be taken to prevent any undue exertion of market power by market participants.

Market design, like any other economic or engineering optimization exercise is about trade-offs and creates its own winners and losers. The MBED proposal has not been explicit about it. However, all regulators and market designers should always remember the Chesterton fence and their nemesis — law of unintended consequences. This problem is even more severe for democracies, where such problems can end up stonewalling the process of long term steady and gradual reforms. E.g. Dabhol experience with foreign investment in electricity generation, California crisis experience. Both these crises, completely ending up defining the future structures and development in the respective regions.

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<sup>17</sup> Although functionally, one tends to dominate the majority of the market

<sup>18</sup> In American market design debates, this problem was known as the “separation fallacy,” elaborated in the below paper

[https://sites.hks.harvard.edu/fs/whogan/Hogan\\_FERC\\_RTO\\_Functions\\_filin\\_%20only%20031202.pdf](https://sites.hks.harvard.edu/fs/whogan/Hogan_FERC_RTO_Functions_filin_%20only%20031202.pdf)

## Conclusion

In this response, one of the glaring deficiencies, which I acknowledge, is the lack of data-driven analytical insights. Much of the argumentation in this response is driven by counterfactuals, hypotheticals, and questions simply because there is so little public data to either dispute or verify the claims made in CERC Staff papers. The Annexures are a useful methodological clarification, but without having access to the data used in the CERC Staff Papers, it is difficult to engage in data-driven analytical debate. **One of the requests of this response is that all data used in models and simulations in CERC Staff Papers should be made publicly available, so that respondents and researchers can work through the models to understand CERC Staff's insights. Public consultation cannot be done on the back of private analysis.** Such public sharing of data would also be consistent with CERC's larger mission of "improving access to information for all stakeholders."

Ultimately, this response is neither a call for inaction, nor for maintaining the status quo. The urgency for change in Indian power markets is very real, given the pains the sector is feeling at the moment. But invoking the urgency of cost-savings risks the Parmenides fallacy, where one possible future (a centralized spot market in this case) is compared to the past to justify abrupt change, rather than comparing many possible futures and choosing an appropriate path. MBED and a transition to universal spot markets is but one of the ways Indian power markets can accomplish economic efficiency. It is well worth considering other options, before committing to a path which would likely be the most significant change in Indian power markets since the Electricity Act, 2003.

Rather, I hope this response has constructively engaged with the MBED proposal, while highlighting some of the gaps in knowledge, risks, and problems that fully implementing such a proposal may bring. The MBED pilot in the proposal is a welcome experiment, but it should be pursued the way FERC pursued the formation of RTOs; giving incentives to states to participate in the market and then leaving it up to them to participate in whichever form they see fit.

Finally, since this response has covered many different ideas, here are a few key thoughts which should be taken from this document.

1. It is difficult and often impossible to predict market participants' actions beforehand; creating incentives for market participation is a good step forward. Regulatory fiat for market participation is not.
2. There are no easy substitutes for the development of state capacity, to engage with power markets and to more broadly manage the power system and its finances. Capacity is a precondition to engaging with such markets. Market design cannot solve these problems.
3. There are multiple paths to an efficient DAM. There should be serious consideration of alternatives before committing to one model. (eg. American vs. European market designs.)
4. For market design of any kind to work properly, a larger vision and sequencing of reforms needs to be envisioned and publicly articulated. RTMs, DAMs, Ancillary Services, FTRs, LMPs etc. are only part of the solution.
5. Market design cannot ignore larger systemic issues (eg. NPA problems), the interaction between design and its larger implications must be considered closely