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CAN WE AFFORD A SINGLE CLEARING PRICE ELECTRICITY MARKET?

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The price of electricity is becoming an increasing hardship for consumers both here and abroad. Agenda-driven interest groups are responding as they always do in times of crisis. First, blame one's opponents. Second, categorically dismiss any suggestion one's own agenda might be a contributing cause. And finally, adopt a Churchillian posture of "never letting a good crisis go to waste," which is to say, proclaim the only way to restore order is to double down the support for one's particular agenda.

"Electricity policy… wasn't a model of coherence and defined purpose before the affordability crisis—now it's in shambles"

Has electricity become costly because we rely too heavily on fossil plants facing high natural gas or delivered coal prices? Or is it instead because our push for variable wind and solar is creating a shortage of supply for fossil plants we need when the sun isn't shining or wind blowing? Many argue it's because we haven't built enough high voltage transmission. Nonsense, others respond, the crisis results from a failure to embrace demand response, or nuclear power, or distributed generation. Is it the war in Ukraine which has roiled markets? Covid-19? Can we point the finger at liquefied natural gas exports? How about interest rates, a tight labor market and supply chain disruptions? We need to go all in on hydrogen (or pick your advanced energy or storage technology). That sounds expensive say others. Not as expensive as the alternative is the rejoinder. What about subsidies; somebody is paying for those, right? Or finally, maybe we just need to accept that coping with a new-norm of extreme weather brings higher prices—a point that brings us right back to fossil plants and climate policy.

Given the crowds competing to influence electricity policy, this quickly gets complicated and confusing for policymakers. Too often, the policymaker is offered a binary choice between uncompromising extremes. Electricity policy, particularly at the federal level, wasn't a model of coherence and defined purpose before the affordability crisis—now it's in shambles. Nonetheless, a couple of things are clear:

- *We are still in the early innings of an electricity transition that will continue to impose serious costs on economies which, in turn, will inflate retail bills for years, likely decades into the future; and*
- *If it comes to choosing between an affordable cost of living and the electricity transition, stopping the immediate pain to suffering households and businesses will prevail over any policy response to climate change.*

How should policymakers respond? Capping wholesale electricity prices almost left Australians in the dark back in June and resulted in the unprecedented temporary suspension of their national electricity market. What about windfall profit taxes? Or shifting the cost to subsidize green technologies from ratepayer to taxpayer? Both are examples of dubious ideas being floated to cushion the

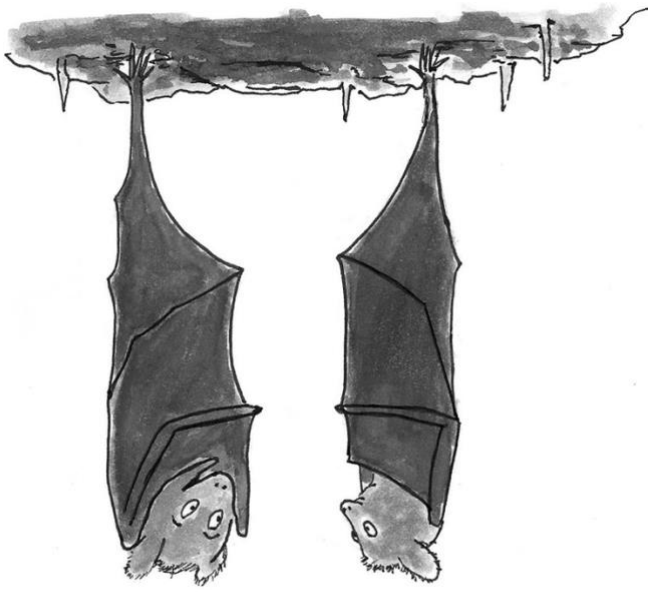
blow to European consumers of high wholesale electricity prices. Some of these same ideas—notably, the concept of shifting cost burdens from ratepayers to taxpayers—found their way into the recently passed Inflation Reduction Act in the U.S.

Given "solutions" like these to the affordability problem either won't work or involve an unpalatable choice between economic and climate goals, it's tempting to chalk up the problem to transitory market turbulence with the hope it will all go away once natural gas prices return to earth. This "shrug of the shoulders" perspective also allows electricity market supporters to argue that it's mistaken to look to the markets that price electricity for solutions because the culprit causing high electricity prices is far upstream (out of control fuel prices) or can be found in macro forces outside of the sector's control (inflation, supply chain constraints, the weather).

"A global decarbonization of arguably the most foundational sector of the economy… is a radical transformation — not a point in the business cycle"

The hope that cost pressures are temporary and will naturally abate takes a kind of buoyant optimism usually reserved for fans of the Ottawa Senators or Baltimore Orioles. A global decarbonization of arguably the most foundational sector of the economy and an electrification of other sectors that, since their modern inception, have relied on combusting fossil fuels is a radical transformation—not a point in the business cycle. Rising cost pressures abound across this transformation and they promise to persist for decades. But there's at least one entry that falls on the positive side of the ledger, namely the almost free operating costs of renewable solar and wind generators. Here, the effect should be to moderate or at least hedge rising prices. And this is where the electricity markets have some explaining to do.

Advocates often claim wind and solar are the cheapest sources of electricity. To call this "debatable" would strain even the finest examples of British understatement. Still, it's true that because the sun and wind are "free" fuels, the marginal operating cost of such plants is zero or near to. Wholesale electricity markets, of the sort organized and administered by independent



system operators and regional transmission organizations ("ISO/RTOs") here and in other parts of the world, run complex auctions to arrive at a single clearing price paid to all suppliers of electricity. This single clearing price reflects the price offered into the auction by the marginal supplier. The highest priced offer—from the last unit taken by the system operator to meet demand—sets the price for the entire supply stack.

Organized wholesale electricity markets being what they are, all manner of exception and qualification to this rule can be noted. But the general truth is that each supplier (regardless of its actual marginal costs) is paid the price offered by the highest supplier taken to clear the market.

"[H]igh wholesale electricity prices in ISO/RTO regions are partially explained by a policy choice we control"

Consumers, and indeed many policymakers, might be surprised to learn that where ISO/RTO markets operate, wind and solar generators with no operating costs to speak of, and who offer their supply into these markets typically at a zero price, get paid as if they were the most expensive plant on-line meeting load. Today, at peak hours, the most expensive plant in these markets is an older, less efficient "peaker" plant passing along in its price high natural gas fuel costs. So far this summer, in ISO/RTO markets such as ERCOT, PJM, CAISO and MISO, average hourly clearing prices regularly exceeding $100/MWh and prices in consecutive peak hours crossing the $1000/MWh mark are not unusual.

The point being that high wholesale electricity prices in ISO/RTO regions are partially explained by a policy choice we control and not simply by unavoidable exogenous factors affecting electricity markets. More specifically, the design of ISO/RTO markets to price all electricity to buyers at the margin and to pay this same price to all sellers:

- *denies consumers the benefit of zero-marginal cost sun and wind generation in many high price hours; and*
- *provides no assurance that payments to individual sellers meet the "just and reasonable" requirement of the Federal Power Act.*

We must stop shrugging our shoulders and instead address the single clearing price auction—a design element universally prevalent in ISOs/RTOs, but otherwise rarely seen in commercial and financial markets outside of wholesale electricity.

Let's be clear. Blackboard economic theory supports ISO/RTO marginal cost pricing and the single clearing price. And it's easy to confuse whether zero-marginal cost plants reduce wholesale market prices (they do in many hours) with the different question we're asking, which is whether the clearing price (whatever it may be) is correct for a particular seller. Our view is it might

simultaneously be too high for one seller, and too low for another. And we arrive here because we observe two points, one academic the other pragmatic. Both can be described as "forest" not "trees" points, and both are ignored in debates over the arcana of electricity market design, such as wrangles over "pay as bid" versus "single clearing price" and other arguments over how we might reform ISO/RTO markets to make them work in harmony with renewable energy and climate policies.

First, electricity has always struggled to fit the definition of a commodity. It may sound glib, but it might be better characterized as a phenomenon* or as a necessary service. Either way, the changes occurring to the grid move wholesale electricity further from looking and behaving like a commodity. Second, putting aside the academic argument over the nature of what's being bought and sold, pricing the full generation stack at the marginal cost will result in intolerably high prices for consumers, very likely for a long time into the future. This will threaten the energy transition and should cause policymakers to ask whether we can afford the single-clearing price construct, even if we assume its theoretical merit.

Let's examine these two points further.

Is Electricity A Commodity? ISO/RTOs pay all suppliers a single clearing price because they assume they can treat MWs of capacity and MWhs of energy as commodities like ounces of gold, bushels of wheat, or barrels of oil. Well-functioning commodity markets result generally in one price per unit at a given time, separated only by costs exogenous to the commodity, such as different shipping costs or different taxation or royalty regimes. But the textbook definition of a commodity is that one unit is fungible to the next. Holding to the fungibility assumption has always been tricky in wholesale electricity markets due to the unique character of electricity, including (1) the variety of ways it can be produced, (2) the very different operating parameters of the machines that produce it, (3) highly inelastic short-term demand, (4) structural market power, and (5) the real time nature of its production, delivery and consumption, etc. This is a complex subject, occupying much thought and debate among electricity economists and market design theorists. Those interested in a more approachable inquiry into the problems that arise from treating all electricity as fungible can find further discussion here.

"Holding to the fungibility assumption has always been tricky in wholesale electricity markets due to the unique character of electricity"

* One of us recalls the prescience in 1989 of a mentor in Washington DC, an energy professional nearing retirement, who had just participated in transitioning natural gas from regulated wellhead pricing to the freely traded natural gas markets we have today. When it came to electricity, he eyed replication of this experience with skepticism. His stated reasoning: "natural gas is a commodity – electricity, however, is a phenomenon!"

In any case, the transformation of the grid with the introduction at scale of non-dispatchable, variable generation (like wind and solar) or technologies with highly constrained run times (like batteries) or voluntary resources (like demand response) further strains the fungibility assumption. And it should prompt policymakers and regulators to examine the theoretical logic that instructs us to pay a MW or MWh of wind, battery, or demand response the same price as is paid to a natural gas peaker or nuclear plant, for example.

"[I]f the grid of the future needs increased flexibility, why would we pay flexible and inflexible producers the same price?"

Ask, for example, whether it make sense to pay the same price for firm versus non-firm service? Similarly, if the grid of the future needs increased flexibility, why would we pay flexible and inflexible producers the same price? Not only is the fungibility assumption out the window at this point, but so too is basic fairness. As FERC regulators say, not all discrimination—as in different prices for different services—is "undue." Put differently, on-demand generation is frankly more valuable than generation operating only when the weather cooperates. ISO/RTO markets that make these generation services compete head-to-head—as if they are either identical or perfect substitutes—are doomed to overpay for inferior service.

Another way to think about this is to ask whether the ISO/RTO is really transacting in commodities? Or instead, is it buying a varied combination of electricity attributes and performance which the operator must combine to maintain grid security and resource adequacy? We might learn a lesson here from Enron's attempt in the late 1990s to commoditize and trade coal by the ton. That market broke down quickly with buyers howling at frustrated sellers/traders because their delivered coal failed to meet required specifications. Ash, heat, moisture, sulfur and volatile matter content values differ widely among sources of bituminous coal. It turned out, the only thing "fungible" when it came to coal was the carbon element. Yet because no one consumes carbon as such, no one wants to trade carbon as such. Similarly, is the ISO/RTO really purchasing, and is wholesale load actually seeking to buy, electrons as such? Or does the transaction really involve a highly bundled product/service that, practically speaking, resists being unbundled into individual components, which (like ash or moisture) have no independent value except when combined with the other attributes?

Marginal Pricing in A Rising Price Environment. Our second point is more pragmatic. Part of the ISO/RTOs' logic to price electricity at the margin is the expectation that, over the long term, efficiency gains (including innovation) and cost disciplines wrought by competition will induce new efficient generators to enter at the margin and cause declining marginal prices relative to average price

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of the existing supply stack. This is a perfectly reasonable assumption—until it isn’t.

What’s upsetting this expectation is a growing intervention in electricity markets, with public and political support, to hasten investment in green technologies, with secondary regard to the cost of these investments. In other words, one can no longer assume that new entry will be more cost effective and cheaper than the average price of the existing fleet. The growing efficiency and declining cost advances in the semiconductor industry famously have followed “Moore’s Law” for 50 years. The push for carbon free supply means the electricity industry is pursuing a very different economic model.

This has important implications to the single clearing price markets administered by ISO/RTOs. Carbon-free resources, like offshore wind or new nuclear or advanced energy storage technologies, along with the attendant call to massively build out the transmission system, while expensive, are necessary and urgent if the US is to do its part to address climate concerns. Accordingly, electricity consumers (or their alter ego, the taxpayer) pay for these investments, supported by renewable portfolio standards, renewable energy certificates, investment and production tax credits, non-bypassable retail charges, and other support and subsidy mechanisms. Sometimes the added cost results simply from changes operators must make to keep the grid reliable, as evident from the “conservative operations” paradigm seen in ERCOT since winter storm Uri.

Importantly, these cost pressures result from a huge structural transformation and should not be confused with the ups and downs of a normal business cycle. It’s easy to hope that electricity prices will ease once inflation is tamed, natural gas and coal prices return to the mean, and we find ourselves at a different point in the business cycle. And no doubt the macroeconomic environment will improve at some time. But realistically, how can a transformation compelling decarbonizing the electric sector and electrifying other sectors have any effect other than to raise electricity prices, not just for a cyclical few years, but for a very long time as the transformation unfolds and until new and wholly disruptive technologies emerge?

This vision of the future seems to be taking hold as others start to notice the anomaly of how supposedly "cheap" renewable electricity is being priced in ISO/RTO markets. For example, speaking in Berlin following the G7 summit in June, UK Prime Minister Boris Johnson called to abolish the single clearing price feature of the wholesale electricity market in his country, observing that "(p)eople are being charged for their electricity prices on the basis of the top marginal gas price, and that is frankly ludicrous." For detractors inclined to dismiss the departing Prime Minister, note agreement from the other end of the political spectrum by Doug Parr, chief scientist, and policy director for Greenpeace UK, who tweeted in response: "Johnson is right—the system was set up in 1990 when the only things competing were different forms of fossil fuel generation. Nobody then (nor in fairness, even in 2010) foresaw cheap renewable power. But because of the pricing system the public do not get that benefit."

"Whatever variant these ideas may take, they implicitly amount to… a rejection of the fungibility assumption"

Specific proposals to replace the single clearing price in the UK remain unformulated, at least publicly. But the goal suggested by the regulator would be to uncouple the price of renewable electricity from natural gas prices and enable renewables to play a greater role in setting price (read: lowering price) in the wholesale markets. This may entail separate procurement regimes for renewable and fossil electricity, with the ultimate price paid by retailers reflecting a weighted averaging of a renewable clearing price and fossil clearing price. Whatever variant these ideas may take, they implicitly amount to (1) both a rejection of the fungibility assumption and the notion that new entry by rule will be cheaper than the average price of the existing fleet, and (2) a move to adopt some form of differentiated pricing in the wholesale energy market.

"There will be a bit of a wait while we figure out a market solution to your problem."

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Conclusion. We don't blame climate policies for rising energy prices. But nor can we accept that high electricity prices result simply from turbulence in natural gas and other global markets. In regions that chose to establish ISO/RTOs, the single clearing price auction, predicated on the ideology that electricity should be treated as a fungible commodity, is a design choice causing consumers in these regions to pay more for wind and solar electricity than they should.

This design is not a fait accompli. The FERC and its overseers in Congress should be asking why we persist in paying a single clearing price to all electricity producers in ISO/RTOs. This is not the same as gutting these markets and returning somehow to cost of service regulation. Asking competitive markets to recalibrate given changed circumstances and to develop a pricing regime that is fairer to consumers and all producers in ISO/RTO regions—not to mention more reflective of operational realities—is asking to improve these markets, not repudiate them. Investors in renewable generation might be enjoying the windfall of high prices in ISO/RTOs. But for the rest of us seeking politically sustainable climate policies, the worry is that the grid transformation now underway will die on the cost-of-living hill if electricity bills become intolerable for business or households.

About the authors

Vincent Duane is a Principal at Copper Monarch, LLC. He advises energy companies on strategies to optimize their investments in wholesale electricity markets both in the United States and globally. He additionally advocates to improve the market design, governance and operations of independent electric system operators in the context of a decarbonizing electricity industry. Duane has spent over 30 years in energy on behalf of public power and industrial consumers, integrated utilities, merchant generators, financial trading firms, renewable developers and transmission owning entities. Until 2020, he was a senior Vice President at PJM Interconnection charged with legal, external affairs, corporate strategy and compliance responsibilities. Previously, he was an officer at a publicly traded merchant developer and power trading firm and at a public utility holding company affiliate. He began his career in the private practice of energy law in Washington DC.

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