UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Hybrid Resources Docket No. AD20-9-000

COMMENTS OF MARK AHLSTROM[1]

The power grid is an amazing machine. I graduated in the earlier days of computers, spending twenty years in the software industry before coming to electric power for my last twenty, but I greatly admire the engineering creativity that was used to solve complex problems with mechanical components and analog devices in our conventional resources.

For any machine, however, what really matters is what it does for us. It's the services at the interface that provide value to the user, the customer, or the engineer who is using that machine as part of a larger system. Whether we accepted a machine because it inherently provided some useful services or explicitly specified the services and then designed the machine to provide them, there is a set of services provided by any machine or device, and those services are what has value to us.

Viewed in this light, it is easy to see why the digital revolution has transformed other industries and our lives. In the early days of software and digital electronics, we learned that hardware and software are interchangeable to a surprising degree. Consider what happened to photography—some amazing digital cameras look and act very much like earlier cameras that used film and mechanical shutters, but are built from completely different technology. Other amazing digital cameras look like cell phones. But to the user, they are all cameras, and we've found that digital cameras not only provide us with all the traditional services of a camera, but can be cheaper and faster, while also fostering ongoing innovation that has given us new services that we couldn't even imagine before. Given sufficient electronics, software, energy and storage, we can create essentially any kind of camera that we want.

When it comes to the power grid, we are cautious about changing things. We put a high value on reliability and we are evolving the world's most complex machine while it continuously operates. We make huge investments in our electrical machines and expect them to run for decades. Even so, we have diverse resources in the grid and we know that different technologies can provide similar services and responses at their point of interconnection. We have defined interconnection requirements, performance standards and market products around these services, and because we know that there are multiple ways to provide a service, we've learned that we want such requirements and market products to allow performance-based and technology-agnostic solutions whenever possible.

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So, what does this have to do with hybrid resources? I define a hybrid resource as a combination of multiple technologies that are physically and electronically controlled by the hybrid owner/operator behind the point of interconnection and offered to the grid operator (or to some other customer) as a single resource. As with digital cameras, given sufficient electronics, software, energy and storage, we can create essentially any kind of electrical machine that we want. The services and performance levels that we require at the point of interconnection may affect the design and the cost, but there is no doubt that we can build it.

To be clear, we live in a physical world and electrical machines have a physical manifestation at their point of interconnection, such as injecting power, supporting voltage, responding to frequency deviations and so forth. Our digital resources, including hybrid resources, give us more options for providing services at the point of interconnection, and this is true for both co-located resources that are offered as multiple resources at a shared point of interconnection and hybrid resources that are offered as a single resource. However, particularly as storage becomes less expensive and the size of the storage component continues to increase, it will be the "hybrid as a single resource" that allows us to exploit the flexibility and the power of innovation to its full capability.

As with digital cameras, hybrid resources also give us the option of emulating a conventional device (which is largely what we have required so far, such as with Order 842 and 827 for frequency response and voltage support) or providing somewhat different responses that might be better or allow more efficient use of new resource types (such as with Order 841 for energy storage resources). For hybrid resources, it is worth looking at both approaches.

For the first approach, our established services and responses came from what we knew. Given the conventional resources that were available when we built the grid and initially designed the markets, we largely accepted the characteristics of these resources and we made it work. We didn't have a lot of flexibility to change them. At this point, we have a lot invested in our approaches, our market design, and our energy management and market software.

So, this is a valid and logical starting point—in addition to emulating the desired kind of electrical machine, a hybrid resource can use its software and analytics to look like a conventional resource, but with fewer constraints and more flexibility. All RTOs should allow hybrid resources, if they wish to do so, to use an existing market participation model. Just as a conventional plant provides its parameters for startup time and minimum run time, a hybrid could provide its own parameters. This may not be the optimal way to extract the full value from a hybrid resource, but I see no logical reason why we would prevent a hybrid that can emulate a gas plant (but with no startup cost, no startup time, no minimum run time, and a faster ramp rate) from participating in this way.[2]

But we should also recognize that resources that are flexible and can more dynamically adapt to what the system needs should be encouraged and rewarded, and this applies not just to the hybrid resources that we are discussing here today, but to a wide range of emerging flexible resources that we will see in the future. Moving more resources toward one-part offers without advance commitment requirements, startup costs, minimum generation levels or other constraints is a benefit to the system. Resources that can make a broad set of offers, allowing the market to select the services that are most needed and valued through co-optimization, are a benefit to the system. Resources that respond logically, flexibly,

[2] For additional information on the motivation for and design of hybrid resources, including discussion of their offers and flexibility, see the Hybrid Power Plants document posted at the ESIG "Hybrids and Emerging Flexible Resources Task Force" page at **https://www.esig.energy/hyflex-hybrids-and-emerging-flexible-resources/**.

quickly and accurately to control signals, price signals and contingencies are a benefit to the system. The fundamental rule for maintaining reliability is to keep the system balanced in real time, so flexible, logical and responsive resources that can help do that should be encouraged and valued.

In return for these benefits to the system, we should expect future progress and innovation in our day ahead, intraday and real time markets and operating practices. We should consider how rules can better reflect the capabilities of modern flexible resources, acknowledging that we can get the maximum value from all highly flexible resources by allowing offers and schedules to be updated as close to real time as practical. For example, flexible, variable or energy-limited resources of many types would benefit from intra-hour schedule adjustments that are analogous to the rolling five-minute forecasting treatment that all RTOs provide to variable resources. Intra-hour schedule adjustments would allow them to offer additional services that would be beneficial to the system, and this could largely be done with the existing dispatch software that is used for variable renewable resources.

The critical issue for hybrids, both for the hybrid plants and the markets that use them, is that we retain (and encourage) ongoing innovation. A battery is more than just an energy price arbitrage device. A hybrid combination of generation and storage is different than separate generation and storage plants. By increasingly drawing our attention to the services that are most needed by the system at any given time—by thinking about what the system would truly like to have, rather than making do with what conventional plants could inherently provide in the past—we can evolve toward more elegant and powerful power systems. We must avoid our current trends toward increasing market complexity through a patchwork of exceptions. Instead, we should encourage our markets to define new services that are directly related to the needs the evolving power system and allow resources to innovate more freely in providing them. This is our pathway toward more elegant and powerful markets for the future.

Some will argue that it is simply more "globally efficient" to continue to keep all components separate and allow the grid operator to have complete visibility, control and optimization responsibilities. Some will argue that a resource cannot confidently provide reliability services if the system operator cannot directly verify the details of exactly how much stored energy is already available now for providing some service later. Others will argue that a hybrid must inherently be a more expensive and risky way to provide services. While these feelings may initially seem intuitive, there are numerous examples from a wide range of other industries and applications that show that these intuitive feelings are incorrect when it comes to real-world applications and implementations. In many other industries, the leading players who discounted the innovative potential of digital alternatives to their traditional products were left behind.

The real questions for today are simple and important to consider: If a resources wishes to provide services and responses at the point of interconnection as a hybrid that is treated as a single resource, and if it can provide such services with the same quality, reliability and forced outage rate as a conventional resource, with offers to do so that are fair and competitive, why should it not be allowed to do so? If markets can adapt their focus toward the essential services that they ideally want and need, not being forced to simply accept the characteristics that conventional resources could offer in the past, why would we not encourage this as a path toward more elegant and inclusive markets? A hybrid, and particularly the option of having a hybrid that participates as a single resource, is a critical step that will allow both resources and markets to evolve toward more powerful and elegant solutions.