SEVEN MICROGRID QUESTIONS FOR MICHAEL BURR

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Michael Burr founded the Microgrid Institute in 2013, and Microgrid Finance Group in 2016. As Executive Director and Principal Consultant, he coordinates multidisciplinary work addressing development and operation of energy microgrids. Burr has produced more than 20 volumes of energy industry journals and led formative industry initiatives to accelerate adoption of advanced energy technologies.

Michael began his career in 1988 on the editorial staff of Independent Energy magazine. In the 1990s, after serving as communications director for the National Independent Energy Producers trade association, he began an independent analysis and consulting practice. In his career, he has also served as editor of PennWell's Electric Light & Power magazine, as editor-at-large for Inside Counsel magazine and editor-in-chief of Public Utilities Fortnightly, the journal of record for the U.S. investor-owned utility industry.

Q1: Before we jump into a conversation about micrgrids, can you give us a bit of background about Microgrid Insitute?

A1: Microgrid Institute (MGI) was launched in 2013 as a think tank to support the development of resilient energy microgrids and help clear the path forward.

Q2. In your experience with microgrids, have you come across propane as a component of a system? If so, what was the main driver?

A2: Yes, including two currently active projects that MGI has been supporting. MGI serves as an owner's representative for a **microgrid now under construction** at the San Pasqual Band of Mission Indians (SPBMI) Reservation, located an hour north of San Diego, California. MGI helped design the project, arranged funding, and supported the competitive procurement process to select Industria Power as the design-build contractor and GridScape Solutions as the primary equipment vendor. The microgrid has containerized batteries, three carport solar arrays, and a 150 kW propane generator.

The second project is at the Minnesota Department of Natural Resources (DNR) Red Lake Wildlife Management Area. The project includes two off-grid microgrids that will use propane –

the Norris Camp, including DNR headquarters, and the manager's residence down the road. MGI led the project's first phase, producing an engineered design that DNR anticipates procuring in the next phase.

Both projects are similar from a design perspective, but the climate at these locations couldn't be more different. Temperatures fall below -40° F in the Red Lake Wildlife Management Area, and rise above 100° F in San Diego County, which shows you the flexibility propane brings. It's a fuel that can be used practically anywhere.

Q3. San Pasqual in Southern California and Red Lake in Northern Minnesota seem like they have very little in common, but do they actually share a few unique attributes?

A3. Absolutely. Environmental sensitivity is the main driver for including propane at both locations.

The Minnesota DNR site is adjacent to an old-growth forest. Plus, both sites were already using propane for heating and appliances and neither location has a natural gas supply available. Another commonality is that both projects require dispatchable generation sources with fuel that is readily available and clean.

In addition to environmental performance, capital cost also is a key consideration when specifying generator types for microgrids. Liquefied propane generators with capacities under 150 kW are competitive against diesel generators on an up-front cost basis.

Q4: Do you expect propane prospects to increase, decrease, or remain the same with the incoming Biden administration?

A4: It's too early to tell. It's fair to say the demand for microgrids would likely grow faster in an administration that is more interested in sustainability and reducing the carbon footprint. The EPA may likely clean up its act and increase its focus on climate, driving more investment in energy sustainability and resiliency.

Also, with a more consistent federal climate strategy, utilities might be able to take a more orderly and thoughtful approach to increasing the resiliency of their systems. These factors point to a strong microgrid outlook – and anywhere natural gas is not available, propane is certainly a winner.

Outside the microgrids market, I'm also involved in a **fuel-switching stakeholder process** for Minnesota to explore whether state policy should change to allow fuel switching in utility incentive programs. The Minnesota Department of Commerce is exploring the issues around the Conservation Improvement Program (CIP), which prohibits using CIP funds to incentivize

switching from electricity to natural gas or delivered fuels — or vice-versa.

The bottom line is propane prospects for power generation in remote applications remain high even though propane use in the residential appliance market is down due to electrification.

Q5: What is the main barrier in treating propane as a distributed energy resource?

A5: Usually, when people are talking about DERs they are referring to renewables – small wind and solar facilities. But indeed propane-fueled power generation is a distributed energy resource (DER). The question is whether it's the best choice for a given DER application. Natural gas is cheaper and has lower emissions; hence you choose natural gas if it's available, not propane. Where natural gas is not available, it comes down to the cost-benefit analysis.

Currently, propane is at a disadvantage against diesel for larger-scale applications, because gas gensets cost more than diesels. The price difference is due mainly to manufacturing capacity; large diesels are much more widely used for various purposes. As more customers specify cleaner-burning diesel engines, the cost difference could narrow to the degree manufacturers shift capacity to building larger gas engines.

Q6: We've heard about the concept of "Power to X" – meaning using electrical power to create, for example, hydrogen, which can be stored, whereas electricity is harder to store at scale. What about the idea of propane being used as a virtual battery?

A6: Because propane is a fossil fuel, it's not an energy storage technology. By comparison, if a facility were to produce hydrogen via renewable energy from electrolysis, and then store it to fuel power generation later, that would be an energy-storage technology. Viable technologies that could bring storage at scale in the near term include flywheels and flow batteries. Flow batteries could be great for large-scale, long-duration storage because they can store a lot of energy in scalable tanks containing relatively cheap electrolyte.

Q7: And speaking of batteries, what role are batteries playing in your microgrid design thinking?

A7: Microgrid designers are always trying to balance various resources to provide a secure power supply in case the grid goes down. In my experience, the most cost-effective approaches today keep the battery size small, specifying battery storage for short-duration purposes, and rely on a fueled generator for longer-duration outages. Where natural gas supply isn't available, a propane tank is a more cost-effective form of stored energy than a larger battery.