



aggreko

Solving the power availability problem

FORGET GRID CONSTRAINTS – EXPAND AT THE PACE AND PLACE YOUR CUSTOMERS DEMAND

It's common knowledge that demand for data storage is outstripping the ability of many national grid networks to supply the capacity, transmission or distribution required to keep up with the needs of their market

Nevermind that take-up rarely matches stated capacity needs: if end users don't have certainty over timing and availability of capacity, they may take their business elsewhere.

Onsite, natural gas-based generation can be the solution to grid power constraints. This could be a bridging solution enabling speed to market with the grid catching up a year or two down the line. It might be a supplement to an existing grid supply to enable expansion. Equally, it might make sense to go off grid completely and for the longer term.

Aggreko can help you satisfy any of those needs with a gas and battery hybrid power plant, which might also incorporate solar, cogen or trigen, depending on your needs.

Let's examine the benefits of an onsite power generation plant using the 'energy trilemma', a well-known priority conflict model used to establish the required balance between security of supply, cost and sustainability. Given the primary challenge is getting sufficient power to site, let's start with security of supply and develop that theme to talk about power quality too.

SECURITY

One of the biggest benefits of an onsite plant is speed to market. Conservatively, Aggreko can go from a standing start to commissioning an onsite 20MW plant in less than 3 months. We have delivered a 95MW gas plant in Myanmar, where the logistics were uniquely challenging, in less than four months. But the longest pole in the delivery tent is generally not design, engineering or logistics; it's often planning and permitting. This is generally a national or regional issue but even with a planning and permitting schedule of six months, an onsite plant will often be complete well before the grid arrives.

There are challenges: a power plant needs land (additional and adjacent to the data centre) and fuel (gas). Aggreko can fit a 20MW plant on to around 2,100m² and we are well known for smart layouts, designed to maximize available land. A reasonable planning yardstick is around 120m² per MW.

Gas availability is another factor dependent on geography. Piped gas is the preferred option. If there isn't already gas at site, a rough rule of thumb for running pipe from the mains in Europe is around €70k per 100m, which compares favourably with around €100k per 100m for electricity distribution costs. Even where piped gas is not available, Aggreko has considerable experience of trucked LNG with onsite storage, which is equally viable for smaller projects and extremely safe, contrary to popular perception.

Having spoken about securing a supply in very quick time, let's explore the quality of that supply. The power quality parameters of a 1MW to 150MW thermal microgrid, especially gas rather than diesel, will always struggle to compete with larger grid equivalents. This is where the integration of a battery begins to demonstrate benefit. Aggreko has assembled batteries specifically for the data centre market with three power quality parameters in mind:

frequency stability, step load management and availability. We offer guarantees of: +/-4% frequency stability and 1100kW load steps in plant using a single battery (significantly more where we incorporate two or more batteries. 98% availability is standard at N+2 engines but we can reach 99.95% at N+4 engines. The battery also enables a plant built to run at loads above 10MW to run as low as 800kW during ramp up.

So onsite plant uptime is broadly equivalent to the developed-world grid availability. In countries where the grid is less stable, onsite solutions are much more resilient. In fact, Aggreko has a project in Nigeria where it was desirable to come off grid for reasons of reliability. Even in Dublin, our projects ran without interruption during last winters' storms while the grid failed five times.



COST

Having talked about securing high quality power, let's investigate the costs. Aggreko uses an opex-only model. There is no capital equipment purchase because we design, engineer, build, commission and decommission then demobilise the plant ourselves. We retain ownership of the assets throughout and take responsibility for their operation. Often outside our scope are planning, permitting, civils and gas procurement (fuel and delivery to site) though we have strong track record of taking each of those in-house depending on the situation.

In a world where there is uncertainty over grid prices, swiftly changing technology in both power generation and within the data centre, as well as potential for changes in the regulatory framework for emissions, acquiring large plant brings

significant risk. A power plant you acquire now could be considered highly inefficient well before you have achieved a return on the investment. Equally, the cost of an inefficient plant could make you uncompetitive in the market place. Far better to think in the 2-5 year horizon and use mobile, modular and scalable solutions to increase your flexibility, sustain your advantage and keep you at the forward edge of the technology curve.

Using electricity and gas price forecasts from various sources and taking a house view, we estimate grid COE over the next 6 years in Dublin to average around €126/MWh. An onsite plant deployed for a six year project, starting at around 1.5MW (total load) in year one and ramping up to 18MW in year six will be almost exactly the same

cost as the grid on a MWh basis: €126. And of course, there is speed to market to consider. Development land and with a grid connection and sufficient capacity may simply not be available. So even in areas where grid cost is low, a gas and battery hybrid may be the only option, not just the most cost effective.

We looked at the power quality enhancements a battery can bring above. Let's now consider the cost benefits. A recent proposal for a two year deployment ramping from around 1MW to about 17MW showed sufficient spinning reserve displacement to save around €500k in gas costs. Genset dispatch optimization can also reduce the number of gensets required, resulting in further significant savings.

SUSTAINABILITY

The use of a 1MW 30-minute battery also brings particulate emissions reductions. Around 4,000 tCO₂e will be saved across a two year 12MW project. And that brings us to the third prong of the energy trilemma: sustainability.

Many customers have genuine concern for the environment and have made commitments to reduce their carbon footprint. Some are interested in achieving the standards required to enable permitting or in achieving efficiencies which may have a cost reducing effect with which comes an environmental dividend.

Onsite gas generation plants based on reciprocating engines meet the

emissions requirements laid out by the EU. For plants with less than 50MW thermal input we can produce 18MW electrical output at 95mg/Nm³ NO_x at 15% O₂. For plants over 50MW thermal, which have to comply with the Industrial Emissions Directive, rather than the Medium Combustion Plant Directive, we can reach 20mg/Nm³ NO_x at 15% O₂ using selective catalytic reduction (SCR).

The other key emissions issue is noise. With our sound attenuating kits, our generators' sound pressure does not exceed 75dB(A) 1m from the generator, at a height of 1.5m. We have also built sound attenuating walls where proximate receptors have required our plant to get below 50dB(A).



OTHER DEVELOPMENTS

A range of other developments in the Aggreko onsite generation solution include use of waste heat for increased electrical efficiency and trigen (combined power and

cooling), integration of renewables, use of green walls to complement sound attenuation and alternative fuels, including biofuel. As well as our standard 1.5MW generator,

we are also bringing larger engines in to our fleet to increase power density and efficiency.



CONCLUSION

The power availability problem is a significant hurdle for the data centre industry to clear as it continues to expand. The industry has been a trail blazer in so many ways over the decades. As other industries look away from the grid, increasingly to onsite generation, it makes sense that data centres lead the way.

The results: increased power security with the quality of supply you need; grid competitive costs; enhanced environmental performance. And crucially, all this can be delivered at the pace and place your customers demand. Finally, by turning to Aggreko's opex only model, you receive a turnkey solution which deleverages you from technology and regulatory risk.