

Our energy working for you.™



**Power topic #5756** | Technical information from Cummins Power Generation

# Off-the-grid power

## Onsite power for remote mining locations.

■ White Paper

By Ananth Parameswaran, Director of Power Systems and Global Marketing

The need for a secure, efficient power supply is as important to mining operations as the equipment used by the mine to keep production up and running, sometimes on a 24/7 basis. Many remote mine sites are located at a great distance from the nearest power grid, resulting in the need to establish reliable off-the-grid onsite power generation capability.

For these isolated mining locations, multiple diesel fueled power generators operate as a local micro-grid to meet all onsite energy demands. The power demand can be considerable, sometimes exceeding 50 megawatts (MW) at larger mining sites.

### Mining requires substantial power

Mining sites in remote areas, far from reliable utility power, rely on onsite power systems for both prime and standby power. Multiple diesel-fueled generators are often used to supply this power. It is not unusual for a large site to require 50 MW of output — equivalent to the engine power installed in 20 of the industry's largest haul trucks.

The power demand of the mine site will evolve as the mining operation develops, from exploration to mine construction and then expansion. Older installed power systems may be replaced to take advantage of newer products with improved fuel efficiency and lower emissions.

While all remote mine sites off the grid will require prime power generator sets, other mine sites on the grid may invest in generators for standby emergency back-up use during local power outages. Mines not initially connected to the grid may use generators for prime power generation until transmission lines are built. The generators can then move to standby operation. Temporary power provided on a generator rental basis is another option for start-up mines and for situations where a mine may require additional power capacity for a limited period of time.



**Figure 1:** Cummins supplied a 14MW standby power system for South Deep gold mine in South Africa. The seven generators can start up, synchronise and be online within 30 seconds.

Only generators robust enough to operate at high reliability under extremes of ambient temperature or at high altitude can be considered for applications at mining sites. For this reason, diesel engines already proven in large mining equipment are the preferred choice for onsite power generation installations, as they offer a proven performance.

This engine commonality greatly simplifies the diesel engine servicing required on the mine site, contributing to easier and lower cost of service. The proven durability of Cummins engines in mining equipment to achieve long life-to-overhaul is also replicated in the generator installations.

## Natural gas power onsite

If the mine site is located close enough to a gas pipeline to make tapping in a feasible option, natural gas fuelled generators can offer an attractive option in place of diesel-powered generators for base load prime power. For these situations, reliable prime power from natural gas-fired power stations have enabled mine operators to significantly reduce their cost of energy.

## Standby and prime power

Generator sets and installations are typically rated according to the number of hours and the related duty cycle they operate, ranging from emergency standby power (ESP) to limited-time running power (LTP), prime power (PRP) and continuous (COP).

Each of these applications place increasingly higher running time and load hours on the generator set, with a corresponding reduction in rated output to ensure reliable operation. Generator frequency may be either 60 Hz or 50 Hz, depending on which area of the world the mine site is located, adding a further influence on the rated output of the generator set.

A popular generator used on mine sites, such as the DQK Series from Cummins Power Generation utilizing a Cummins QSK60 diesel engine, will be rated 2250 kW at 60 Hz for emergency standby use, while for continuous use will be rated lower at 1600 kW for unlimited hours use. For mine sites requiring 50 Hz frequency operation, the same generator will have a lower 2000 kW rating at standby and 1230 kW for continuous applications. The same QSK60 engine platform provides up to 2700 hp (2013 kW) when configured for haul trucks and excavators.



**Figure 2:** This diesel generator set from Cummins Power Generation is typical of those providing prime or standby power for remote mining locations.



## About the author

Ananth Parameswaran is the Director of Power Systems and Global Marketing at Cummins Power Generation. In this role, he has global responsibility for marketing and product planning for integrated power systems, power distribution and power plants.

Prior to Cummins, Ananth was an entrepreneur in India and also worked with the Tata Group. He has a bachelor's degree in mechanical engineering from the College of Engineering, Pune and an MBA from Harvard University.

## Onsite Power Systems

Onsite power systems are typically installed as a connected series of containerized generator sets with associated power control and switchgear systems. In other examples, customized enclosures or even a dedicated power station facility is constructed to accommodate larger, open generator sets. The move to a dedicated power station facility is driven by the larger footprint of the higher output generators.

For example, while the 16-cylinder Cummins QSK60 engine provides around 2 MW generator output accommodated within a standardized container, the 18-cylinder QSK78 with up to 2.6 MW requires a customized enclosure or is situated within a power station facility.

There is a power choice the mine site can make between using a larger number of lower rated generators, or a smaller number of higher rated generators. Depending on the specific power requirements, economies of scale can be realized by utilizing a fewer number of higher output generators to reduce the requirement for paralleling switchgear and automatic transfer switches.

As these installations require an integrated network, the mine operator needs to work with a power supplier who understands their business and is able to provide a complete, plug-and-play service. By the nature of the industry, mining projects can take place, anywhere, at any time, and pre-integrated systems enable rapid set-up of power installations so that energy can be made available within very short lead-times

Apart from the generator sets themselves, projects at mine sites will often require transformers, paralleling systems, switchgear, containerization or acoustic enclosures, cooling and remote monitoring. Expert guidance with power system design, application engineering, installation and commissioning play a key role in optimizing the specific power solution for the mine site, particularly with product service support already embedded with the mining industry.



**Figure 3:** Cummins Power Generation generators in climate-controlled enclosures provide power for a gold mine in West Africa.

The power load demand of an off-grid mine is dependent upon the size of the infrastructure supported, the commodity being extracted and if the mine is open pit or underground. Metals mining may undertake processing onsite with crushing, concentration and even smelting, accounting for a high power demand.

Underground mines can use double the amount of electrical power per ton of mined material compared to open pit mines. Shafts and lifts require power, as do extractor fans, lights and dewatering pumps. Deep mines require air conditioning, while mines in cold climates may require heating. This equipment can impose load ups of typically 5 MW demand, with additional power requirements for standby generators in place for emergency situations.

For additional information about onsite power systems or other energy solutions, visit [power.cummins.com](http://power.cummins.com).



**Our energy working for you.™**  
[power.cummins.com](http://power.cummins.com)

©2014 Cummins Power Generation Inc.  
All rights reserved. Cummins Power Generation and Cummins are registered trademarks of Cummins Inc. "Our energy working for you.™" is a trademark of Cummins Power Generation.  
GLPT-5756-EN (03/13)

