Three ways to reduce operating costs of power generators with remote management

How remote management can be used to cut costs and improve maintenance

www.hms-networks.com

Three ways to reduce operating costs of power generators with remote management

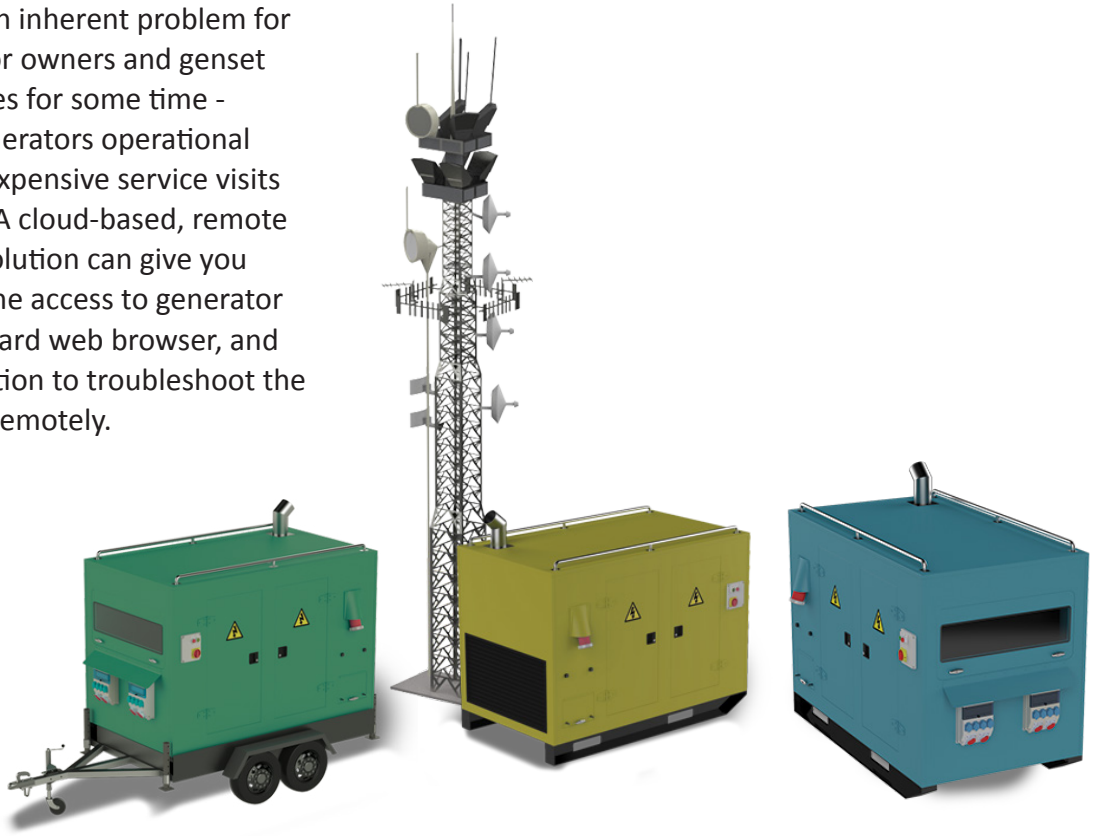
Contents

Three ways to reduce operating costs of power generators with remote management

1.0 Introduction

Regardless of whether a power generator is used as a backup generator or is supposed to run 24/7, it is critical that it will perform as expected. But how can you make sure that the power generator will start up or is running when required? And when this not the case, how will you know and can you find the reason why?

This has been an inherent problem for power generator owners and genset rental companies for some time - keeping the generators operational while keeping expensive service visits to a minimum. A cloud-based, remote management solution can give you immediate online access to generator data via a standard web browser, and a direct connection to troubleshoot the generator unit remotely.



In this whitepaper, we describe ways in which remote management can be used to reduce the operating costs and improve control for a genset fleet.

Three ways to reduce operating costs of power generators with remote management

2.0 Three ways to cut operating expenses for power generators

There are many things that can be done to improve the operation of existing gensets, but the key factor to successfully being able to reduce operational costs is information. By understanding when, how and if the generator is operating, we can make better decisions regarding site maintenance and take action when necessary. Below are some examples of how access to information helps us make better decisions and therefore reduce operating costs.

1 - Perform service only when needed

Power generators are often serviced according to a pre-determined schedule. This is usually based on running hours, but by understanding how the generator has been operated, the type of load that has been applied, the number of starts performed, and the fuel consumption, it is possible to plan services more pro-actively. As a rental company you may want to make sure the generator is not misused and to keep track of its location. As site visits are costly, with a remote management system you can optimize costs by only sending service teams to generators that need a service.

The challenge is to know when service is needed at each site. A remote management solution, provide data on running hours, oil pressure, battery status, coolant temperatures, generated power output, current fuel level, GPS position etc. Notifications may also be generated when a critical level has been reached, for example if the generator running hours exceed a service interval, or by being pro-active with a warning just prior to exceeding these running hours. By being able to analyze the operation of each generator remotely, you will be able to understand their health and more efficiently schedule service visits in the field.

Some advanced remote management solutions also offer remote access functionality. This means that you can open a secure network connection to your power generator in the field and perform deep analysis or change settings using the vendor supplied configuration and service tools. Just as if you were directly connected to the genset controller on site.

Another benefit could be if a webcam is installed on site, you can remotely view and get an understanding of the actual installation site access prior to visiting it. This is also a great way to confirm that things are working as expected. And if they are not, then to see what you might need to take with you for a site visit (the right spare parts, a ladder, and some boots?)

Three ways to reduce operating costs of power generators with remote management

2 - Test start generators remotely to reduce start-up problems

Just like a car that has been parked for an extended period, a generator engine that has not run for a long time is likely to have start-up problems. For back-up power generators that are not needed very often, it is important to regularly perform operational tests. Remote test starts can be made with a remote management solution that has control capabilities and is connected to the generator controller. With a simple action such as a remote operational test, you may increase the likelihood of the generator working on the day there is a power outage and it needs to perform. A well-maintained generator operates better and has lower operating costs since unplanned service visits are an expensive option.

3 - Minimize and reduce the effects of fuel theft or leakage

Fuel theft can be a significant problem. In certain regions, as much as 40% of genset fuel is reported to be stolen. Avoiding fuel theft completely is a challenge since it is often stolen a little at a time, during transportation, at fill-up, or from the power generator in the field.

A remote management system that connects to a fuel sensor can be used to ensure proper operation, for example it can confirm that the right amount of fuel is delivered at a refill. By using an intelligent level sensor, such as an ultrasonic sensor, it is possible also to continuously track the fuel level of the tank. The sensor can be calibrated to sense a full tank and by knowing this we can verify that the tank is properly refilled. A good fuel level sensor can detect variations down to a few liters of fuel. An abnormal decrease in content may be detected and indicate that the fuel is being stolen or that there may be leakage from the tank.

With a remote monitoring system that supports alarms, a notification can be sent immediately when the theft occurs. Even if it might be hard to catch the thieves, we are at least aware that the fuel has been stolen and can schedule a refill to ensure the generators have the fuel needed to operate. Tracking the level of fuel in a tank increases the awareness of what happens to the fuel on site and helps users understand when theft occurs. In some cases, where organized theft is common, this may help detect patterns and direct actions to be taken.

2.1 Remote monitoring puts you ahead of the game

Modern remote monitoring technology enables instant access to data from equipment in the field. While we can use this technology to reduce operating expenses as described above, it also brings other benefits. By being able to have full control 24/7 and be instantly notified of any operational issues, the end-user also receives improved service quality. To get this information, we need to gather it from the field equipment to a remote management server where it can be stored, accessed, and processed. The remote management server is usually hosted in a data center. The next chapter describes how this process works.

Three ways to reduce operating costs of power generators with remote management

3.0 How remote management works

There are four main elements to a modern remote management solution.

The first is the physical layer that comprises a communication gateway or RTU, also called an IIoT (Industrial Internet of Things) gateway. This is connected to your equipment, acquires the data, and transmits the data to a remote management server. This data connection works both ways and data can be sent back through the gateway.

The second element is the central remote management server that collects and stores the remote data. The remote management server can also offer additional services such as data presentation, reporting and analysis of the collected data, as well as provisioning and management of the remote gateways.

The third element of a remote management system is the possibility to interact with third party applications, enabling the data collected to be forwarded using technologies such as a RESTful API (Application Programming Interface).

Remote management offers secure access to field data from remote sites. The above example comes from the Netbiter Remote Management solution from HMS Industrial Networks.

The fourth element is a service that provides a secure transparent communication link to the equipment referred to as Remote Access. This allows for remote programming, more advanced troubleshooting or interaction with the connected equipment using vendor specific tools.

Three ways to reduce operating costs of power generators with remote management

3.1 The communication gateway (IIoT Gateway)

Communication gateways are devices that handle the connection to the equipment being monitored and controlled. The connection is generally through a serial or Ethernet based communication link and might use a protocol such as Modbus RTU, Modbus TCP or SNMP.

In most cases the communication gateway needs to be able to work independently from other systems once deployed. For this reason, the communication gateways usually offer a store and forward functionality where locally collected data is stored inside the gateway. If the connection to the overall management system fails, this ensures that data is never lost as it is stored and uploaded once the uplink connection is re-established.

Generator performance data, together with information regarding events occurring in the field, can be sent to the management server by the communication gateway. This data or notifications can be sent based on local conditions or at preset intervals as demanded by the application.

To communicate with the management server, the gateways generally use either mobile networks, such as GSM/GPRS or 4G, or Ethernet based communication using TCP/IP based protocols.

An example of a communication gateway - The Netbiter EC360 from HMS

Some communication gateways are also being equipped with local intelligence, the ability to perform local calculations and logic functions on the collected data, or trigger alarms based on multiple conditions. This also reduces the amount of data to be sent between the communication gateway and the management server. This is known as Edge processing.

3.2 Connecting to remote sites

A common challenge to solve is gaining network access to the remote equipment installed in on site. Many solutions exist but they often require open data ports in firewalls or bespoke VPN based connections. It is normally better to avoid such solutions as open ports in a firewall reduce the protection of the site and VPN based access may be difficult to manage for non-permanent installations. A more secure method is to use a solution where the communication gateway initiates and maintains the connection to the remote server (only outgoing TCP/IP connections need to be open) and also uses communication protocols that only map selected data from selected equipment to the remote server, instead of opening transparent access to the field site.

Another benefit gained from the gateway-initiated connection, is that no special SIM cards with public or static IP addresses are required when using a mobile connection, which is a common requirement with power generators.

Three ways to reduce operating costs of power generators with remote management

3.3 The central management server

A remote management system is not only about the information that is collected from the equipment such as power generators. Another important aspect to consider is how to commission, manage and maintain the communication gateways themselves so that they are up to date from a security point of view (more on security later). As the fleet of remote equipment grows over time this can become a major overhead. This is usually referred to as device management.

Argos from HMS is an example of a central management server

It may also be a good decision to use a solution where the communication gateways can be pre-configured for the intended application. This makes installation simple and requires no programming or IT expertise so solutions are easier to deploy in the field.

This also allows for equipment to be managed based on the application, regardless of installation site. As both the data configurations and the gateway settings are centrally managed, the device management server can offer better re-usability and scalability, as well as an up-to-date cloud-backup of gateway configurations in case a communication gateway gets damaged in the field.

3.4 Data presentation and integration

The information which is stored on the management server is best presented using a standard web browser, this removes the requirement of installing and maintaining specific software or hardware media. There are normally several different tools and functions available in the server to simplify the presentation and analysis of the data from the remote equipment. Some common presentation features are geographical overview of the installations, customizable dashboards, and reports.

Data presented in graphical dashboards can either be historical data, collected at regular time intervals, or “live” data requested on-demand. Caution should be taken when data is requested on-demand, as this can drive up the cost for data transfer when using connectivity over cellular networks.

The server might also offer functions to provide access to the data stored through RESTful APIs. Today, a RESTful API is the most common way to share data over the Internet and between different applications such as logistics and service management systems.

Three ways to reduce operating costs of power generators with remote management

3.5 Remote Access

Remote access establishes a transparent connection between your computer and the equipment over the internet, creating a link to the equipment which operates the same as if you were directly connected!

Remote Access enables more advanced capabilities compared to data collection. Protocols such as Modbus RTU or TCP can be run over pre-established serial or ethernet communication interfaces. Remote Access enables troubleshooting and configuration utilizing equipment vendor specific software tools, enabling capabilities such as remote firmware update of the connected equipment, extraction of internal data log files from a controller, or accessing an internal webserver such as on a webcam to view the remote site.

From a security point, it should be possible to set limits on the remote access connection.
A recommendation is to have the option to limit the access based on user rights, the connected IP-address, data port or interface. It should be possible to restrict, from the remote site, when a remote access connection should be enabled and also to indicate when a connection is active.

Remote access is an important part of a remote management system to enable sophisticated trouble shooting.

A remote access connection of DEIF controllers enabling using DEIF utility software remotely.

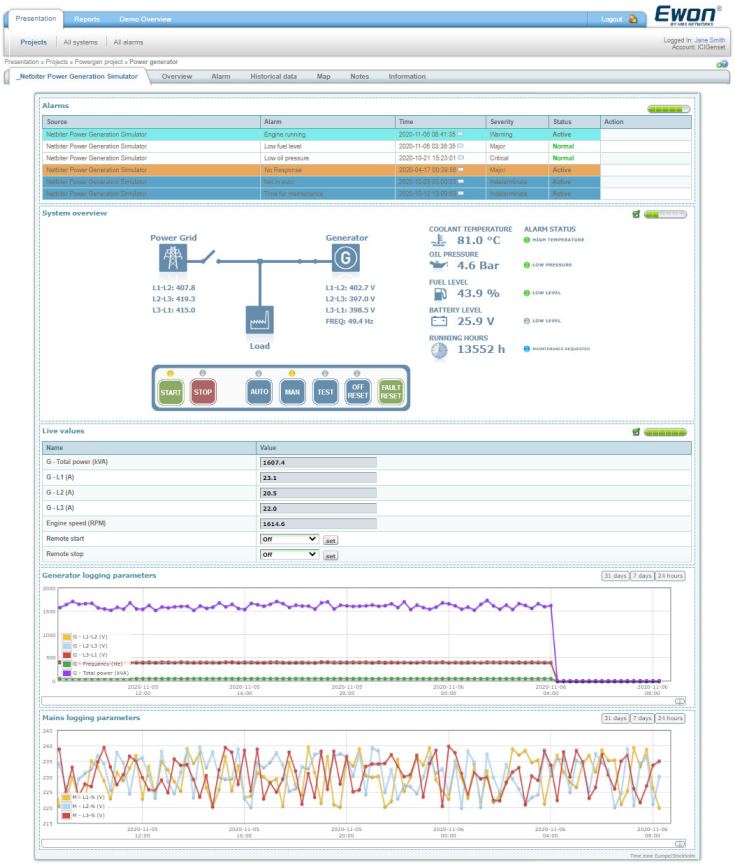
Three ways to reduce operating costs of power generators with remote management

4.0 What information can you get from your power generators?

Remote monitoring can be used to monitor and control all parameters of your power generators in the field.

You can, for example:

- Check fuel levels
- Monitor fuel consumption and see when it's time to refuel
- Check oil pressure
- Check battery status
- Check coolant temperature
- See the current and generated power output
- Track the location of mobile generators via GPS
- Detect unauthorized movement of equipment through geo-fencing
- Test start your generator remotely
- Prioritize your workload with alarm severity levels
- Direct alarms to go to the correct service staff



Example of a dashboard

But modern remote management can also offer remote access to your equipment, meaning that you can do configuration remotely using the vendor's own utility/ configuration software. Just like being on site.

4.1 What could you gain with remote management?

- Improve service to customers
- Reduce on-site scheduled and emergency service visits
- Receive and direct alarms to service personnel whenever certain thresholds are reached
- Generate reports on how different equipment is performing and analyze over time

Three ways to reduce operating costs of power generators with remote management

4.2 What about older power generators?

Today it is common that power generators are equipped with an intelligent controller, Modbus RTU/ TCP is the de-facto communication standard which enables detailed monitoring. What about controllers that are not equipped with an intelligent controller and do not have the possibility to upgrade to one?

Simple monitoring can be a retrofitting option. It is common among simpler genset controllers to have support for various digital or dry contacts to indicate faults or operating status. These I/O are usually configured in the genset controller based on functionality. Another possibility is to use in-direct monitoring where additional sensors are added, such as energy meters to monitor loads or mains. Some remote communication gateways support various I/O that can enable this type of monitoring.

Here are a few examples of what can be monitored or even controlled using basic I/O:

- Generator running indicator
- Generator start/stop
- Generator alarms
- Emergency stop
- Starter battery monitoring
- Fuel level
- Running hours

To extend this further, if the power generator is equipped with an ECU (Engine Control Unit), there are communication gateways that support the CAN-J1939 communication interface and protocol. This offers monitoring of the power generator's ECU and detailed data can be acquired such as RPM, engine temperatures and fuel consumption.

Three ways to reduce operating costs of power generators with remote management

5.0 What about security?

Establishing a secure communication path with a remote monitoring solution requires solving a few technical challenges (such as secure access through firewalls). Moving data off-site raises concerns over both its security and availability.

By using solutions that are “firewall-friendly” and restrict communication to only the intended data, it is possible to limit the amount of information that can be accessed. This reduces the possibilities of misusing the remote access. Remote management solutions also use encrypted communication to avoid eavesdropping on the data exchange.

Another method to ensure the security of wireless communications over GSM or 4G, is the use of dedicated SIM cards with a private APN supplied by the mobile operator. This means that it is not possible to ping or access the remote site through link other than via the intended connection from the management server.

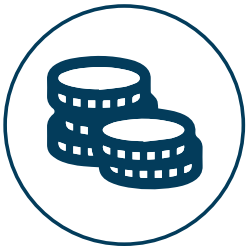
Security should consist of a layered approach where multiple security precautions are implemented. Today various security standards are referenced such as ISO 27001 and IEC62443. These mandate how vendors manage security, from their company management point of view to how the products and services are developed, and this should be something to consider when choosing a vendor.

While remote management vendors are to a large extent reliant on cloud infrastructure solutions such as AWS and Microsoft Azure, it is important to point out that it is the remote management provider who is responsible for developing and maintaining its application in a secure way. It is common practice to regularly perform so called security audits of the remote server and remote gateway, and to ensure that the security protection is up to date and to detect any security holes.

Access to the remote management system is normally centrally controlled and requires authentication. Multi-level password layers are used to provide permissions to access different functions, and the server authenticates users and ensures their correct access levels. The server may also record all user access as well as attempted access. A secure and reliable remote management solution requires encryption both between the power generator in the field and the cloud service, as well as between the cloud service and the user’s web interface.

Three ways to reduce operating costs of power generators with remote management

6.0 Finding your solution for optimal ROI



Custom-made remote monitoring systems will give you the exact functionality you need, but they are often costly to develop and time-consuming to deploy. It is common to utilize multiple vendors, solutions and services to complete or develop the desired system.

A challenge with this approach is how to manage a system over time and keep it up to date, while still focusing on your core products and services.

A ready-made remote solution makes it possible to quickly deploy systems at a lower initial cost. Many solutions are based on a Software-as-a-Service business model (SaaS) which allows for very low initial investment as you only pay for what you use. As your requirement grows, these solutions commonly offer further integration possibilities, as mentioned, to extend capabilities along with your business model.

Today many genset vendors also offers their own remote solutions which are specific to their products. While this is beneficial for one particular product, this approach can be difficult to manage, resulting in multiple vendor specific systems and solutions, especially if you are using equipment from multiple brands, or if you want to monitor additional, external, peripheral equipment in conjunction with your genset.

An important factor to consider is that the solution should be a good fit with the genset control panels that you are using. Some remote management solutions, like the Netbiter and Argos from HMS, have specialized options for power generators, including pre-defined configurations for a wide range of control panels from different manufacturers, as well as built-in features for fuel level management etc.

The cost of a communication gateway is normally less than the average cost of a service visit, so ROI is easily calculated and quickly achieved. And by cutting down on travelling, it is also possible to reduce a company's carbon footprint and make service visits only when really needed.

6.1 What are the costs involved?

You pay for the communication gateway which connects to the power generator. Most modern remote management solutions offer different service levels for cloud access. Free versions with basic functionality are often available offering a very quick return-on-investment. Premium services are commonly offered with additional capabilities and functionality such larger data storage, reporting, API integration and user management, to mention a few.

Data transfer charges needs also to be considered, especially if the data is transferred over mobile networks.

Three ways to reduce operating costs of power generators with remote management

7.0 Conclusion

In this paper we have shown how a remote management solution is a good fit for power generator operators. It can reduce operating costs, extend the lifetime of equipment and improve the planning of service visits and refueling. And even a current install base can easily be upgraded for simple monitoring and control.

Current remote solutions offer much more than simply an alarm when something needs attention. Data can be processed and analyzed to improve operating parameters. Generators can be remotely started to check their availability when needed. Engineers can be sent where and when they are needed, and they can take the right parts with them.

No matter which solution you choose, the ROI will most likely be fast. A service visit is usually the same cost as a single remote management gateway, meaning that you may have a payback time of only a few months, weeks or even days.

Act now and get started today!

Work with HMS Networks. The number one choice for industrial communication and IIoT.

Anybus® BY HMS NETWORKS

Ewon® BY HMS NETWORKS

Intesis™ BY HMS NETWORKS

Ixxat® BY HMS NETWORKS

hms-networks.com