

Black start – essential for power plant security



Back-up diesel or turbine sets for black starting the main generating plant used to be a common occurrence at power stations. The reasons for the lack of these facilities at most modern plants can be technical, but more often than not they are commercial - the extra capital costs for black starting can be prohibitive.

Plant and grid failures are few but power companies and plant managers need to bear in mind that accidents and systems failures do occur. Without black starting, re-establishing the supply system can be difficult, severely delayed and therefore costly. Investing in a

Black start is the procedure for recovery from total or partial shutdown of electrical supplies throughout the country's national transmission system or supplier distribution network. A little additional outlay on capital cost to ensure back-up for potential systems failure can prove to be a time and money-saving option.

All power stations, with the possible exception of small hydro-electric generating stations, need an electrical supply to start up. To be able to black start, a station must have some form of independent auxiliary supply with sufficient capacity to supply the unit auxiliaries while a main generator is prepared for operation.

This additional power source is usually provided by a smaller peripheral black start generating plant, which is started from a battery or other energy storage device. Once operational, the power plant can then be used to energize part of its local network, providing supplies for other plant within the area to enable them to start-up.

For partial or total shutdown of the transmission system, the general principle of recovery includes re-establishment of isolated power stations to provide 'power islands'; these are then integrated into larger sub-systems eventually allowing the re-instatement of the whole national grid system. By having this capability at a number of strategically located sites, electrical supplies can be rapidly restored.



secure back-up is essential to minimize the consequences of system failure.

Power companies should be able to start up the main generating plant within an agreed period and without use of external power supplies. Black start should also supply enough power to run auxiliary equipment at the power station throughout an agreed

start-up period. The station as a whole must be able to provide at least three sequential black starts to allow for possible tripping of the transmission system during the re-instatement period.

Rising demand in the Middle East

Power failures in the Middle East are usually caused by overloads during the summer's extremely hot temperatures or grid short circuits commonly caused by substation transformer overloads.

Demand for power in this region is increasing on average by 6 to 10 % per year. As a result, Middle Eastern countries are obliged to invest in large gas or steam turbine power plants to meet this demand. This growth in power plants and the need for power security have meant that black start facilities in the Middle East are a developing niche market for Wärtsilä.

Another factor in the equation is the need to carry out water purification on an increasing scale. It is the rule, rather than the exception, that each plant is equipped with a black start facility to start the turbine in case of total grid blackout and to maintain power to safety equipment. Output of black start facilities is dependent on the turbine type and the type of safety equipment the customer wants to connect to the black start.



U.A.E:

Tawella B	3x16V25	total output 9 MW
Umm Al Nar	1x9R32	total output 3 MW
Jebel Ali A	2x16VUD45	total output 4 MW

OMAN:

Al Kamil	1x18V200	total output 3 MW (under commissioning)
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SAUDI ARABIA

Shoailba	6x18V32	total output 34 MW
PP9	2x18V32	total output 10 MW

ALGERIA

Hassi Mesaoud	1x18V200	total output 3 MW
Hassi Berkine	1x18V200	total output 3 MW

Current Wärtsilä black start projects in the Middle East.

Although there are obviously special heat and humidity conditions in the Middle East, these do not pose real problems for black start as long as the correct maintenance procedures are followed. The main priority is increased regularity of inspection and cleaning of filters to avoid problems with dust and sand.

As a vital piece of safety equipment, black start facilities must be maintained in line with Wärtsilä's recommendations and the site conditions. Test black starts should be performed regularly every week



or fortnight to ensure that all auxiliaries are performing properly and that the load sequence is correct.

To handle higher temperatures and humidity in the Middle East, the size of the radiator is usually increased and special materials are employed to avoid fast corrosion. This can affect the investment cost

of the black start facility itself of course. But black start investment costs are low compared to the investment of the power plant and the increased levels of security achieved through black start.

Extensive Wärtsilä experience

Wärtsilä has extensive global experience of supply black start systems. In the Middle East, the company currently has eight black start facilities with outputs ranging from 3 MW up to 34 MW. Wärtsilä is also working on many ongoing black start projects for power plants and various industries in the United Arab Emirates, Kuwait, Qatar, Oman and Saudi Arabia.

An interesting development in the Middle East is that the increasing number of heavy industries established in the region over recent years require high-capacity emergency gensets (above 3 MWe) with black start capability. Recent Wärtsilä sales of this kind of equipment in the Middle East include two 18V200 engines, each with a capacity of 3 MW, to QAFCO in Qatar. ■

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