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Diesel Fuel & Back-Up Generation

Issues for CEOs, Risk Managers and Diesel Users

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Executive Summary

Diesel back-up generators are a common and effective way of protecting organisations against the economic and social consequences of power disruptions. This paper provides information and general advice on issues organisations should be aware of to ensure that back-up systems operate effectively when most needed. This paper is separated into two sections.

Section 1 provides CEOs, risk managers and diesel users with some background on the diesel market in Australia, including the key supply and demand issues that may arise with a power disruption. Demand for diesel in Australia is increasing due to strong use in industrial sectors (such as mining and agriculture) and an increase in passenger cars using diesel. The rising demand for diesel has also been driven by unexpected events, such as the Varanus Island gas disruption in 2008 and Victorian/South Australian heatwaves and bushfires in 2009.

Section 2 examines the issues an organisation needs to consider in the maintenance and testing of back-up generators and their fuel. For ease of reference, checklists have been developed to assist organisations in gaining a better understanding of their generator and fuel requirements.

While there may not always be a business case for organisations to take steps to address many of the issues, an awareness of these issues will be useful in preparing and revising contingency arrangements.

Issues to Consider - Summary

Supply and availability of diesel - see section 1.4

- Increased demand for diesel during a power disruption
- Interdependencies between diesel and the liquid fuels, electricity and transport sectors
- Government allocations during a liquid fuels shortage

Generator maintenance and testing - See Checklist at section 2.1

- Regular generator testing under load
- Generator spare parts
- Trained maintenance personnel

Fuel requirements - See Checklist at section 2.2

- Generator operation capacity
- Fuel testing and management regimes
- Refuelling contracts
- Access to fuel in the event of government intervention

Introduction

While the Australian energy industry has a strong track record for reliable energy supply, the exposure of energy infrastructure to a range of potential hazards, including natural events and deliberate attack, means that uninterrupted supply cannot be guaranteed. Diesel back-up generation is a common and effective way of protecting organisations against the economic and social consequences of power disruptions.

The first edition of this paper was developed in 2005 by the Energy Infrastructure Assurance Advisory Group (EIAAG) and the National Oil Supplies Emergency Committee (NOSEC) to assist CEOs and risk managers in assessing and revising contingency plans incorporating diesel back-up generation.

This revised edition had been updated using current statistics, recent incidents and fresh perspectives to maintain and enhance its relevance to CEOs in their emergency planning activities, particularly if they have a need for diesel. Section 1 provides an overview of diesel supply in Australia and outlines issues that are likely to impact on the ability of organisations to source diesel fuel during a significant power disruption. Section 2 outlines factors that should be considered by organisations in relation to the effective operation of individual generation systems.

Section 1: Supply and Availability of Diesel

Key issues for CEOs and risk managers:

- Demand for diesel is likely to increase during a large scale electricity disruption.
- Simplified domestic supply chains have reduced the amount of diesel fuel available at short notice.
- In the event of an actual production or supply disruption or diesel shortage, the major refineries in Australia have rapid and comprehensive strategies in place to respond to such disruptions
- The supply of diesel may be slowed during a power disruption due to interdependencies with the electricity and transport sectors.
- Governments may allocate fuel to essential users during a liquid fuels shortage which may coincide with, or be caused by, a power disruption.

During an extended power disruption, organisations relying on diesel back-up generation may need to replenish their fuel supply at short notice. The ability to source this fuel will be dependent on a number of factors external to the organisation, including:

- an increase in the demand for diesel;
- the amount of fuel available in the supply chain to meet short-term increases in demand;

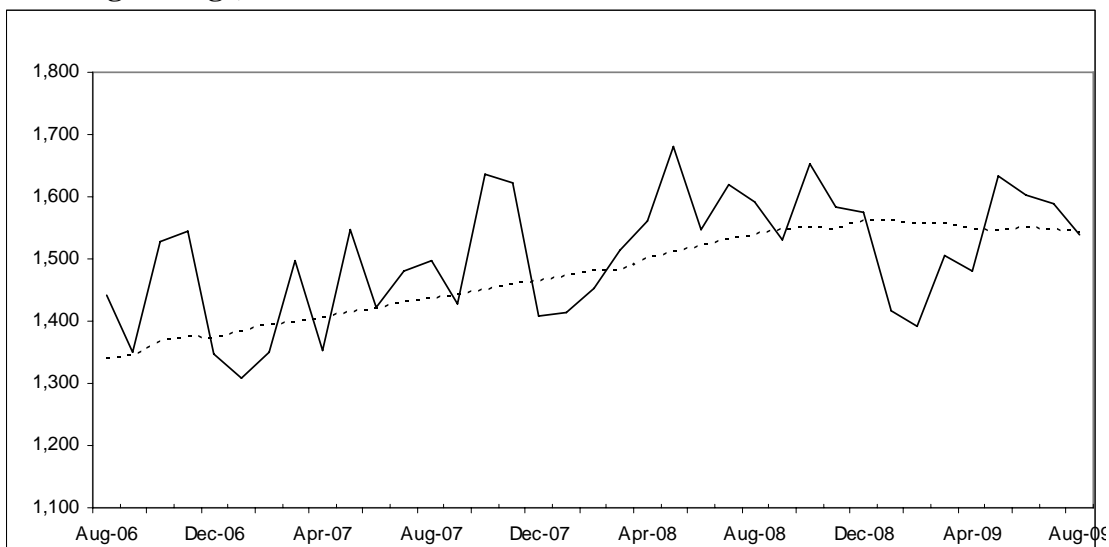
- interdependencies between the electricity and transport sectors;
- availability of delivery vehicles, particularly during peak demand periods e.g. mini-tankers (see Case Study at 2.2); and
- regulatory arrangements which may be used to allocate fuel during an emergency or shortage.

While there may not always be a business case for organisations to take steps to address many of these risks, an awareness of these issues will be useful in preparing and revising contingency arrangements.

1.1 Demand for Diesel

As Figure 1 below shows, the demand for diesel fuel has been growing strongly in Australia in recent years on top of strong industrial use (through mining, transport and agricultural industries). This growth is due to factors such as increased use of diesel in passenger vehicles but also due to a number of unforeseeable events such as the Varanus Island gas disruption and Queensland floods in 2008, and the South Australian/Victorian heatwaves and bushfires in 2009. With regard to the Varanus Island gas disruption, as a result of some businesses fuel switching to diesel to replace gas, it was reported that the demand for diesel increased to between 3.0 to 3.3 mega litres per day, an increase of between 30 to 40 percent of normal rates.ⁱ

Figure 1ⁱⁱ: Sales of Automotive Diesel Oil (mega litres, dotted line 12 month moving average)



During an extended or widespread power disruption, demand for diesel fuel could be expected to rise sharply. Many organisations have back-up generation, however most generator tanks hold insufficient fuel to allow operation beyond 24 hours, with a limit of several hours being quite common. As such, there would potentially be numerous organisations seeking to refuel their generator tanks at very short notice.

Further, many emergency and essential service vehicles operate on diesel fuel. There is likely to be an increased call on these vehicles to operate in the event of a significant

power disruption, for example through the need for increased police patrols and SES assistance. Although the aggregate fuel required by these vehicles is likely to be a small part of available supply, their refuelling may be prioritised over other organisations (section 1.3).

In Australia, the majority of diesel is sold in bulk to commercial and industrial customers in the mining, transport and farming sectors on long term contracts through commercial tender arrangements. Diesel also has inelastic demand with changes in prices.

1.2 Diesel Supply

Simplified Supply Chains

A third of Australia's diesel fuel is imported. Maintaining a reliable fuel supply is the highest priority for the downstream petroleum industry and government. There are also strong competitive pressures on industry to reduce inventory and maintain efficient supply chains (the same economic driver for many product supply industries). To illustrate the changes to the liquid fuel supply chain over the last decade as a result of these competitive pressures, the Australian Institute of Petroleum (AIP) reportsⁱⁱⁱ that:

- there is little or no surplus tankage for crude oil at refineries, and crude tanks operate between full and relatively low inventory on a regular basis, in line with the supply shipping pattern;
- fuel distributors increasingly supply their customers directly from large terminals or other seaboard facilities, rather than double handling product through depots as in the past;
- the use of storage tanks at depots has typically been decommissioned leaving less capacity for storage;
- the reduction in the number of secondary storage facilities and ongoing decreases in the number of retail service station sites has resulted in an overall decline in the amount of product in the domestic distribution system; and
- the requirement for increased fuel imports since 2003 to meet domestic fuel demand, has meant that Australian refiners have had to consider more international supply options to meet demand.

These trends have reduced the level of supply available to be called upon at short notice. The level of consumption cover in the diesel supply chain will vary depending on the time of year and a range of other operational factors; however in 2007-08 it averaged 13 days, down from 17 days in 2003-04 and 22 Days in 2000-01^{iv}. These 'days of cover' generally refer to coverage in 'average' or 'normal' demand and supply periods, and during periods of unexpected demand spikes for example, 'days of cover' will likely be lower than normal (eg. during major agricultural harvests that commence at short notice)

Risk of Fuel Supply Disruptions

Unplanned events can impact on refinery and supply operations and create fuel supply challenges at short notice. CEOs and Risk Managers must ensure they have a broad understanding of market issues and industry management strategies in order to best negotiate these situations.

Each liquid fuel supply or production disruption involves a series of events which develops in its own way. The actions to address the situation will also unfold in a dynamic manner with different impacts at different points in the supply chain. There are a variety of potential events in the supply chain which may or may not prove to be an issue for certain types of fuel customers, such as:^v

- refinery production disruptions;
- delay in supply of crude or product from another location;
- actual demand exceeding identified supply requirements of customers; and
- stocks insufficient to meet short-term shortfalls in supply.

The impact of these factors on supply is rarely felt by consumers as refiners and major fuel suppliers are adept at managing these issues as part of day-to-day operations. However, shortages could occur where a normally manageable disruption in liquid fuel supply coincides with a significant power disruption, both due to the rise in demand for fuel and where refinery or distribution operations are affected by the outage.

Approximately 65 per cent of the diesel fuel consumed in Australia is produced by local refineries. Further to this, domestic refineries source 72 per cent of their input from imported crude oils.

How Industry Manages Disruptions

In the event of an actual production or supply disruption or diesel shortage, the major refineries in Australia have rapid and comprehensive strategies in place to respond to such disruptions and established protocols with the state and territory governments, and the Commonwealth. The range of response options can be categorised into four types, namely:

- in-refinery options (e.g. repairing the production unit or handling facility, drawing down refiner stocks, truncating any current maintenance program, increasing production throughput and other technical refinery options);
- sourcing supplies from other refiners;
- sourcing supplies internationally (e.g. purchasing term, spot, partial or stranded loads or redirecting international cargoes bound for other ports); and
- carefully and equitably allocating available bulk fuel supplies to customers.

The Australian Government's National Energy Security Assessment 2009^{vi} and Liquid Fuel Vulnerability Assessment both assessed Australia's international supply chain as reliable^{vii}. Diesel can readily be sourced from overseas, including the potential for ships to be redirected to Australia or different Australian ports at short notice. Asia is a

useful and regular source for diesel, meeting Australian quality standards, in the event of a shortage or disruption. However, it would still take approximately 10-15 days for supply from Asia to reach the Australian market.

The Australian Government does not maintain strategic stockpiles of diesel fuel for emergencies, however the current level of *industry* stockholdings reflects a considered assessment of the operating conditions throughout the supply chain. The level of stockholdings also accounts for risks that are more likely to be encountered by refiners and others in operating the supply chain.

1.3 Interdependencies

The increase in demand for diesel fuel during a power disruption is likely to be accompanied with declining or sporadic supplies of diesel fuel due to the interdependencies between liquid fuels and the electricity and transport sectors.

Many elements of the diesel supply chain are dependent upon electricity, with varying levels of back-up capacity installed. For example, the majority of service stations do not have back-up generation facilities and would be unable to pump diesel during an outage. Where refineries and terminals are affected by a power outage, production would be interrupted at the refinery, transfers to terminals would be interrupted, and loading of trucks at the terminals would be impacted. The capability of this infrastructure to recover quickly or to switch to an alternate power supply varies by location, but could take up to 24 hours at a terminal.

A rise in the demand for diesel to refuel generator tanks would also create an increased demand for trucks and qualified drivers to transport the diesel. These may be potentially difficult to source at short notice. Other transport-related factors, such as congestion and lack of operating traffic lights, may also impede the prompt delivery of fuel to many areas.

1.4 Regulatory Considerations

In the event that a power disruption causes, or coincides with, a liquid fuels shortage, governments may intervene to allocate fuel to essential users. Government intervention may be at the State/Territory and/or Federal level, depending on the extent and duration of the power and the fuel supply disruptions.

All Governments have emergency response legislation in place to respond to a jurisdiction liquid fuel emergency. At a national level, the *Liquid Fuel Emergency Act 1984* (LFE Act) provides the Minister for Resources and Energy with wide-ranging emergency powers to control the allocation of scarce liquid fuels (including diesel). The LFE Act is supported by the *Liquid Fuel Emergency Guidelines 2008*. These provide the Australian Government and the fuel industry with guidance on matters that a decision maker must consider in making a Determination under the Act, to manage a national liquid fuel emergency.

The National Oil Supplies Emergency Committee (NOSEC) is the main executive channel through which governments and industry formulate their overall management

response in the event of an actual or likely fuel shortage with national implications. NOSEC has developed a National Liquid Fuel Emergency Response Plan which provides the operational guidelines for responding to a national liquid fuel emergency.

Consistent with Australian Government policy, measures developed by NOSEC to manage a fuel supply shortage would attempt to minimise government intervention. In the event of significant liquid fuels disruption, Industry capabilities such as sourcing additional stock and allowing the market to reduce fuel demand through the price mechanism, would be encouraged in the first instance. Failing these measures, the Government would seek voluntary restraint with the support of the oil companies or through public awareness campaigns. Depending on the severity of the shortage, the Government may move to a system of reserving bulk supplies for ‘essential’ users and controlling retail sales.

Classification of essential users has been defined in the LFE Act and LFE Guidelines 2008, where the classification is defined by the user’s need for a particular refined petroleum product to undertake an activity that relates to:

- Australia’s defence; or
- the provision of the particular product as fuel for ships and aircraft engaged in international or domestic trade or commerce; or
- the export of the particular product from Australia; or
- activities essential for the health, safety and welfare of the community as listed in the ‘Liquid Fuel Emergency (Activities – Essential users) Determination 2008’ (the Determination).

Those activities listed in the Determination include:

- ambulance services;
- corrective services;
- fire or rescue services;
- police services;
- public transport services;
- State Emergency Service or an equivalent organisation; and
- taxi services.

Section 2: Diesel Back-Up Generators

In addition to the external factors impacting on diesel supply, there are a number of issues that organisations should be aware of in relation to their individual diesel generators, including their maintenance, testing and fuel requirements.

2.1 Generator Maintenance and Testing

Diesel back-up generators are a common and reliable mechanism for assisting organisations respond to power disruptions. However, for effective operation in the event of an outage, generators must be well-maintained and tested regularly.

The specific testing and maintenance procedures for generator units will vary in accordance with its make, size and operating conditions; however as a guide, industry experts suggest that generators should be tested at least once a month, if not more often^{viii} It is also reported that the rate of discovery of potential problems when systems are tested under load for at least half an hour is almost twice the rate of when a system is tested by manually starting the generating equipment and letting it run without load^{ix}

The following checklist covers some of the critical questions that CEO's/Risk Managers may be asked regarding their building's back-up generator during a power outage.

Experts estimate that, during the North American blackout which affected more than 50 million people in 2003, **more than 20%** of back-up generation systems either did not start, or ran for only a few minutes before sputtering out – this was largely due to the insufficient testing and maintenance of the generators

source: NFPA (endnote viii)

Generator Maintenance and Testing - Checklist for CEOs and Risk Managers			
Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does your building's back-up generation have the capacity sufficient to maintain necessary operations for an extended outage?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the generating plant itself robust enough to withstand continuous operation in hot weather?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is there sufficient airflow around the generator to prevent overheating?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Has the wiring on the premises been adequately structured to support back-up generation?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	In the event of load rotations or 'rolling blackouts', is the electrical installation on the premises adequate to maintain essential operations while diverting the non-essential operations to the external (grid) supply?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you know where and how the organisation sources spare parts for the generator?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the organisation have a maintenance contract for the generator?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the organisation maintain the recommended maintenance procedures?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the generator exercised monthly?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is the generator operated under load to adequately test the entire system?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you know how many people in the organisation are trained to maintain and operate the generator unit? Are these personnel 'on call'?

2.2 Fuel Requirements

The potential difficulties in sourcing diesel fuel outlined in Section 1 of this paper also highlight the importance of taking prompt action to secure fuel supply in the event of a significant power outage. Organisations (and the relevant personnel within organisations) must know and understand their fuel requirements, including how long their generator will operate before requiring refuelling; the availability of additional on-site storage; and the quantity of fuel required to support the power needs of the organisation for essential and/or non-essential operations.

Organisations should also be aware that diesel fuel has a useful life, and fuel suppliers typically recommend fully turning over backup diesel stocks each year to help ensure continued fuel quality. In addition, diesel stocks should preferably be replaced in winter so that the fuel can be used in all Australian seasons. Summer grade diesel fuel would cause filter blocking in winter due to wax precipitation and settling. Organisations who plan to rely on backup diesel stocks should discuss their specific fuel and storage requirements with their fuel supplier to determine what fuel management measures are appropriate.

The following checklist covers some of the critical generator-related questions that CEO's/Risk Managers may encounter during a power outage.

Fuel Requirements - Checklist for CEOs and Risk Managers			
Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you know what type of Fuel is required? i.e. for generator tank/vehicle etc.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you know the capacity of the organisation's generator fuel tank?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Do you know the daily fuel requirements for continuous operation of the generator under load?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is on-site fuel storage available? Do you know storage capacity?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the organisation have a fuel testing/fuel management regime?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is there a replacement schedule in place for stored fuel (including the generator tank)?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Is there sufficient access for refuelling tanks? Are small refuelling trucks required?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Does the organisation have a contracted supplier for emergency refuelling?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Would the organisation be considered an 'essential user' under state/territory or LFE arrangements?

An example of how a State Government would manage a disruption is outlined in the case study below. This case study examines how a power outage affects liquid fuel supply and the issues that can arise in refuelling back up generators in the Brisbane CBD. This case study is useful in that it summarises issues raised in both sections 1 and 2.

Case Study: Brisbane CBD

- All Brisbane CBD Critical Infrastructure operators who own or tenant buildings rely on emergency building power generators during power outages. These buildings must have power supplied continuously to maintain insurance policy requirements (i.e. fire detection, security).
- Most of these operators have emergency generator fuel to allow at least 24 hours of operation. Only some building managers have contracts with a mini tanker operator for diesel resupply.
- South East Queensland mini-tanker operators have about 40 mini tankers in the region which can be used for refuelling emergency generators.
- The majority of mini tanker jobs are contracted to large customers outside of the CBD. Generator refuelling tasks in the CBD are infrequent.
- A mini tanker dispatcher determines the urgency and quantity of refuelling requests. Contracted buildings are given priority; other fuel orders can't be filled until sufficient customer details are provided. Mini tanker operators recommend that all building managers establish contracts to streamline supply in emergencies.
- During a power outage, mini tanker dispatchers could expect hundreds of calls per hour and long delays would be likely.
- Mini tanker operators are unlikely to be able to break contracts with customers outside the CBD unless an official emergency was declared by the Queensland Government and directions given to divert to CBD resupply.
- Operators have estimated that with 24 hour operation and all mini tankers diverted to CBD generator refuelling, about 150 refuelling jobs could be completed every 24 hours. Some forward positioning of larger fuel tankers to supply the mini tankers may be necessary to avoid long road trips for the mini tankers to the fuel terminals.
- With the above mentioned arrangements optimally in place, most Brisbane CBD building generators could be refuelled without loss of power to buildings, this could be sustained indefinitely and critical infrastructure services could be maintained.

Conclusion

There are a number of issues which will impact on the effectiveness of organisational risk management strategies incorporating diesel back-up generation. External to their business procedures, CEOs and Risk Managers should consider that the ability of their organisation to source diesel may be affected by increased demand, reduced consumption cover in the supply chain, regulatory arrangements and interdependencies with transport and electricity.

From an internal perspective, CEOs and Risk Managers should consider their fuel requirements and ensure their generator is well-maintained and tested regularly. Organisations should also discuss their specific requirements with their fuel supplier to determine what fuel quality management and storage measures are appropriate.

It is acknowledged that there may not always be a business case to address many of the issues outlined in this paper, however an awareness of them will assist CEOs and Risk Managers in preparing and evaluating effective contingency arrangements. Where appropriate, organisations are encouraged to reduce exposure to these risks, for example through contracting emergency fuel supply, replacing their diesel stores regularly and understanding how external factors such as regulatory arrangements will impact on their ability to source diesel during a significant electricity disruption.

Contact Details

Energy Infrastructure Assurance Advisory Group (EIAAG)

The EIAAG is part of the Australian Government's Trusted Information Sharing Network (TISN). It facilitates the sharing of information between the owners and operators of liquid fuels, gas and electricity infrastructure on threats, vulnerabilities and appropriate measures and strategies to mitigate risk. The EIAAG is comprised of representatives of the Australian Government, all State and Territory Governments, industry associations and the owners and operators of energy infrastructure.

Further information on the EIAAG and the TISN can be found at www.tisn.gov.au or email eiaag.secretariat@ret.gov.au.

National Oil Supplies Emergency Committee (NOSEC)

NOSEC is the main executive channel through which Governments, in cooperation with industry, formulate the overall response to a widespread fuel shortage. NOSEC reports to the Ministerial Council on Energy (MCE) and comprises officials from the Australian Government, State and Territory Governments and the oil industry.

Further information on NOSEC is available at www.ret.gov.au
The NOSEC Secretariat can be contacted at NOSECsecretariat@ret.gov.au

Endnotes

ⁱ Western Australia Office of Energy, Gas Supply and Emergency Management Committee Report to Government, September 2009,

<http://www.energy.wa.gov.au/cproot/1574/14976/GSEMC%20Report%20to%20Government.pdf>

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ⁱⁱⁱ Australian institute of Petroleum, Maintaining supply Reliability in Australia, April 2008,

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^{viii} National Fire Protection Association (US), *Ensuring Reliable Emergency Power*, 2004

^{ix} Electrical Generating Systems Association, *Diesel Fuel Basics*,

<http://www.egsa.org/powerline/plarticle.cfm?article=44>