

# **Distributed Generation opportunities for Lines companies**

16 June 2005

# International trends toward DG

- Internationally, distributed generation is attracting increasing interest and policy attention.
- There are five major factors behind this trend:
  1. Electricity market liberalisation,
  2. Developments in DG technology,
  3. Constraints on the construction of new transmission lines,
  4. Increased customer demand for highly reliable electricity, and
  5. Concerns about climate change.

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Why is DG of interest?

## 1. Managing risk

- Peak capacity/system efficiency
- Enhancing network security
- Installed on demand side – increases system diversity and manages supply risk

## 2. Enhancing profitability

- Reducing network operating costs – response to price signals
- More capital efficient - deferral of capex/staged upgrade

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Why is DG of interest?

## 3. Business growth opportunities

- Creation of a 'virtual utility'
- New technologies to control output from DG at multiple sites to respond to market conditions.
  - Auto synch control panel
  - SCADA or Internet dispatch
  - Internet monitoring
- Integrating DG into load management
- Re-establishing a relationship with end use customers

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# What has created renewed interest?

## 1. Business imperatives

- The need for ongoing investment to match increases in demand and/or security of supply
- Seasonal distribution bottlenecks
- Realisation that the pro-active stance taken by some may leave the cost/risk burden with others
- Lack of alternatives – buying time

## 2. Regulatory changes

- Allowing 50MW of fossil fuel generation capacity (or 20% of maximum demand) and unlimited renewables (excluding hydro)

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# What has created renewed interest?

3. High cost of sustaining centralised distribution
4. Information
  - Pro-active nature of some Lines Companies
  - Advocation of a new paradigm (e.g. CAE)
  - Overseas trends toward DG
5. Availability of technology
  - Technological advances in generators – lower emissions, fuel efficiency, automatic synch control
  - Greater number of installed generators/capacity
  - Current affordability of smaller scale generators

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# DG technologies

- Reciprocating engine
  - Diesel
  - Gas
- Gas turbine
- CHP
- Photovoltaic – main application in solar water heating (energy substitution)
- Wind – if farm sizes are 1MW to 5MW

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Reciprocating engine

- Most common technology
  - Low capital cost
  - Large size range
  - Fast start-up to load (20 seconds)
  - High electric conversion (up to 46% - 85% with CHP)
  - Good operating reliability
- Types of engines
  - Diesel
  - Natural gas, biogas, landfill, coal-bed methane

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Diesel engine

- Stable technology constantly being improved
  - Electronic engine management system
    - Increased fuel efficiency; and
    - Lower emissions
- Low CO<sub>2</sub> emissions but high NO<sub>x</sub>
- Capital costs around \$300/kW
- Running costs around 20c/kWh – suited to short duration peak orientated operation
- Very competitive on delivered energy basis

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Gas engine

- Types
  - Conventional – spark ignition
  - Bi-fuel/direct injection of CNG/LNG
- Low NOx emissions
- Capital costs around \$600/kW
- Running costs around 9c/kWh - can provide baseload for day running
- Allows a degree of fuel switching
- Optimise use of gas and electricity networks

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Gas turbines

- Originally developed for jet engines
- Small industrial turbines 1–25MW
  - Simple cycle
  - Recuperated – captures exhaust thermal energy to preheat combustion air
  - Combined cycle – incorporates a steam turbine
- Lower electrical efficiency than gas engines
- Lower maintenance costs
- Capital costs \$800/kW

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Micro-turbines

- Smaller units – 30-200kW
- Low combustion temperatures yield lower NOx
- Significantly quieter/smaller than equivalent sized engine
- Capital cost \$2,000/kW
- High quality power/  
mission critical application
- Technology integrated into CHP



PHOTO: INGERSOLL-RAND

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Combined Heat and Power (CHP)

- Higher fuel efficiency (up to 85%)
- Low incremental capital costs
- Most economical where electrical requirement matches heat load
- Can be used for cooling – makes it applicable for industrial and *commercial* use
- Next to diesel generation, the biggest area of market growth internationally

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Comparative costs

	Capital (NZD/kW)	Efficiency
Diesel/bi-fuel	\$280 - \$350	25% - 45%
Gas engine	\$550 - \$700	20% - 35%
Gas turbine	\$750 - \$850	15% - 35%
Microturbine	\$1,500 - \$2,500	25% - 30%
CHP		50% - 85%

# How can DG be deployed?

1. Embedded capacity at key host load sites
2. Embedded capacity on a semi-permanent site
3. Mobile generation plant that can be located anywhere in the network – can target multiple applications

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# DG configuration #1

- Embedded capacity at key host load sites
  - Typically a permanently installed generator owned by a customer
  - Primarily to ensure security of supply for customer's premises and to manage demand charges
  - Sized to the customer's load and not exported unless rewarded with favourable terms
  - Ideal candidate for CHP if waste energy can be used in an industrial/commercial process i.e. heating or cooling

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Permanently installed diesel generators



**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# DG configuration #2

- Embedded capacity on a semi-permanent site
  - 1MW – 5MW of synchronised generators feeding 11kV mains
  - Containerised generators, dedicated transformers and control modules
  - Capable of being shifted to alternative locations – good medium term solution
    - Upgrade deferral, staged line upgrade, GXP demand management
    - Service and security standards not able to be met economically any other way
  - Owned/leased/hired by Lines Company

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Mobile diesel generators



**POWERHIRE**  
GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

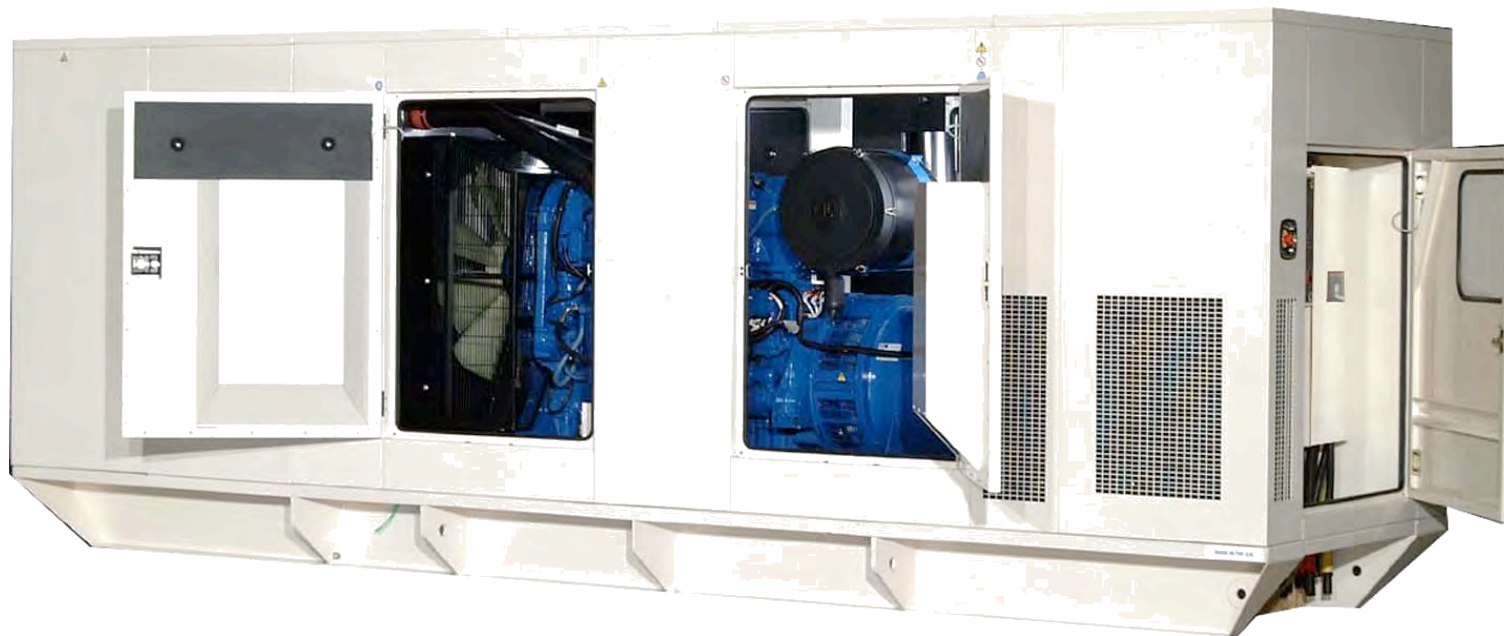
# DG configuration #3

- Mobile generation plant that can be located anywhere in the network
  - Smaller mobile generating plant (300kVA – 700kVA)
  - Can target multiple applications
  - Peak management and security improvement
  - Covers multiple injection points within the network
  - Owned or leased by Network Company
  - Cost effective approach – as included in the CAE guide

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# FG Wilson 700kVA canopy generator



**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Hurdles for DG investors

- Need partnership with industry player to manage 5 – 10 year paybacks
- Access to benefit sharing is controlled by the industry
- Cost plus attitude to demand management and upgrade
- Resistance to departure from the status quo

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Business issues

1. Pricing structures don't always signal long term economical solutions
2. Displaces retail sales of centrally distributed power
3. Retailing of electricity produced by small scale DG unprofitable unless delivery savings recognised

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Business issues

4. Uncertainty of the benefits that could arise over the life of the investment – risk is countered by the flexibility of the application
  - Preliminary investigation and feasibility (CAE)
  - Hire of the necessary plant and equipment to prove the concept (Power Hire)
  - Lease of the necessary plant and equipment on a term between 3 and 10+ years (Power Hire)

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# Business issues

5. Management of DG assets not core business
  - Power Hire can provide you with a total managed solution whereby you can dispatch the capacity as and when required.

# Implications for network design

- Network will have different long-term requirements
- Continuing trend to DG with new technologies
  - Fuel cells and micro-CHP
- Evolution of the ‘virtual utility’
  - Control both customers loads and generation at multiple sites via Internet
- Network companies become co-ordinating agents
  - Two-way flow of communication and control
  - Optimise the system to supply power and services
  - Protect the system against faults

**POWERHIRE**

GENERATOR SETS • SALES • HIRE • INSTALLATION • 24HRS

# **Distributed Generation opportunities for Lines companies**

16 June 2005