Gas to Energy Solutions

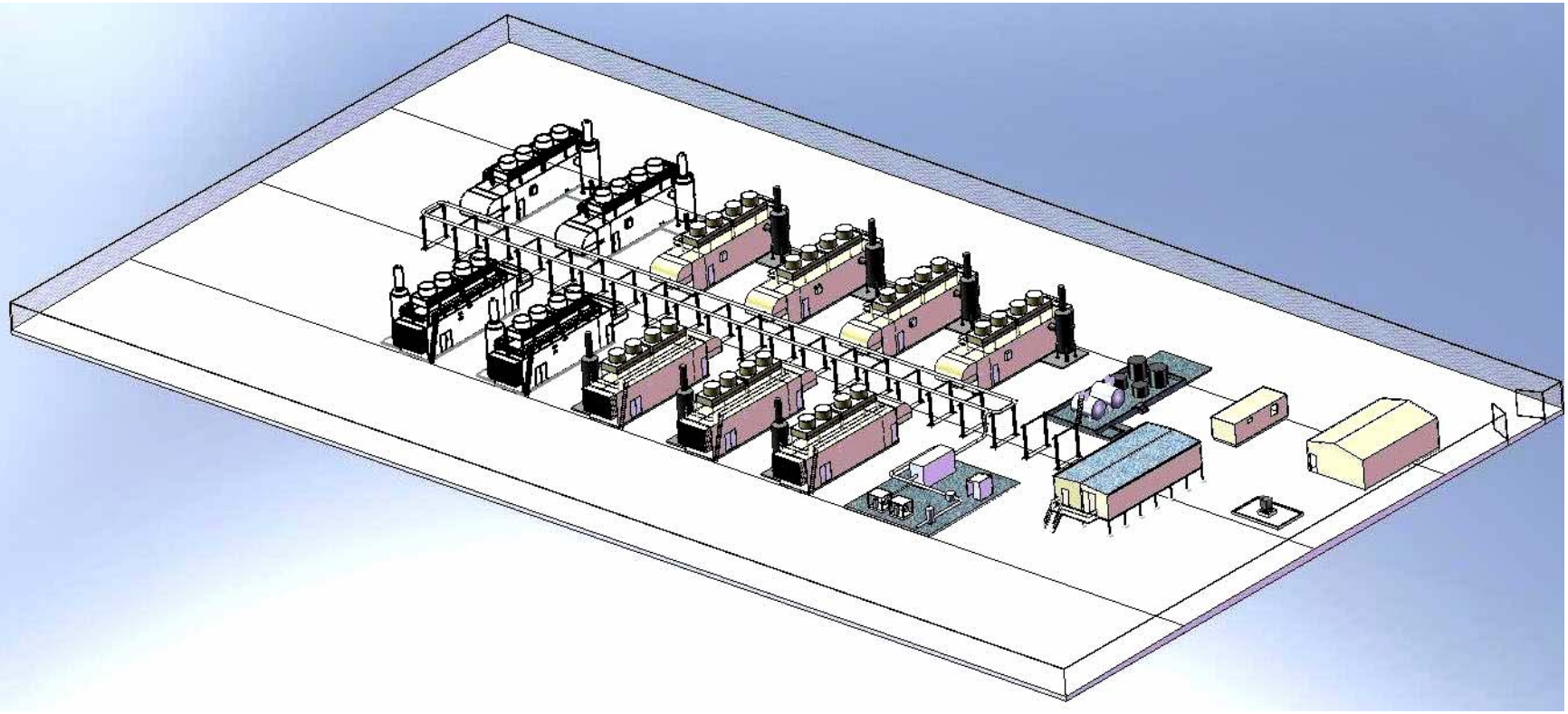
M2M Conference, St Louis 25th September 2007

"Concept to Creation"

Overview of Presentation

- Introduction
- Clarke Energy & GE Jenbacher Background
- Technical and Commercial Challenges
- Design and Delivery Approach
- Operation and Maintenance – Life Cycle
- Case Examples

Introduction - Concept

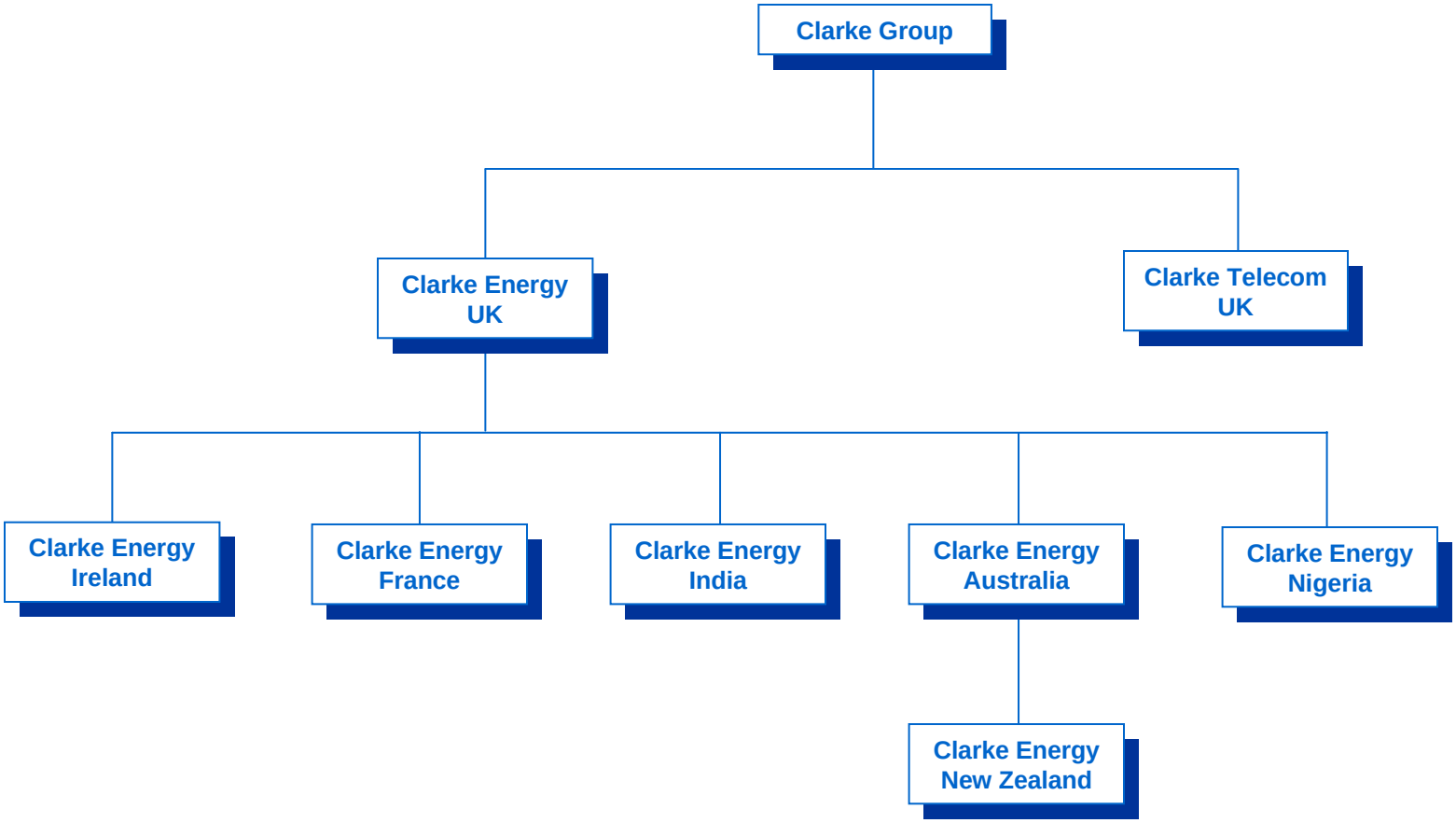


Introduction - Creation

Clarke Energy background

- Established in the UK as a specialised engine service company in 1989, operating now in 7 countries
- GE Jenbacher's largest independent distributor
- Clarke Energy has installed capacity of over 1,500MW of GE Jenbacher products worldwide, equating to 6% of the worldwide power generation market share.
- Total service solutions provider in Supply, Design, Install and Operate
- Over 900Mw under Operation and Maintenance contracts

Clarke Energy background - Structure



Clarke Energy highlights

- Sole distributor for GE Jenbacher engines
- Designs and builds complete power stations
- Extensive design and project team experience
- The major product and service provider in Coal Seam / Coal Mine applications in Australia, UK and regions where CE operate
- Most experienced suppliers and operators in CSM/CMM generation
- In Coal Gas - Over 235 MW on 17 sites in Australia and the UK.

GE Jenbacher background - Four Types Engine Range

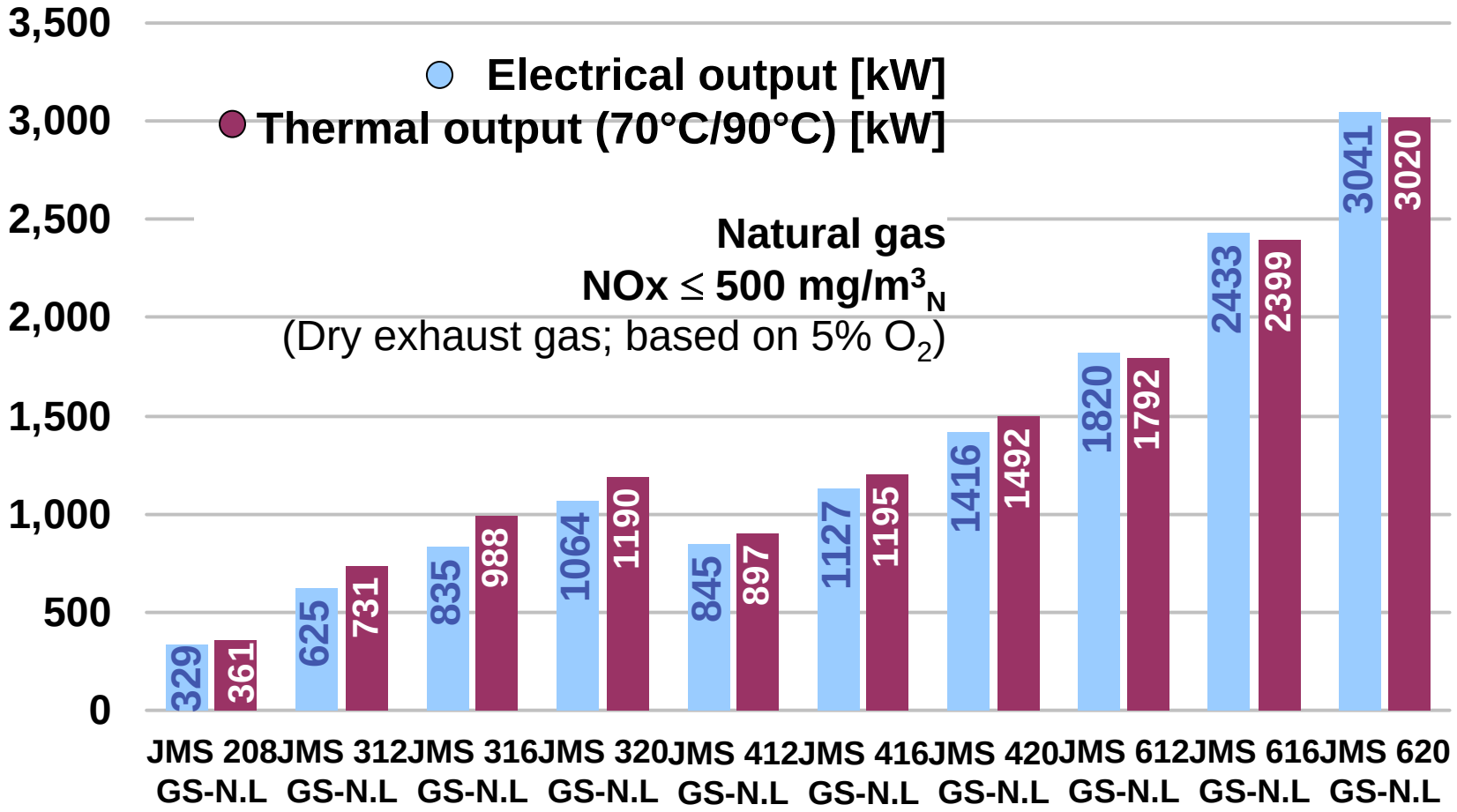
Type 2: 330kWe

Type 3: 500kWe to 1,065kWe

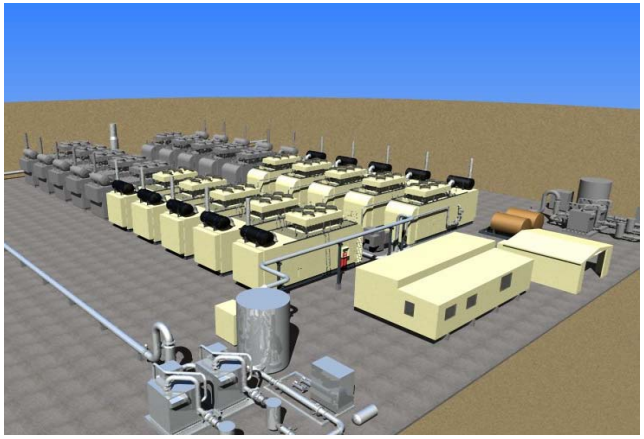
Type 4: 845kWe to 1,416kWe

Type 6: 1,800kWe to 3,041kWe

GE Jenbacher - Product line 2007



Technical and Commercial Challenges



- Fuel Gas supply and availability
- Quality of gas - conditioning
- Connection and Export availability - NSP
- Economics – PPA, CapX / OpeX, Timeline,GSA
- Regulatory consents – AGA, NEEMCO etc
- Approvals – Timeline and Development consent

Fuel Gas - Properties, Characteristics of CSM/CMM gas

- Coalbed Methane (CBM)

  - coal mine gas from unmined deposits (CH_4>90%)

- Coal Seam Methane (CSM) (also known as CMM)

  - coal mine gas from active mines (pre drainage)

    - rapid CH_4 -fluctuations/air content (O_2- content)

- Coal Mine Methane (CMM)

  - coal mine gas from abandoned (closed) mines

    - relative stable CH_4 -content/no O_2 - content

Key Technical Challenges

- Gas pretreatment (filter, condensate drainage, preheating, drying...)
- Layout for large LHV range (turbo charger tuning, gas train, gas mixer, peripheral system...)
- High dynamic of power - and combustion control (emission control)
- Modular design for augmentation or reduction in gas reserves

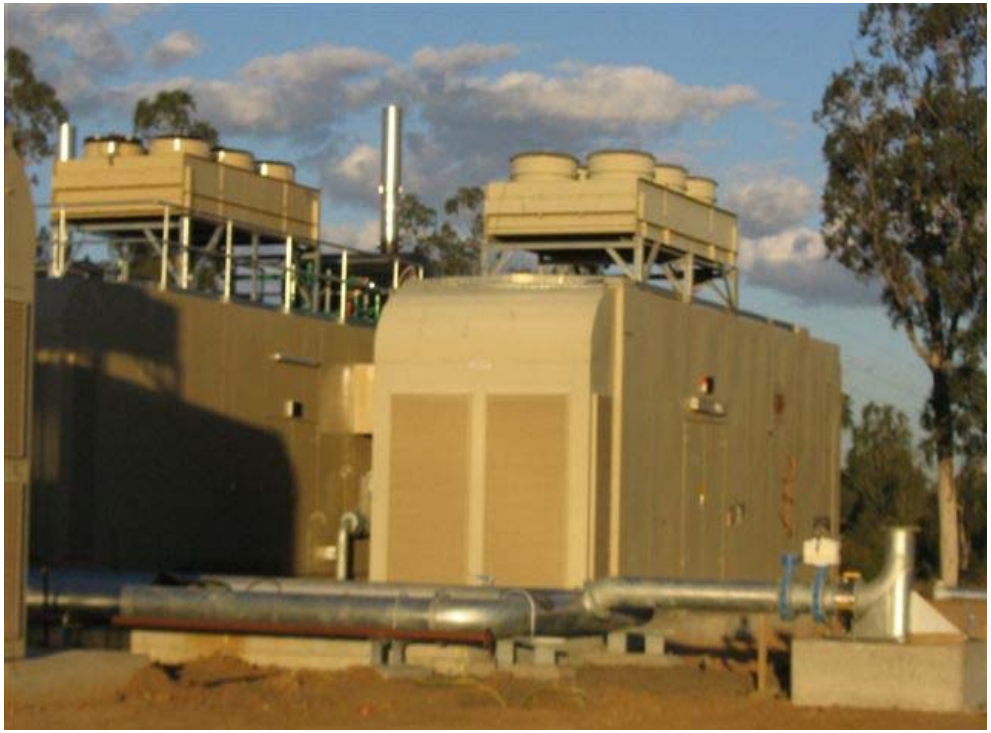
Gas Conditioning / Cooling CSM/ CMM

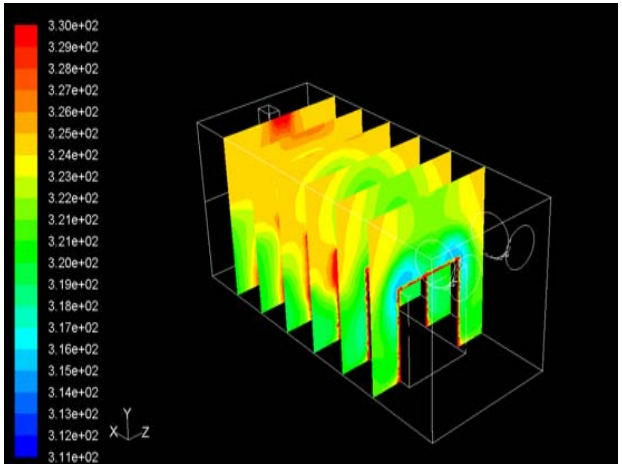
Examples

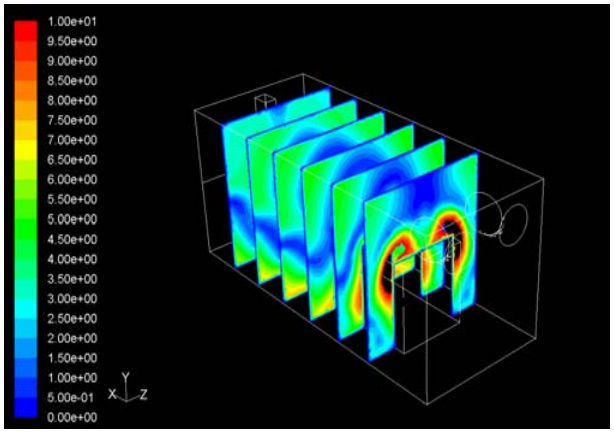
Design & Delivery Approach

- Proven Design in modular approach, flexibility
- Proven NEMMCO registration and Schedule 5 experience
- Proven Type B gas appliance approval
- Proven EPA and EIS model for emissions acceptance
- Proven package airflow design – temperature and velocity
- Proven noise isopleth parameters

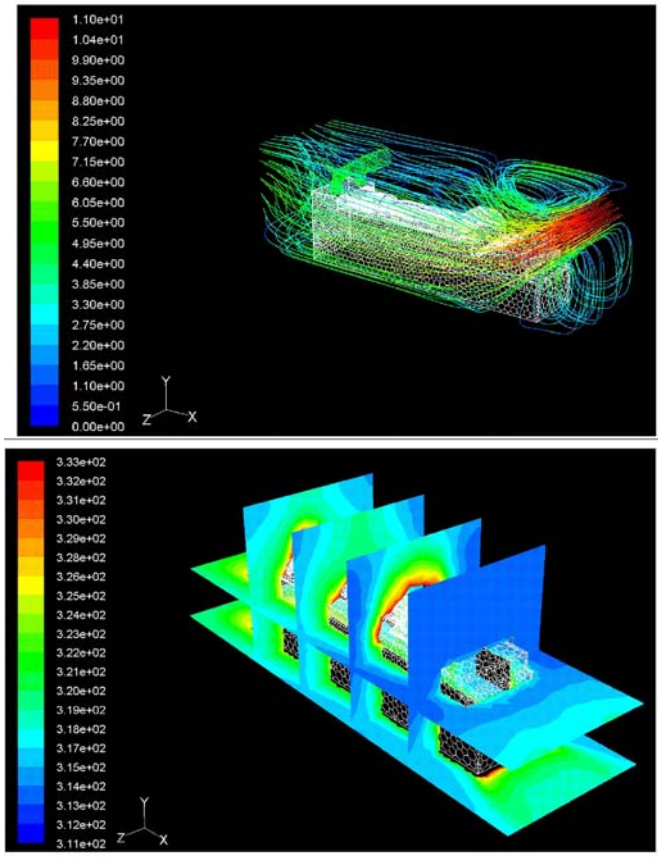
Design & Delivery - 'Fast Track' approach and performance





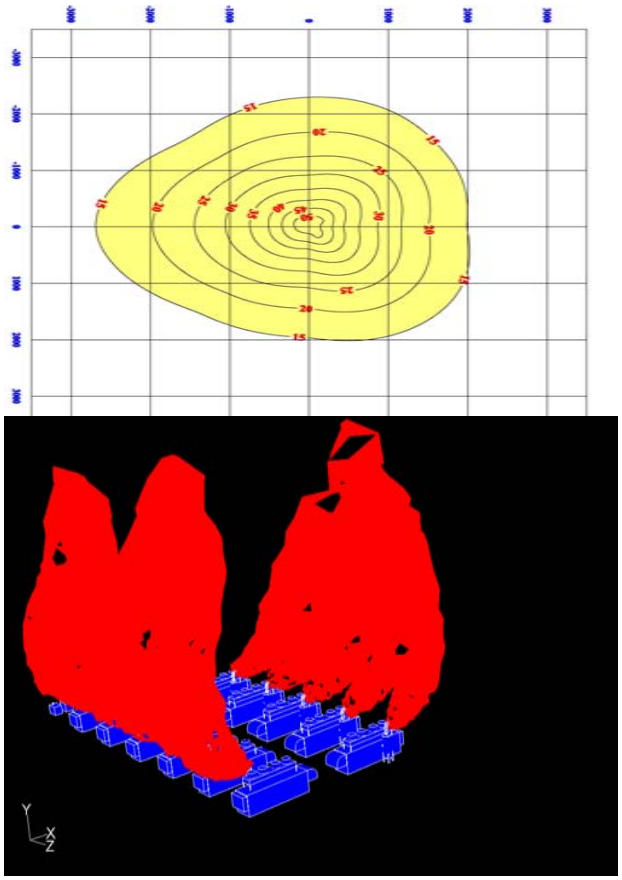


Design & Delivery - ‘Fast Track’ approach and performance



B: Temperature in K

Design & Delivery - 'Fast Track' approach and modular design



Utilisation of CMM & CSM Gas with GE Jenbacher Gas Engines

Examples

Coal mine gas utilization with GE Jenbacher Gas Engines

Plant	Engine type	Electrical output	Commissioning
Saarbrücken/G	JMS 208 GS S.LC	253 kW	1991 – 94
Stawe Herne/G	JMS 208 GS S/N.LC	2 x 253 kW	1997
	JMS 320 GS S.LC	1003 kW	2000
Dinslaken/G	JMS 620 GS S/N.LC	2 x 2717 kW	1998
Shirebrook/UK	JGS 616 GS N.L	5 x 1940 kW	1999
Halemba/Pol	JMS 312 GS S.L	543 kW	2000
Bielszowice/Pol	JMS 312 GS S.L	543 kW	2000
Tahmoor/Aus	JMS 320 GS S.L	5 x 1043 kW	2001
Thoresby Colliery/UK	JMS 420 GS S.L	2 x 1412 kW	2001
GAS I + II/G	JGS 320 GS S.L	2 x 1043 kW	2001

Coal mine gas utilization with GE Jenbacher Gas Engines

Plant	Engine type	Electrical output	Commissioning
Wheldale/UK	JGS 620 GS S.L	3 x 2717 kW	2001
	JGS 616 GS S.L	2060 kW	2001
Fenne/G	JMS 620 GS S.LC	14 x 2717 kW	2002/03
Maltby-UK Coal 1 - 3	JGS 420 GS N.L	3 x 1413 kW	2002
Welbeck UK Coal	JMS 420 GS S.L	1413 kW	2002
Stillingfleet 1 – 3/UK	JMS 420 GS S.L	3 x 1413 kW	2002
Kellingley 1 – 2/UK	JMS 420 GS S.L	2 x 1413 kW	2002
Minegas 1 – 4/UK	JGS 420 GS S.L	4 x 1413 kW	2002
Teralba , NSW	JGS 320 GS S.L	12 x 1,065 kW	July 2004
Sasyadko/Ukraine	JMS 620 GS S.L	22 x 3030 kW	2004-06
Oaky Creek, QLD	JGS 320 GS S.L	12 x 1,065 kW	July 2006
Daandine, QLD	JGS 620 GS S.L	11 x 3,041 kW	March 2007
Glennies Creek, NSW	JGS 320 GS S.L	10 x 1,065 kW	September 2007
Moranbath Nth, QLD	JGS 620 GS S.L	15 x 3,041 kW	August 2008

Clarke Energy Australia – Coal Mine Installations – Oaky Creek

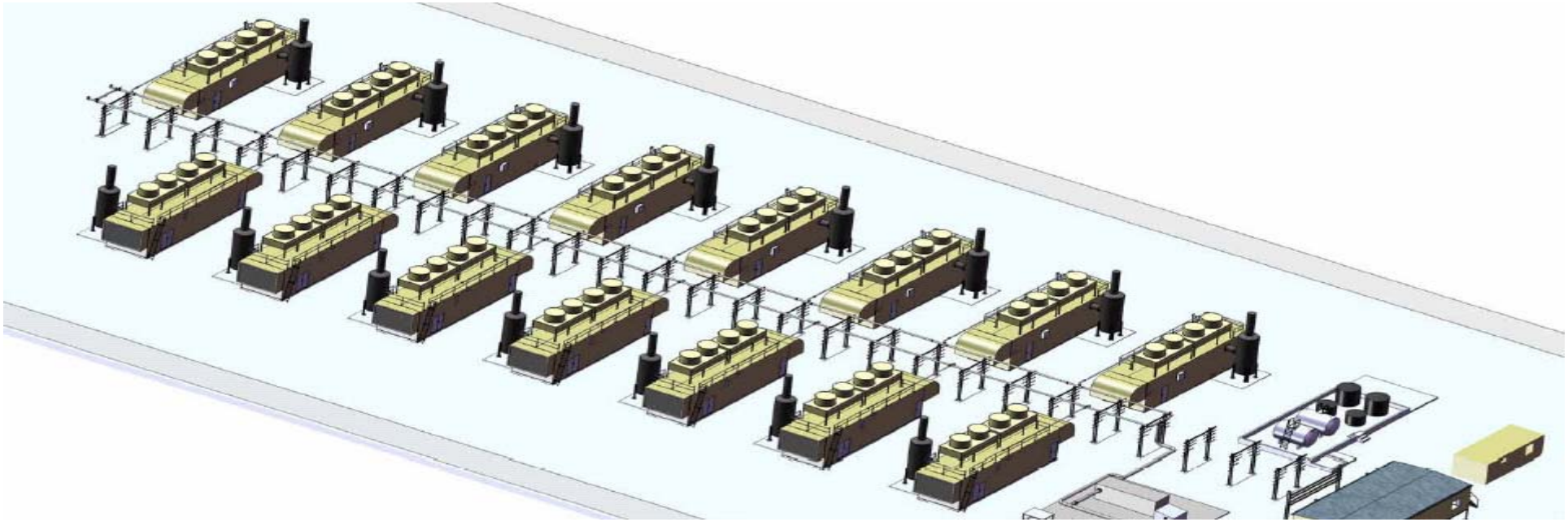
- Full turnkey installation
- 13MWe power output
- 12 x JGS 320 engines [expanding to 20)
- Coal Mine & Coal Seam Methane
- Long term O & M contract
- Commissioned June 2006

Clarke Energy UK – Coal Mine Installations – Shirebrook Colliery

- Full turnkey installation
- 9.7MWe power output
- 5 x JMS 620 engines
- Closed Coal Mine
- Long term O & M contract
- Commissioned May 1999

Clarke Energy Australia – Coal Mine Installations – Moranbah North

- Full turnkey installation
- 45 MWe installed capacity
- 15 x JGS 620 engines
- Coal mine / seam methane
- Commissioning Aug / Sept 2008



Clarke Energy Australia – Coal Mine Installations – Glennies Creek

- Full turnkey installation
- 11MWe installed capacity
- 10 x JGS 320 engines
- Coal mine / seam methane
- Commissioning Sept / October 2007

Clarke Energy Australia – Coal Mine Installations - Teralba

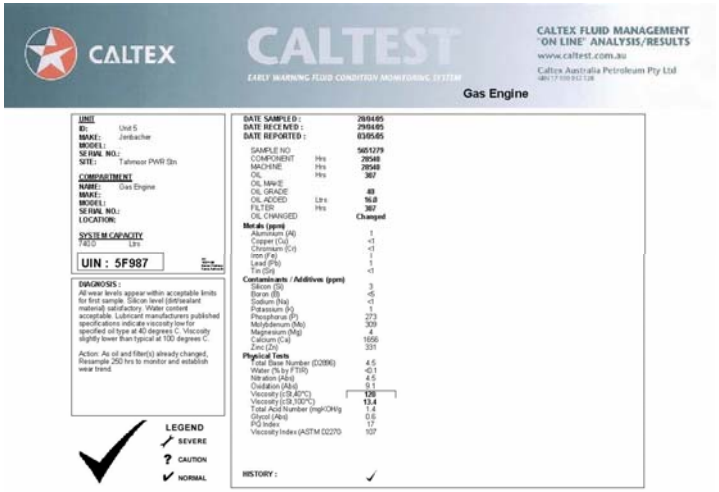
- Full turnkey installation
- 8MWe power output
- 8 x JGC320 engines
- Closed / Abandoned Mine
- Commissioned June 2004
- Long term O & M contract

Clarke Energy Australia – Coal Seam Installations – Daandine, Qld

- Full turnkey installation
- 33MWe installed power
- 11 x JGS 620 engines
- Coal seam methane
- Long term O & M contract
- Commissioned Feb 2007

Operation & Maintenance – Life Cycle

- Planned and unplanned Maintenance
- Accurate / reliable data
- Certainty of costs / performance


CALTEX

CALTEST

CALTEX FLUID MANAGEMENT "ON LINE" ANALYSIS/RESULTS

www.caltest.com.au

Caltex Australia Petroleum Pty Ltd

EARLY WARNING FLUID CONDITION MONITORING SYSTEM

Gas Engine

UNIT
ID: Unit 5
MAKE: Jenbacher
MODEL:
SERIAL NO.:
SITE: Tahmoor PWR Stn

COMPARTMENT
NAME: Gas Engine
MAKE:
MODEL:
SERIAL NO.:
LOCATION:

SYSTEM CAPACITY
740.0 Ltrs

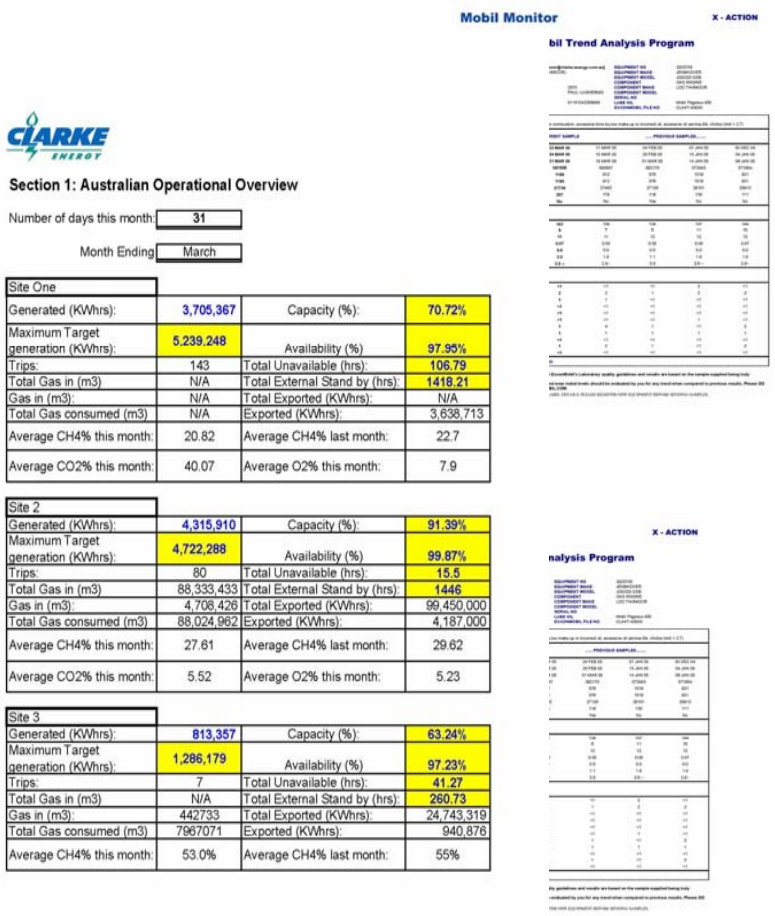
UIN : 5F987

DIAGNOSIS :
All wear levels appear within acceptable limits for first sample. Silicon level (dirt/sealant material) satisfactory. Water content acceptable. Lubricant manufacturers published specifications indicate viscosity low for specified oil type at 40 degrees C. Viscosity slightly lower than typical at 100 degrees C.

Action: As oil and filter(s) already changed, Resample 250 hrs to monitor and establish wear trend.

LEGEND
SEVERE
? CAUTION
NORMAL

DATE SAMPLED :		26/04/05
DATE RECEIVED :		29/04/05
DATE REPORTED :		03/05/05
SAMPLE NO		5051279
COMPONENT	Hrs	29540
MACHINE	Hrs	29540
OIL	Hrs	367
OIL MAKE		
OIL GRADE		40
OIL ADDED	Ltrs	16.0
FILTER	Hrs	367
OIL CHANGED		Changed
Metals (ppm)		
Aluminium (Al)		1
Copper (Cu)		<1
Chromium (Cr)		<1
Iron (Fe)		1
Lead (Pb)		1
Tin (Sn)		<1
Contaminants / Additives (ppm)		
Silicon (Si)		3
Boron (B)		<5
Sodium (Na)		<1
Potassium (K)		1
Phosphorus (P)		273
Molybdenum (Mo)		339
Magnesium (Mg)		4
Calcium (Ca)		1056
Zinc (Zn)		331
Physical Tests		
Total Base Number (D2896)		4.5
Water (% by FTIR)		<0.1
Nitration (Abs)		4.5
Oxidation (Abs)		9.1
Viscosity (c@,40°C)		126
Viscosity (c@,100°C)		13.4
Total Acid Number (mgKOH/g		1.4
Glycol (Abs)		0.6
PQ Index		17
Viscosity Index (ASTM D2270		107
HISTORY :		✓


Mobil Monitor

X - ACTION

bil Trend Analysis Program

CLARKE ENERGY

Section 1: Australian Operational Overview

Number of days this month: 31

Month Ending: March

Site One			
Generated (KWhrs):	3,705,367	Capacity (%):	70.72%
Maximum Target generation (KWhrs):	5,239,248	Availability (%)	97.95%
Trips:	143	Total Unavailable (hrs):	106.79
Total Gas in (m3)	N/A	Total External Stand by (hrs):	1418.21
Gas in (m3):	N/A	Total Exported (KWhrs):	N/A
Total Gas consumed (m3)	N/A	Exported (KWhrs):	3,638,713
Average CH4% this month:	20.82	Average CH4% last month:	22.7
Average CO2% this month:	40.07	Average O2% this month:	7.9

Site 2			
Generated (KWhrs):	4,315,910	Capacity (%):	91.39%
Maximum Target generation (KWhrs):	4,722,288	Availability (%)	99.87%
Trips:	80	Total Unavailable (hrs):	15.5
Total Gas in (m3)	88,333,433	Total External Stand by (hrs):	1446
Gas in (m3):	4,708,426	Total Exported (KWhrs):	99,450,000
Total Gas consumed (m3)	88,024,962	Exported (KWhrs):	4,187,000
Average CH4% this month:	27.61	Average CH4% last month:	29.62
Average CO2% this month:	5.52	Average O2% this month:	5.23

Site 3			
Generated (KWhrs):	813,357	Capacity (%):	63.24%
Maximum Target generation (KWhrs):	1,286,179	Availability (%)	97.23%
Trips:	7	Total Unavailable (hrs):	41.27
Total Gas in (m3)	N/A	Total External Stand by (hrs):	260.73
Gas in (m3):	442733	Total Exported (KWhrs):	24,743,319
Total Gas consumed (m3)	7967071	Exported (KWhrs):	940,876
Average CH4% this month:	53.0%	Average CH4% last month:	55%

X - ACTION

nalysis Program

Advantages of Proven Experience and Product

- Certainty of Cost and Time
  - Administration and Tender call period
  - Proven Specification and Design completed
- Certainty of Delivery
  - Proven build model
  - Proven approvals
  - Continuous improvement gains
- Certainty of Early Generation
  - Shortest engine delivery in the market today
- Competitive Design and Delivery

The Benefits of the Clarke Energy / GE Jenbacher Partnership

GE JENBACHER

Equipment design

Equipment development

Equipment manufacture

Parts manufacture

“Product Quality Focused”

CLARKE ENERGY

Proven Design and integration of BoP

Project & Construction Management

Commissioning

Service & Maintenance

Parts Stockholding

“Customer / Project Quality Focused”

and

"The Perfect Partnership" for coal mine applications

Contact www.clarke-energy.com