

GAS ENGINE GENERATORS

3^{Tech}

Power • People



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Total power solution provider

Now over 30 countries worldwide
Come, join the pride!

For over 15 years 3Tech has been delivering electrical energy to people worldwide by providing reliable prime and standby power solutions.

Our own LionRock® range of world class AC and DC Generators form the core of any primary or backup power requirements all over in the world. From a small mobile telecom tower to major infrastructure such as airports, hospital and data centre – LionRock® generators are powering all the electrical equipment as well as providing heat and cooling through our trigeneration system.

Our manufacturing facilities in Dongguan, China and Lagos in Nigeria offer wide range of products and solutions to cover nearly all areas in the world.

In the area of renewable energy, our extensive portfolio of solar energy systems including the award winning Town Island solar project in Hong Kong clearly demonstrated our capability.

From powering an entire island using completely renewable energy using solar panels and wind turbine to BIPV integrated buildings, the 3Tech engineering team delivered numerous complete solutions from design, delivery, installation, commissioning and ongoing maintenance to customers in over 30 countries and 5 continents.

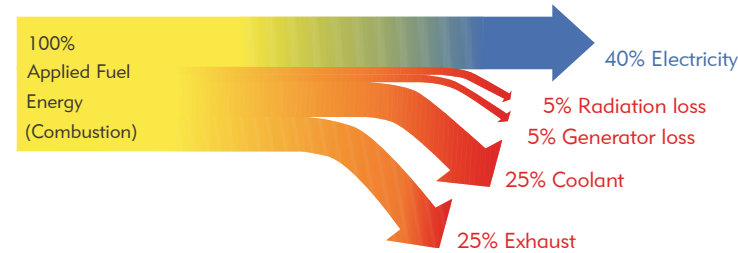
Wherever you are and whatever energy requirement you have, 3Tech with LionRock® is your first choice of conventional and renewable energy solutions.



All reciprocating engines over 100kW are water cooled. Below is a typical 1000kW reciprocating engine generator energy distribution.

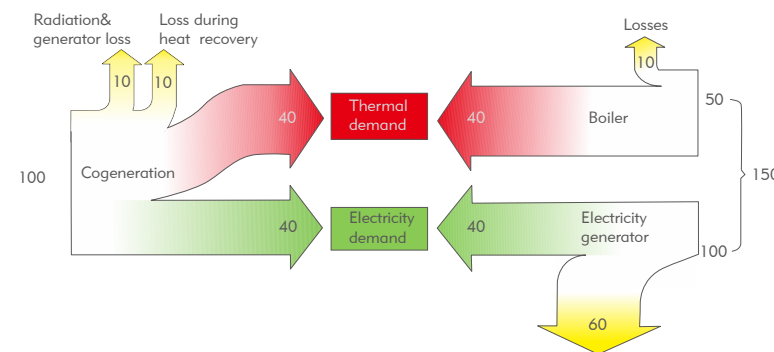
Electrical output = 40%
Cooling water = 25%*
Exhaust gas = 25%*
Radiation and alternator loss = 10% (typically 5% each)

Typical Energy Split of diesel and gas reciprocating engines



Benefits of Cogeneration

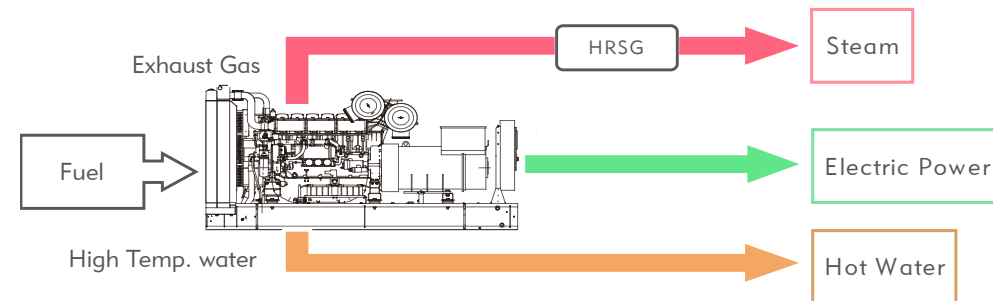
Below is a comparison of a cogeneration system against a traditional way of electricity generation and heat generation through a boiler.



It is quite clear that there is a saving of 50 units of fuel cost (or 33% reduction) by using cogeneration to produce the same amount of electricity and heat.

Apart from fuel cost saving, the reduction of fossil fuel usage also reduce the greenhouse gas emission from the system and hence a lower carbon footprint by same portion.

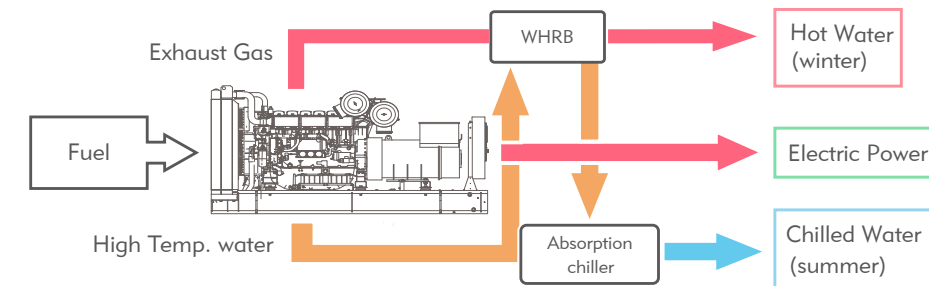
Power + Steam + Hot Water Generation



Similar to cogeneration, trigeneration is also known as combined cooling, heat and power (CCHP). The third form of energy to provide cooling is achieved by absorption chiller.

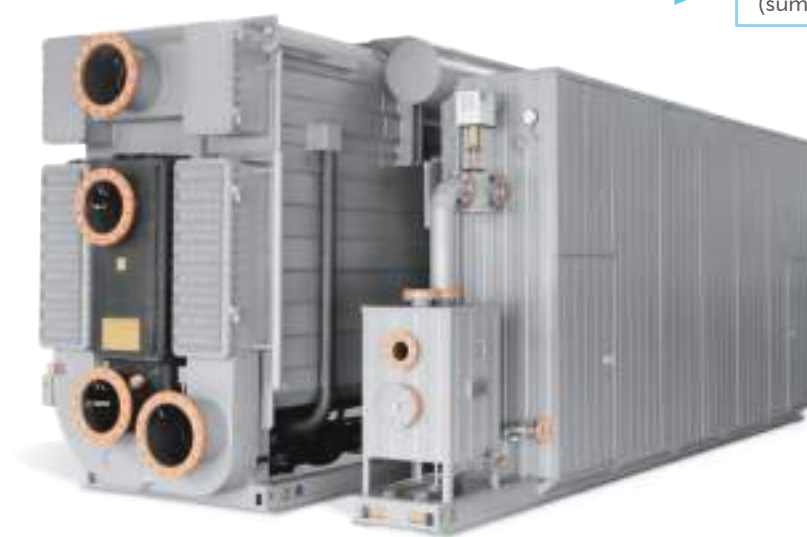
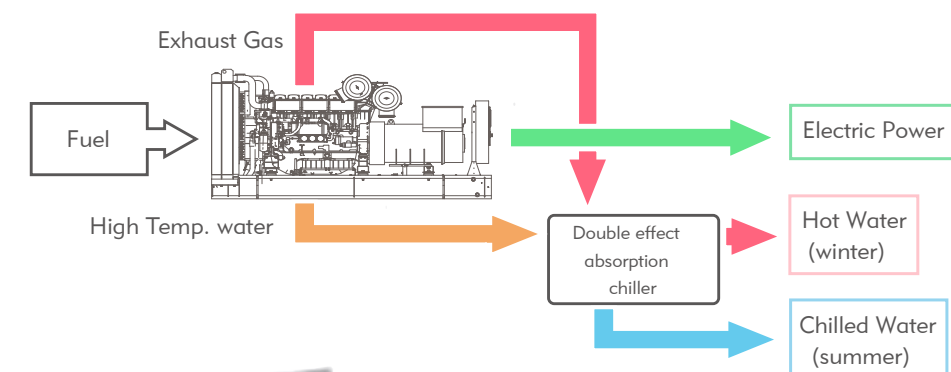
As the absorption chiller is able to provide heating water during winter and cooling water during summer, it is a complete HVAC system to replace electric chiller and hot water boiler by one piece of equipment. In terms of recovering the waste heat from a reciprocating engine, exhaust heat can be used to provide hot water through waste heat recovery boiler (WHRB). By combining with the engine cooling water, hot water is provided as one source of heat energy to be fed to the absorption chiller. This is also called single effect or single stage absorption chiller.

Power + Hot Water or Chilled Water Generation with single stage absorption chiller



In order to simplify the interface of the absorption chiller and a reciprocating engine in terms of waste heat recovery, there is another type of absorption chiller that can be fed with the engine cooling water and exhaust gas directly. This is the two stages or double effect absorption chiller.

Power + Hot Water or Chilled Water Generation with two stage absorption chiller



LionRock® Products for Cogeneration / Trigeneration

LionRock® offers full range of equipment for cogeneration and trigeneration application from Power Generator of various fuel including natural gas, LPG, biomass gas and coal seam methane gas.

Power Generators

LionRock® offers wide range of internal combustion engines as the prime power drives. Below is the summary of the key ranges.

Gas engine generator sets

LionRock® offers a standard range of gas reciprocating engine powered generator set from 30kW upto 600kW. This range is stoichiometric combustion range. Although the electrical efficiency is lower, they are suitable for island mode operation with very good response to load transient. The overall cogeneration efficiency is still as high as 80% with hot water supply.

Apart from rich burn gas engine, LionRock® also offers a wide range of lean burn engine with the latest digital combustion control technology from 100 to 1000kW. The lean burn gas engine generator is able to achieve upto 42% electrical efficiency and is the best in the same power class.

With the suitable heat recovery, LionRock® lean burn gas engine generator is able to achieve overall efficiency of 85% with various hot water, steam production as well as trigeneration with absorption chiller.

In addition to natural gas from pipeline, LionRock® gas engine generator is able to work with other gas sources such as coal seam methane gas, landfill gas and other biomass generated gas with suitable treatment. There will be minor derating on the generator output depending on the gas composition. LionRock® gas engine generator has the capability to burn the widest range of gas.

Heat recovery equipment

LionRock® offers both shell tube type and stainless steel plate type heat exchanger for hot water energy recovery as well as engine cooling system dumping using electric radiator and cooling tower to meet various thermal and electricity demand. LionRock® also offers exhaust heat recovery hot water or steam generator to suit the various thermal load requirement.

Cogeneration Module

LionRock® offers complete Cogeneration package in a factory assembled module with optional acoustic enclosure to 70dBA at 1m. These cogeneration package is modular design and can be deployed to site easily. As the package is fully tested in factory before shipment. This greatly reduces the space and time required to commission the system on site.

Absorption chiller

LionRock® offers full range of world leading Broad Absorption chiller including single and two stages design as well as with additional burner to further increase the chilling capacity.

LionRock® Solution for Cogeneration / Trigeneration

The success of a cogeneration or a trigeneration system depends on a lot of factors from electricity demand, thermal load requirement, balance of energy at different time and season, fuel option and availability, space requirement, integration with existing system, modification of existing system to allow suitable interface, electricity tariff, fuel cost etc.

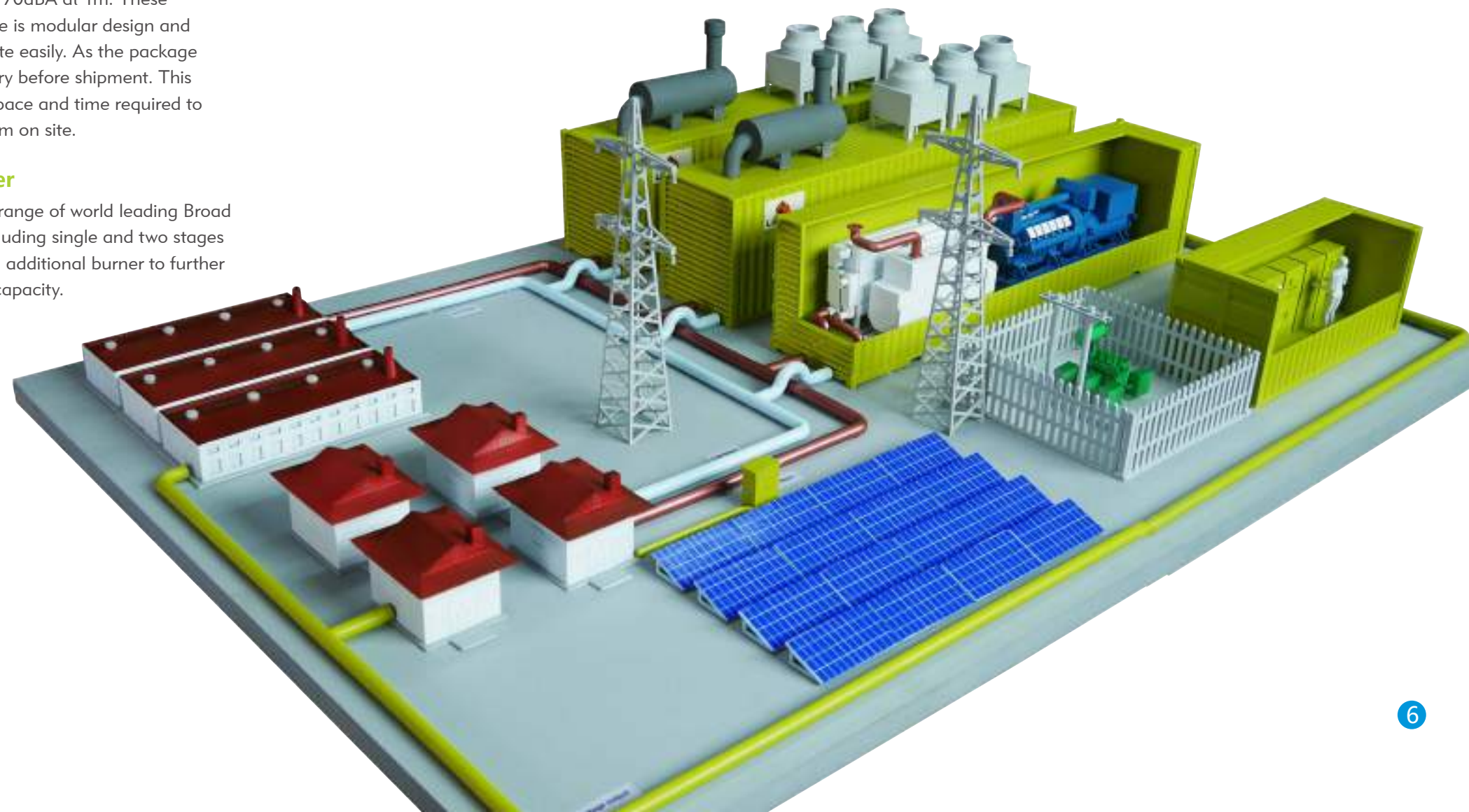
It is a very long list of factors need to be considered. Therefore, the first step is a feasibility study to review all the factors to decide if cogeneration is the best option to address customer's energy need.

LionRock® inhouse team has strong experience and highly qualified electrical and mechanical engineers. Their extensive experience in dealing with building

services in different type of facility from commercial office, hospital, data centre to residential blocks allow design of suitable cogeneration system to meet the various energy needs of such facilities.

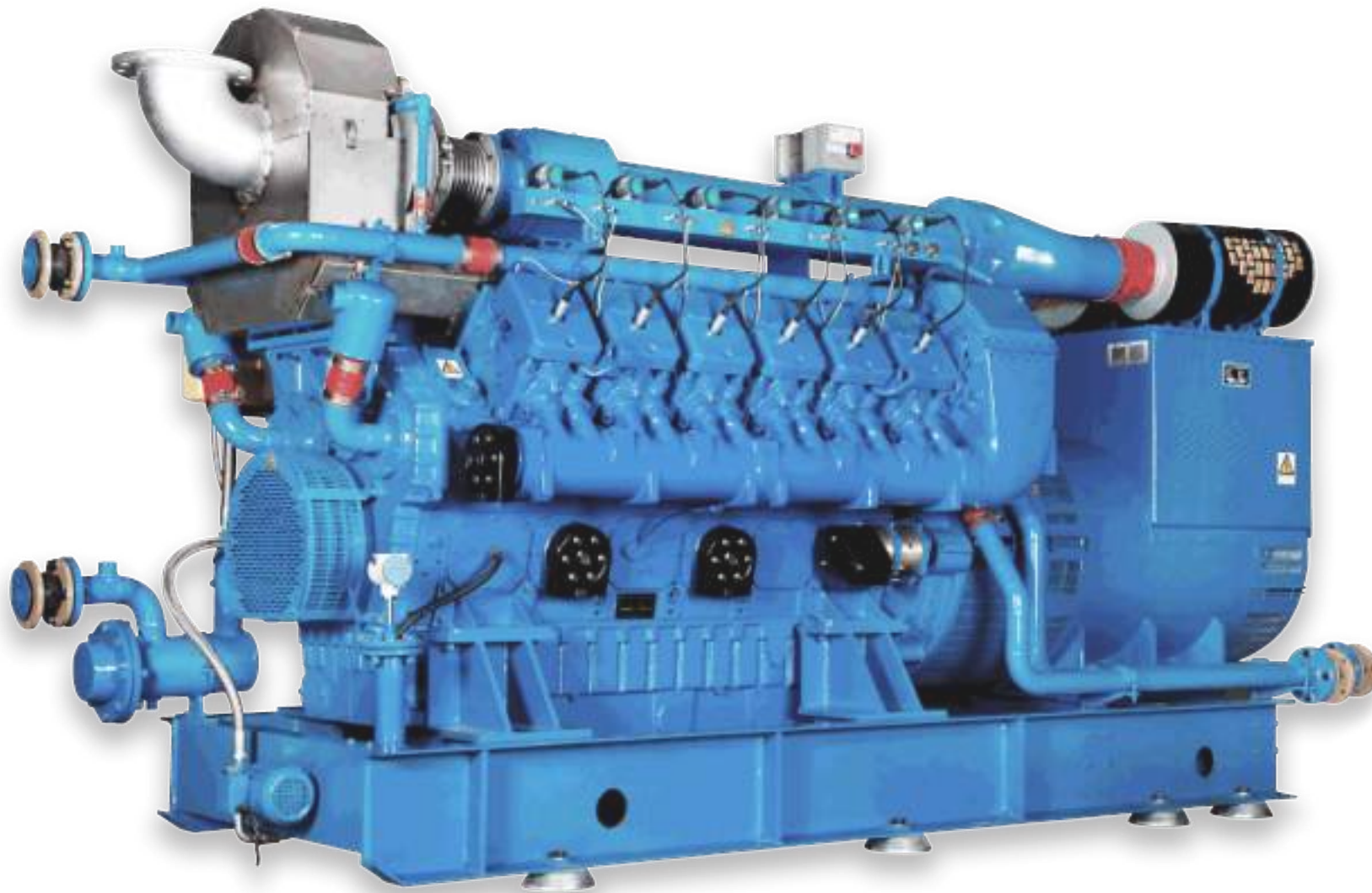
In terms of industrial application, LionRock® offers full energy audit of customer production process to identify all areas of energy need and their interaction.

LionRock® offers full turnkey solution from project planning, engineering design, procurement and construction to commissioning before hand over a system to customer. Aftersales and maintenance services are to be followed to ensure hassle free services to customer.



LionRock®

Gas engine Generators



LionRock® gas engine generators use natural gas, the cleanest fossil fuel available, to provide the most efficient way of using the available energy. Electricity is one of the best way to transfer energy from the generating point to the user point. In addition to the high electrical efficiency, LionRock® gas engine generators also offer excellent heat recovery to meet various thermal demand to achieve over 85% total efficiency throughout the whole range of products.

LionRock® gas engine generators as well as heat recovery equipment can be packaged within standard shipping containers for easy and quick deployment of the system on site. The design is completely modular and allow easy integration and expansion at any time without scarifying any efficiency reduction.

Other than normal 400V, 50Hz system, high voltage at 11kV is also available in exactly the same footprint of the low voltage equivalent.

In addition to natural gas, biomass gas, coal seam methane etc. are some other example of successful systems delivered by 3Tech.

Currently, LionRock® offers two ranges of gas engine generator products. One series cover rating up to 800kW using the latest German digital combustion

control technology. With the latest microprocessor technology and data collection facility, the combustion process will be optimized through analysis of operating data and implementing the fuel and spark ignition timing control. That is why we can achieve the highest electrical efficiency of this power range.

Other benefits including optimised lube oil management and excellent consumption, maximum availability and highest reliability for longer operating life.

The 1000kW gas engine generator is a completely China developed technology. Output power is conservative for extended operating life and high reliability. Unlike other Chinese product, first class control components are used and tuned by the world class engine experts.

Other than the high efficiency and reliable operation of the 1000kW class gas engine generator set, owner will benefit from the most competitive parts and services support program offered by 3Tech.

3Tech also offers solution of combine cycle using steam turbine with multiple units of the gas engine.

400kW to 800kW

1000kW

Generator Set Technical Data

Generator model	Unit	LRMWG400	LRMWG600	LRMWG800
Output capacity	kWe	400	600	800
Frequency	Hz	50	50	50
Voltage	V	400	400	400
Current	A	725	1087	1449
Length	mm	3100	3700	4100
Width	mm	1500	1500	1600
Height	mm	2200	2200	2200
Weight	kg Dry	5200	6900	8500

Generator Set Technical Data

Generator model	Unit	LRLYG1000
Output capacity	kWe	1000
Frequency	Hz	50
Voltage	V	400
Current	A	1812
Length	mm	4700
Width	mm	1700
Height	mm	2300
Weight	kg Dry	10300

Engine details

Bore / Stroke	mm	132 / 160	132 / 161	132 / 162
Displacement	Litre	17.5	26.3	35.0
Engine Speed	rpm	1500	1500	1500
Mean Piston Speed	m/s	8.0	8.0	8.0
BMEP	kPa	1900	1890	1890
Recoverable heat	kWt	428	654	854
Thermal efficiency	%	45.2	45.8	45.3
Electrical efficiency	%	42.3	42.0	42.5
Total efficiency	%	87.5	87.8	87.8
Engine emission standard	NOX ≤ 500 mg / Nm3			

Engine details

Bore/Stroke	mm	170/195
Displacement	Litre	53.1
Engine Speed	rpm	1500
Mean Piston Speed	m/s	9.8
BMEP	kPa	1580
Recoverable heat	kWt	1170
Thermal efficiency	%	39.5
Electrical efficiency	%	46.2
Total efficiency	%	85.7
Engine oil capacity	Litre	160
Exhaustgastemperature	degC	<500
Engine emission standard	NOX ≤500mg/Nm3	

Generator details

Capacity	kVA	500	750	1000
Insulation / Temp rise class		H / F	H / F	H / F
Number of pole		4	4	4
THD at no load	%	< 1.5%	<4%	< 4%
THD at full load	%	< 2.0%	<4%	< 4%
Efficiency at 100% @0.8PF	%	94.6	95.4	95.5
Efficiency at 75% @0.8PF	%	95.0	95.4	95.6
Efficiency at 50% @0.8PF	%	94.9	94.6	95.3
Transient reactance, X'd	%	16.6	12.9	15.5
Transient Time Constant, T'd	ms	100	100	180
Subtransient reactance, X''d	%	11.7	10.34	13.2
Subtransient Time Constant, T''d	ms	10	10	18
Heat rejection at full capacity	kW	22.8	28.9	37.7
Voltage regulation	%	0.5	0.5	0.5

Generator details

Capacity	kVA	1250
Insulation / Temp rise class		H/F
Number of pole		4
THD at no load	%	<3.5%
THD at full load	%	<3.5%
Efficiency at 100% @0.8PF	%	95.7
Efficiency at 75% @0.8PF	%	95.9
Efficiency at 50% @0.8PF	%	95.5
Transient reactance, X'd	%	16.1
Transient Time Constant, T'd	ms	180
Subtransient reactance, X''d	%	13.7
Subtransient Time Constant, T''d	ms	18
Heat rejection at full capacity	kW	44.9
Voltage regulation	%	0.5



CCHP for Industrial or Commercial Facilities

GLOBALFOUNDRIES, Dresden, Germany

Dresden's Global Foundries energy supply centre uses a gas engine trigeneration system because the generator sets provide reliable high-quality electricity to the production facility. The waste heat is being diverted to the heat recovery system to provide free heating and cooling.

Gas powered gensets can simultaneously deliver electrical energy for electrical loads and heat energy for the heating of industrial plants. While the efficiency of separate grid power and natural gas boilers is often less than 50%, our CCHP projects offer:



- Energy efficiency of up to 90%
- Lower energy costs than with separate heat and power generation systems
- Lower emissions than with separate heat and power generation systems

Xishan Durpin Power Generation Project

In conjunction with the state coal mine in Taiyuan, three units each rated 1703 kW generator sets were installed in 2008. The plant uses the coal mine ventilation air as the fuel. This ventilation air stream contain high level of methane and is a safety hazard to the mining operation. 430 million cubic metre of gas was consumed and generated 80 million kWh electricity per annum. The process met the requirements of the CDM (Clean Development Mechanism) certification and qualified for CDM subsidies.

Four more gas generator sets were order after the first successful year of operation. The total installed capacity exceeds 12MW.



- Improve mining safety
- Reduce Greenhouse gas emission and hence the carbon foot print
- Reduce the Energy cost and generate additional income



Changsha Huanghua International Airport Project



Changsha Huanghua International Airport 1x 1000kW gas engine generator trigenation.

Benefits include :

- Deliver improved output and reliability
- Offer lower operating and maintenance costs
- Reduce environmental impact
- Reduced energy costs
- Efficient utilization of resources
- Increased revenue opportunities

More projects



Shanxi Shanghuang Power Generation project

The site is a coal seam methane gas production facility. The high methane content gas produced will be delivered to users through the gas pipeline. The project is to provide cleaner energy to the people in Shanxi province. As the site is so remote, it is important to have reliable electricity to keep the gas compressors operating to secure the gas supply. Two LionRock 1000kW gas engine generators in special purpose built enclosure were used to provide the power to the gas compressor plant on a 100% redundant operation. Both generator sets use the same coal seam methane gas produced from the site for operation. This substantially save the cost to bring in mains power infrastructure and provide the additional reliability.



Nanjing Broad Kirin Technology Park

This is a trigeneration project with a 600kW gas engine generator set. Apart from electricity, thermal energy is used to provide heating in winter and cooling in summer with an absorption chiller. The system basically provide all the energy need of the technology park and achieve an overall efficiency of near 85%. Kirin Technology Park is the brain of scientific and technological innovation platform. Nanjing municipal government established the Park as the world class technology research facility for the international renowned enterprises and organisations.



Hong Kong Landfill gas generator

This is a small 100kW landfill gas generator plant for the landfill site office operation. It is inside 3Tech's world renowned silent enclosure to achieve a noise level that is technically not audible inside the office nearby. As the gas is completely free, the electricity generated save a lot of money for the landfill operator that the initial investment can be paid off in as short as 2 years. 3Tech is responsible for the installation and maintenance of the plant for the user.



French Geotexia Biogas Plant Project

The biogas plant in Brittany, France uses biogas from pig manure and industrial fats (about 700 m³/h) is supplied to two 800 kW container generator sets. The factory is characterized by the use of fully recovered fermentation residues to produce solid fertilizers. Wastewater passes through after osmosis and hydrolysis techniques have been used for tree irrigation.