



Introduction to

Networked InField Compression

for

Coal Seam Gas Field Development

Networked InField Compression and High Pressure Low Diameter Coiled Piping is the answer to ever increasing CSG Field Development Costs.

February 2010

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1. INTRODUCTION

Benefits

The **Networked InField Compression System** offers Coal Seam Gas Producers the following benefits over large scale centralised compression systems:

- **10% plus more gas by way of increased flow levels and/or well life;**
- **20-40% less environmental impact;**
- **30-40% less capital cost or better;**
- **20-30% less annual operating costs;**
- **30-40% less installation time; and**
- **Flexibility for changing field conditions & reservoir performance.**

Other operational advantages are set out in this document.

Conventional Concept

Large scale CSG Field Developments in Queensland have recently been driven by the LNG feed gas volume demand which, to date, have been developed around large centralised compressor stations designed and constructed on conventional gas project guidelines.

2010 will see Final Investment Decisions made by the major CSG LNG Proponents that will forever change the face and direction of the industry in Australia.

The Initial Advice Statements and Environmental Impact Statements lodged by Proponents to date, generally, indicate that the major players are sticking with the conventional wisdom of large scale, inflexible, expensive centralised gas processing systems.

Networked InField Compression

Experience in the United States and Canada over more than four decades has shown that the best CSG field lifecycle costs are achieved with low capital cost, flexible infrastructure and in-field compression close to well heads to extract the most from gas reserves. Reservoirs perform better with compression closer to the well head.

EPS Compression Pty Ltd in conjunction with Cameron Compression Systems has developed a **Networked InField Compression System** which includes facilities from Wellhead to the connection at the sales gas pipeline.

2. SCOPING STUDY 100TJ/d

The scale of field development proposed by the various CSG LNG Proponents varies considerably and the expected performance from the reservoirs also varies with individual well gas flows ranging from 300mcf/d to 1.5mmcf/d or more.

For the purposes of this Paper we have assumed a field gas delivery requirement of 100TJ/d from vertical wells each producing 0.5 TJ/d. The remaining 8 TJ/d is utilised for power generation for Wellheads, Compression, and ancillary items such as dehydration, offices and amenities.

The numbers in this document, based on 100TJ/d, are completely scalable as the Networked InField Compression is modular in design and can be replicated to suit any required field size.

The Key Data for this study is shown in Table 1.

100TJ/D CASE	
GAS PRODUCED	
Gas Production per Well	0.5 TJ/d
Total Produced Gas (Wells)	108 TJ/d
Total Fuel Gas (Compression, TEG and Wells)	8 TJ/d
Total Sales Gas @ 10MPa	100 TJ/d
FACILITIES	
Wells	216
Number of Low Pressure discharge points per well	2
Field Compression Stations	24
Central Compression Stations	3
Ratio of Field Compression Stations : TJ/d	01:04.5
Total Installed Compression horse Power	26,400 BHP
Well Head Pressure	105 kPa (variable)
OPERATING PRESSURES	
Low Pressure Gas Pipeline Pressure	100-105 kPa
Intermediate Pressure Gas Pipeline Pressure	3.5 – 4.5 MPa
High Pressure Gas Pipeline Pressure	10 MPa
PIPELINES	
Water pipeline dist. (DN110/200/355)	238/79/10 km
Low Pressure Pipeline dist (DN110)	238 km
Intermediate Pressure Pipeline dist (DN100)	88km
High Pressure Pipeline dist (DN100)	20 km

Table 1 - Scoping Study Data

3. NETWORKED INFIELD COMPRESSION

The system comprises of Bays, Rows, Pods, Well Heads, Low Pressure Pipelines, Intermediate Pressure Pipelines, Field Compressors, Booster Compression Stations, and High Pressure Pipelines. Figure 1 depicts the elements.

- The System is based on an interconnected network of gas gathering pipelines at various pressures set out on a grid pattern.
- Based on the Scoping Study Data shown in Table 1, the Networked InField Compression design allows for 216 wells, each with production of 0.5 TJ/d, clustered into Pods of nine wells each connected to a single Field compressor via low pressure pipelines.
- The wells are spaced at 1,000 metres making the Pods 2 km across and the InField compressors approximately 3 km apart.
- The grid design is based on three Bays, numbered 1, 2, 3, and Rows referenced A to H with the Bays intersecting at Pods with the same nomenclature, e.g. Pod 2D.
- The drill pattern in Figure 1 makes the base case for discussion within this Paper.

An alternative to the drilling pattern shown in Figure 1, utilises **horizontally drilled clustered wells** on a common drill pad (see Figure 2).

- The clustered well pad has the added benefit of eliminating all low pressure HDPE gas and water gathering lines.
- The compression requirements remain the same for the purpose of this paper where the well clusters comprise 8-10 wells with similar gas volumes.

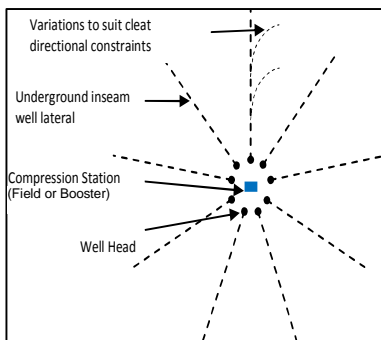


Figure 2 - Pod utilising clustered horizontal drilling pattern

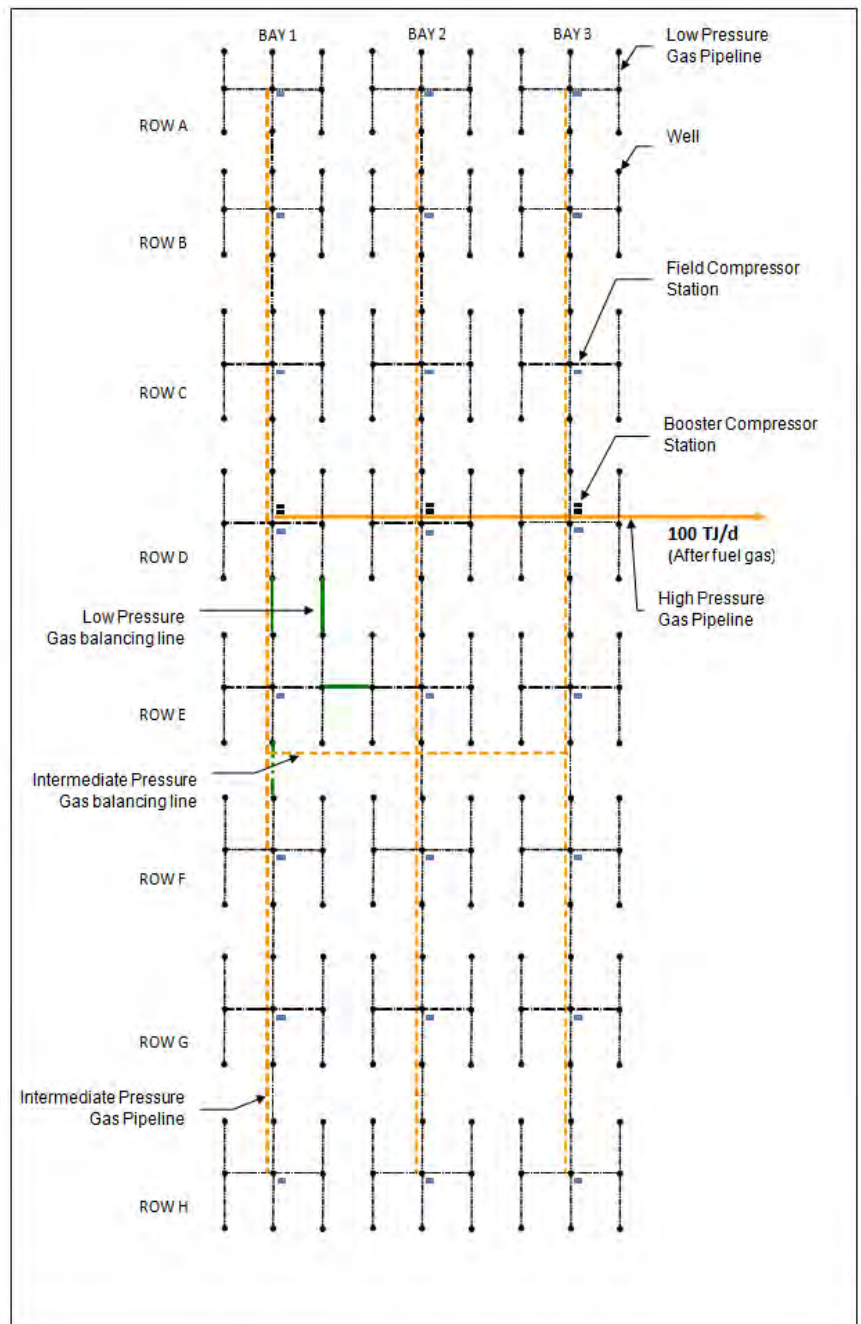


Figure 1 - Networked InField Compression with vertical drilling pattern

4. WELL HEADS

There are 216 wells, each producing 0.5 TJ/d of gas totalling 108 TJ/d.

The lean designed Well Head is divided into two parts:

- Gas regulation; and
- Water displacement.

Unlike traditional methods, the majority of the infrastructure is relocated back at the Field Compressor.

Gas regulation consists of manual valves for isolation and pressure regulation, set at the Low Pressure Line maximum operating pressure (in this case 500 kPa).

Other traditional functions such as communications, flow metering and automated pressure control, are centralised at the Field Compressor.

There are a number of options available for water displacement depending on water volumes and operator preferences. Most power required is to dewater the Well, where other Well ancillaries can be operated via gas instruments or small solar panels.

To provide power generation for dewatering, the Infield model offers two methods:

- A low speed gas fired single piston Ajax engine with a generator driving ESP's or hydraulic drives, this system is very low maintenance; or
- A high speed gas fired conventional engine and generator providing power to ESP's.

Power generation is located at each well site eliminating reticulation of power.

5. PIPELINES

Water Pipelines

Water pipelines maintain a common pressure rating throughout the field, and share a common trench to the compressed gas pipeline.

There is approximately 238 km of 110 mm HDPE and 88 km of 200 mm & 355 mm HDPE operating at 580 kPa.

The water lines connect to the Well Head, and route via the Field Compression Station, and Booster Compression Station. The water pipelines terminate at the edge of field for the operator to select and install the preferred treatment method.

Low Pressure Gas Pipelines

The Low Pressure Gas Pipelines connect from the Well Head pressure regulator (set at 500 kPa) to a combined Well Head Stand located at the Field Compressors.

The Low Pressure Gas Pipeline operates at 100 kPa, based on the central Well Head Stand. As such, aside from the Well Head pressure regulator, the Low Pressure Gas Pipeline acts as an extension of the well in order to centralise the well head components.

There is approximately 238 km of 110 mm HDPE Low Pressure Gas Pipelines. The 110 mm pipeline is supplied in coiled form and can be ploughed in together with the water pipelines.

The Low Pressure Gas Pipelines are interconnected between respective vertical neighbours via balancing lines. If one sector of the field produces a higher than anticipated volume of gas, balancing lines can be ploughed in. The effect is to distribute the gas across multiple Field Compressors.



Coiled pipe is quicker and easier to install

An example is shown in Figure 1, Pod 1E, where the green lines transfer surplus gas to the neighbouring Field Compressors.

Intermediate Pressure Gas Pipelines

Field Compressors to the suction header at the Booster Compression Station. The pipeline operates at approximately 3,500 kPa to 4,500 kPa based on the Field Compressor discharge pressure. There is approximately 88 km of Intermediate Pressure Gas Pipeline. The gas pipeline used is a flexible high pressure pipe typically less than 6" that is stored in coil form. Where required, the pipeline is paired to reduce pressure losses.

High Pressure Pipelines

The High Pressure Gas Pipeline connects from the Booster Compressor discharge header to the sales gas line. There is approximately 20 km of High Pressure Gas Pipeline operating at 10 MPa.

The gas pipeline used is a flexible high pressure pipe similar to the Intermediate Pressure Gas Pipeline.



Trenching laying multiple lines

6. COMPRESSORS

Field Compressors

There are 24 Field Compressors each processing approximately 4.5 TJ/d supplied by the surrounding wells. The suction pressure is initially set at 100 kPa and discharges at approximately 3,500 kPa to 4,500 kPa.

Field Compressors can be positioned anywhere within a Pod to accommodate physical terrain constraints or proximity to buildings, roads or to meet landowner preferences.

The Scope of the Field Compression facilities includes a full LSTK, comprising EPC Services, Site Preparation, Earthworks, Perimeter Fence, Freight, Instrument-Electrical Equipment, common Well Head Valve Stand, Control Panel, Data Communications incoming/outgoing, Lighting, Infrared Fire Protection, Lightning protection, one Ajax Integral Engine/Compressor, Lube Oil Storage Tank, Pre-compression Gas/Water Knock out separator, Compression Station Valves, Noise Abatement, Oily Water Separator combined with Water pump and Waste Oil Storage, Steel Pipework, Installation, Commissioning, Performance Testing and Warranties.

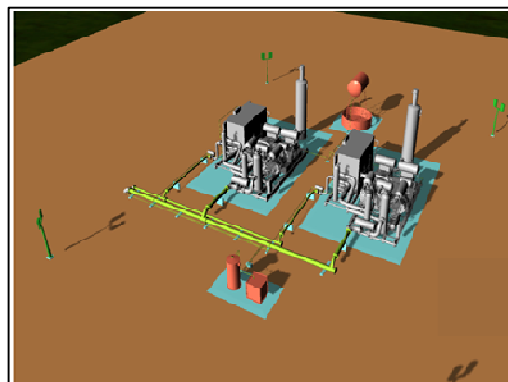
The gas enters the Field Compressor at the Valve Stand from the Low Pressure Line, and is then directed to a buried pre-compression Water Separator. Each well has individual Flow Metering, and Pressure Control, enabling the user to remotely operate the Well Head pressure from 0 kPa to 500 kPa, with a nominal 100 kPa initial set point.

This enables the compression capital to be minimised during the initial years of the field by increasing the suction pressure. In the later years, the well head pressure can be reduced to extract more tail gas, whilst maintaining the Field Compression at capacity as the suction pressure and gas volumes decrease. With the addition of a master control system, the field can be tuned remotely either at a field control station or at a more centralised control centre.

Booster Compression Stations

Three Booster Compression Stations are located at Row D, each containing two compressors of the same design as the field compressors. The Booster compressors compress the gas to sales gas pressure of 10 MPa.

The infrastructure scope of each of the three Booster Compression Stations is the same scope as the Field Compressors, but with some additional facilities at the third Booster Compression Station including a 'genset', an office, 2 x 50 TJ/d Dehydration skids and a Metering Station.



Typical Booster Compression Station

7. THE BENEFITS OF A SYSTEM THAT WORKS

Field Layout, Bays, Rows and Pods

- An adaptable, organic system that can take advantage of constraints and opportunities as well performance is confirmed.
- The InField system does not have the same pressure losses associated with larger centralised facilities that run wet gas over longer distances. This is one of the reasons the InField compression model has a lower requirement for horse power, which in turn reduces CAPEX and OPEX.
- Ability to 'tune' the field for optimum results via adding balancing lines, or relocating compressors.
- Further fine tuning can be done remotely via a master control facility to adjust well head and compressor suction pressures.
- Able to synchronise surface facilities to match nearest constrained activity.

Wellheads

- The majority of Well Head components are relocated to the Compression Station reducing costs and the Well footprint.
- The components at the Well site are minimal infrastructure and do not require routine inspection.
- Access to critical components is at the Compression Station accessed by a smaller number of higher quality roads.
- Well Head power for water drainage is a declining requirement and should be low CAPEX.

Pipelines

- The pipelines are designed on an interconnected network, operating on different pressure settings (Low and Intermediate). The interconnection enables flexibility in operation to extract the most from the field.
- The InField Compression model requires lower pipeline diameters to the point that nearly the entire field pipe is stored in coil form and ploughed in, at lower cost.
- Reduced pipe diameters, means lower friction loss, less compression required, lower CAPEX and lower OPEX.
- Lower energy and earth moved to install low diameter pipes, with significantly less corridor area required. Corridors may reduce from 25 metres to 8 metres.
- Ploughed in pipe can be more economically installed at greater depths with very large savings in installation time.

Compression

- Compression Station installations are lean, reducing installation time, cost and environmental impact.
- CAPEX is reduced as Compression Stations approach high volume manufactured skid designs and lower horse power required per TJ produced.
- The lower horse power is partly attributed to the use of AJAX Integral Compressors, requiring approximately 30% less horse power than screw compressors under similar conditions.
- In addition, by placing the compressor infield, the suction pressure is higher. The InField model is not subject to the same amount of line losses. This has the effect of further reducing the horse power required.
- Well Head pressure can be reduced. By lowering the well head pressure (from 100 kPa to 10 kPa) total recoverable gas increases by approximately 10% providing 10% more gas for no additional CAPEX.
- The AJAX Integral engine/compressors have the capability to compress gas to higher pressures enabling the use of high pressure flexible piping. Traditional Screw compressors being offered are not able to discharge at sufficiently high pressures to economically utilise low diameter high pressure flexible pipe.

- Compression nodes can manage the smaller slugs of water in the higher pressure low diameter gas lines without the need for low point drains.
- Each Compression Station provides an interconnected Intermediate pressure network increasing flexibility in field management. A compressor can be lifted off the network and the surrounding compressors will draw gas from that sector. Properly designed, there will be no loss of production if a compressor is closed down.
- Ajax Integral engine/compressors are two stroke gas fired, low speed and highly reliable. The AJAX approaches 99% availability on its normal maintenance cycle.
- In this configuration, Gas compression is a lot easier and more cost effective to relocate as field condition or performance change.

8. COST EFFECTIVENESS

Capital Costs

Pipelines

- Placing compressors close to the wells allow for the use of 110mm HDPE gathering lines operating at 100 kPa and intermediate pressure gas lines of 100mm between the field compressors and the booster compressors operating at approximately 3,500 kPa to 4,500 kPa.
- High pressure lines from the booster compressor stations to the sales gas line operate at 10,200 kPa and will comprise two or more small diameter flexible pipes.
- All flexible pipelines come in coils and can be laid with trenching equipment at the rate of up to 8 km per day. The gas gathering lines can be laid with the 100mm HDPE water lines in the same trench.
- There is a substantial cost saving and time saving in laying coiled piping over conventional piping, particularly where the conventional system requires large diameter piping needing multiple welds.

Compressors

- The field compressors and the booster station compressors are the Cameron Ajax integral compressor. There are 30 compressors for a total of 26,400 BHP approximately 30% lower in required horse power than traditional screw compressors.
- Other horse power savings are achieved by not using large diameter wet pipelines with greater frictional losses and restrictions caused by water pooling at low points.
- **Less BHP = Less cost in Capital and Operations.**
- Gas drive engines remove the cost of generating and reticulating power for electric drives.
- The Capital Cost for a 30 MW power station to run electric drive compressors for a 100TJ/d plant is in the order of an additional \$30 million. This is not required for the model proposed.

Compressor Installation

- All compressors and coolers are skid mounted and do not require expensive civil foundations and surrounding infrastructure.
- A typical installation cost with ancillary equipment for the compressors is significantly lower than conventional separable units.
- Ajax integral compressors can be fully installed and commissioned within 14 days depending on soil conditions.



Ajax: Simple, low cost installation. The vertical exhaust stack shown above may be buried for noise attenuation.

Engineering

- The Networked InField Compression System is a model that can be replicated as the Coal Seam Gas Field develops.
- Once the basic model is established for the field conditions, further Engineering costs required are minimal. There are no significant civil works with building structures and extensive concrete.
- The barriers to develop a field are greatly reduced as the plans can be more easily replicated.

Re- Locatable Facilities

- It is a fact of life in the CSG industry that fields vary from location to location and reservoir behaviour can be unpredictable. Locations within fields can have short production periods, running down within 5 years while other locations might keep producing for 20 years.
- The skid mounted Field and Booster compressors can be easily and cost effectively relocated to match the field as it is better understood.
- The facilities are gas powered, making the cost of relocation lower than electric drive systems.

Operating Costs

- The single biggest Operating Cost for any compression system is Fuel Gas. This is independent for gas engines or gas engines to power electric drives. The amount of fuel Gas required is directly related to BHP used. The less BHP, the less the Fuel Gas consumed.
- **Networked InField Compression requires approximately 30% less BHP to achieve the same compressed gas output due to compressor and field efficiencies.**
- Ajax compressors consume significantly less fuel gas per mmscfd of gas compressed.
- The two stroke Ajax compressors also have significant operational and maintenance costs savings over conventional separable units requiring less oil, parts, servicing and downtime.

9. ENVIRONMENT

Footprint

There is no question that the overall footprint and land usage is reduced using this model.

- The proposed small pipeline diameter will reduce main pipeline corridors from 25 metres to 8-10 metres or less. The extensive use of small diameter pipe compared to conventional centralised compression models provides Proponents with an opportunity to reduce infringement of landowners utility of the land by over 50% on main field pipelines.
- Wellheads do not require gas/water separation at the surface and the overall land area can be greatly reduced at each well.
- InField compression has a significantly lower land usage and environmental footprint.

Air Emissions

- The Ajax integral compressor has low emission levels and meets all industry standards. The proposed DPC-2804LE and DPC-3404LE models have the following emissions based on standard models without catalytic convertors compressing pipeline quality gas:

Table 2 - AJAX Air Emissions

	Emissions (Gm /Bhph)				
	NOx	CO	HCT	NMHC	CH2O
DPC-2804LE	2.0	1.2	6.1	1.2	0.3
DPC-3404LE	2.0	1.1	6.1	1.1	0.3

Noise

- Ajax integral compressors are a two stroke and the noise generated in full operation is comparatively low requiring less, if any, noise mitigation measures.
- Similarly, because the engine and compressor is an integral unit vibration is low, and will not impact facility operation.
- Noise levels for the AJAX DPC-3404LE are described in the following table. This data is expressed as Sound Pressure Levels (SPL), and they are based on a typical 3404LE package with a standard

cooler, a standard intake air system, and a VANEC 141 exhaust silencer. This data is based on free field conditions.

- For the following table, these SPL's are expressed with the 3404LE operating at 970 BHP @ 440 RPM. The table lists the SPL's at 10 feet and at 320 feet from the package.

Table 3 - AJAX Noise Emissions

Octave Band	Mid-Band Frequency (Hz)	@ 10 feet from 3404LE	@ 320 feet from 3404LE
Average	Weighted dBA	94	64
1	31.5	101	75
2	63	103	76
3	125	102	71
4	250	93	60
5	500	91	59
6	1000	88	59
7	2000	85	58
8	4000	80	49
9	8000	75	38

- A further low cost noise attenuation measure available with the Ajax, if required, is to bury the exhaust stack horizontally on the ground. This system significantly reduces noise and is used in the USA where compression is immediately adjacent to inhabited buildings.

Visual Impact

- The amount of equipment that will be moved to the Field or Booster Compressor location will reduce the visual impact of the majority of well heads.
- The field compressors are at least 3 km apart and because of the substantially smaller Cooler and low profile engine/compressor the visual impact is minimal. Creating noise attenuation earth mounds and tree planting will camouflage these units.
- The Booster Compressor stations are two compressor units and the same concept of camouflaging will apply.

Electric Reticulation

- There is no electrical reticulation via overhead powerlines or buried power lines.

Construction Disruption

- Although there are a greater number of compressor units they are minimal infrastructure facilities and can be installed in less than one week, ensuring there is limited disruption to landowners and intrusive access on land is minimised.
- The extensive use of coiled low diameter pipe allows for pipeline corridors to more readily follow fence lines, irrigation channels and roadways.

Rehabilitation

- Rehabilitation following installation of pipeline facilities and compressor stations is significantly reduced. Similarly, the absence of "construction" works minimises soil disruption.

10. SOCIAL BENEFITS

- The use of small diameter spooled piping can be laid up to 8 times faster than conventional length piping methods thereby reducing the disruption to landowners, road users and rural communities generally.
- Similarly the minimal infrastructure compressor stations can be installed in a matter of weeks, not months, as may occur for large central compressor facilities. Disruption to landowners and local communities is significantly reduced.
- Land use in rural communities is reduced allowing greater scope for agricultural pursuits.
- There is greater scope for local employment during the installation and operational phase with local contractors being able to contribute.

- Similarly, the ongoing operations do not require high level specialised skills and quality training programs can be put in place to ensure there is a sense of local involvement.
- The fundamental premise that more gas will be extracted from this resource with in-field compression is a benefit to the whole community.

11. SAFETY

- There are no large scale facilities that could create a major incident.
- Significantly reduced operator driving time. There are few to no low point drains to manage. In addition, many of the critical components have been located at the Field Compression Stations, eliminating the need to regularly visit wells.
- The field can be remotely tuned via a master control centre.
- Fewer but better roads can be constructed to the Compression Stations only to inspect the critical components.
- No overhead power lines are required, particularly in irrigation areas where power lines are a known safety issue.
- The interaction between power lines, irrigation sprays and crop dusters was a key focus of Australia's "look up and live" campaign.
- There are no buried power lines required.
- As Coal Seam Gas projects develop, there will be hundreds of kilometres of gas pipelines crisscrossing the country. The more pipe that is installed, the greater the risk there will be a clash and a rupture of a gas pipeline. If the pipelines are installed alongside electrical power cable, then there is a combination of a fuel source and ignition source. Using the model presented here, minimises the interaction between electricity and gas.

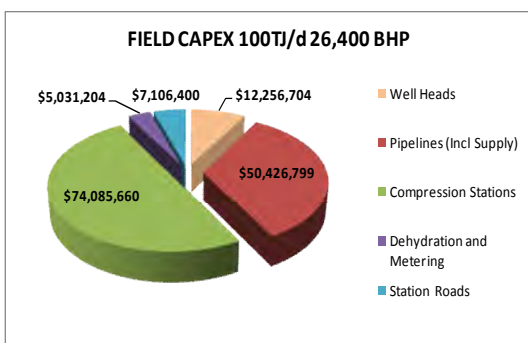
12. COSTS

Capital Costs – Equipment

- The Capital Costs of equipment in this model are based on the scope of work described herein.
- Costs include the well head valves, downhole pump, power generation, water and gas pipelines within the field limits, field and booster compression stations, dehydration, metering and site office.
- Field and Booster Compression Stations costs shown below are firm Lump Sum Turn Key prices, the pipelines and roads are subject to additional site data.
- Costs are current at February 2010.

Capital Costs – Installation

- The installation costs used in this model are subject to soil conditions however are based on a typical site.
- Pipeline costs, supply and install, again are subject to the site specific requirements.



Phase	Asset	Total
EPC Services	Compression Stations	\$5,610,480
	Pipelines	\$4,627,199
EPC Services Total		\$10,237,679
Supply	Dehydration and Metering	\$2,380,500
	Well Heads	\$9,643,104
	Compression Stations	\$45,494,190
Supply Total		\$57,517,794
Installation	Dehydration and Metering	\$2,448,304
	Well Heads	\$2,613,600
	Compression Stations	\$20,874,990
	Pipelines (Incl Supply)	\$45,799,600
	Station Roads	\$7,106,400
Installation Total		\$78,842,894
Commissioning	Dehydration and Metering	\$202,400
	Compression Stations	\$2,106,000
Commissioning Total		\$2,308,400
Grand Total		\$148,906,767

Operating Costs

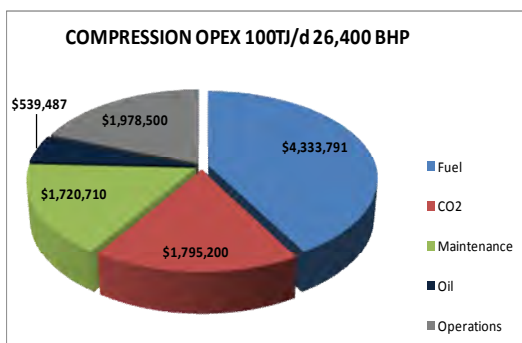
The annual OPEX includes all costs to run the field equipment from the well head to the sales gas line. It comprises:

- All routine maintenance parts and labour;
- Operations labour;
- Oil consumption;
- Fuel Gas; and
- CO2 tax.

The AJAX Integral engine/compressors have been selected for this application as they are very efficient, highly reliable, and easy to service.

The gas driven engine saves the cost of reticulating electricity, and is easy to relocate to open up new fields as the old fields deplete.

- The AJAX can operate at a minimum of 99% availability. A performance warranty will be offered to give confidence in operating availability.
- The Networked InField Compression field can operate at 100% availability due to the well interconnections.



Type	Deliverable	Total
Maintenance	Consumables	\$30,000
	Labour	\$351,750
	Major Service	\$635,670
	Parts - Annual	\$225,750
	Parts - Bi-annual	\$477,540
Maintenance Total		\$1,720,710
Oil	Oil	\$539,487
Oil Total		\$539,487
Operations	Insurance	
	Overheads	
	Operators	\$1,798,500
	Vehicles	\$180,000
Operations Total		\$1,978,500
Fuel Gas	Fuel Gas	\$4,333,791
Fuel Gas Total		\$4,333,791
CO2 Tax	CO2 Tax	\$1,795,200
CO2 Tax Total		\$1,795,200
Grand Total		\$10,367,688

13. LIFECYCLE COSTS AND NPC's

The Networked InField Compression system presents a low capital and operating cost model that, without other considerations, results in a significantly lower Net Present Cost over the lifecycle of the CSG field development project than alternative systems.

If a financial model comparing alternative field development compression systems is to be fine-tuned and fairly compared, Operators must also take into account the following additional advantages of the Networked InField Compression System:

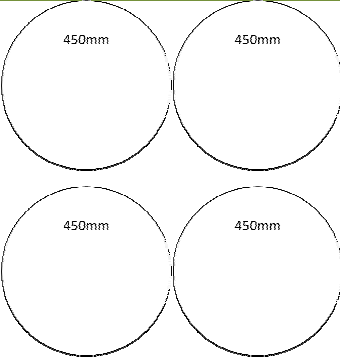

- Time and cost saving on FEED study;
- Time and cost saving on Design Engineering;
- Benefits of "cookie cutter" development model for future projects;
- Cost saving from limited capital outlay over shorter "construction" period;
- Earlier sales gas availability;
- Flexible low cost relocation of compression as field reservoir changes;
- Low cost of adding additional compression by banking units;
- High residual value of skid mounted movable compression at end of field life; and
- Lower rehabilitation costs at end of field life.

The benefits of this model over a centralised compressor station concept are numerous however it is cemented in the fact that 10% plus additional gas can be recovered.

Using our model figures of 216 wells of 1.5Pj @ 10% and a gas price of \$4.00Gj, additional revenue of \$130 million can be expected.

14. NETWORKED IN-FIELD COMPRESSION V'S CENTRALISED COMPRESSION

Table 4 - Networked InField Compression Model compared to Centralised compression model

	HIGHLY CENTRALISED MODEL	NETWORKED IN-FIELD COMPRESSION MODEL
COMPRESSION		
Compressor Station : TJ Ratio	1: 50+ TJ/d	1 : 3-18 TJ/d
Gas Production	100TJ/d at 10MPa	100TJ/d at 10 MPa
Well Head Pressure/Suction Pressure	100 kPa / 30 kPa	100 kPa/ 95 kPa
BHP required (compression)	38,557	26,400
PIPELINES		
Gathering line diameters (mm)	110, 160, 200, 250, 355	110
Approximate Spine line pressure	100 kPa to 50 kPa	3.5 to 4.5 MPa.
Respective Size difference in spine lines.		
For consideration	Road transport, Earth moved, Right of Ways, ability to route obstacles, water build up and associated pressure losses.	Compressed gas no low point drains, ploughed in deeper, able to skirt field boundaries.
Corridors: Rights of Way	25 meters	8 meters
COSTS		
CAPEX	\$260M (electric drive inc power generation)	\$149M
OPEX	\$15 M (screws, reciprocating & generators)	\$10M
Revenue Benefit		plus \$130M of additional gas
Installation Time		
Compression	4-8 Months	8 days per Field Compression Station
Spine lines	Up to 1 km per day	Up to 8 km per day

Networked InField Compression and High Pressure Low Diameter Coiled Piping is the answer to ever increasing CSG Field Development Costs.