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ITEM 6

Technology Selection

Technology Options Considered

Technology	Nameplate Efficiency
Open cycle Gas Engine	44%
Duel Fuel Gas Engine	45%
Combined Cycle Gas Engine	47.4%
Open Cycle Gas Turbine	35-38%
Small Combined Cycle Industrial Gas Turbine	43%
50-100MWe Combined Cycle Gas Turbine	50-52%

Technology Selection Criteria Performance Factors

	Engines	**Turbines**
Temperature Nameplate at standard conditions	0.4%	3.3% (at temp range 0-45 deg C)
Altitude MASL	0	5%
Degradation Average life cycle derating	0.5% (range 1% over 7.5 years)	2% (CCGT, range 0-3.5% over 3 years)
Cogeneration (with GP plant 11MTh)	0	4% (CCGT)
Parasitics Compressor and direct loads	1.5%	2.3% aux(CCGT) / 1.2% Comp
Availability	94.7%	90.6% (CCGT)

Technology Selection Criteria Performance Summary

	Nameplate output	Hourly Average output (less derating factors)	Yearly output average (Less availability)	Gross efficiency refer 2005 GT world handbook	Net efficiency (gross efficiency less derating)
6-9MWe Engines	105MWe	102MWE	96.6MWe	44%	43%
18MWe CCGt	106.2 MWe	92.6MWe	83.9MWe	43%	36.3%
36MWe CCGT	108.3MWe	94.6MWe	85.7MWe	50.5%	42.9%
100MWe CCGT	100.8MWe	88.0MWe	80MWe	52.2%	44.3%

Power Station Cost

excludes contingency, indirect costs and owners costs

No off	Size MWe	Technology	Equipment supply US$x10^6	Installation US$x10^6	Direct Costs US$x10^6
16	6.57	Engines	54	19	73
6	17	CCGT	77.4	23.6	111
1 (2+1)	130	CCGT S206B	73.3	30.7	104
1 (1+1)	106	CCGT S106FA	60.5	25	85.5

Technology Selection Criteria
Capital Cost per delivered KWe

No off	Size MWe	Technology	Direct Costs USx10^6$	average yearly ouput MWe	$ per delivered kWe
16	6.57	Engines	73	96.6	$756
6	17	CCGT	111	83.9	$1,323
1 (2+1)	130	CCGT S206B	104	85.7	$1,213
1 (1+1)	106	CCGT S106FA	85.5	84.8	$1,008

Technology Advantages

Gas Engines	**CCGT**
No Water use	Lower O&M costs
Schedule Schedule	Efficiency for large units
Maintenance on n-1	
Capital Cost $/kW	
Flexible operation, load follow	
More Local Involvement	

Technology Selection Criteria Summary

- **Engines at Sheberghan have minimal derating, higher availability and lower direct cost so capital cost per delivered kWe is much lower**.
- Engines are similar net efficiency to mid size CCGT ie that is direct fuel $/kWe will be similar to 36MWe CCGt.

Technology Selection Criteria Summary

- CCGT's require large amounts of water for make up water to cooling tower.
- A gas engine plant can easily be staged, added to or sections of it moved with minimal effort. Flexible operation.
- Gas engines have the lowest whole of life cost per unit delivered into the Transmission Grid.

What it would look like?

- Plains End – Colorado – 111MWe

Capital Cost Power Station

- Direct Plant Cost - $73MM
- Indirects - $17MM
- HV connection - $2.7MM
- Bridge Repairs - $.25MM
- 110 KV repairs - $3MM
- Allow contingency say $15MM

Operating and Maintenance

- 64,000 hours to first major overhaul. ie 7.5 years
- Minor inspections/replacements at 16,000 / 32,000 / 48,000 hr intervals
- MEW operate and Maintain?. Including minor services eg spark plugs and oil changes at 4,000 hour intervals.
- Agreement with Original Equipment Manufacturer to provide materials and labour for all non routine maintenance.
- OEM will have permanent presence at site due to the size of plant.
- **Requires clean gas**.

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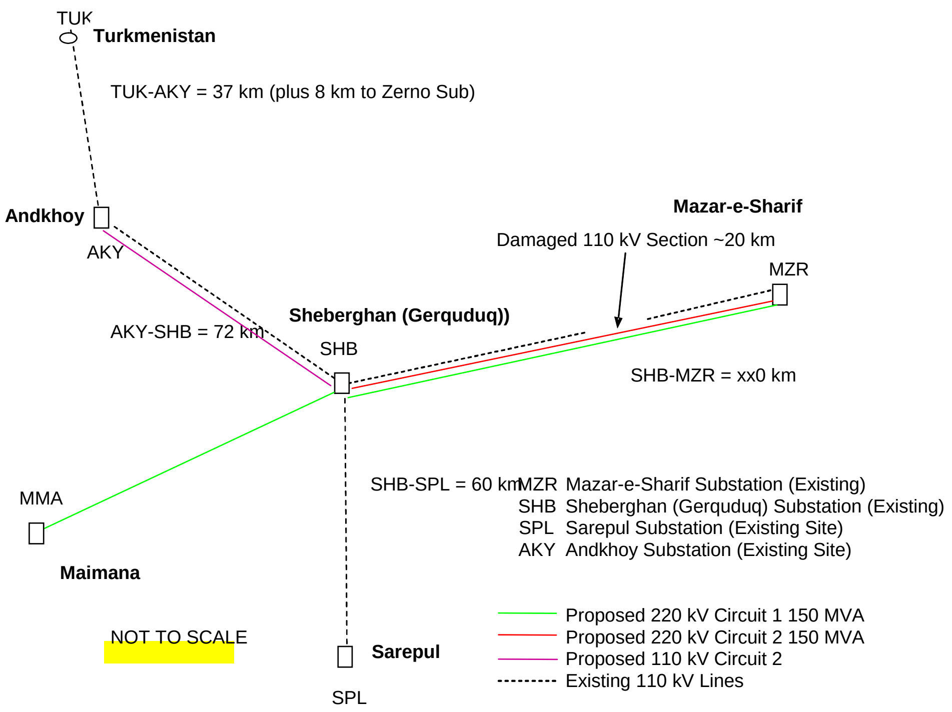
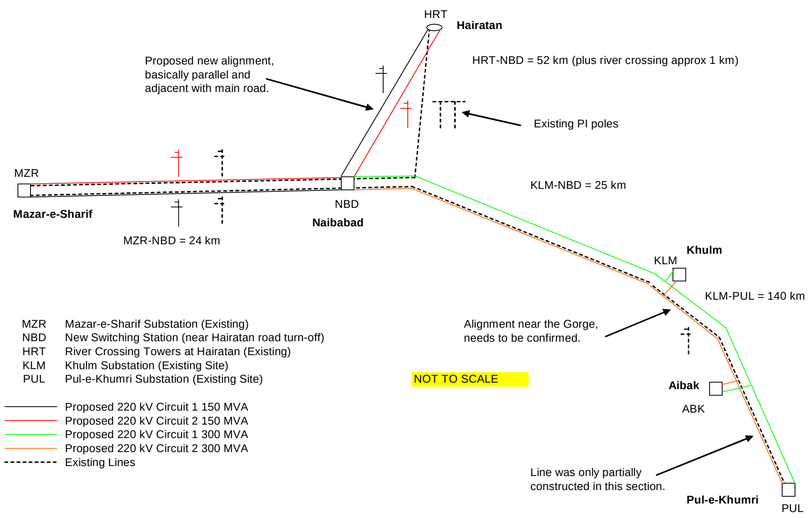
Item 7: Grid Interconnection and Transmission Requirements

Northern Transmission System





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ITEM 8

Current and future gas supply

Overview of Gas Supply

Age	Formation	Gerquduq	Khoja Gogerdak	Yatimtaq
Cretaceous	Albian	?	Substantially depleted	No data
Cretaceous	Aptian	?	Substantially depleted	No data
Cretaceous	Hauterivian	Substantially depleted	Substantially depleted	No data
Jurassic (Sour)	Kogitan	not exploited	not exploited	No data

Overview of Gas Demand (Standard $m^3 x 10^3$ per day)

Figures from May 2003 ADB report unless noted	**2005**	**2008**	**Future**
Domestic and Commercial	220	220	384
Fertiliser Plant Including Embedded Power Station at 35% output	360	0-1,000	0-1,000
Lost Gas	250	5%	5%
105 MWe Power Plant (ref AEAI report)	0	600	600
Total	**830**	**820+**	**984+**

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ITEM 9

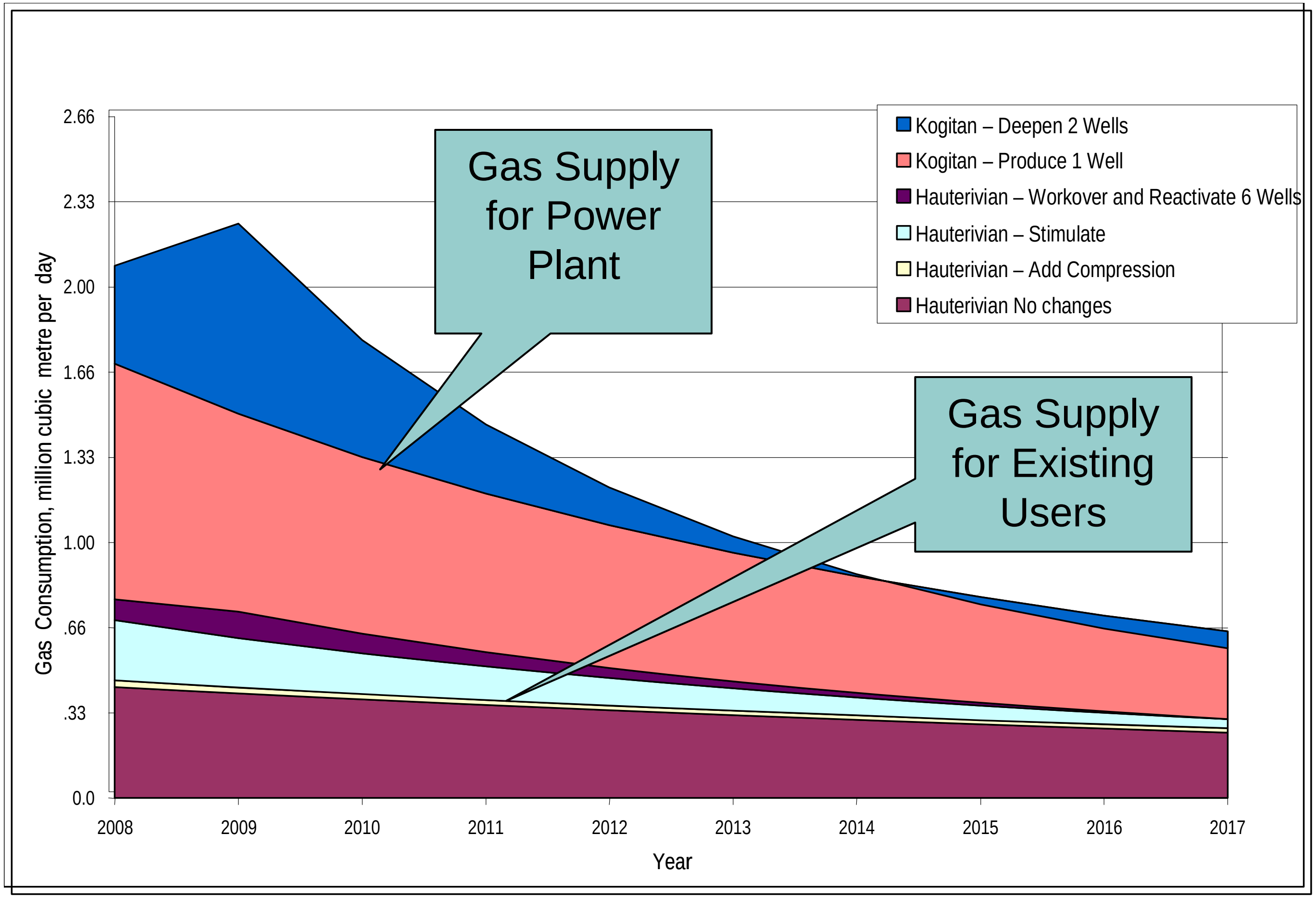
Meeting future supply needs

Well Identification

- Gerquduq: Jurassic Kogitan Formation
  - Well 21 already completed, flow tested at 300,000 m^3 per day
  - Gustavson recommends completion and deepening of wells 76 and 77 into Kogitan Formation
  - Total flow up to 1,000,000 m^3 per day from 3 wells from day 1

Gerquduq Forecast

Gustavson and Associates April 2004



Are 3 wells enough?

- What if this reservoir has problems?
- Production will fall, how quickly?
- A backup fuel supply will be required for the power station.

Power Facility Backup Fuel Supply

- Khoja Gogerdak: Jurassic Kogitan Formation or Yatimtaq?
  - Which wells
  - Some repairs required to existing gathering lines to Gerquduq ?

Possible Well Exploitation

- Gerquduq - well 21, minimal work, already connected
- Gerquduq - well 76, 77 require completion into Jurassic Formation
- Khoja Gogerdak - well 3 minimal work, already tested
- Khoja Gogerdak - wells 9,40,41,42,43 to be perforated and flow tested

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ITEM 10

Gas Composition and Gas Processing

Gas Quality

	Kogitan Raw Gas (typical)	Load 1 Power	Load 2 Domestic	Load 3 Fertiliser
H_2S	1800-9000 ppm	<300ppm	4ppm	<300ppm
CO_2	8.8%	<10%	<4%	<10%
H_2O	3800 mg/m^3	100 mg/m^3	100 mg/m^3	100 mg/m^3

Gas Gathering

- Wells – Flowing pressure , H_2S?
- Flowlines – do we need new ones
- Corrosion inhibition , hydrate (refer pressure)
- Gas Gathering Manifold – pressures , new?
- Interconnecting flowlines to gas processing plant – condition?

Gas Processing Plant

- Free Water Liquid Knockout
- H_2S removal (using Amine) – flow/H_2S levels too high for Iron Sponge
- Dehydration / Dew Point suppression (using Glycol)
- Particulate removal

Gas Processing plant

Services

- Water Supply – , well refurbishment, pumps , Water pipeline – condition, Sliplining.
- Water tank Gerquduq – reuse
- Amine regeneration – Cogeneration opportunity
- Glycol Regeneration – gas fired or use waste engine oil burner

Acid Gas Disposal

- Acid gas flare – location , wind – low cost
- Recompress acid gas stream into well $3-$5MM
- Extract for by-product $5-11MM

Gas Plant Cost

- Direct Plant cost $14MM
- Indirects $7MM
- Qarakent $1.4MM
- No allowance for field connection flowlines, corrosion/hydrate inhibition
- Should allow $7.5MM contingency.
- Well work? Who funds

Gas Processing location

- Proposed location next to Power Station to make use of low grade (120^{o}C) water to regenerate Amine for H_2S removal. 11MWth at 1.25% H_2S and 600,000m^3/day.

Gas System Cost

- Power Facility 691,000 m^3/day includes 10% design margin
  - Total US$30,000,000
- 1,000,000 m^3/day
  - Total US$33,000,000
- 1,500,000 m^3/day
  - Total US$39MM