



# **The Hope for Pakistan's Future**

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**Planning Commission**

## Total Power Generation of World)

No	Source	%	No	Source	%
1	<b>Coal Based</b>	<b>41.61</b>	4	Nuclear	13.75
2	Oil Based	5.63	5	Hydro Power	15.57
3	Gas Based	20.87	6	Others	2.25

## Total Generation capacity of India

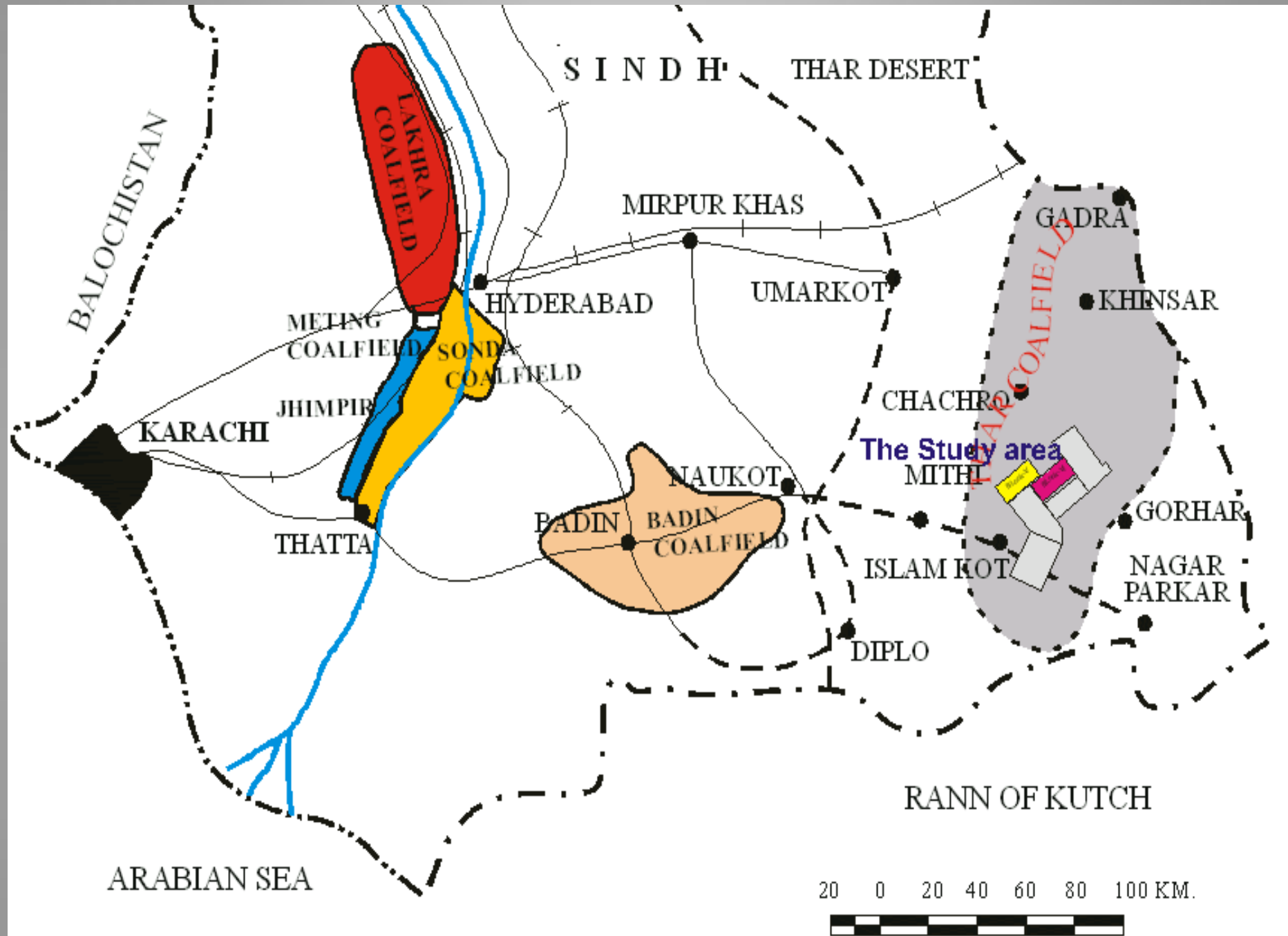
No	Source	%	No	Source	%
1	<b>Coal Based</b>	<b>64.6</b>	4	Hydro Power	22.8
2	Gas Based	53.3	5	Nuclear	2.9
3	Oil Based	0.9	6	Others	9.9

## Total Generation capacity of Pakistan

No	Source	%	No	Source	%
1	<b>Coal Based</b>	<b>2.27</b>	4	Hydro Power	32.54
2	Gas Based	4.50	5	Nuclear	2.23
3	Oil Based	58.37			

# Current Energy Scenario

- Current Energy Crises is causing Rs.230 billion loss ever year (ADB Report).
- Loss of 400,000 jobs, hitting poorest of poor leading to culture of insurgency (Report of Beacon House University).
- Current dependable power supply hovers around 14000 MW in summer whereas it drops down in winter.
- On the other hand power demand in year 2030 would be more than 100,000 MW (PEPCO).
- *In this situation Thar Coal can play a pivotal role in meeting this Energy Crisis both in Long term and Short term.*
- *Coal has to be declared matter of National Security & of Strategic Importance so that Donors and Multilaterals invest in it.*



# Thar Coal Potential

Thar Lignite Coal reserves  
*spread over 9600 sq. km*

175 billion tons

Lignite coal

30 ~ 55% moisture

6200~11,000 Btu/lb

*Generation potential 100,000 MW consuming 536 million tones/year*

**Only viable solution in long term for meeting energy demands of the country is development of Thar Coal.**

- Only Thar Coal can provide guaranteed long term energy security to Pakistan.
- Major tool for Import substitution of expensive RFO in future
- Potential Poverty alleviation tool
- Enhanced Industrial competitiveness due to cost effective energy

*Total reserve is equivalent to 50 billion tone of oil (more than Iran and Saudi Arabia combined oil reserves) or over 2000 TCF of Gas (42 times greater than total gas reserves discovered in Pakistan so far)*

# STATUS OF THAR BLOCKS

	Exploration License	Status
<b>1</b>	<b>Block I</b>	Available for Investment
<b>2</b>	Engro Sindh Coal Mining Company (40% Sindh Government; 60% Engro) <b>1200 MW</b>	Feasibility study due in June 2010; Strip mining and power generation potential 4000MW, 24 million tons/year for 30 years. PEPCO has also Signed MOU for 1200MW Power Plant
<b>3</b> <b>A</b>	Cougar Energy (Australia) Under Ground Coal Gasification Project <b>400 MW</b>	Drilling License awarded to an Australian firm Pilot Burn planned in 36 months; Technology planned is Ergo Exergy ; 400MW planned;
<b>4</b>	Bin Daen Group (UAE)) <b>1000MW</b>	<i>Integrated Coal to power project, 1000MW planned;</i> currently exploring possible partnerships to carry out feasibility studies.
<b>5</b>	Under Ground Coal Gasification Project Dr Samar Mubarakmand <b>100MW</b>	<i>Pilot project for 100 MW planned for mid 2012.</i> <i>Gasifier designed, major equipment ordered, technical team is mobilized, colony being built and drilling in full swing. Pilot burn planned for December 2010.</i>
<b>6</b>	Oracle, PLC (UK) <b>600MW</b>	Strip mining; 600MW planned. ESIA completed; anticipate mine commencement Dec. 2011.
	<b>Block III B, VII &amp; VIII</b>	Available for Investment

A bright blue flame from a torch illuminates dark, jagged rocks in a cave. The flame is the central focus, casting a strong light on the surrounding rock formations. The background is dark, emphasizing the glow of the fire.

# Fire

*Underground coal gasification may provide a secure*

# in the

*energy supply and reduce greenhouse gas emissions.*

# Hole



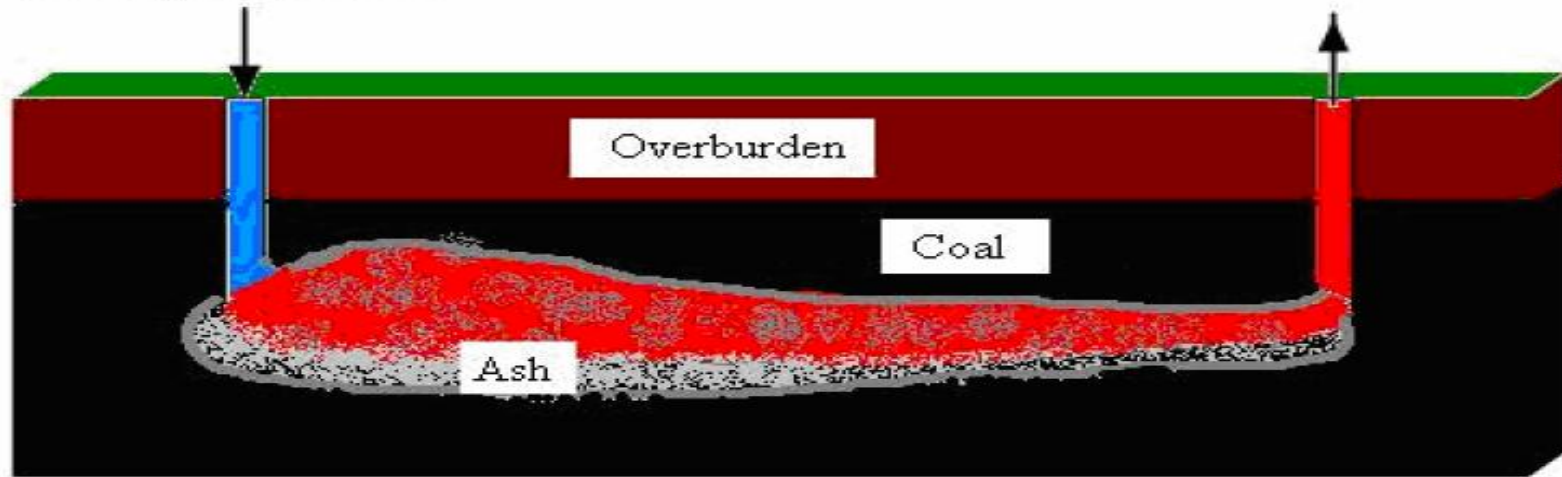


# Distribution of UCG sites



Air/Oxygen & Steam

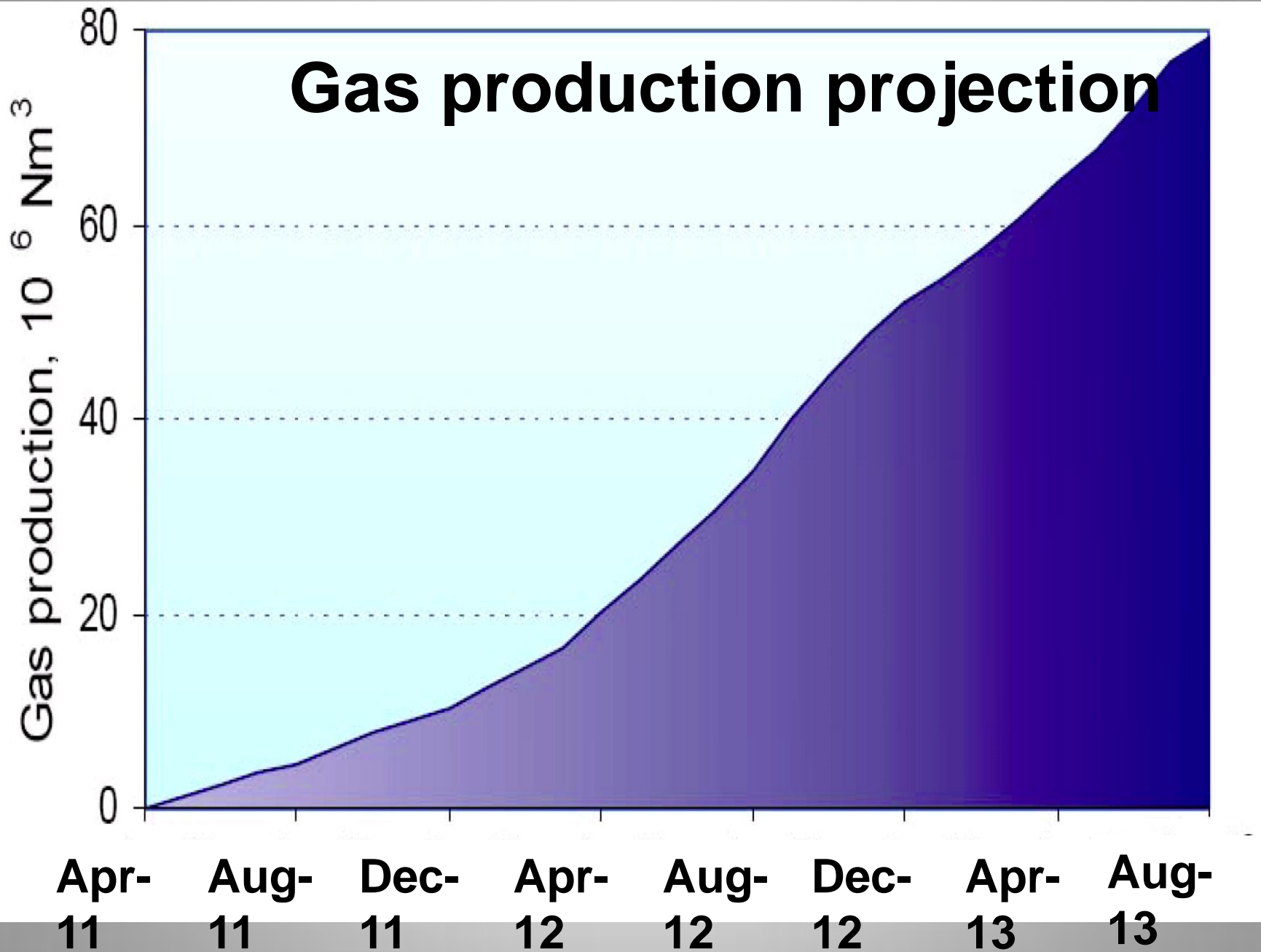
Product gases (CO, CO<sub>2</sub>, H<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub> & steam) and tar

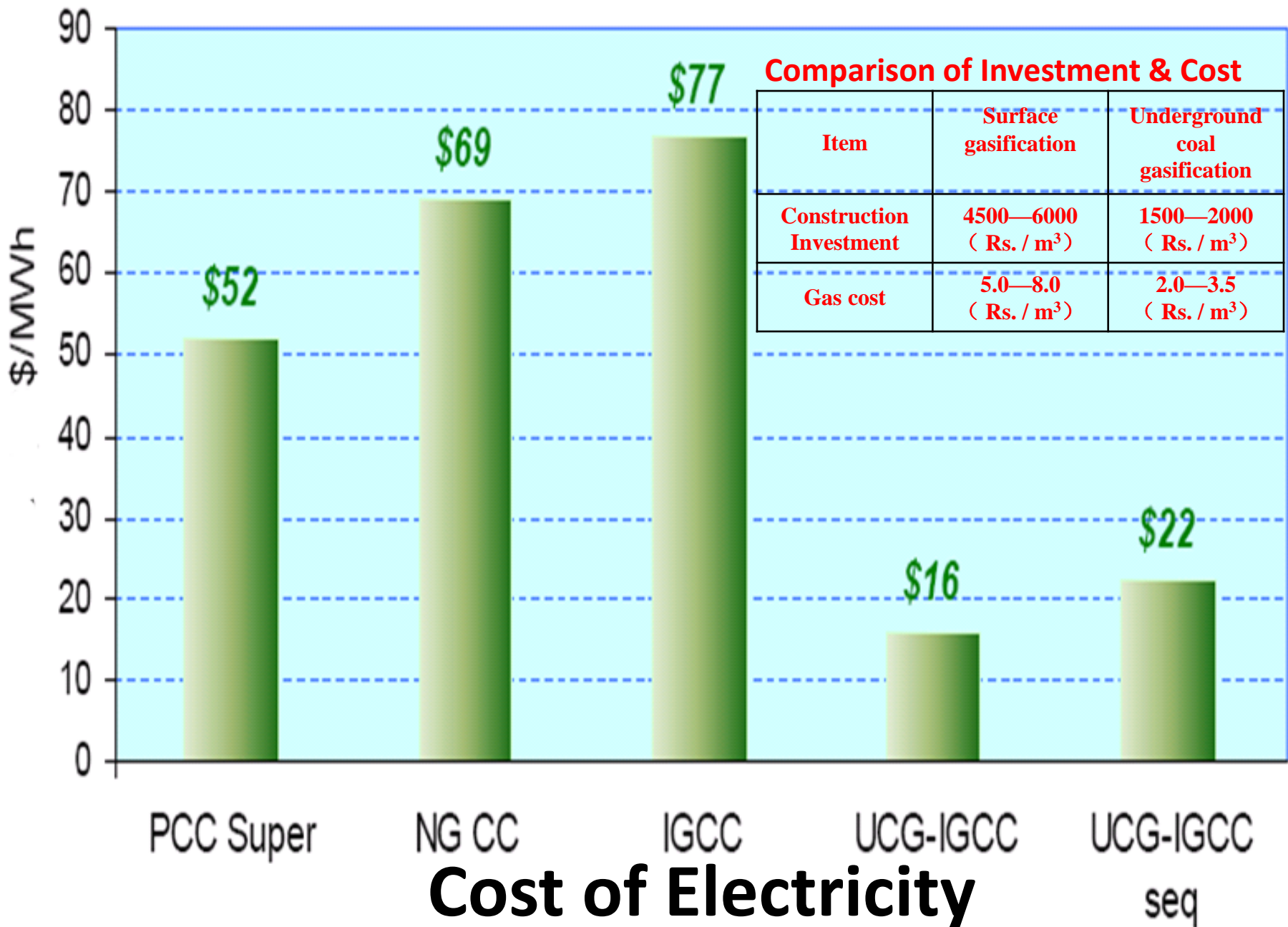


Temperature 200-550°C	Temperature 550-900°C	Temperature more than 900°C
Drying & Pyrolysis Zone	Reduction Zone	Oxidation Zone
Coal $\rightarrow$ CH <sub>4</sub> + H <sub>2</sub> O CO + CO <sub>2</sub> H <sub>2</sub> + C Hydrocarbons	C + H <sub>2</sub> O $\rightarrow$ CO + H <sub>2</sub> CO <sub>2</sub> + C $\rightarrow$ 2CO CO + H <sub>2</sub> O $\rightleftharpoons$ CO <sub>2</sub> + H <sub>2</sub> CO + 2H <sub>2</sub> $\rightarrow$ CH <sub>4</sub>	C + O <sub>2</sub> $\rightarrow$ CO <sub>2</sub> C + $\frac{1}{2}$ O <sub>2</sub> $\rightarrow$ CO CO + $\frac{1}{2}$ O <sub>2</sub> $\rightarrow$ CO <sub>2</sub> Coal + O <sub>2</sub> $\rightarrow$ CO <sub>2</sub> + CO + H <sub>2</sub> O

**Schematic of the processes involved in UCG**

# Gas production projection





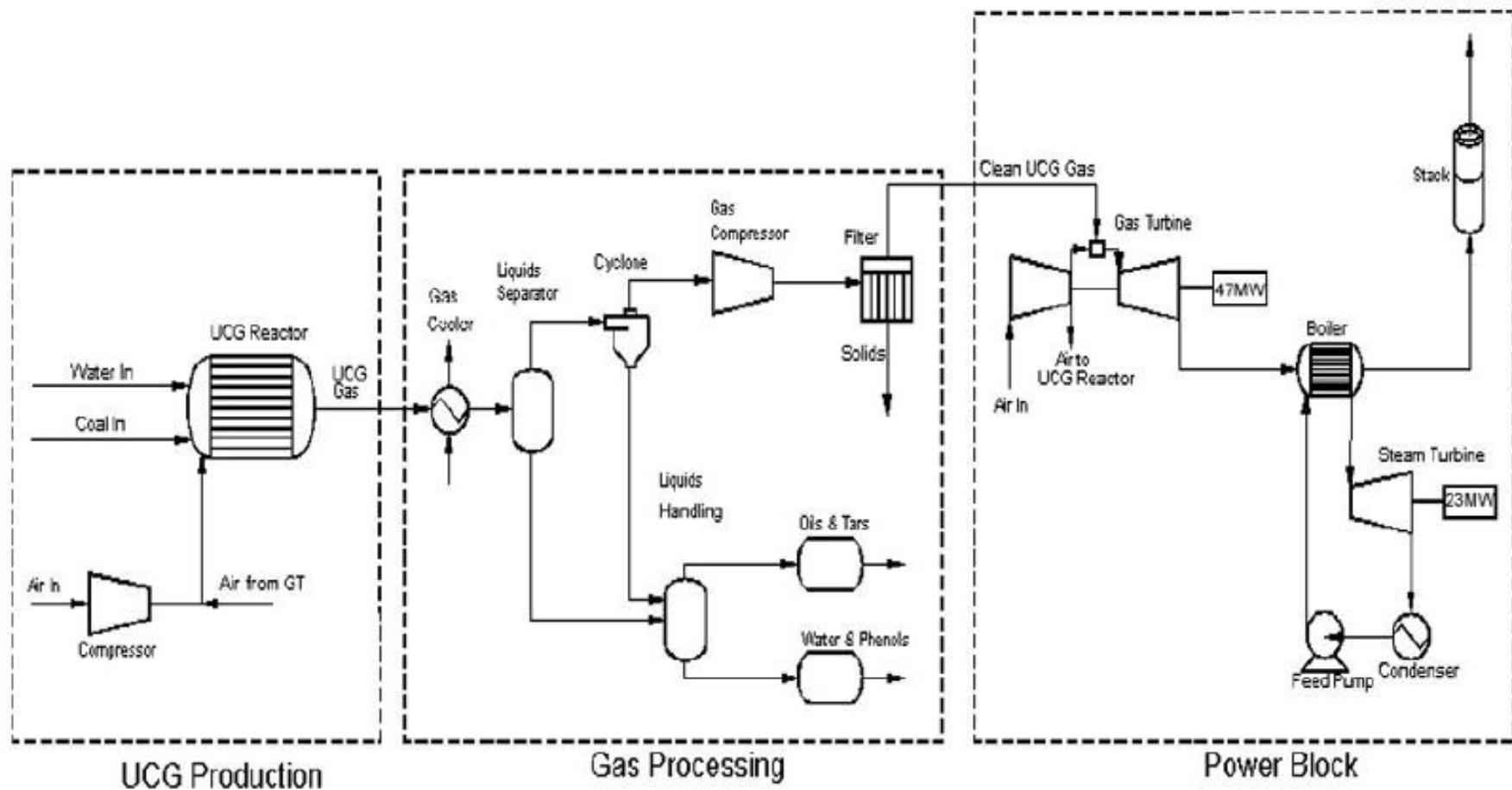
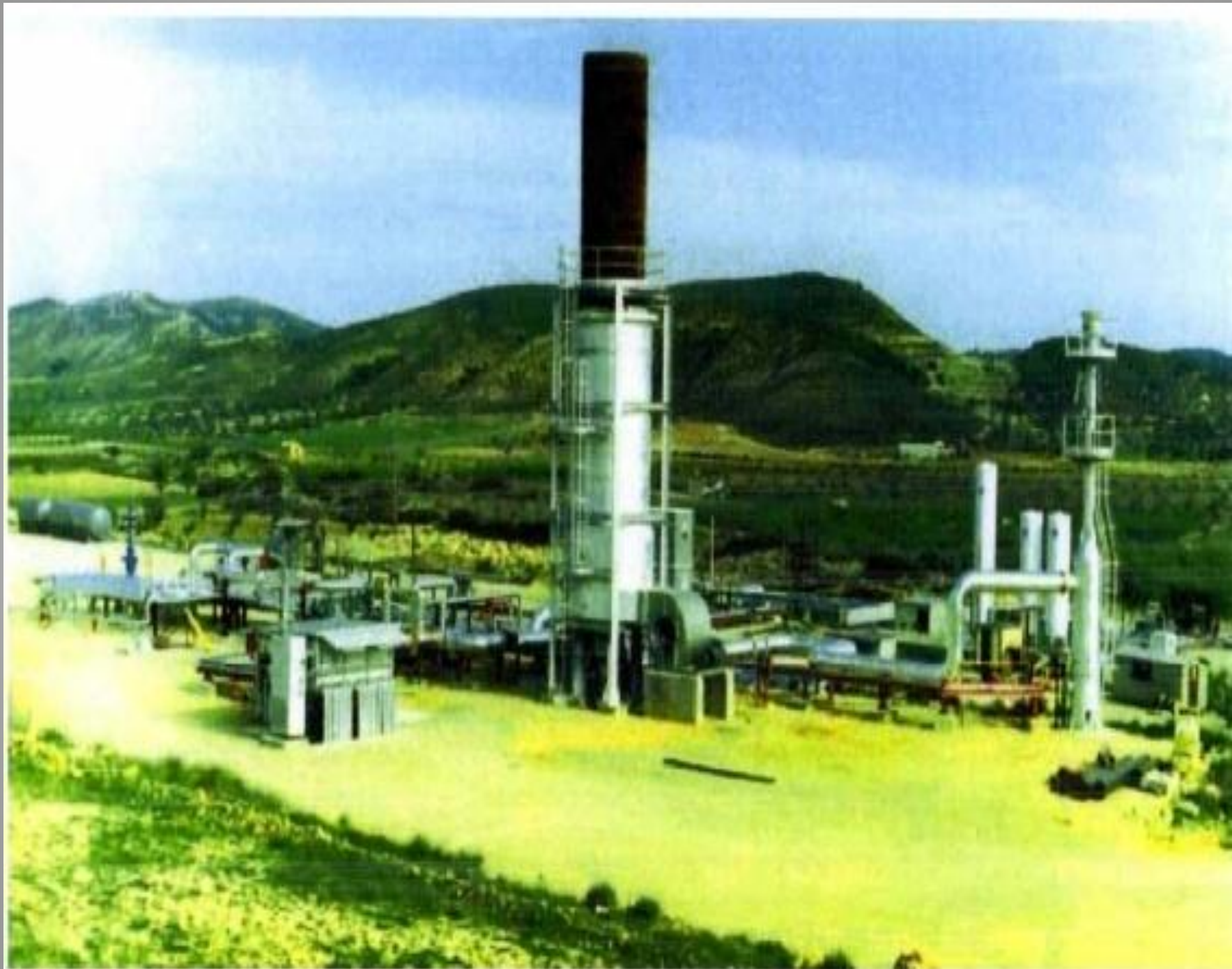
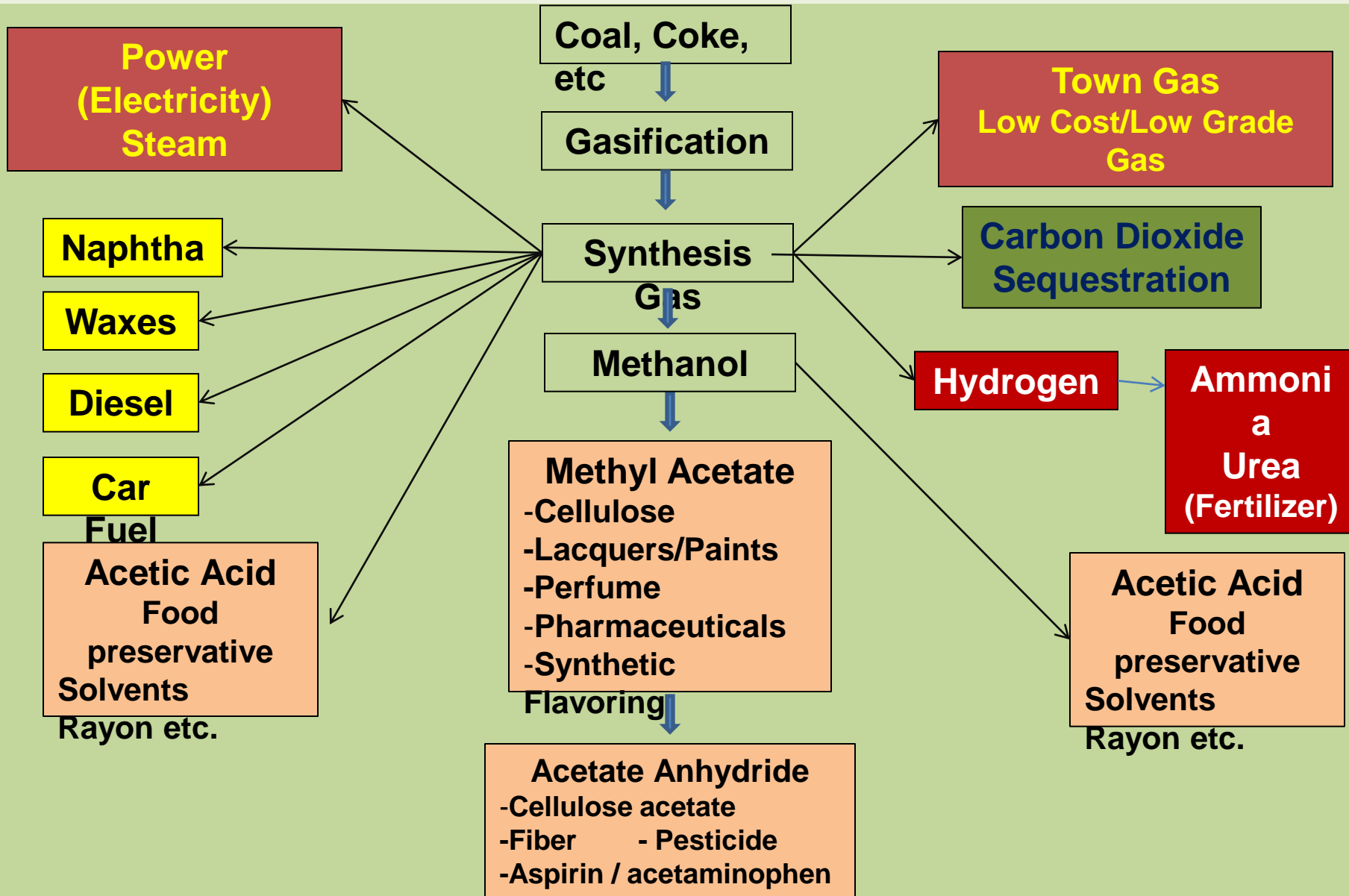


Fig. 1. Conceptual design of Chinchilla UCG-IGCC plant.

A gas compressor is required to bring the pressure of the gas to the level acceptable for the gas turbine. Water separated from the gas flow is used for cooling the raw gas in a heat exchanger and air in the air compressor intercoolers. It will also comprise a part of makeup water needed to operate the steam cycle once a steam turbine is installed.



# Polygeneration Potential of Gasification



# Generation of 100 M Watts through underground coal gasification

<b>Total project cost</b>	<b>US \$ = 115.6 million ( Rs. 9883.6 million)</b>
Total funds received	US \$ = 7.48 million ( Rs. 639.6 million)
Funds allocated in PSDP 2011 – 2012	US \$ = 4.1 million ( Rs. 350.33 million)
of first release of fund & commencement of the project = 28 April, 2010	



# Project Milestone

## a. CIVIL WORK

S. No.	Description	Date	Status
1	Land Acquisition	2 – 7 - 2010	Acquired about 27 acres
2	Residential Colony	17 – 7 - 2010	90 % complete ( 39,312 sq. ft )
3	Technical Plant, workshop, stores, laboratory, compressor station, power station, control room and admin block.	1 – 11 - 2010	60 % complete ( 27,756 sq. ft. )

# Project Milestone

## b. Main Machinery ( All purchases under Sindh PPRA rules )

S. No.	Description	Date	Status
1	Air compressor ( process)	15 – 8 – 2010 Expected delivery (15 –1– 2011)	Not delivered
2	Air compressor ( process) placed to the second lowest for Hitachi Compressor after negotiation at the lowest cost. Expected date of delivery is Third Week of April 2011..	18 – 2 – 2010 (Expected date of Delivery is Third Week of April 2011..)	These machines have been delayed by the manufacturers due to the earthquake and sonami in Japan. Now the expected date of Delivery is Third Week of July 2011..)
3.	Air compressor (Startup)	15 – 12 - 2010 Expected delivery  (15 – 4 – 2011 )	These machines have been delayed by the manufacturers due to the labour shortage. Now the expected date of Delivery is First Week of July 2011.)

# Project Milestone

## b. Main Machinery ( All purchases under Sindh PPRA rules )

S. No.	Description	Date	Status
4.	Diesel Generators	15 -08 - 2010 Expected delivery ( 15 – 12 – 2010 )	Delivered
5	Workshop equipment	15 -08 - 2010 Expected delivery ( 15 – 12 – 2010 )	80 % delivered
6	Steel pipes for casing and surface piping with fittings	15 - 07 - 2010 Expected delivery ( 15 – 12 – 2010 )	90 % delivered
7	Control instrumentation, gas analyzer, industrial computer etc.	25 – 11 - 2010 Expected delivery ( 1 – 4 – 2011 )	60 % delivered
8	Furniture	25 – 11 - 2010 Expected delivery ( 1 – 4 – 2011 )	90 % delivered
9	Air conditioners	15 -08 - 2010 Expected delivery ( 15 – 12 – 2010 )	delivered
10	Vehicles	07 - 07 - 2010 Expected delivery ( 07 – 10 – 2010 )	delivered

# Project Milestone

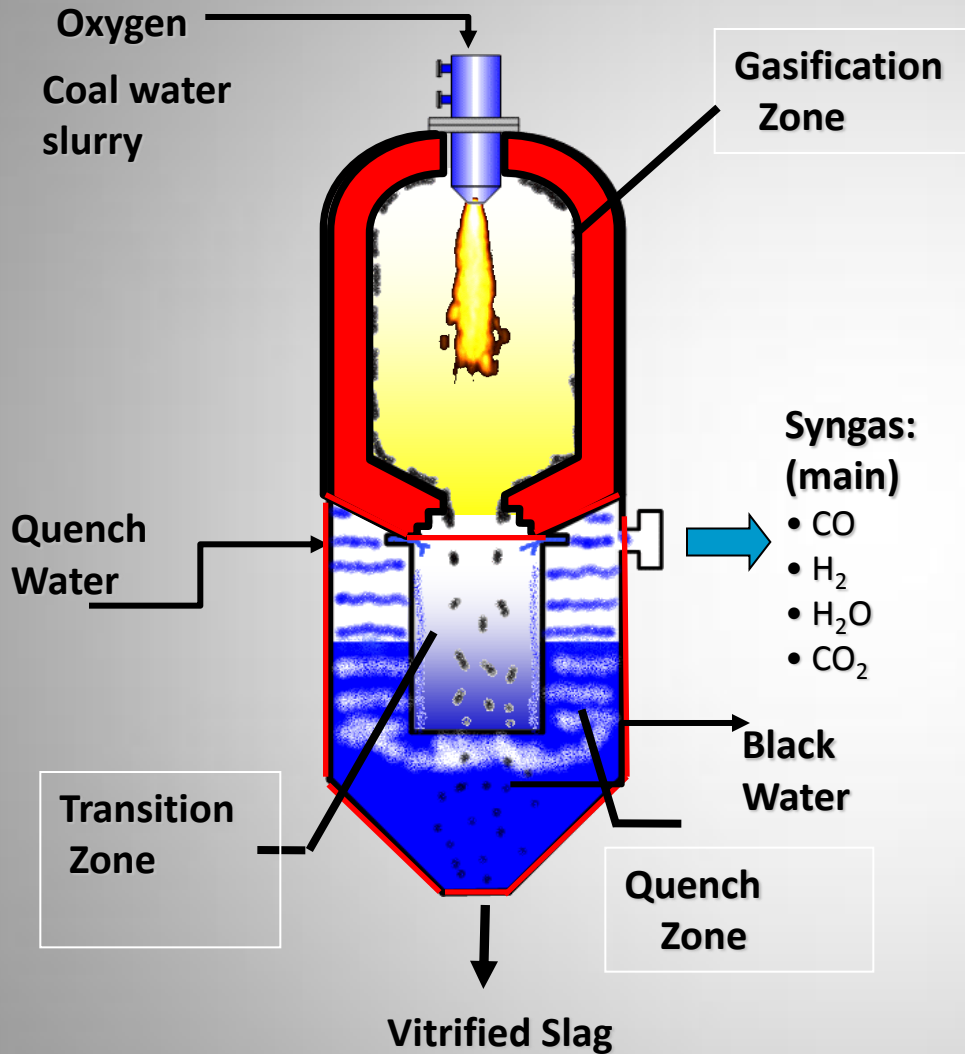
## c. Construction of First 50 M Watts Gasifier 98% Complete (Second gasifier will commence on the availability of funds)

S. No.	Description	Date	Status
1	Drilling	15 – 8 – 2010 ( Expected delivery ( 15 – 6 – 2011 )	98 % complete Total wells Drilled 35 Nos. Total drilling with 8 inch bit 17118 ft. Total reaming with 11 inch bit 1470 ft Total reaming with 15 inch bit 17118 ft. Total coring accomplished 653 ft Total accumulative drilling 36365 ft
2	Casing	15 – 8 – 2010 ( Expected delivery ( 15 – 6 – 2011 )	97 % complete Total number of pipes lowered=18000 feet 900 Nos. 20 ft each
3	Cementation and sealing	15 – 8 – 2010 (Expected delivery ( 15 – 6 – 2011 )	97 % complete Total number of cement bags consumed = 1272 No.

The gasifier is near completion as the deeper coal horizon is being tapped. The drilling to the combustion zone is being accomplished.

# **IMMEDIATE SOLUTION FOR INDUSTRY**

# Coal Gasification



- The Coal Gasifier Op consists of three zones:
  - Pyrolysis zone (CSTR Model)
    - Cracking volatile part of coal
    - Combustion reactions
  - Gasification zone (PFR Model)
    - Char-Gas ( $\text{H}_2$ ,  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{CH}_4$ , etc...) Reactions
    - Char-Oxygen Reactions
    - Char-Steam Reaction,
    - Water-Gas Reaction
    - Methane-Steam Reaction
    - Produce raw Syngas,
    - Coal residue
  - Quench zone (Separator Model)
    - Gas and molten ash quenched in water bath and
    - Conduct Gas, Liquid & Solid three phase separation
    - Ash/slag discharged at bottom as inert



# Coal Gasifier Technologic Specification

煤气出口压力kPa Gas pressure	<0.95	<0.98	<0.98	<0.98	<1.5	<1.5	<1.5
煤气出口温度℃ Gas temperature	400~550	400~550	400~550	400~550	400~550	400~550	400~550
最大炉底鼓风压力kPa Max.blast pressure	2.0	2.45	3.5	3.5	4.0	6.0	6.0
饱和空气温度℃ Saturated temperature	50~65	50~65	50~65	50~65	50~65	50~65	50~65
探火孔汽封压力MPa Steam seal pressure of Poking hole	0.25	0.25	0.25	0.25	0.25	0.25	0.25
水套蒸汽产量kg/h Steam products	45~120	250~300	300	450	500	550	550
水套蒸汽压力MPa Inner steam pressure	0.294	0.294	0.294	0.294	0.294	0.294	0.294
加煤方式 Feeding coal mode	手动、自动Manual, Automatic						
加煤机驱动装置 Coal feeding system	双钟罩加煤、机械加煤机 Bell charging, mechanical charging					双钟罩加煤、液压加煤 Bell charging Hydraulic charging	
灰盘转速r/h Ash tray speed	2.87	2.76	2.23	2	1.7	1.7	1.7
灰盘传动电机功率kW Ash tray driving power	3	3	4	4	4	11×2	11×2
煤斗提升电机功率kW Coal bucket lifting power	1.1	1.1	1.1	2.2	2.2	3	3
排渣形式 Discharging ash mode	湿式，自动排渣，* 干式，自动排渣 Automatically wet discharging ash, * Automatically dry discharging ash						

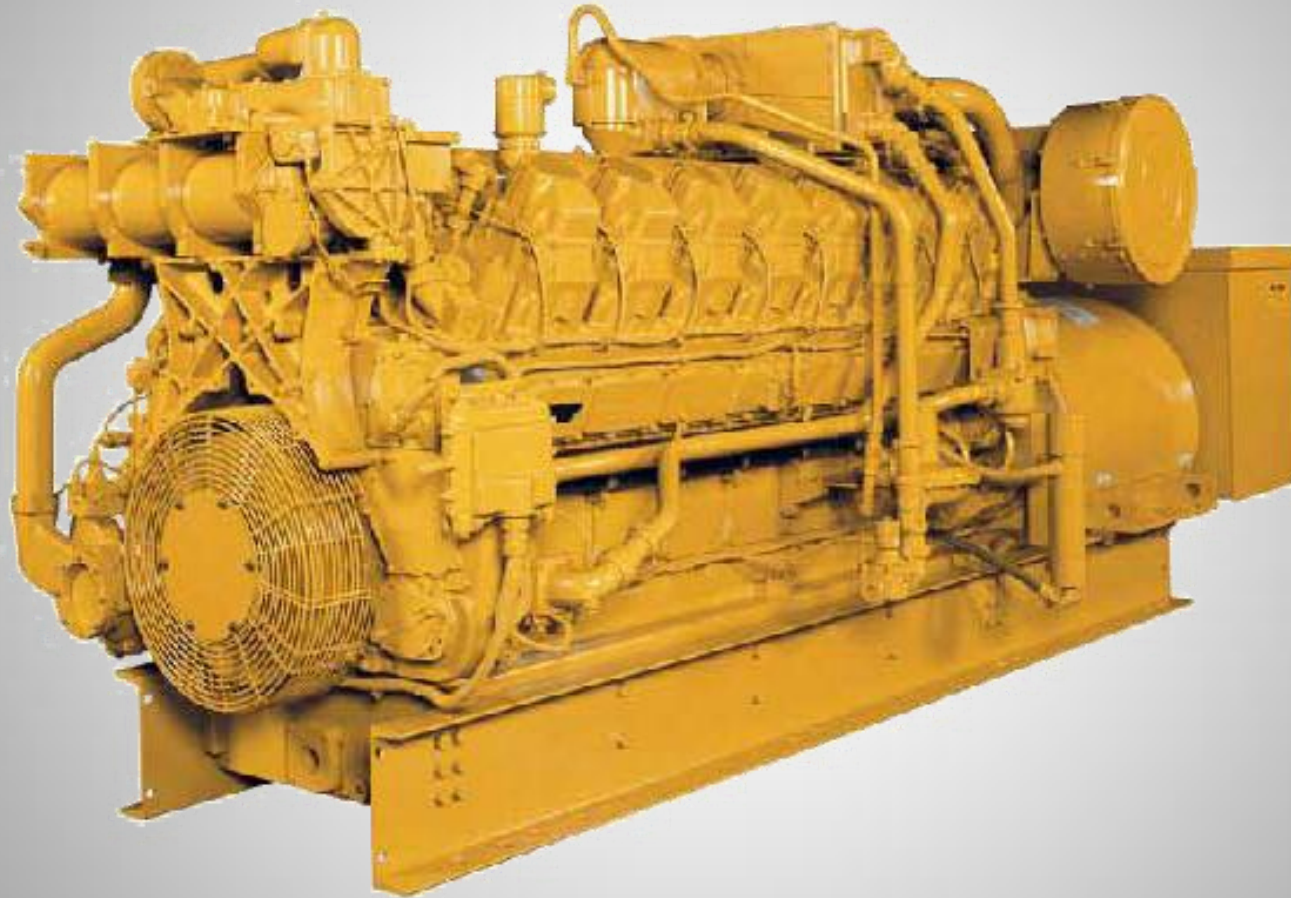


# Technical Specification for Coal Gas Generator



**Model: 500GF1-RM**  
**500KW Coal Gas Generator Set**

# Proposal for Under Ground Coal Gasification Project - Thar

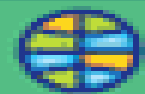


**Caterpillar Gas Generator Set  
Model G3516, 950 Kwe / 1188 KVA**



**RT**  
LONDON  
+55°F

INTERNATIONAL CRIMINAL TRIBUNAL CUTS SENTEN



North Atlantic Ocean

EUROPE

MIDDLE EAST

Mediterranean Sea

TROPIC OF CANCER

**LIBERIA**

**AFRICA**

Arabian Sea

Red Sea

23° 5' N

0°

W 20° E  
PRIME MERIDIAN

EQUATOR

0°

South Atlantic Ocean

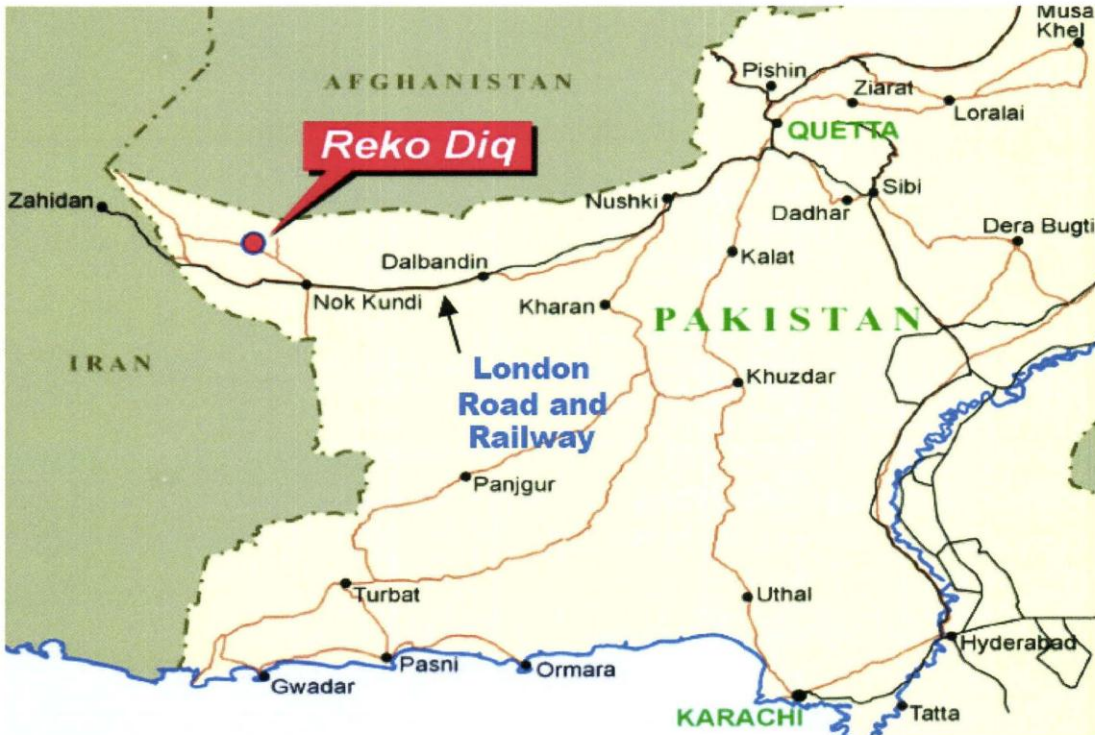
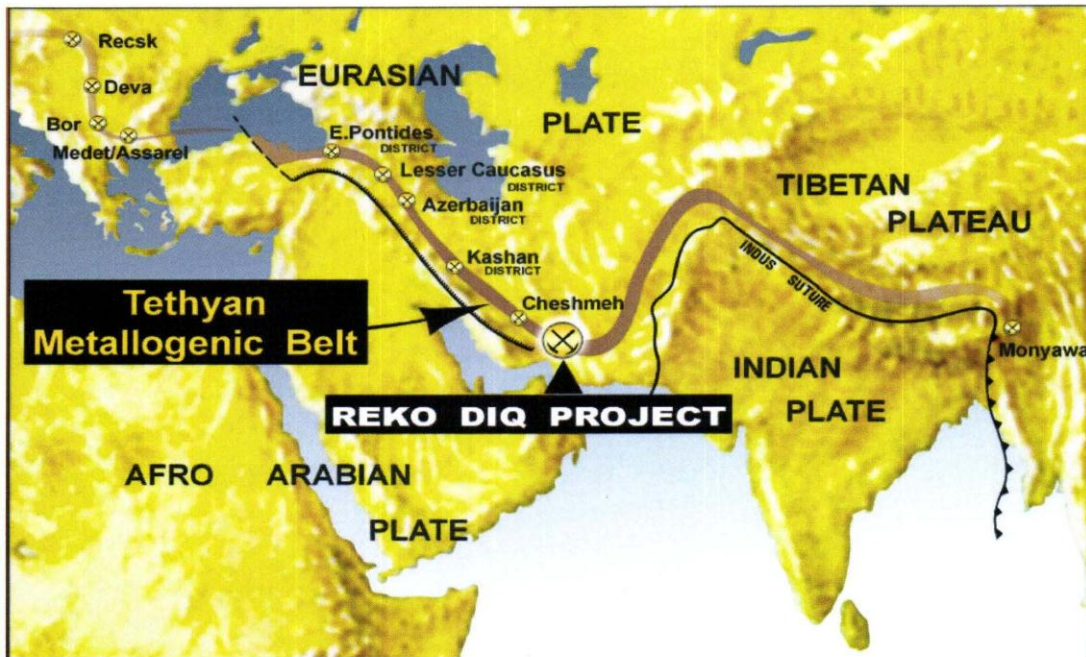
Lake Victoria

Indian Ocean

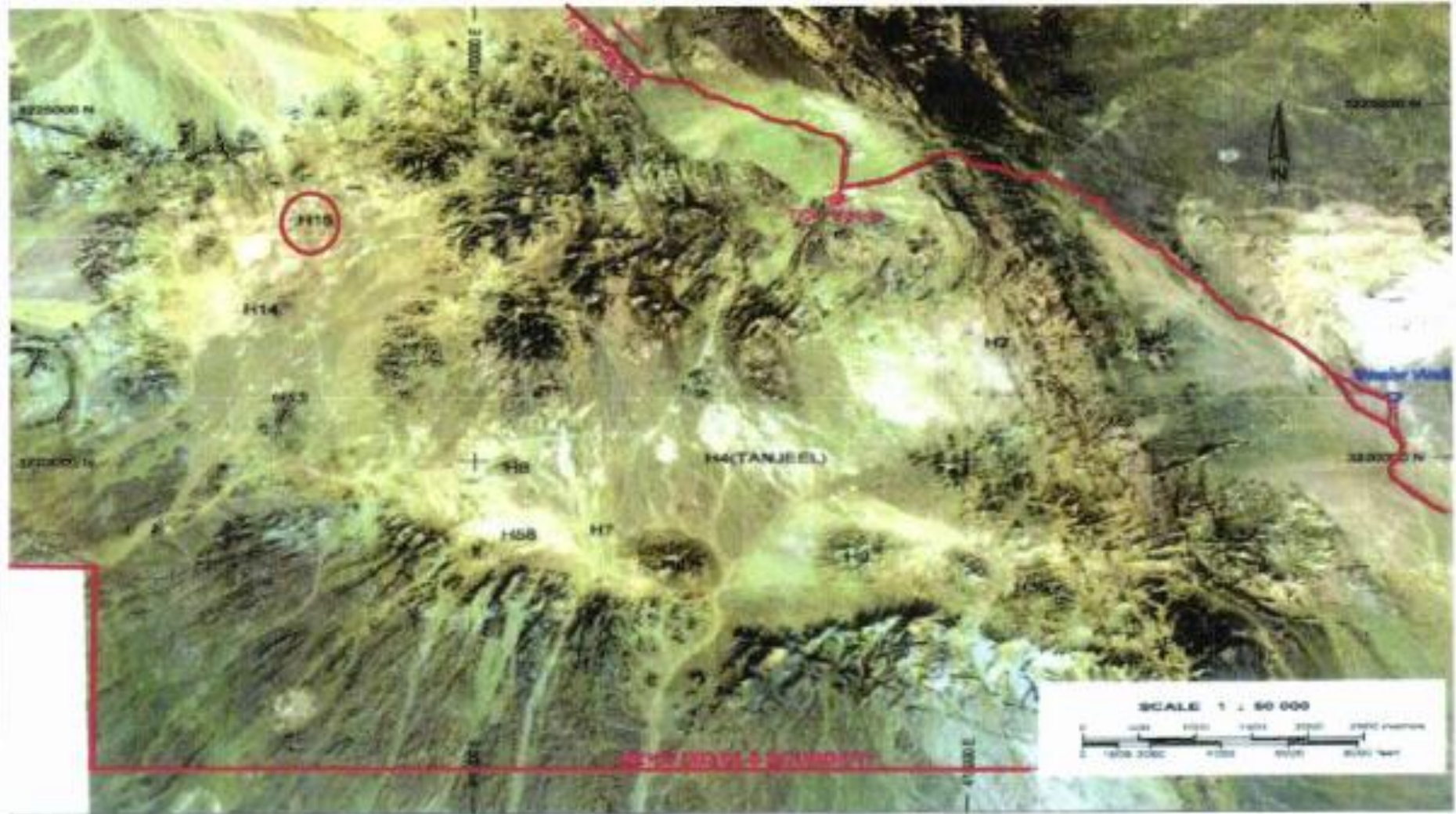
23° 5' S

TROPIC OF CAPRICORN

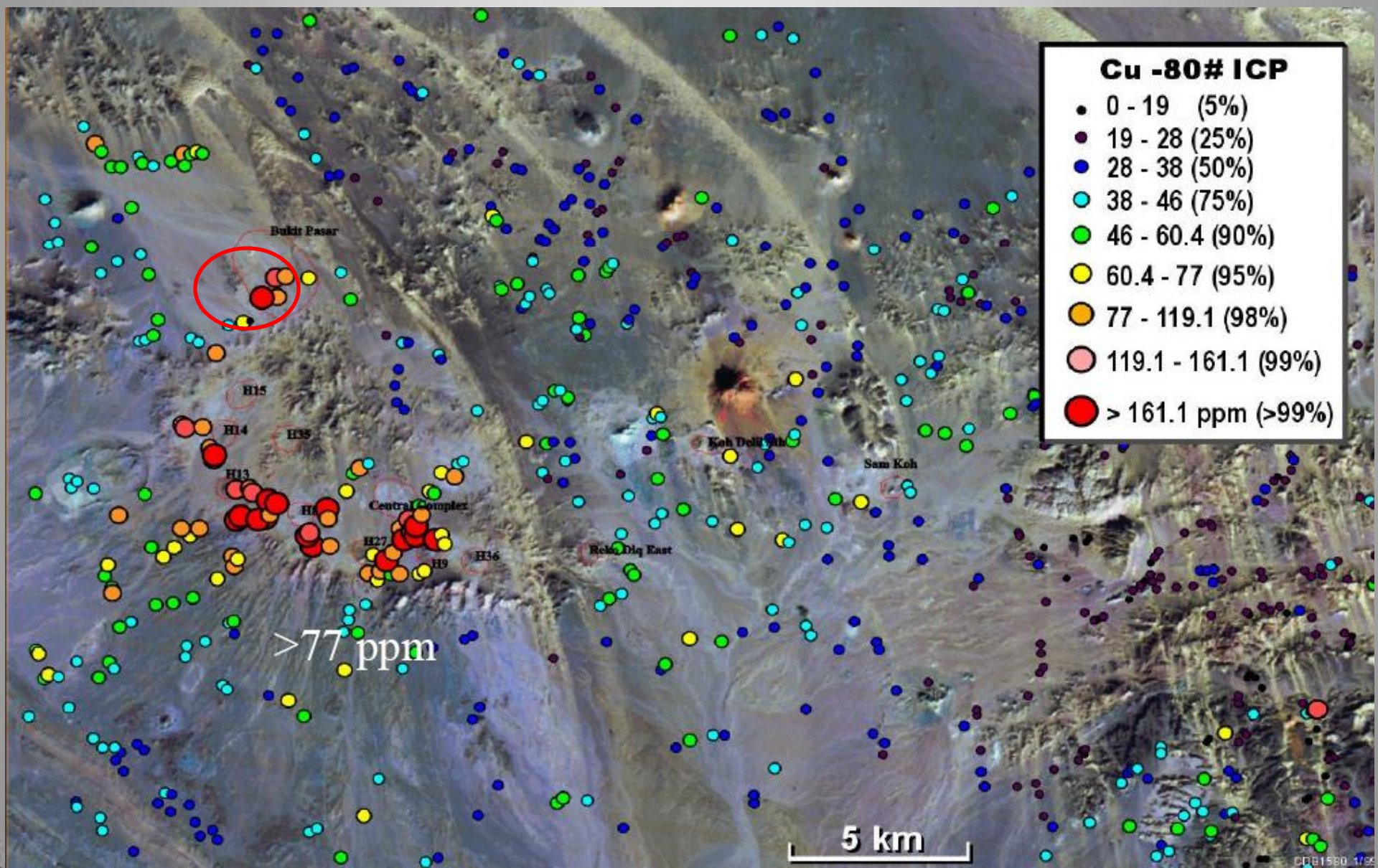




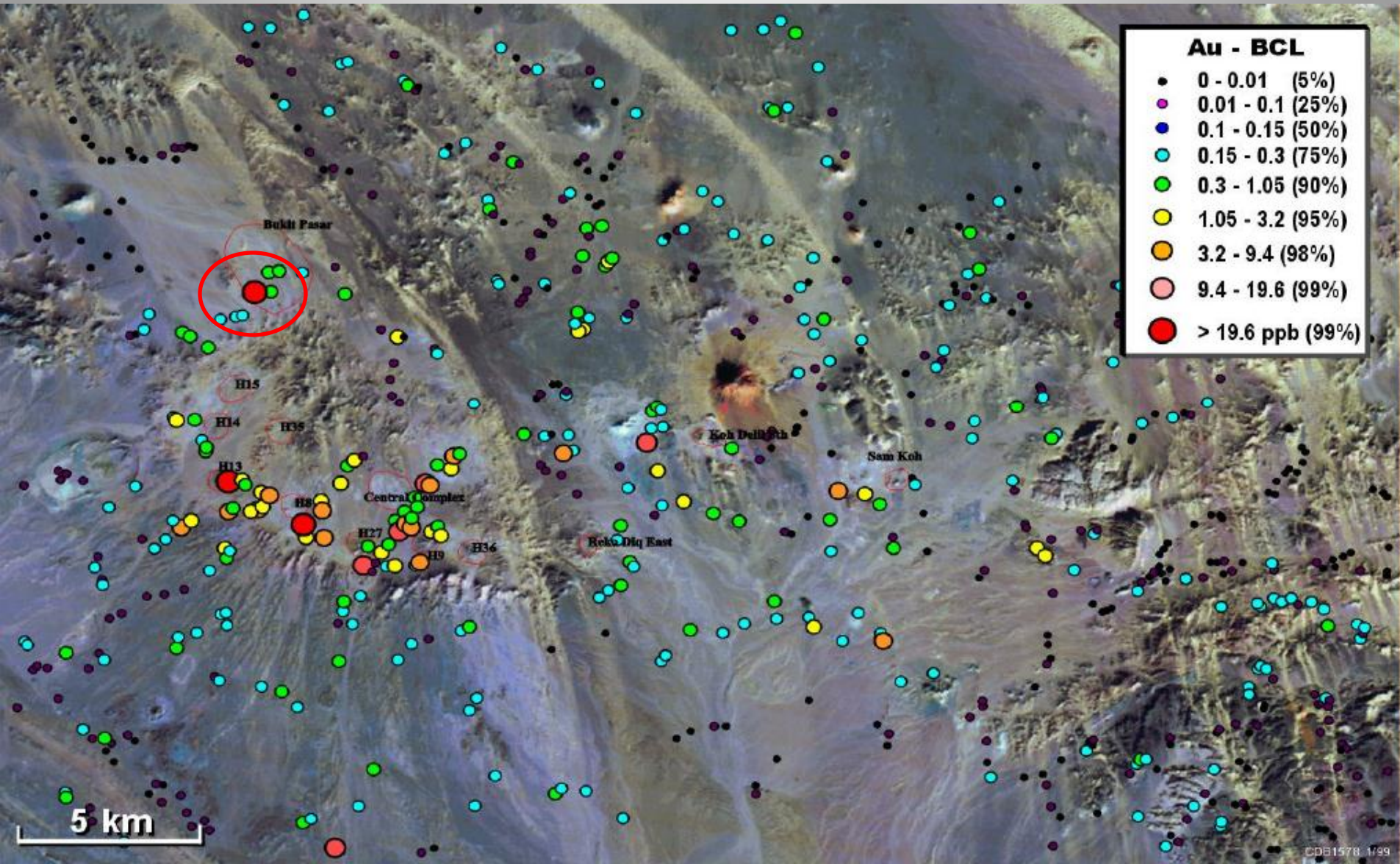
# EL-5 Area



# COPER DEPOSIT IN EL-5 AREA



# GOLD DEPOSIT IN EL-5 AREA



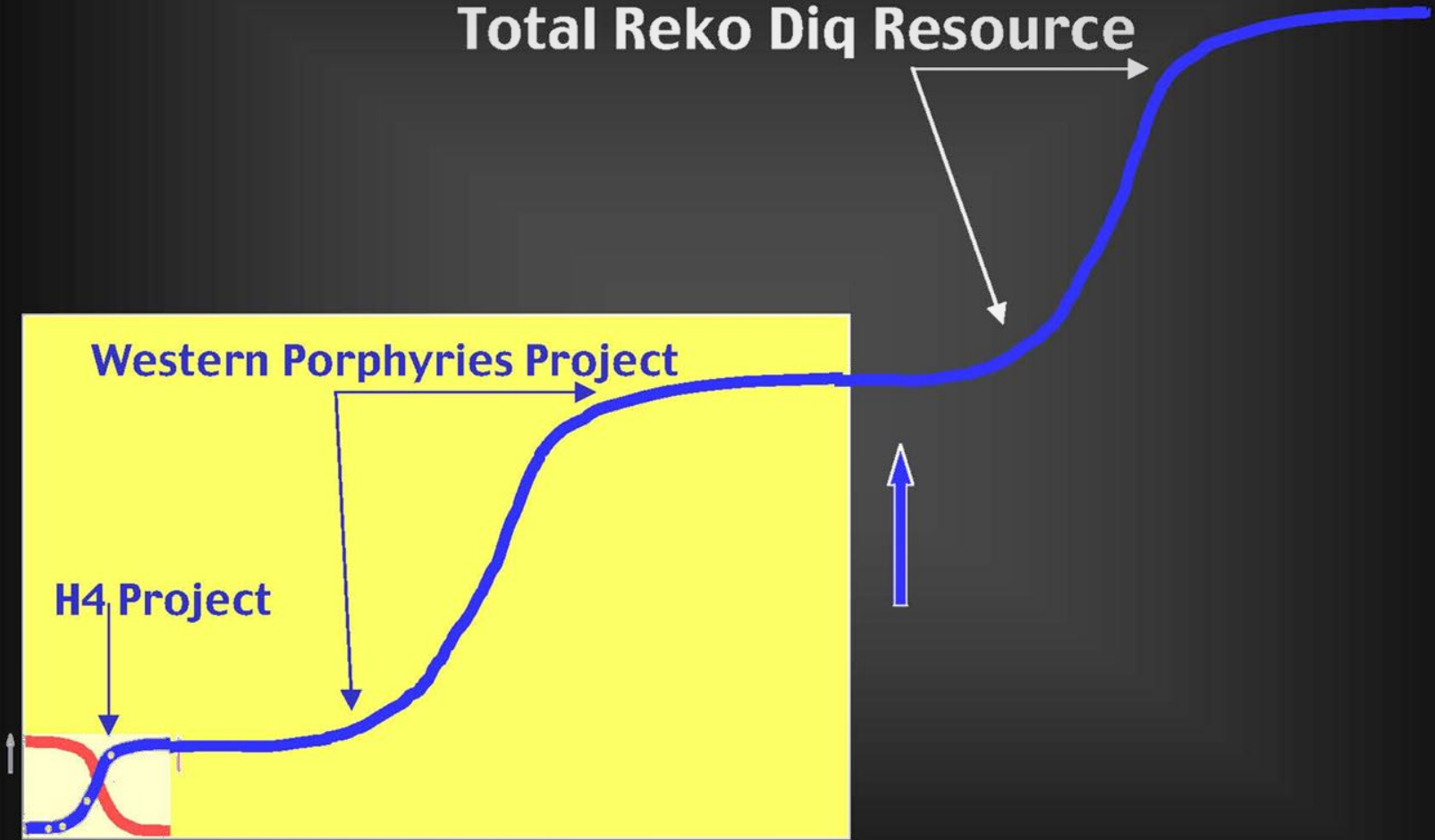


# Total Reko Diq Value Curve

Total Reko Diq Resource

Western Porphyries Project

H4 Project



# THANK YOU

