Cleaning Underground Coal Gasification Synthesis Gas, Prospects and its Challenges

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http://ucg3.coalconferences.org/ibis/UCG3/

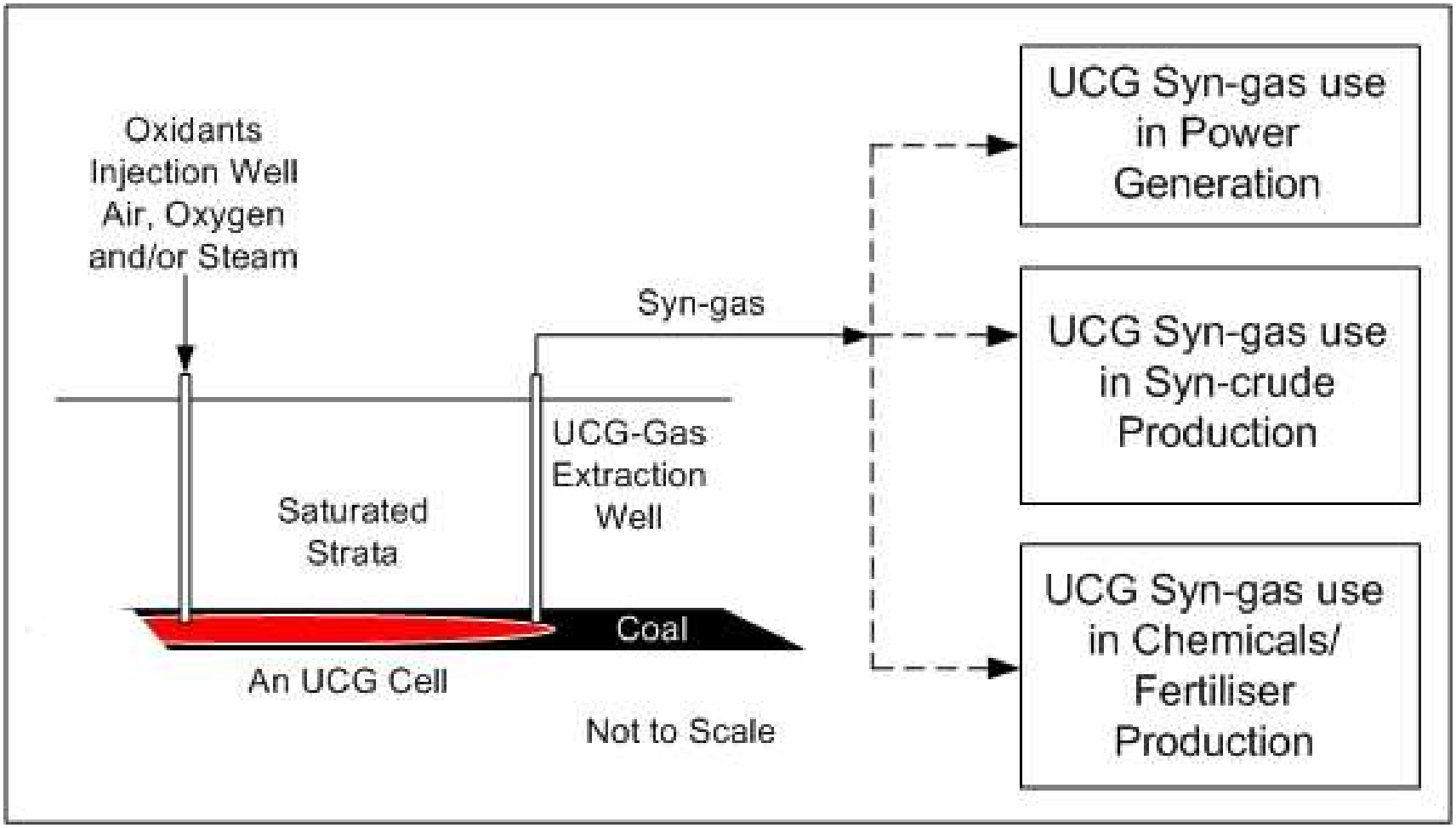
The Potential Promise of UCG

- Underground Coal Gasification (UCG) gives the promise of turning many poor quality coal resources into exploitable reserves by delivering energy in the form of synthesis gas, potentially at very low cost.
- The synthesis gas can be used for generation of electricity and the production of fuels and chemicals by commercially proven technology.

The Challenges of UCG

- There are technical and environmental challenges that are still not fully resolved, a major one being:
- Continuity of production, i.e. flow & quality of syn-gas and another,
- Being the complexity and overall cost of syn-gas clean-up which has to be added to the cost of UCG production.

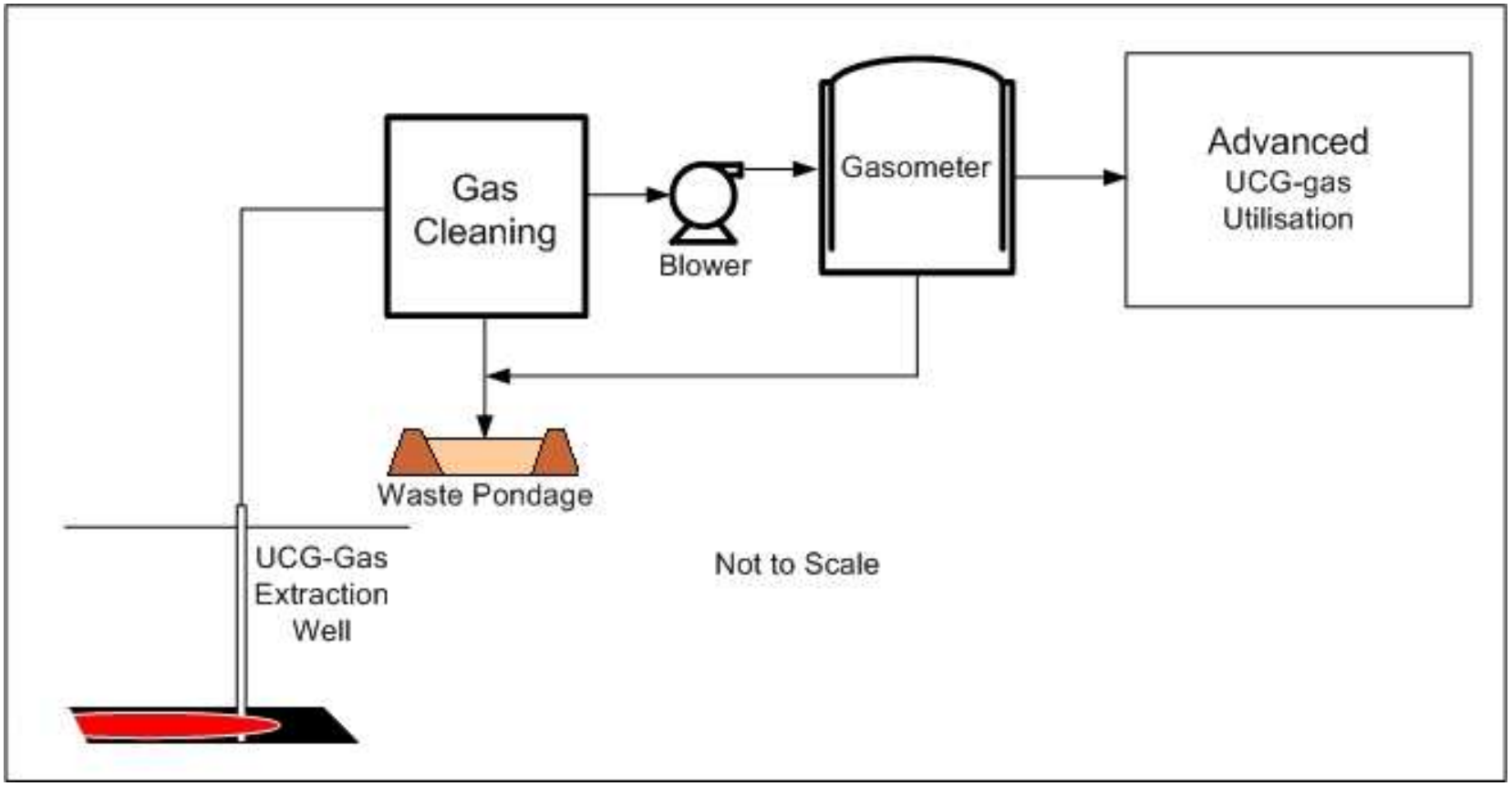
A Simplified UCG Production Scenario



Comparative uses of UCG-gas, costs and risks

Intended Use	Cost	Process Risk
Co-firing Coal Fired Power Stations	Low to moderate	Low to moderate
Firing Dedicated Gas Turbine Power Stations	Moderate to high	Moderate to high
Chemicals and Fertiliser requiring Catalysts	High to very high	High to very high

A more realistic UCG Production Scenario



Syn-gas Flow, Well-head to Advanced Utilisation

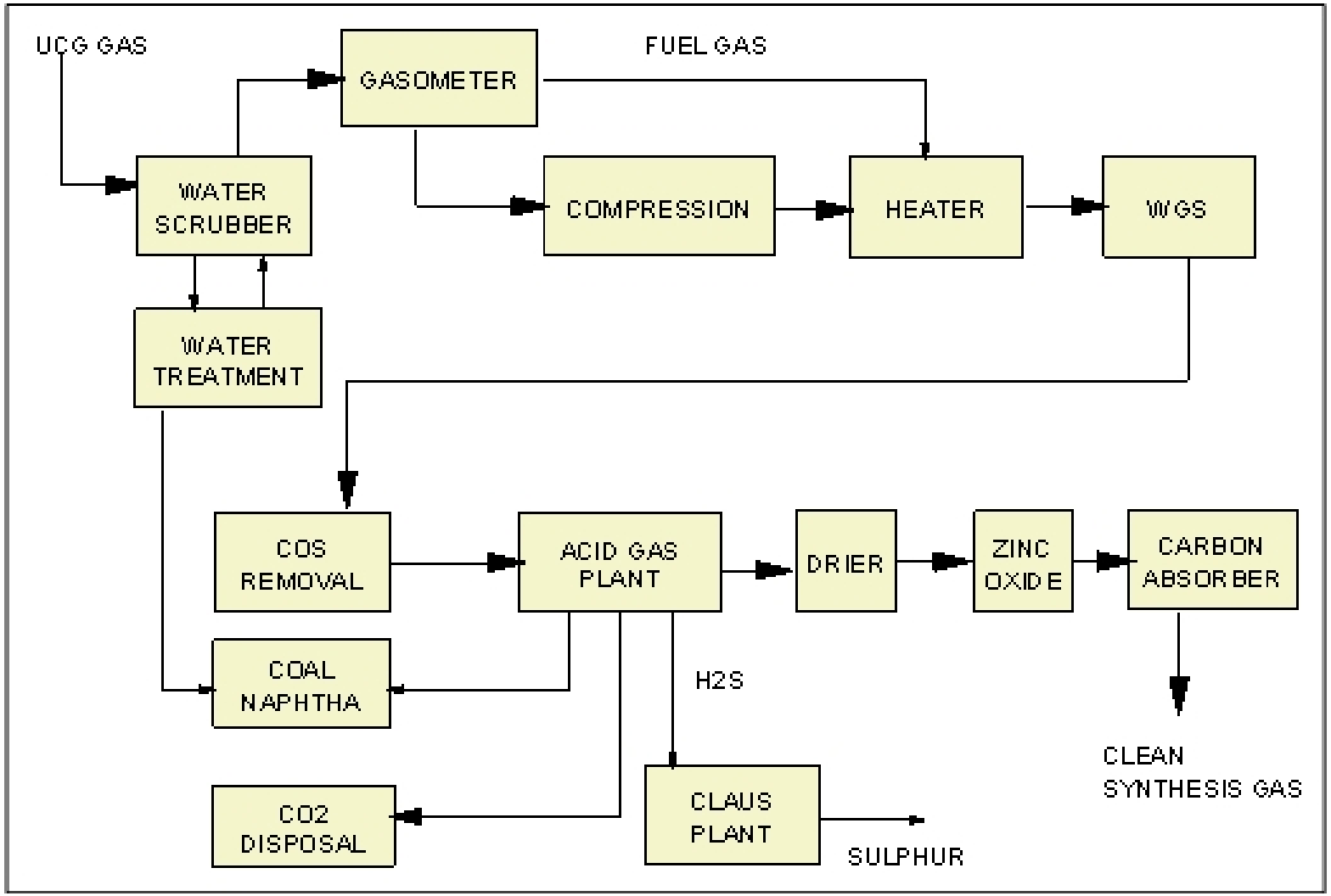
Part of the answer?

The Oval, London, UK

Gas-holders/Gasometers

- A 19th Century Gas Storage Device
- A device that operates at low pressure
- A gas storage system that can safely operate with high levels of hydrogen in the contained gas
- A gas storage device that can have a blending and averaging function
- A gas storage device that has a gas cleaning function (settling/precipitation)
- A convenient sampling point

Syn-gas clean-up an extended view



Managing UCG-gas to Achieve the Highest Use of Available Raw Energy - 1

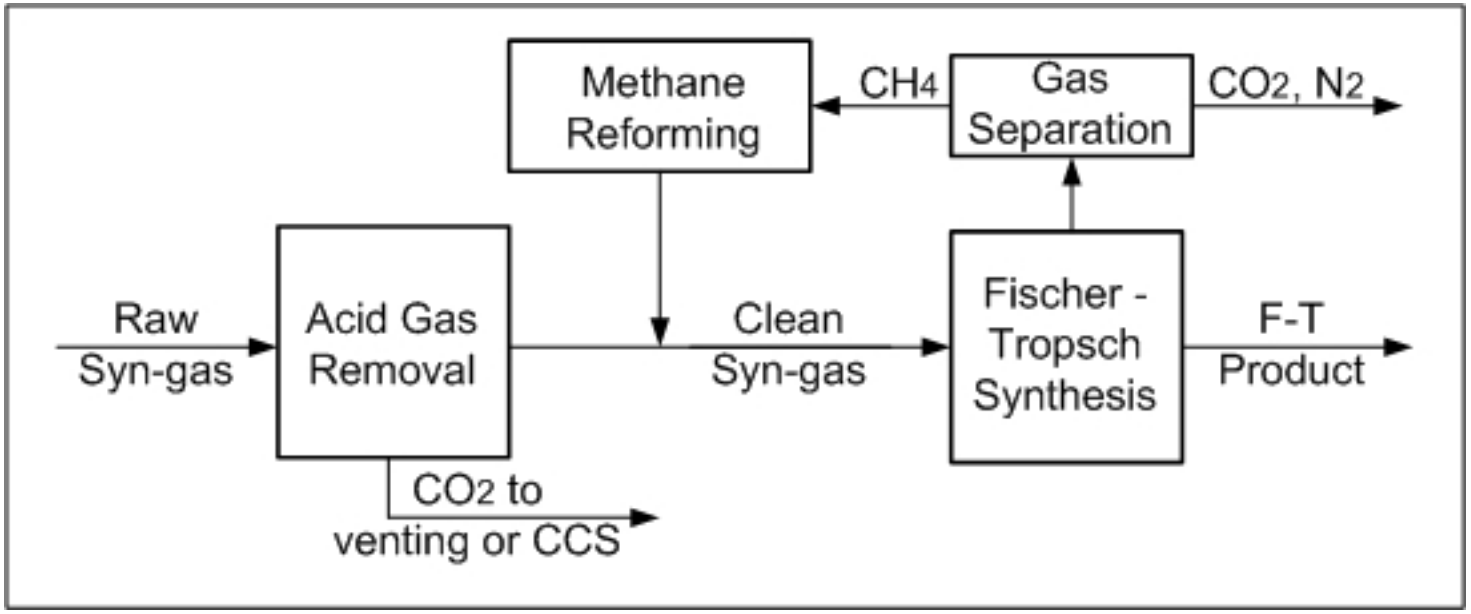
Syn-gas component	UCG	Surface Gasifier
Hydrogen	30·2	36·0
Carbon Monoxide	17·4	52·5
Carbon Dioxide	32·6	10·0
Methane	18·2	0
H_2 + CO	47·6	88·5
MJ/scm	13·3	10·7

Note: UCG gasifier, O_2 blown; surface gasifier, O_2 blown, entrained bed type

Managing UCG-gas to Achieve the Highest Use of Available Raw Energy - 2

- Notes on the comparison:
  - Valuable syn-gas components H_2 + CO are much lower in UCG product,
  - Methane is high in the UCG product, but is inert in most chemical operations and adds to process costs,
  - UCG product contains significant tars and C2+ components, (not present in surface gasifier product) &
  - Both products contain H_2S, COS, NH_3 & HCN.

Managing UCG-gas to Achieve the Highest Use of Available Raw Energy - 3



- Methane here is put through a reformer to produce additional H_2 and CO, or
- The off-gas containing methane can be utilised in power generation.

Surface Wastes Management

- Managing the waste ponds from syn-gas cleaning will be both a challenge from a contents and safe containment points of view,
- Could recycling into active gasification cells be an answer, or
- Could a surface gasifier be utilised for rendering such wastes harmless?

Other developing risks

- Populist anti-coal sentiments will result in excessively strict environmental legislation,
- Coal will be made such a pariah of fossil fuels that project funding and permitting will become impossible, and
- Unconventional oil and gas will continue to make inroads into the fossil fuel business further displacing coal use in all its forms.

Conclusion

- UCG has the potential of being a major monetisation pathway for many stranded coal resources,
- UCG has the potential to be a major source of high value hydrocarbon products, however,
- UCG has challenges that must addressed forthrightly and be overcome.

THANK YOU