

# Underground Coal Gasification (UCG) - A Transformational Technology

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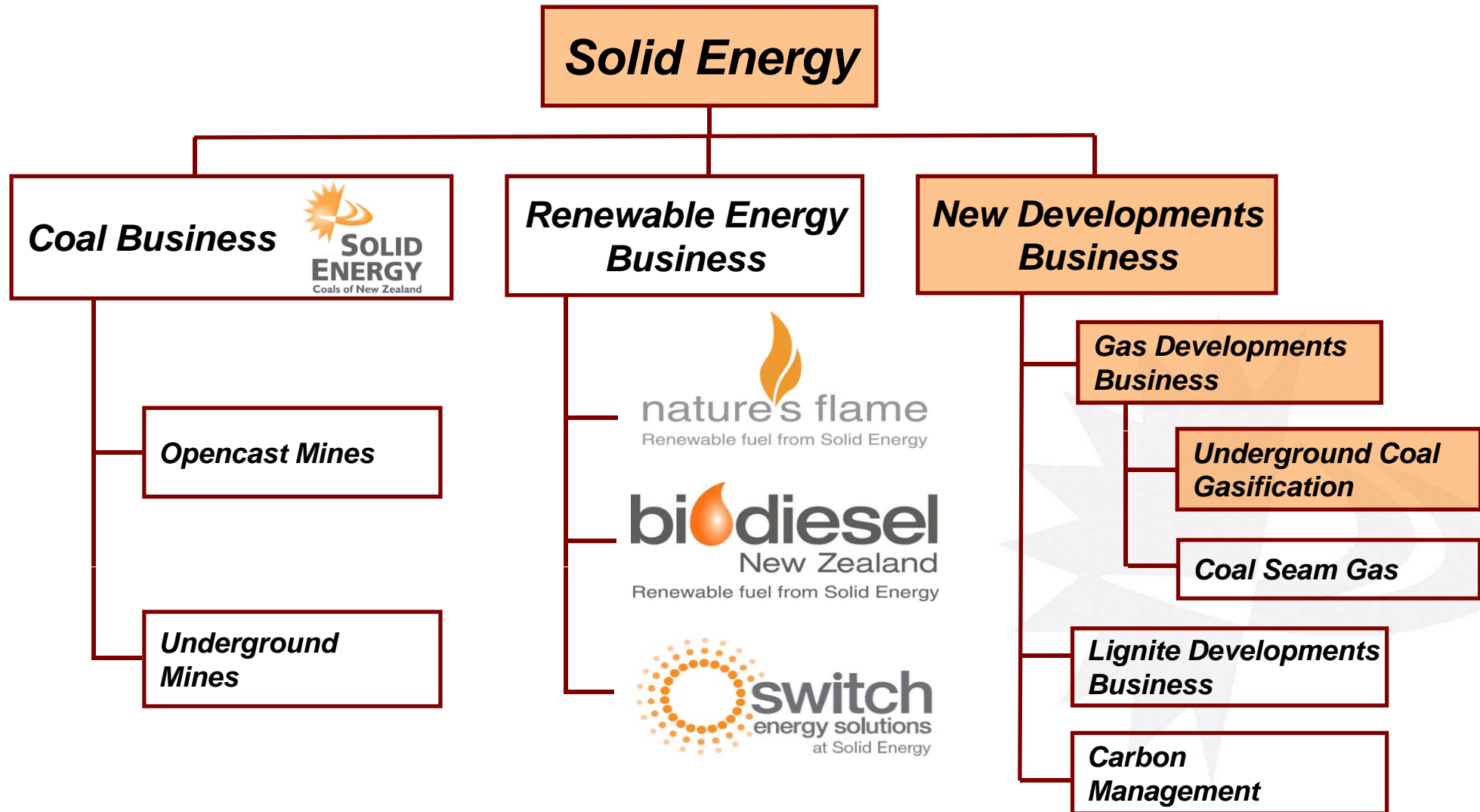
# Solid Energy New Zealand Ltd – Who are we? What do we do?

- A state-owned enterprise
- Major New Zealand energy producer
- New Zealand's largest coal producer (>80% of NZ production in 2008) for export and local markets
- Developing new forms of energy, including coal and renewables, to support and increase New Zealand's energy security, affordability & sustainability
- Employ 1,500 people: ~1,225 staff, ~275 employed on-site contractors.



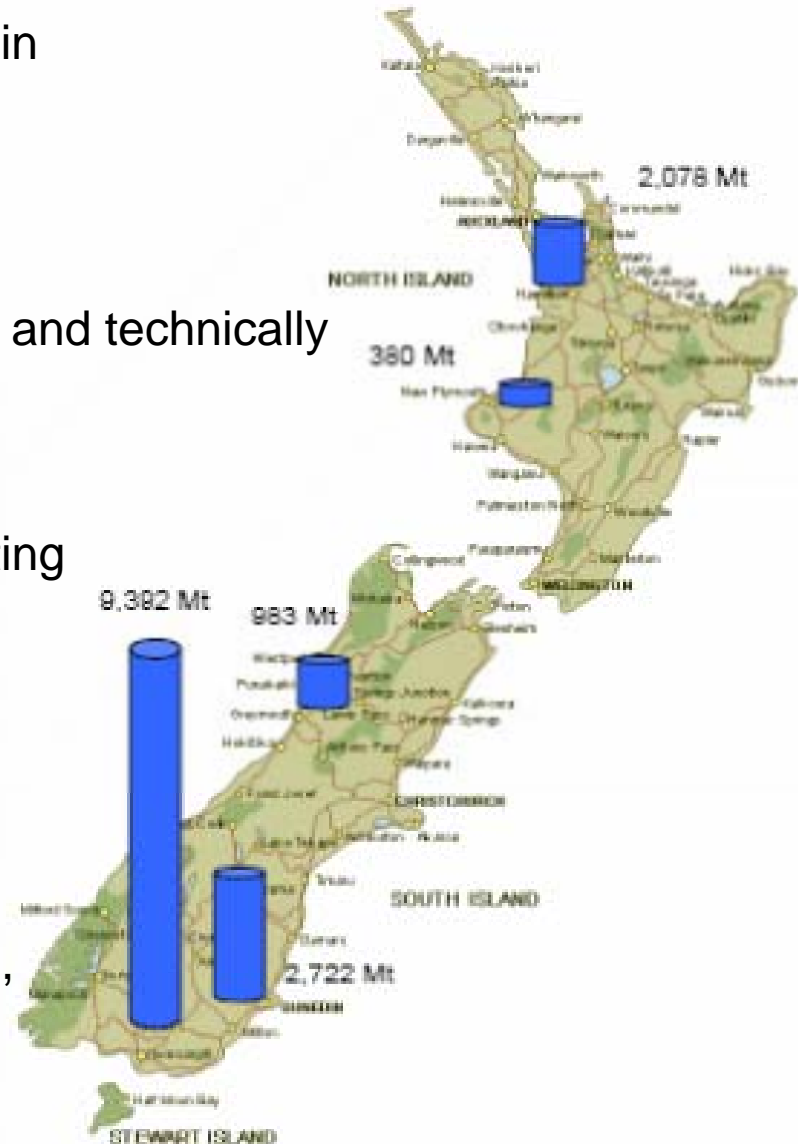
# UCG – a New Developments Project

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# Gas Developments Business Rationale

- The Waikato coalfields are estimated to contain over 2 billion tonnes of coal
  - Equivalent to 10 Maui gas fields
- Much of this is below current East Mine depth and technically difficult to mine conventionally
- The Gas Developments business is investigating alternative ways to extract energy from this massive inaccessible coal resource
  - Coal Seam Gas (CSG)
  - Underground Coal Gasification (UCG)
- CSG & UCG initiatives will add to, not replace, existing mining operations



# Underground Coal Gasification (UCG)

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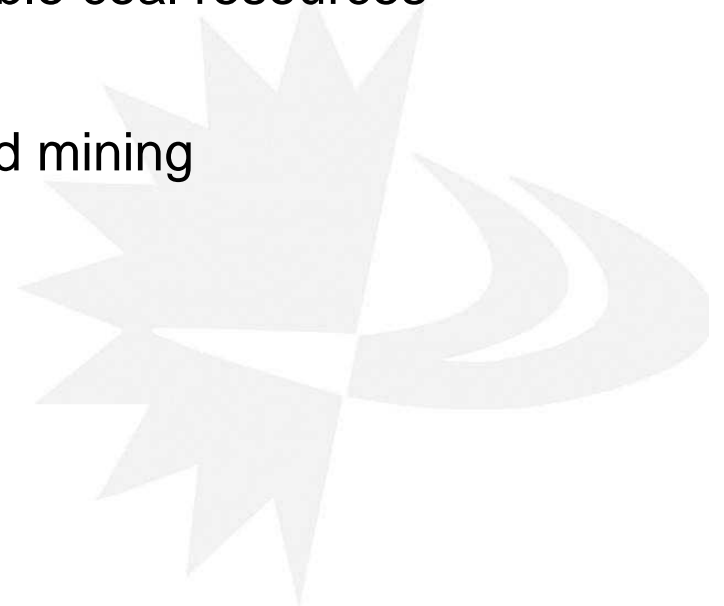
- Complements conventional mining
- Greatly increases recoverable energy resources
- Adds significant value to New Zealand's deep underground coal
- Converts coal into a gas (syngas)



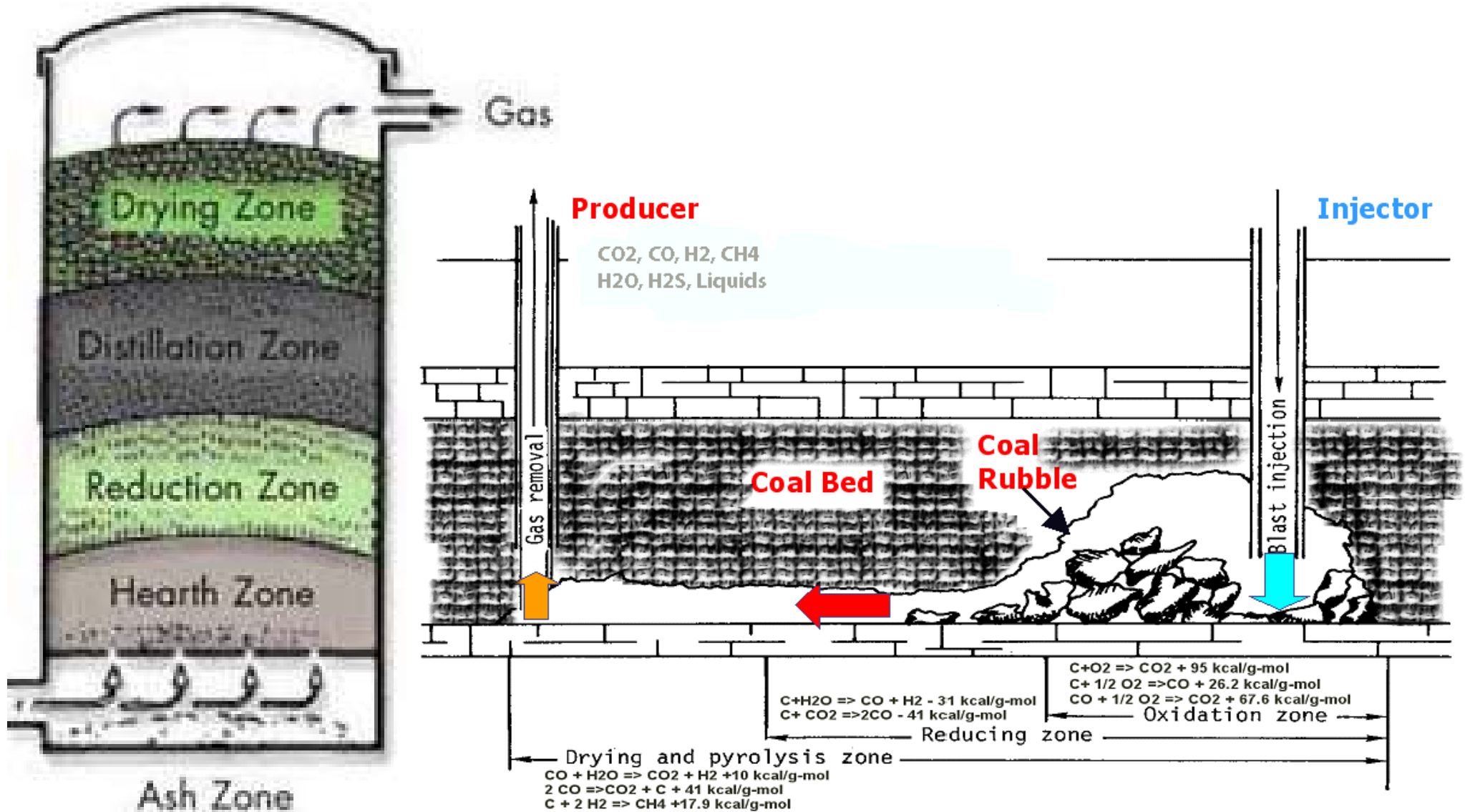
# UCG has advantages over conventional mining

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- Extracts and converts coal to syngas in one step
- Eliminates mining, coal handling equipment and gasification reactors
- Provides access to deep and otherwise un-mineable coal resources
- Eliminates H&S risks associated with underground mining
- Potential of significantly lower energy costs

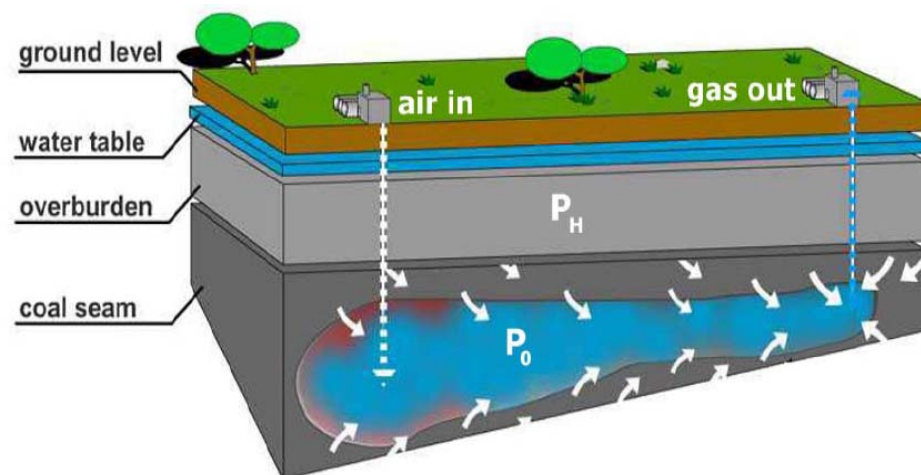


# Analogous to fixed bed gasification



# The defining feature of $\epsilon$ UCG is the creation and operation of a subsurface reactor ...

- The overburden, coal seam and groundwater form the gasification reaction chamber for the  $\epsilon$ UCG process
- $\epsilon$ UCG process operating parameters are governed by the sub-surface conditions that vary with both time and location. Parameters include:
  - geometry,
  - operating pressure,
  - outlet temperature, and
  - flow rates
- Process parameters must be continuously monitored and adjusted to accommodate ever-varying conditions of gasification as the gasifier develops



*ergo* Exergy Technologies Inc.

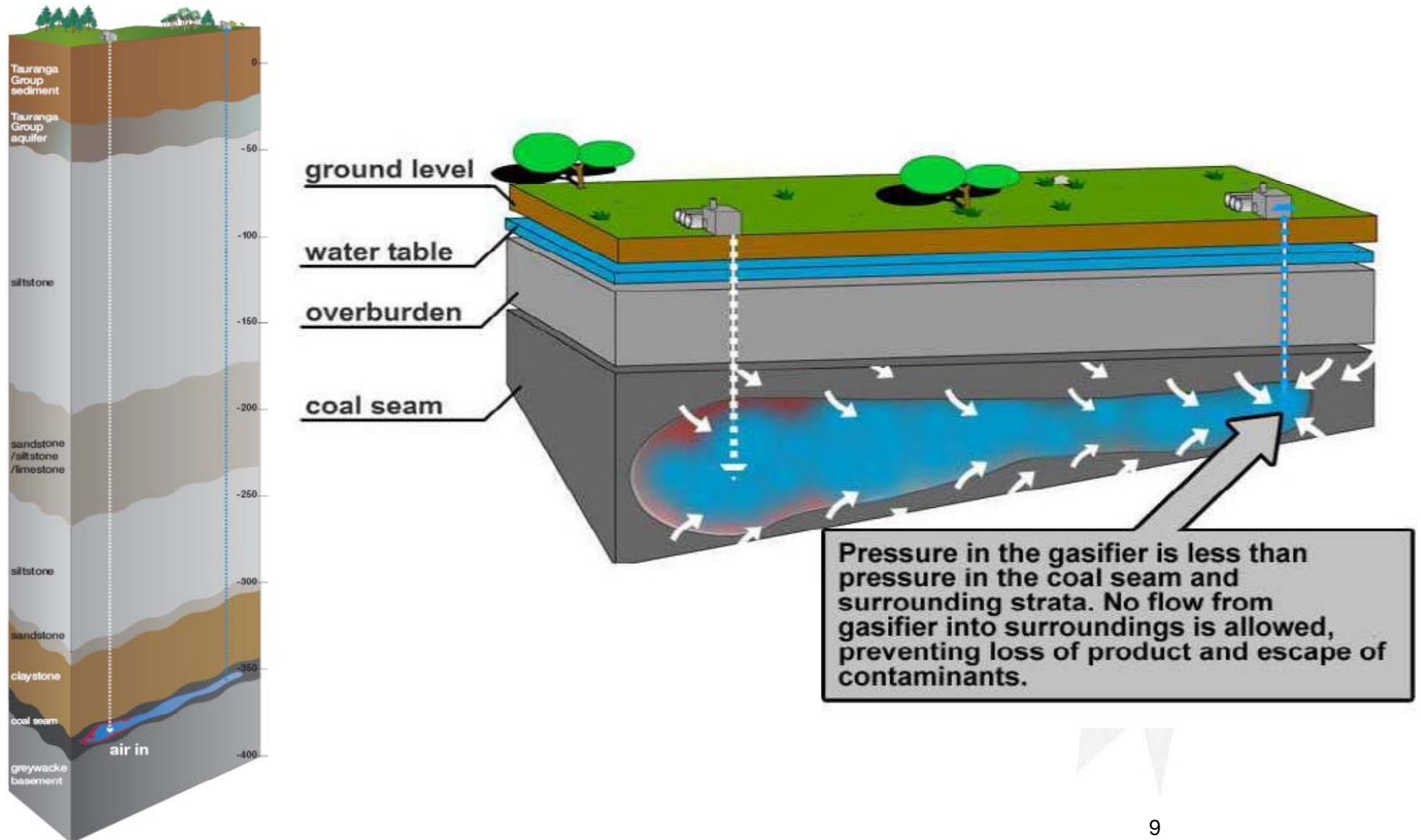




## ... however the subsurface also contains hazards that must be identified and managed.

- Accurate advance knowledge of subsurface hazards is essential
- Typical hazards that must be identified are:
  - Faults and fractured zones
  - Groundwater aquifers
  - Variations in coal seam geometry:
    - Coal seam floor and roof topography (e.g. folds, seam splits, on-lap of basement highs)
    - coal seam thickness (e.g. wash outs, want zones)
  - Weak enclosing strata (near reactor) and overburden (interconnection)
- This allows
  - Viable mine plans to be developed, incorporating the impact of hazards
  - Technical and commercial risk to be quantified and managed
  - Management of environmental effects within regulated limits

# The UCG Process

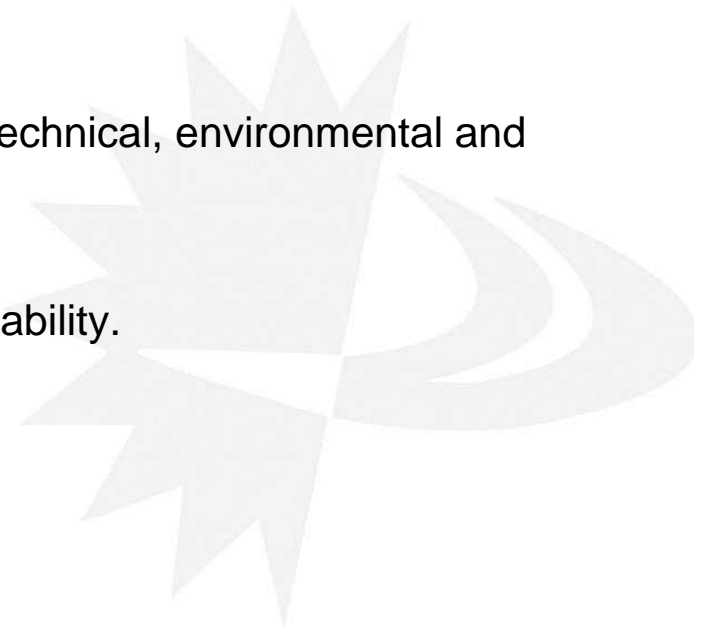


# A Staged Approach

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Solid Energy has planned a staged approach to UCG; each stage is conditional upon satisfactory results from the preceding one.

1. Exploration Drilling
  - To prove sufficient coal present
2. 3D Seismic
  - To determine coal seam structure and faulting
3. Pilot
  - To answer site specific questions and confirm feasibility (technical, environmental and commercial )
4. Demonstration
  - To confirm longer term, larger scale feasibility and sustainability.
5. Commercial
  - Staged project development.



# UCG – The Movie

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# UCG Site – Current State

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# Huntly UCG

Adding value to New Zealand's deep underground coal

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HUNTLY UCG PROJECT

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## Introducing Underground Coal Gasification

Solid Energy is investigating a technology that could allow New Zealand to recover coal from deep, difficult-to-mine coal deposits without digging it from the ground.

Underground Coal Gasification (UCG) uses a carefully managed chemical reaction hundreds of metres underground to convert coal into a synthetic gas, also known as syngas, then bring that gas to the surface through a series of wells.

Syngas can be processed further to produce electricity and a variety of high-value products like chemicals, including transport fuels, fertilisers, liquid products, ethanol, solvents and detergents.

UCG has been performed in more than 15 countries during the past 70 years. Recent technical advances have led to the development of new [UCG projects around the world](#). UCG benefits include its potential to reduce greenhouse gas emissions associated with coal use, improve our ability to access coal resources and expand the number of products we can make from New Zealand's most ample mineral resource – coal.

Solid Energy is developing a small [pilot project](#) in Huntly, just north of Hamilton, to trial UCG technology in local conditions.

GO

### Useful Links

[Solid Energy](#)

[UCG projects around the world](#)

[FAQs](#)

More info at [www.huntlyucg.co.nz](http://www.huntlyucg.co.nz)

Huntly UCG is a Solid Energy New Zealand Ltd project



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Coals of New Zealand