



**Royal Society of Tasmania**

**Australian Academy of Technology, Sciences and  
Engineering**

**Power Options for the Future  
COAL**

**17<sup>th</sup> June, 2014**

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# Content

- Current usage of coal fired power stations in Australia
- Coal resources available and Potential for the power option in Australia
- Risks and advantages; safety issues
- Load capacity
- Power grid considerations
- Political and environmental factors
- Factors specific to Tasmanian

Brown coal – 22%

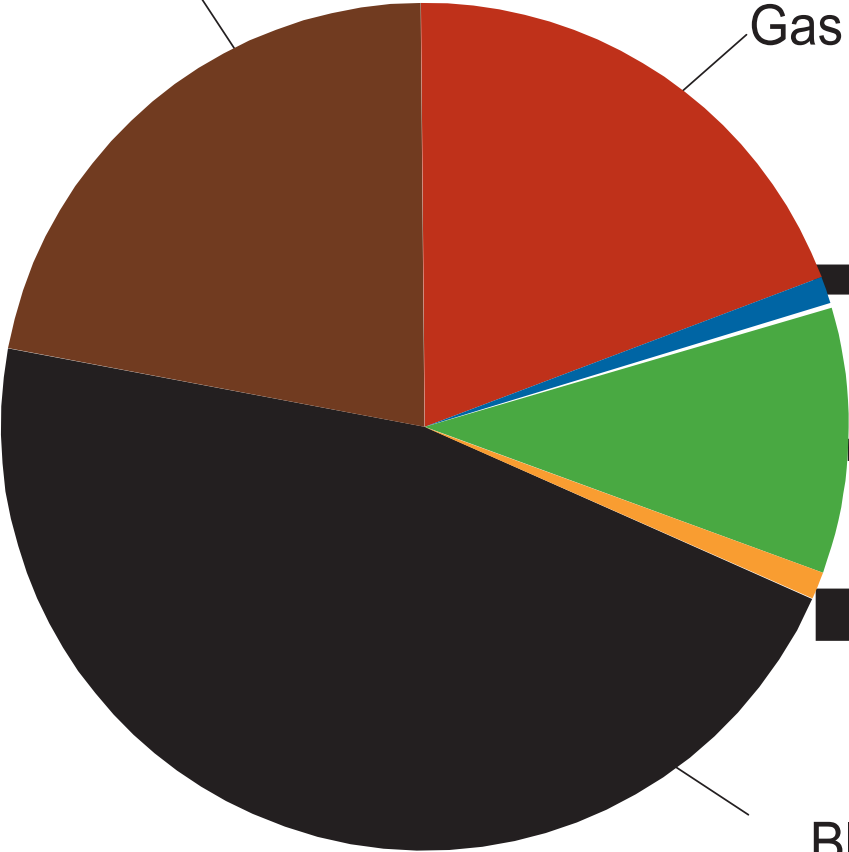
Gas – 20%

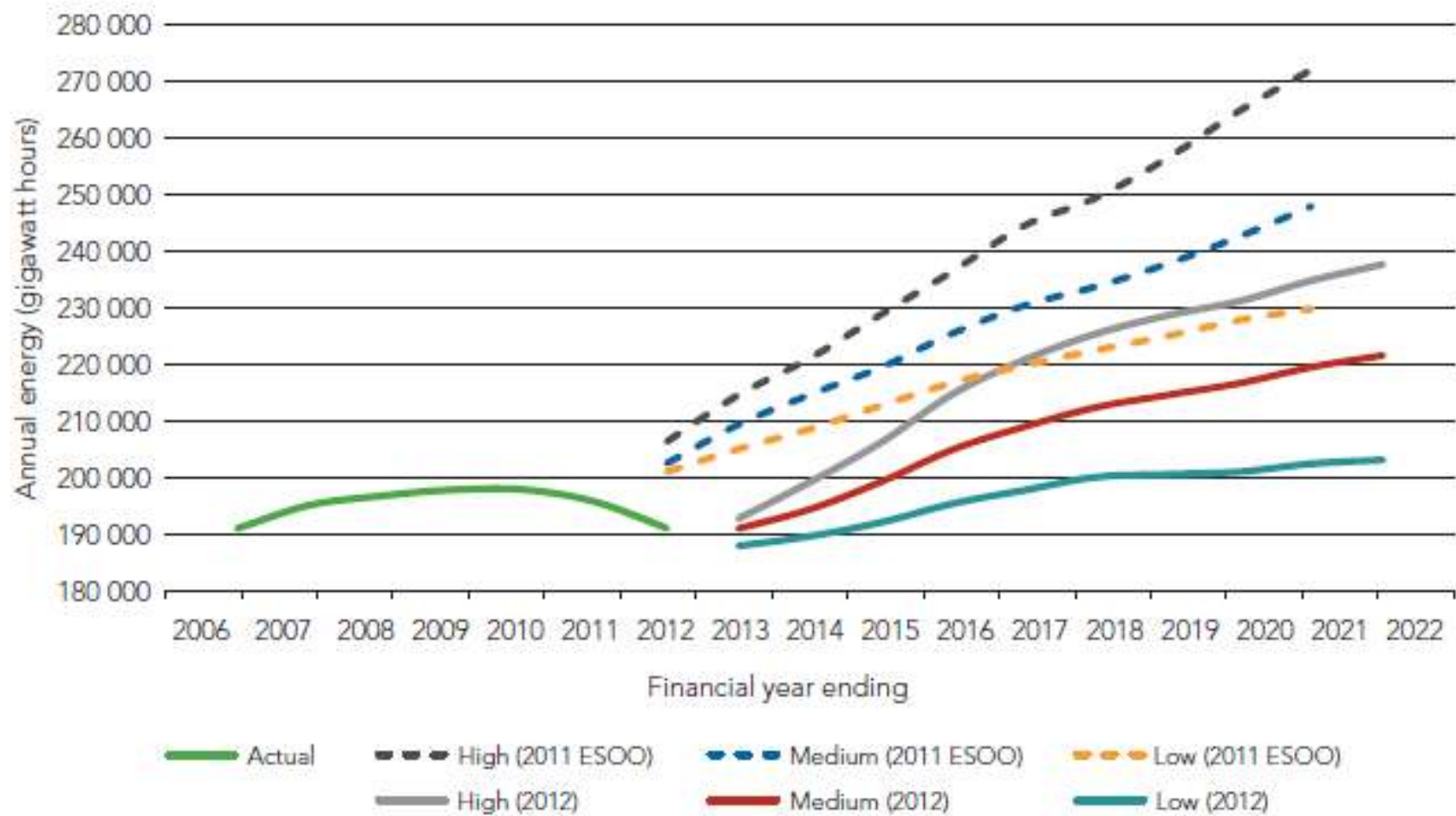
Oil products – 1%

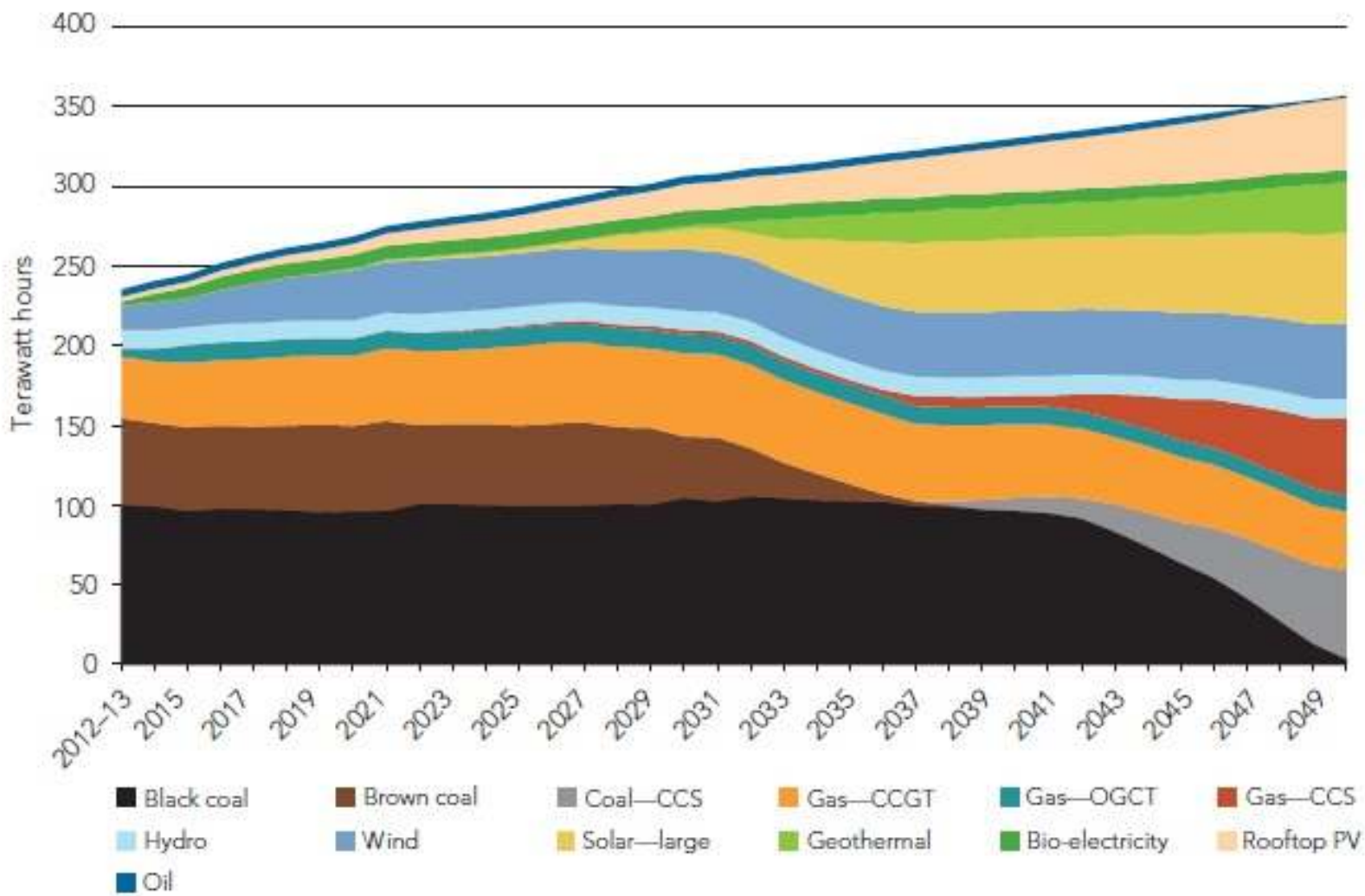
Renewables – 10%

Other – 1%

Black coal – 46%





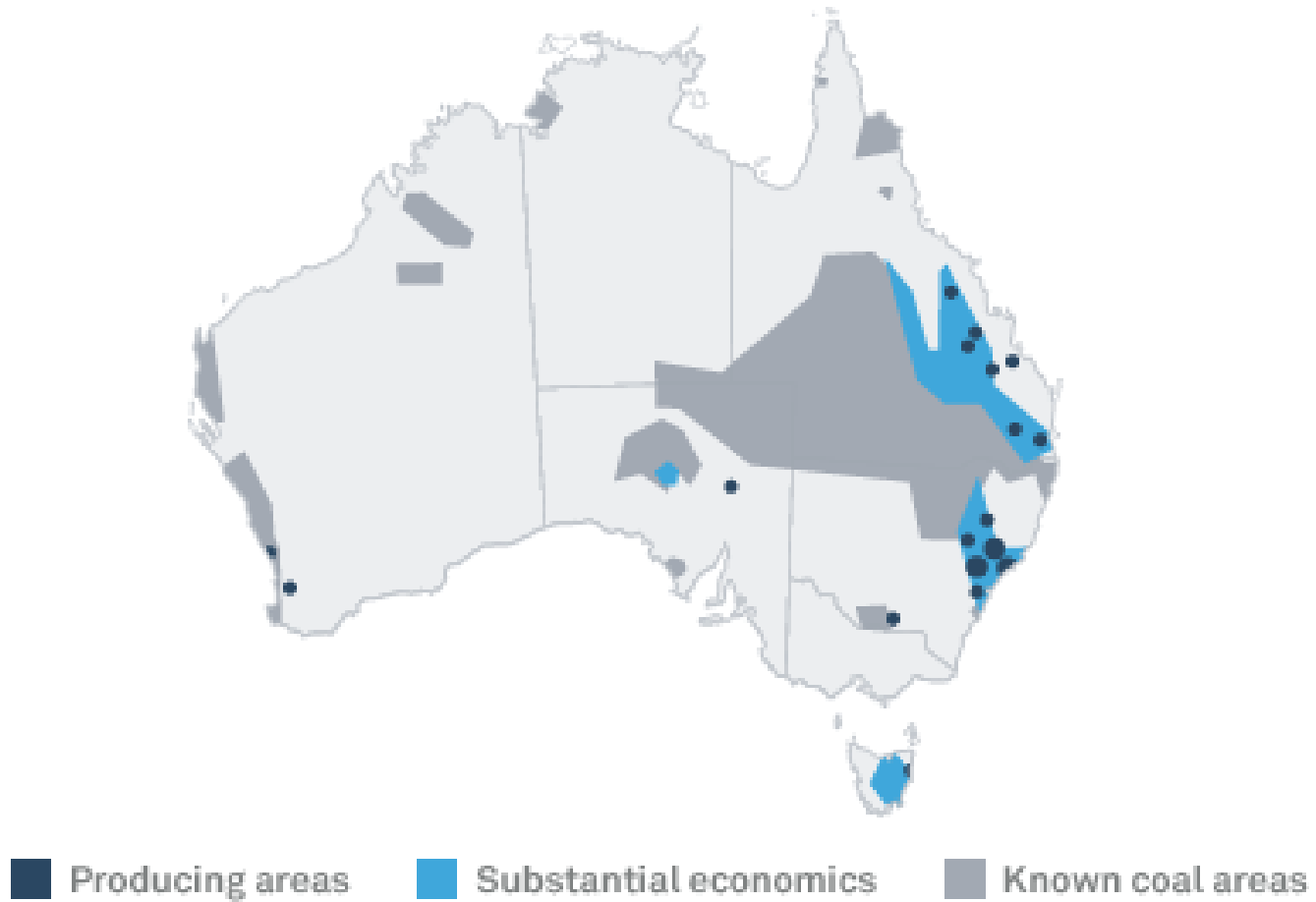


# Australia's economic demonstrated energy resources, 2009 and 2010

	Australia (petajoules)	Share of world (%)	Reserves to production (years)
Coal			
Black coal	1 255 470	10.3	128
Brown coal (lignite)	384 689	8.6	517
Petroleum			
Oil	5 685	0.2b	9
Condensate	12 413	n.a.	38
Liquefied petroleum gas	4 063	n.a.	38
Gas			
Conventional gas	113 373	1.6	66
Coal-seam gas	35 055	n.a.	175
Uranium	648 480	33.0	134

# Australian Coal resources

## Black Coal Resources

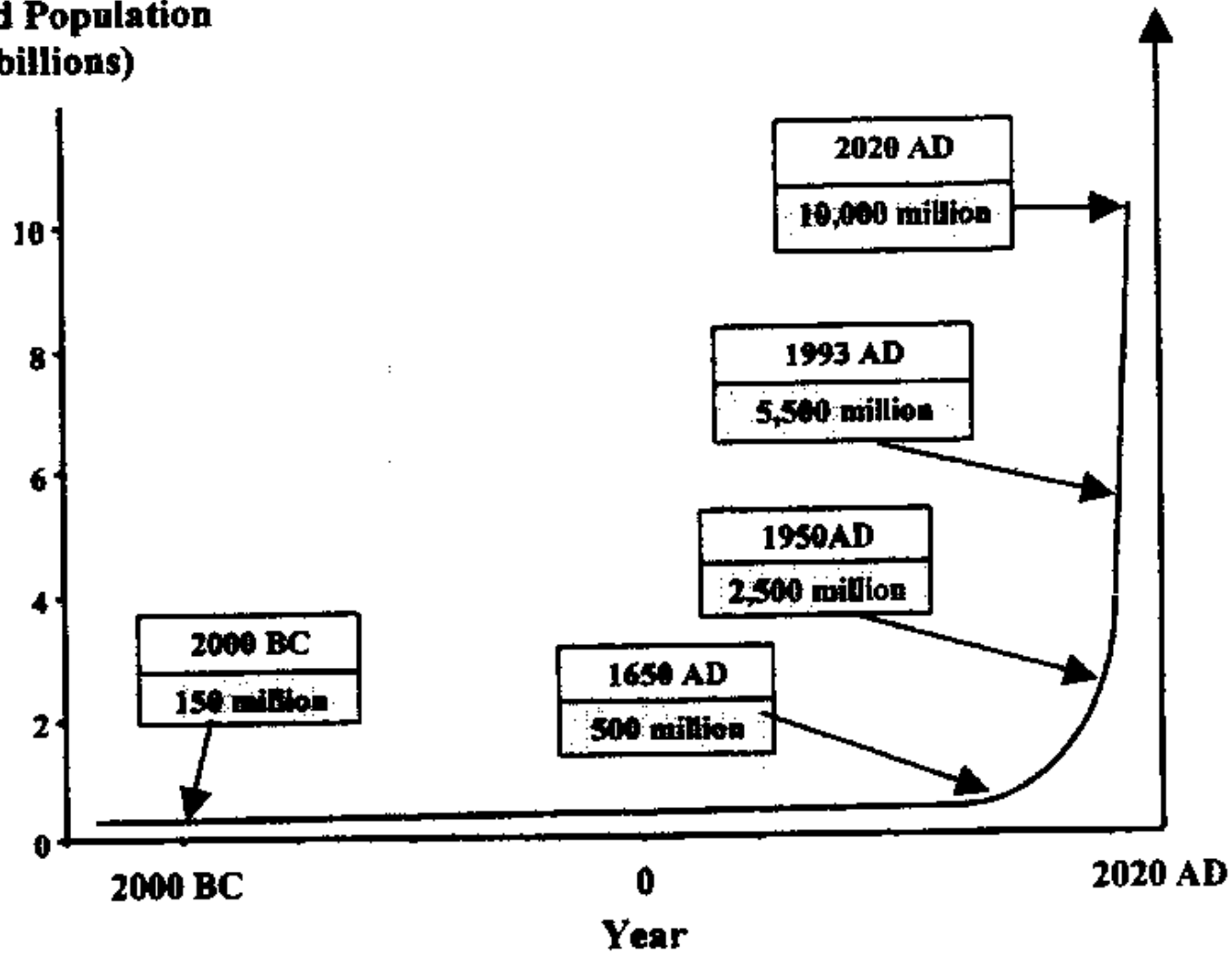


## Identified In Situ Resources of Black Coal, Australia, 2013 (Million tonnes)

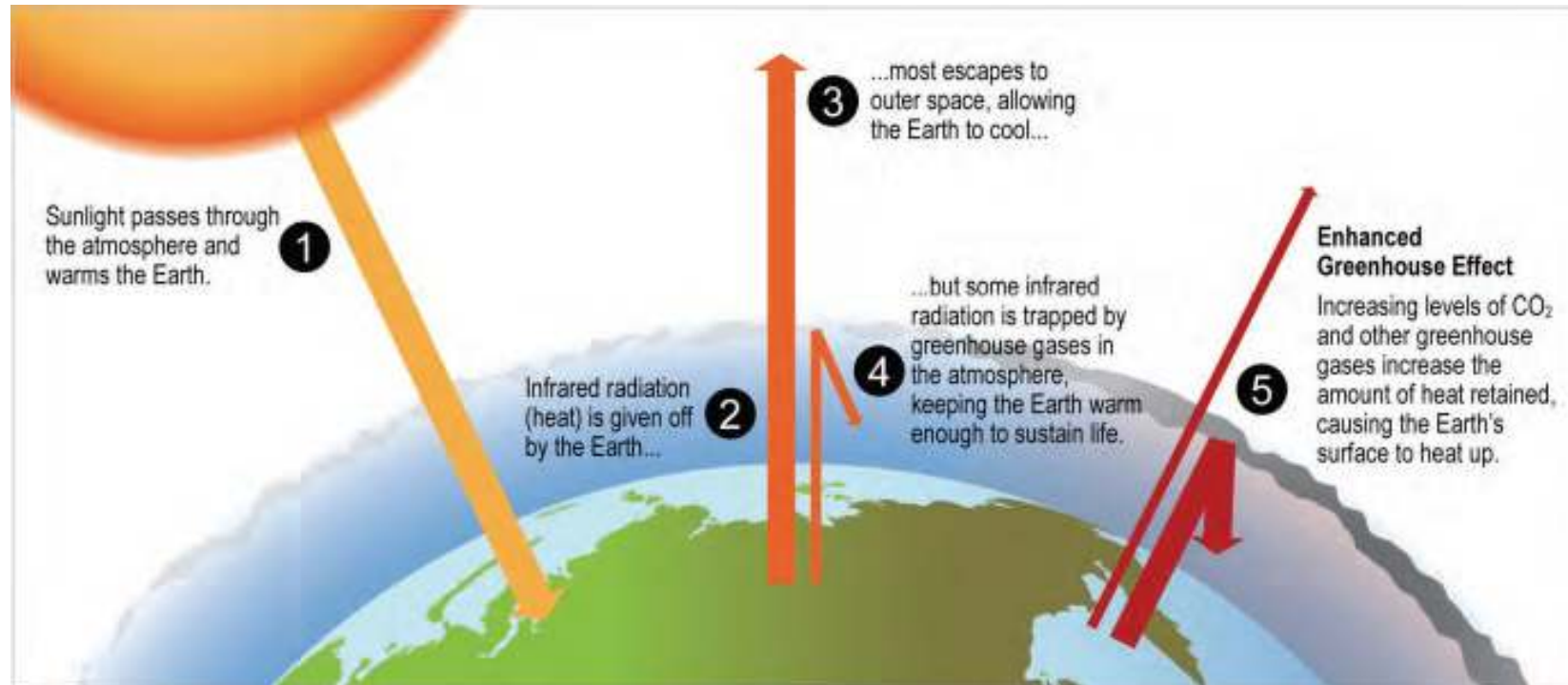
<b>State</b>	<b>Underground</b>	<b>Open Cut</b>	<b>Total</b>
<b>New South Wales</b>	19,530	14,580	34,110
<b>Queensland</b>	12,080	17,300	29,380
<b>South Australia</b>	2,450	3,100	5,550
<b>Western Australia</b>	890	1,300	2,190
<b>Tasmania</b>	500	20	520
<b>Total</b>	<b>34,500</b>	<b>36,300</b>	<b>71,750</b>



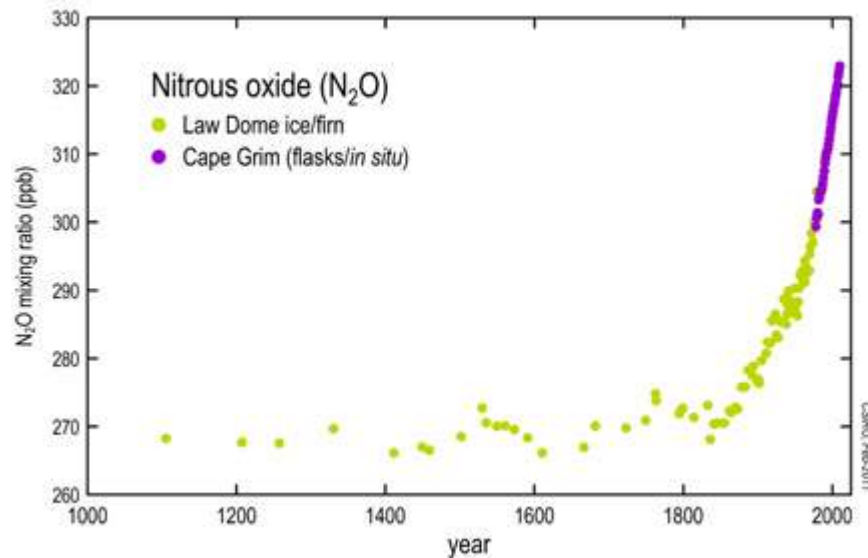
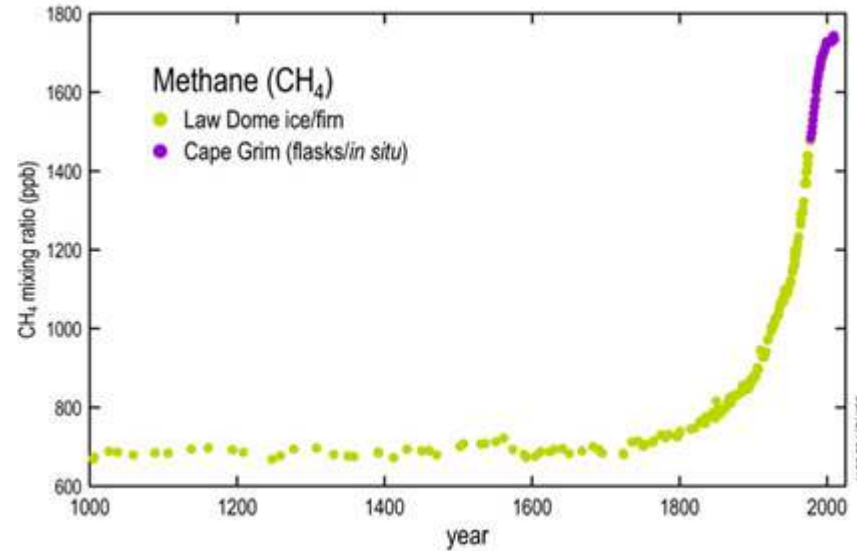
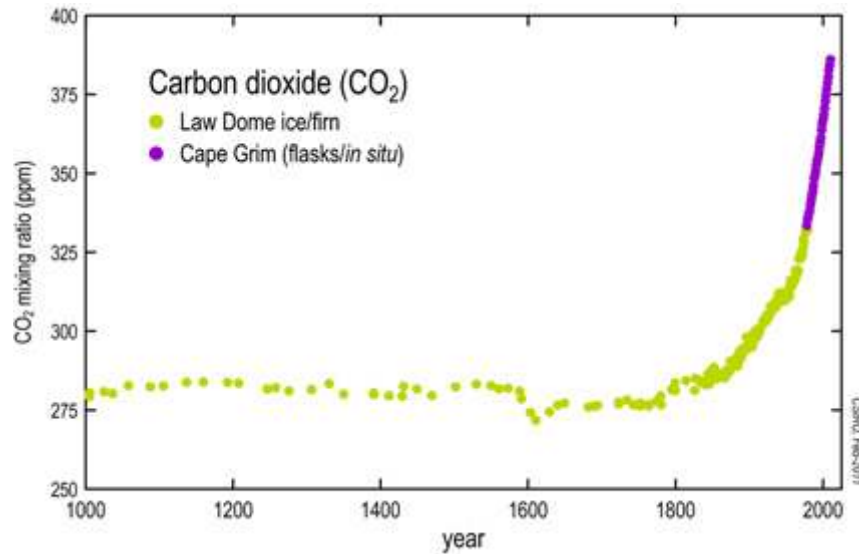
# World Population (billions)



# Enhanced Greenhouse Effect



# Greenhouse gases



## Greenhouse warming potential:

CO<sub>2</sub> = 1 (typically 380 ppm)

H<sub>2</sub>O = 10 (typically 1500 ppm)

CH<sub>4</sub> = 21 (typically 1.8 ppm)

N<sub>2</sub>O = 300 (typically 0.32 ppm)

ppm = parts per million

***Positive proof of global warming.***



***18th  
Century***

***1900***

***1950***

***1970***

***1980***

***1990***

***2006***

# Callide A Oxy Firing Project



Air Combustion Mode

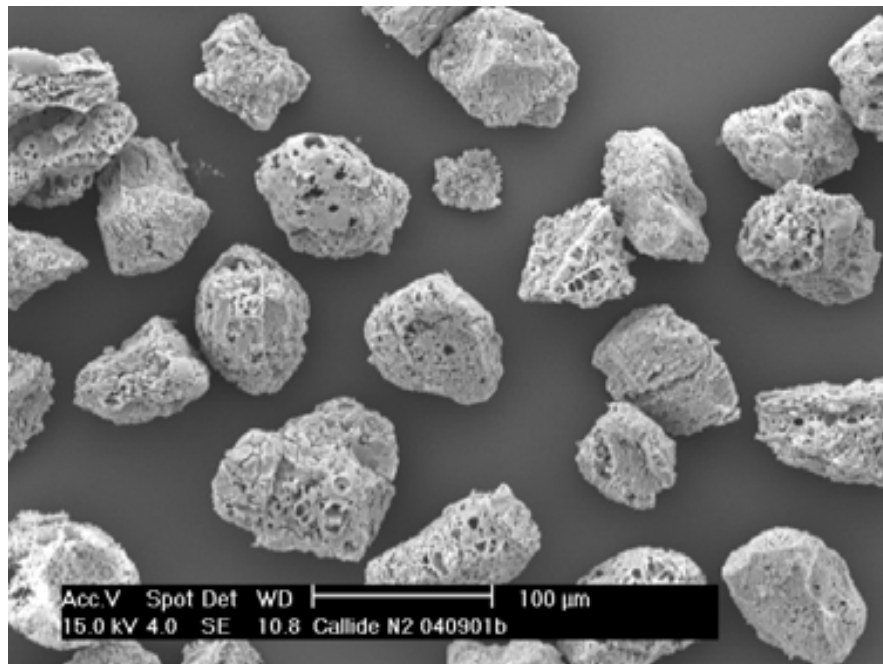


Oxy Combustion Mode

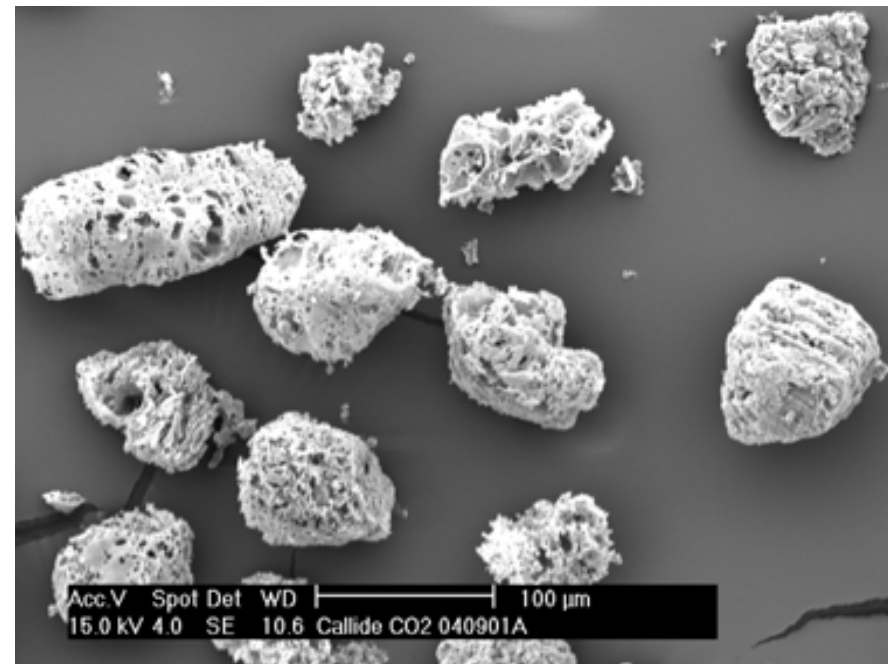


## Char Formation

Air Combustion Mode



Oxy Combustion Mode



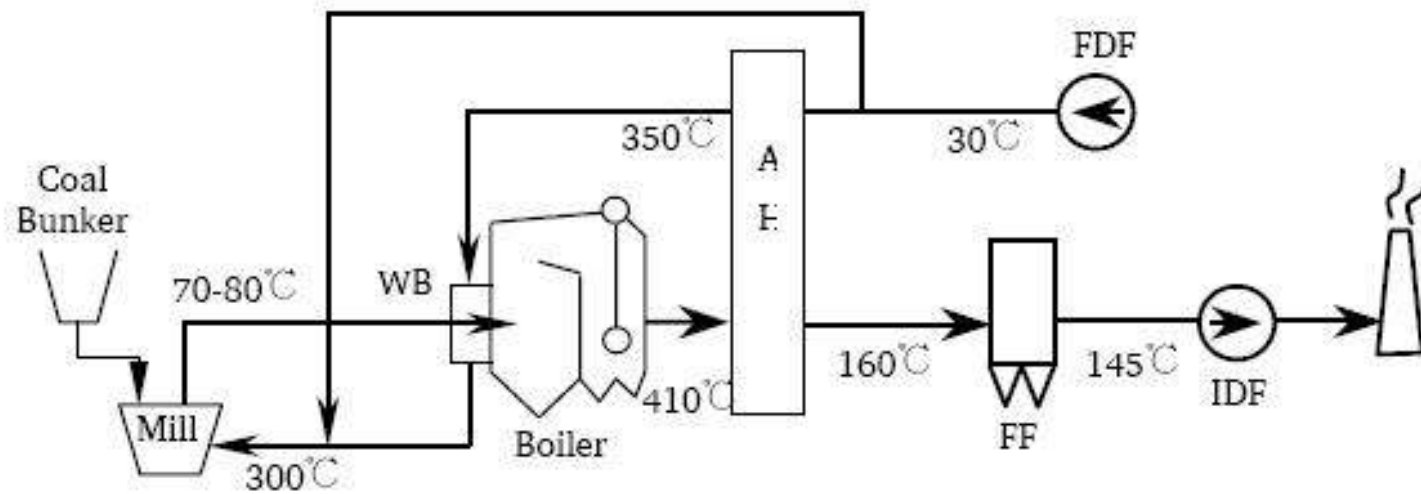
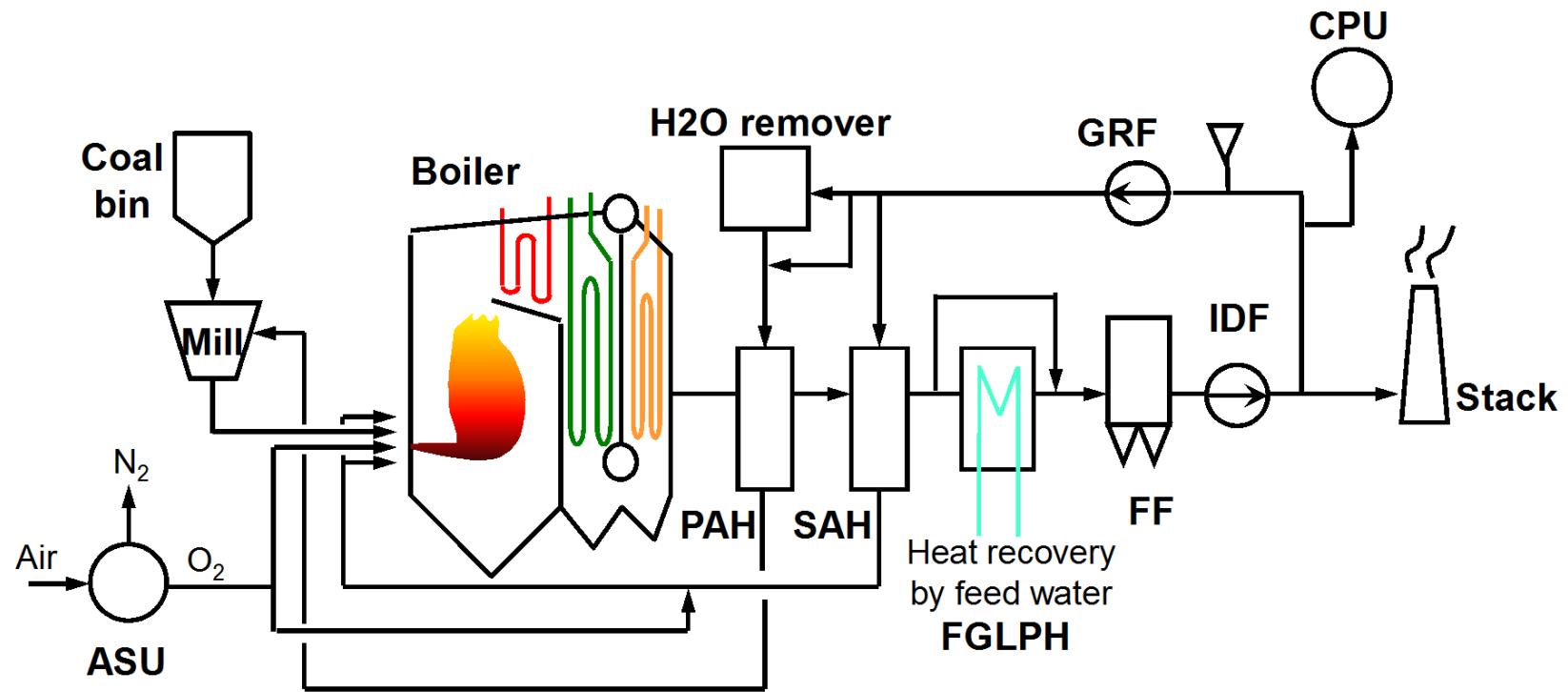
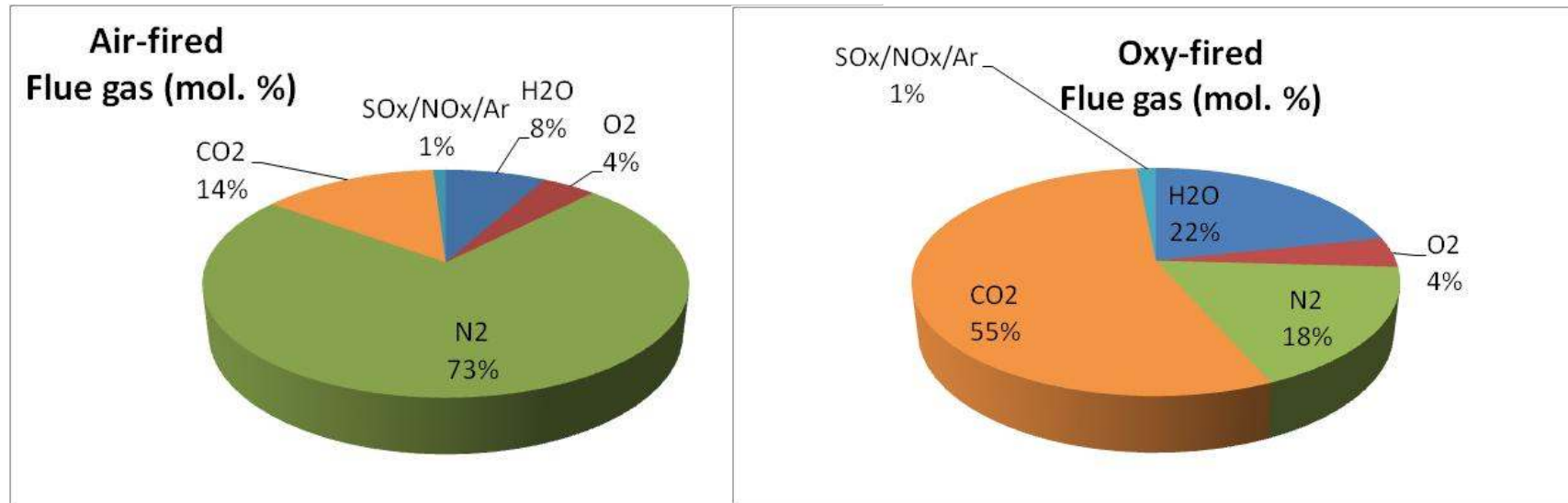


Fig. 1.2.1-2 Existing air and gas flow diagram of Callide-A power plant





# Air-firing versus oxy-firing



# Oxy-firing mode changes

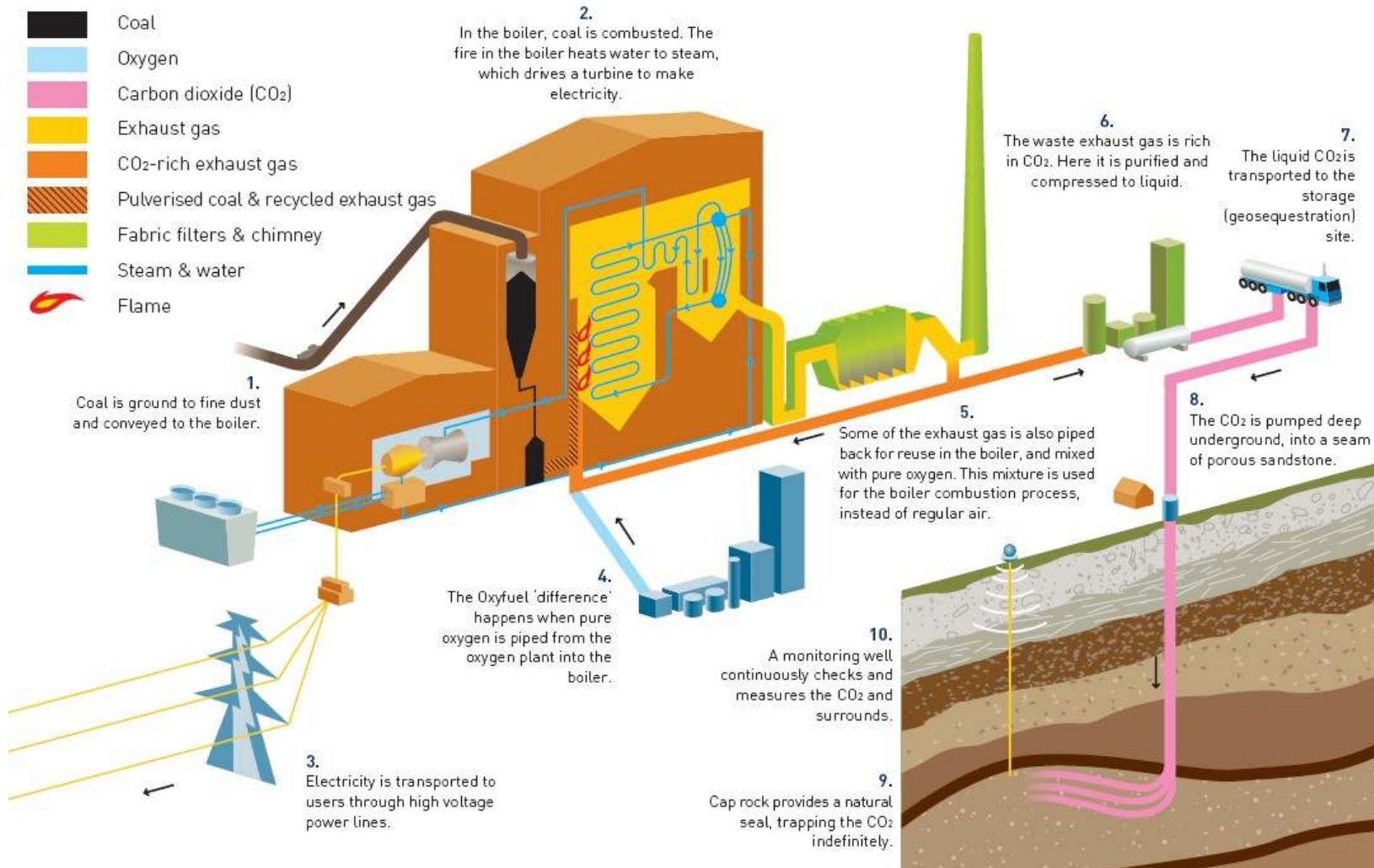
Flue Gas Composition		Air-Firing mode	O2 Sequence	RFG Mode	Oxy-mode
O2	vol %, dry	4.7	6.0	6.8	5.4
CO2	vol %, dry	15.0	16.2	59.9	65.8
CO	ppm, dry	18	20	12	12
SO2	ppm, dry	220	230	800	890
NO	ppm, dry	550	720	1195	965
NO2	ppm, dry	9	10	45	46
H2O	vol %	8	8.5	20.5	21.6
NOx	ppm, dry @ 7% O2	480	680	1220	910
NOx	ppm, dry @ 12% CO2	445	540	250	180
Flue Gas to Stack	kg/s (wet basis)	54	59	15.4	14.0
NOx	g/s	43	61	21	15

**Air-firing mode** means normal air firing

**O2 sequence** means increased O2 to the boiler via O2 injection nozzles but no recirculation of flue gas

**RFG mode** means that the recirculated flue gas sequence has been completed

**Oxy-mode** means that on completion of the RFG sequence the overall O2 is reduced to normal levels and full oxy-mode is achieved



# Callide A site works – Boiler modification



Boiler - before



Boiler - after



## Callide A – Oxygen and CO<sub>2</sub> Capture Plant



# Site works (carbon dioxide capture plant)





IT'LL CUT GREENHOUSE  
EMISSIONS BY A THIRD

TAMARA G.