

## Reducing Emissions from Coal Plants

There are three ways to reduce the CO<sub>2</sub> emissions from a coal plant:

1. Fuel switching - replacing part or all of the fuel with a lower carbon fuel like biomass or natural gas (fuel switching)
2. Efficiency improvement - increasing the efficiency of the plant so less CO<sub>2</sub> is emitted to produce the same output
3. Carbon Capture strategies – capturing the CO<sub>2</sub> in the flue gas and storing it

### 1. Fuel Switching:

Coal plants can be reconfigured to operate using natural gas as a fuel. Natural gas has more heat content provided by hydrogen than coal which creates fewer CO<sub>2</sub> emissions. However, a coal boiler will require significant modifications to operate on natural gas because coal boilers provide radiation which is used to heat water in the water walls while natural gas provides less energy as radiation. Also, in many places natural gas is significantly more expensive as a fuel source than coal.

Coal plants, with minor modifications, can operate with about 5 to 10% biomass added to the coal fuel. Biomass is a renewable fuel and therefore has the effect of reducing CO<sub>2</sub> emissions. However, acquiring a large secure low cost long term supply of good quality biomass fuel can be problematic.

Ontario Power Generation has completed a \$10 million study to completely convert some of their coal plants to biomass. Nova Scotia power is also studying the use of biomass in coal plants.

### 2. Efficiency Improvements:

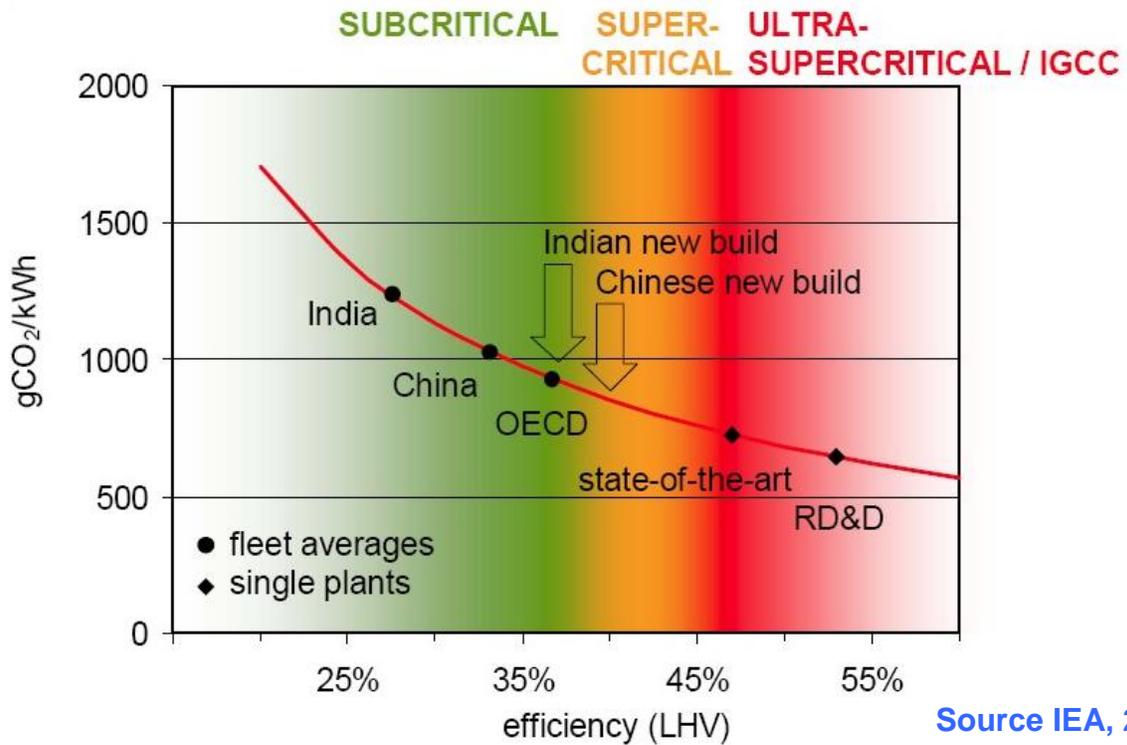
Increasing the efficiency of a coal plant leads to fewer CO<sub>2</sub> emissions for the same power output. There are a number of ways efficiency can be improved:

- Upgrade the facility to slightly increase the main superheat and reheat temperatures of older coal plants
- Rebuild the steam turbines and electrical generators in a plant
- Improve combustion controls
- Improve the quality of the coal by reducing its water or ash content so less fuel will be required to vaporize the water and less heat will be lost to the ash

Efficiency improvements can also be achieved when building new coal plants by:

- Employing high strength alloy steels to allow the plants to produce steam at higher temperatures and pressures
- Employing more efficient steam turbines. New super critical and ultra critical plants are more efficient than their sub critical predecessors.

The following describe the effect of efficiency on CO<sub>2</sub> emissions. A 1% increase in efficiency causes a 2-3% decrease in CO<sub>2</sub> emissions.



### 3. Carbon Capture Strategies:

Coal plants can be configured with technologies to capture the CO<sub>2</sub> present in the flue gas. This process is known as post combustion capture. Amine scrubbing and chilled ammonia technologies are being considered for this purpose. Additionally, firing the coal boiler with pure oxygen (oxyfuel) instead of air generates a flue gas with high concentrations of CO<sub>2</sub> which make capturing this CO<sub>2</sub> less expensive. Neither of these approaches has been employed on a coal plant on a commercial scale.