## HIGH EFFICIENCY LOW EMISSIONS COAL

## **HELE TECHNOLOGIES**

## "HELE clean coal technologies are a key step towards near zero emissions from coal."

IEA Clean Coal Centre

#### What are HELE coal technologies?

High efficiency low emissions (HELE) technologies are a group of diverse technologies developed to increase the efficiency of coal-fired power plants, therefore reducing carbon dioxide ( $CO_2$ ) and other greenhouse gas (GHG) emissions, as well as non-GHG emissions such as nitrogen oxide (NOx), sulphur dioxide (SO<sub>2</sub>) and particulate matter (PM).



VORLD COAL ASSOCIATION

#### Where is HELE being deployed?

HELE coal technology supercritical and ultrasupercritical are operating throughout the world and being deployed commercially in Germany, Italy, India, South Korea, Japan, Poland, Malaysia, Indonesia, Czech Republic, the Netherlands, Slovenia, USA, Australia, South Africa and, particularly, China.

More efficientAdvanced ultra-supercritical45-50%670-740g CO2/kWh290-320g/kWh700°C+Ultra-supercriticalUp to 45%740-800g CO2/kWh320-340g/kWh600°C+SupercriticalUp to 42%800-880g CO2/kWh340-380g/kWhApprox.550°C-600°CSubcriticalUp to 38%≥880g CO2/kWh≥380g/kWh<550°C	Which are HEL	E technologies?	Efficiency rate*	CO <sub>2</sub> intensity	Coal consumption	Steam temperature
Less Efficient	efficient		45-50%	670-740g CO <sub>2</sub> /kWh	290-320g/kWh	700°C+
Less efficient		Ultra-supercritical	Up to 45%	740-800g CO <sub>2</sub> /kWh	320-340g/kWh	600°C+
efficient		Supercritical	Up to 42%	800-880g CO <sub>2</sub> /kWh	340-380g/kWh	Approx. 550°C- 600°C
		Subcritical	Up to 38%	≥880g CO <sub>2</sub> /kWh	≥380g/kWh	<550°C

\*Lower heating value

Source: Adapted from IEA, Technology Roadmaps, High-efficiency low-emissions coal-fired power generation, 2012

### **ENERGY EFFICIENCY**

#### What does efficiency mean?

Efficiency in electricity generation means that less fuel is used to produce the same amount of electricity.

# How much does improved efficiency reduce CO<sub>2</sub>?

A one-percentage point improvement in the efficiency of a conventional coal plant results in a 2-3% reduction in  $CO_2$  emissions.



The cost of converting 400 GW of coal capacity from subcritical to HELE coal technologies in developing countries of NON-OECD regions. This equates to a saving of 6 billion tonnes of  $CO_2$  from 2015 through 2040.

#### **EMISSIONS REDUCTION**

#### Why is HELE important?

Moving the current average global efficiency rate of coal-fired power plants from 33% to 40% by deploying more advanced off-the-shelf technology could cut two gigatonnes of  $CO_2$  emissions now, while allowing affordable energy for economic and social development.

Two gigatonnes of CO<sub>2</sub> is equivalent to:

- India's annual CO<sub>2</sub> emissions
- running the European Union's Emissions Trading Scheme for 53 years at its current rate, or
- running the Kyoto Protocol three times over.

#### Emission reductions by policies / actions, bn tonnes $CO_2$ equivalent

1989-2013 5.6bn   2010 2.8bn
2010 2.8bn
2010 2.2bn
2bn
2010 600m
2012-2025 <b>460m</b>
2005-2013 400m
2007 177m
2004-2014 <b>150m</b>
1991-2014 <b>100m</b>
2008-2012 58m

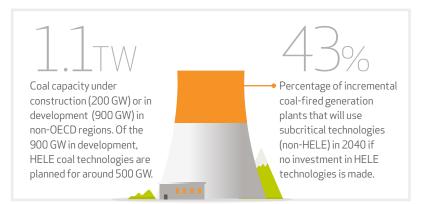
\*Annual emissions are cumulative emissions divided by the relevant period. The estimate for the current emissions avoided under the Montreal protocol is eight billion tonnes of CO2e. \*\*Cars and light trucks

Source: The Economist 2014 and International Energy Agency 2013

### **CARBON CAPTURE**

#### How does HELE relate to carbon capture and storage?

HELE coal technologies are important as a key first step towards the deployment of carbon capture, use and storage technology (CCUS). HELE plants reduce the volume of  $CO_2$  to be captured and hence the capacity of the capture plant required and the quantity of  $CO_2$  to be transported and stored.



## **CLIMATE GOALS**

#### HELE technologies are critical to achieving global climate goals and sustainable development.

Global climate goals can only be met be utilising all low-emission technologies. HELE coal technologies play an important role in achieving greenhouse gas emissions reductions and as a precursor for the deployment of carbon capture, use and storage.

For countries that have decided to use coal, HELE technologies are essential in order to achieve a decoupled economic growth and universal energy access while reducing carbon emissions and other pollutants that affect health and air quality.

The WCA supports a transition away from the least efficient technology in favour of HELE coal-fuelled power generation technology.