

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 (CO₂) and other greenhouse gas (GHG) emissions, as well as non-GHG emissions such as nitrogen oxide (NO_x), sulphur dioxide (SO₂) and particulate matter (PM).

Where is HELE being deployed?

HELE coal technology supercritical and ultra-supercritical 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.

Which are HELE technologies?



	Efficiency rate*	CO ₂ intensity	Coal consumption	Steam temperature
Advanced ultra-supercritical	45-50%	670-740g CO ₂ /kWh	290-320g/kWh	700°C+
Ultra-supercritical	Up to 45%	740-800g CO ₂ /kWh	320-340g/kWh	600°C+
Supercritical	Up to 42%	800-880g CO ₂ /kWh	340-380g/kWh	Approx. 550°C- 600°C
Subcritical	Up to 38%	≥880g CO ₂ /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 CO₂?

A one-percentage point improvement in the efficiency of a conventional coal plant results in a 2-3% reduction in CO₂ emissions.

US\$ 31 bn



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 CO₂ 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 CO₂ emissions now, while allowing affordable energy for economic and social development.

Two gigatonnes of CO₂ is equivalent to:

- India's annual CO₂ 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 CO₂ equivalent

Policy / Action	Cumulative emissions	Period	Annual emissions*
Montreal protocol	135.0bn	1989-2013	5.6bn
Hydropower worldwide	2.8bn	2010	2.8bn
Nuclear power worldwide	2.2bn	2010	2.2bn
Increase average global efficiency of coal-fired power plants to 40%			2bn
Other renewables worldwide	600m	2010	600m
US vehicle emissions & fuel economy standards**	6.0bn	2012-2025	460m
Brazil forest preservation	3.2bn	2005-2013	400m
India land-use change	177m	2007	177m
Clean Development Mechanism	1.5bn	2004-2014	150m
Global Environment Facility	2.3bn	1991-2014	100m
EU energy efficiency	230m	2008-2012	58m
EU renewables	117m	2008-2012	29m

*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 CO₂ to be captured and hence the capacity of the capture plant required and the quantity of CO₂ to be transported and stored.

1.1TW

Coal capacity under construction (200 GW) or in development (900 GW) in non-OECD regions. Of the 900 GW in development, HELE coal technologies are planned for around 500 GW.

43%

Percentage of incremental coal-fired generation plants that will use subcritical technologies (non-HELE) in 2040 if no investment in HELE technologies is made.



CLIMATE GOALS

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

Global climate goals can only be met by 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.