Clean Coal Technology for Power: Global Status and Prospects

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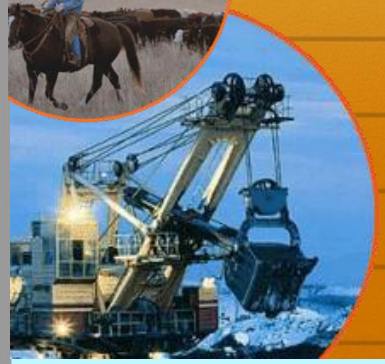
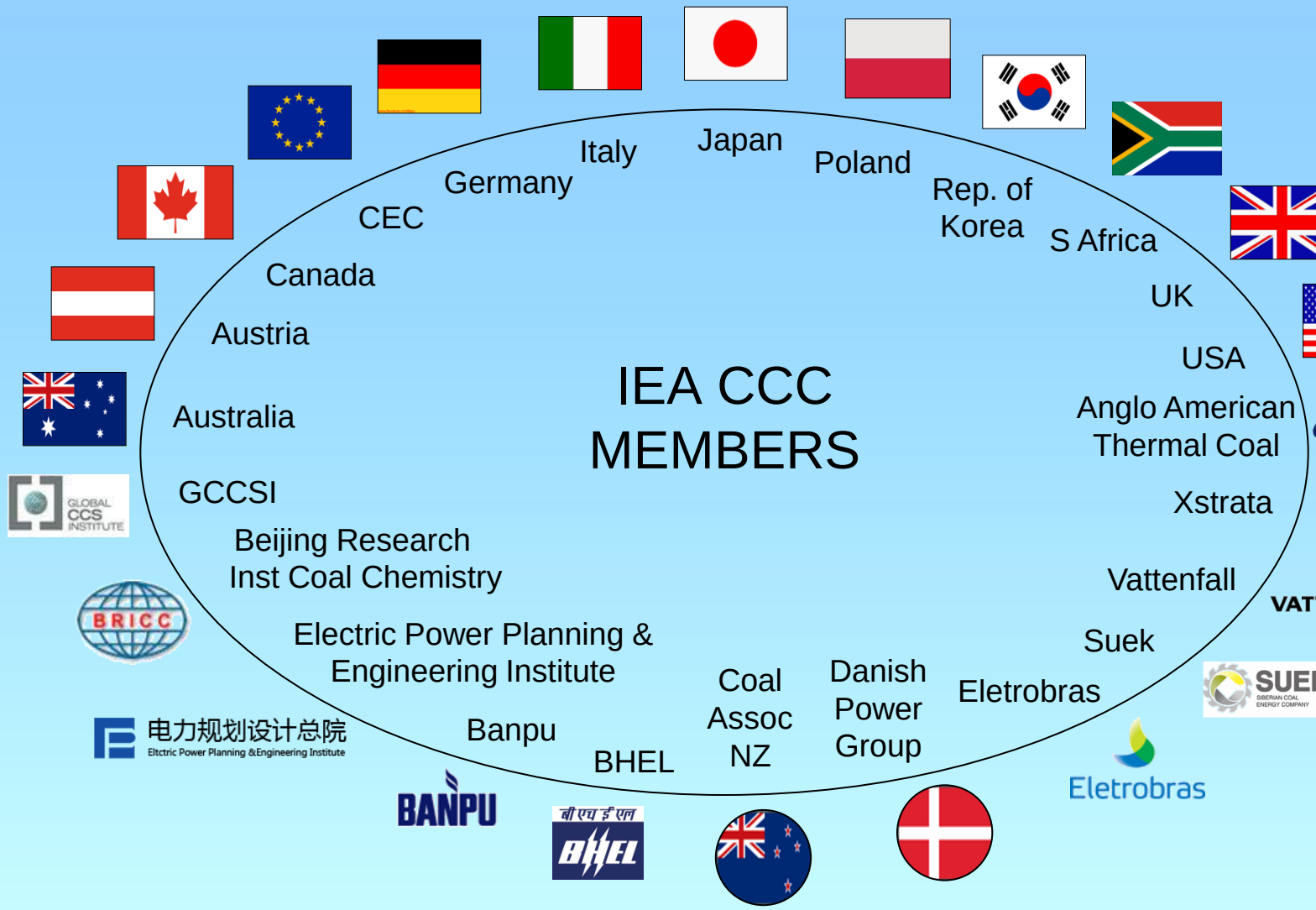


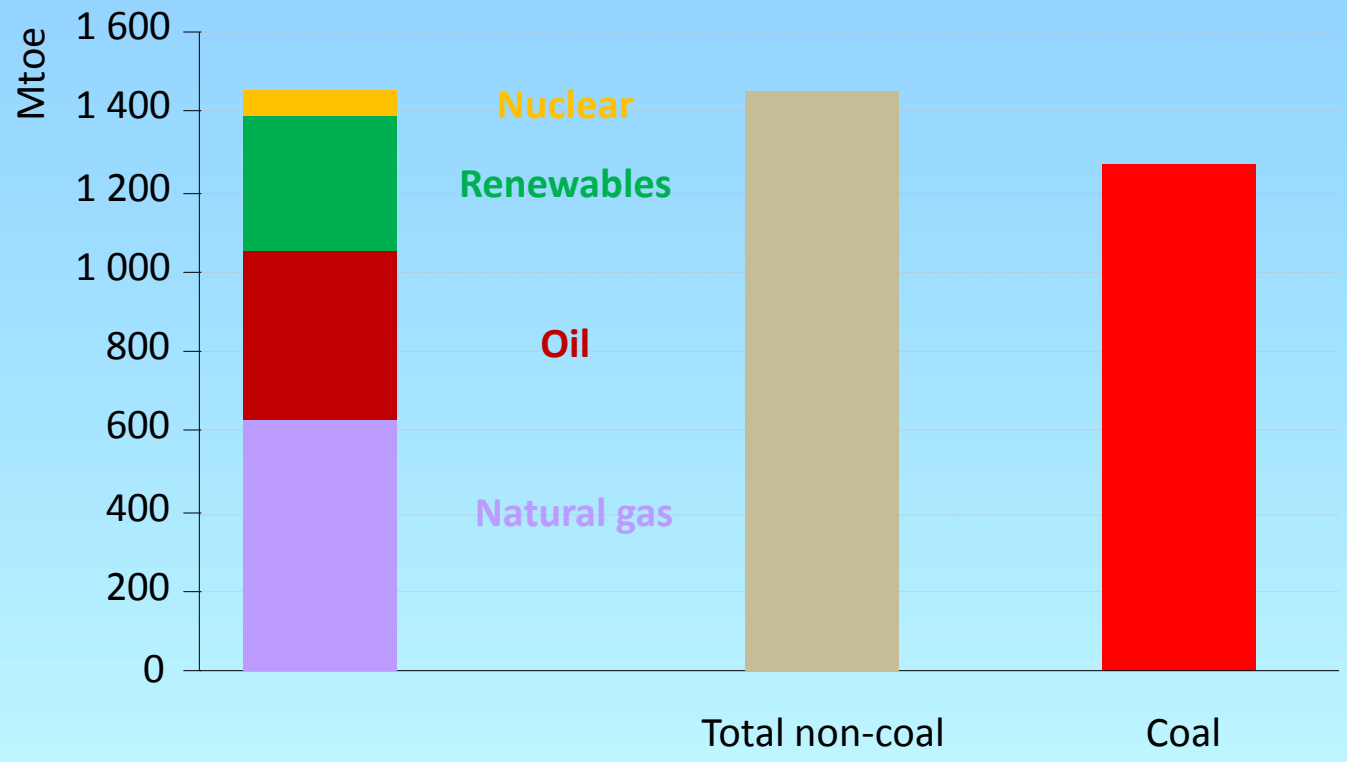
"Cleaner and more efficient coal technology in Russia", Moscow, 10 December, 2012

IEA CCC MEMBERS



IEA WEO 2011: Coal won the energy race in the first decade of the 21st century

Growth in global energy demand, 2000-2010



Coal accounted for almost half the increase in energy use over the past decade, with the bulk of growth coming from the power sector in emerging economies

1. **Examples of Best Practice Today in Coal Fired Power**

2. **Efficient Clean Power Tomorrow?**

3. **Lead in to Carbon Capture**

Torrevaldaliga Nord, Italy

USC, boilers supplied by Babcock Hitachi using bituminous coal

3 units at 660MWe = 1980MWe station

NOx <100 mg/m^3, sulphur oxides <100 mg/m^3, particulates 15 mg/m^3, at 6% O_2, dry; full waste utilisation

Highest steam conditions: 604°C/612°C at turbine: 25 MPa

Operating net efficiency **>44.7% Lower Heating Value basis**

Wet scrubber based limestone/gypsum FGD

NOx abatement **SCR**

Niederaussem K, Germany

USC, tower boiler, tangential wall firing, lignite of 50-60% moisture, inland

Most efficient lignite-fired plant

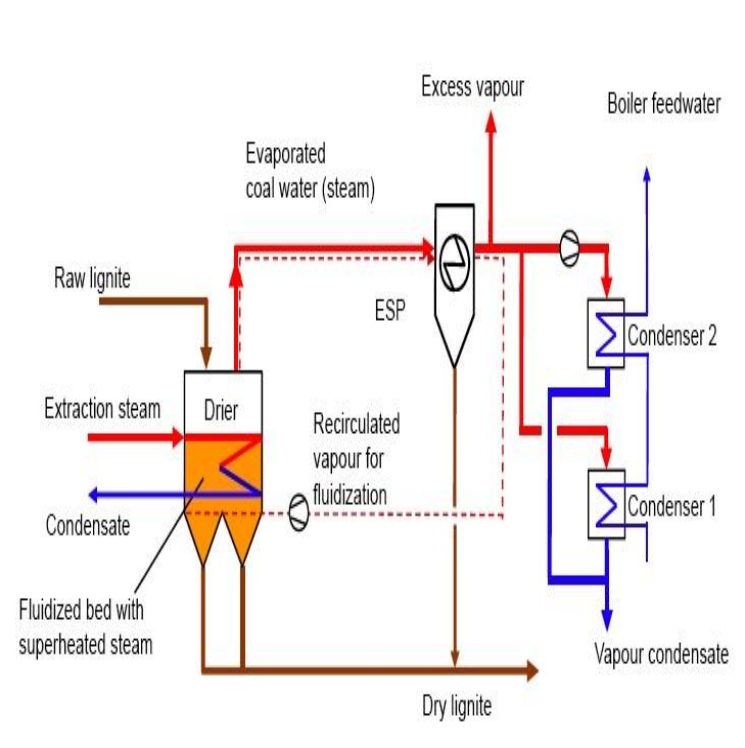
Operating net efficiency 43.2% LHV/37% HHV

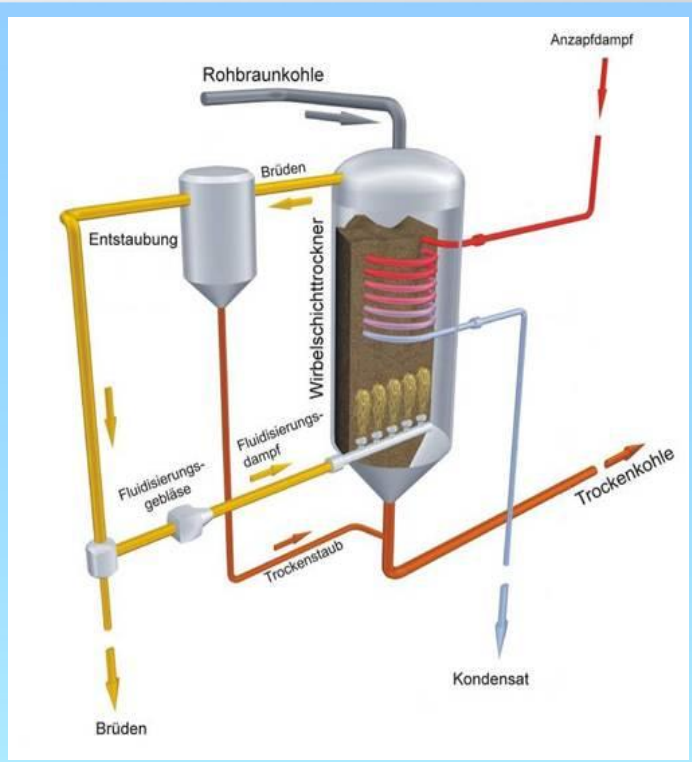
High steam conditions 27.5 MPa/580°C/600°C at turbine

Unique heat recovery arrangements with heat extraction to low temperatures – complex feedwater circuit

Lignite drying demonstration plant installed to process 25% of fuel feed to enable even higher efficiency

Lignite drying





RWE's WTA lignite drying process

Vattenfall's PFBD process

There should be cost savings in a new boiler that will largely offset the cost of the drier (including elimination of beater mills and hot furnace gas recycle systems, smaller flue gas volume). It will also allow plants to have greater turndown

Isogo New Units 1 & 2, Japan

USC, tower boiler, opposed wall firing, international bituminous coal and Japanese coals, warm sea water

Lowest conventional emissions (NOx 20 mg/m^3, sulphur oxides 6 mg/m^3, particulates 1 mg/m^3, at 6% O_2, dry); full waste utilisation

Highest steam conditions: 25.0 MPa/600°C/610°C at turbine: ASME CC 2328 steels in S/H; P122 for main steam pipework

Operating net efficiency >42% LHV/40.6% HHV

Dry regenerable activated coke FGD (ReACT)

NOx abatement: Combustion measures and SCR

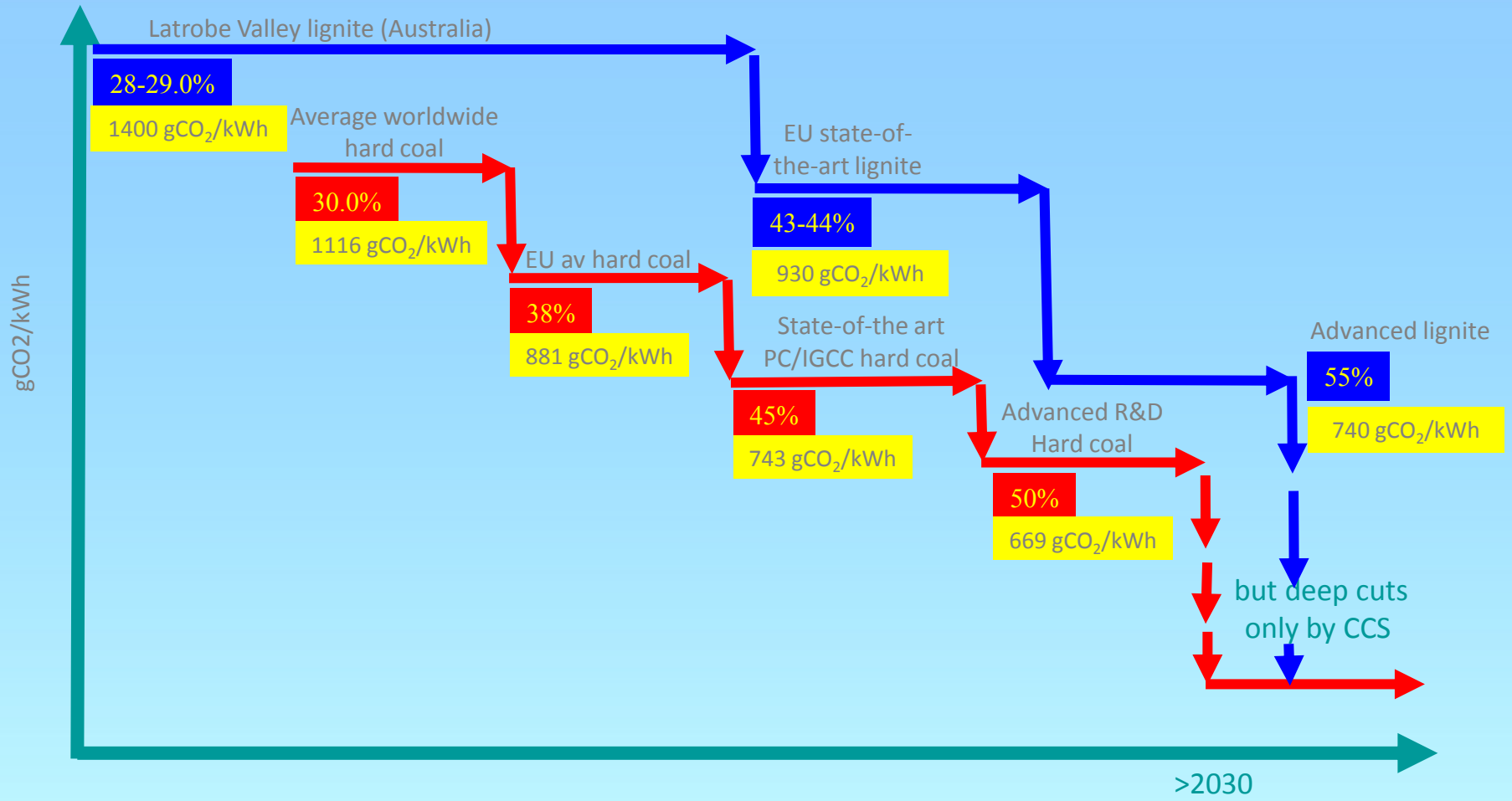
Huaneng Yuhuan 4x 1000MWe USC coal fired power plant, China

Sasan Ultra Mega Power Plant (UMPP), Madhya Pradesh, India

Reliance Power, 6 x 660 MW supercritical units.
24.7 MPa/565/593
Plant connected to the grid in September 2012

Efficient Clean Power Tomorrow

CO_2 emission reduction by key technologies



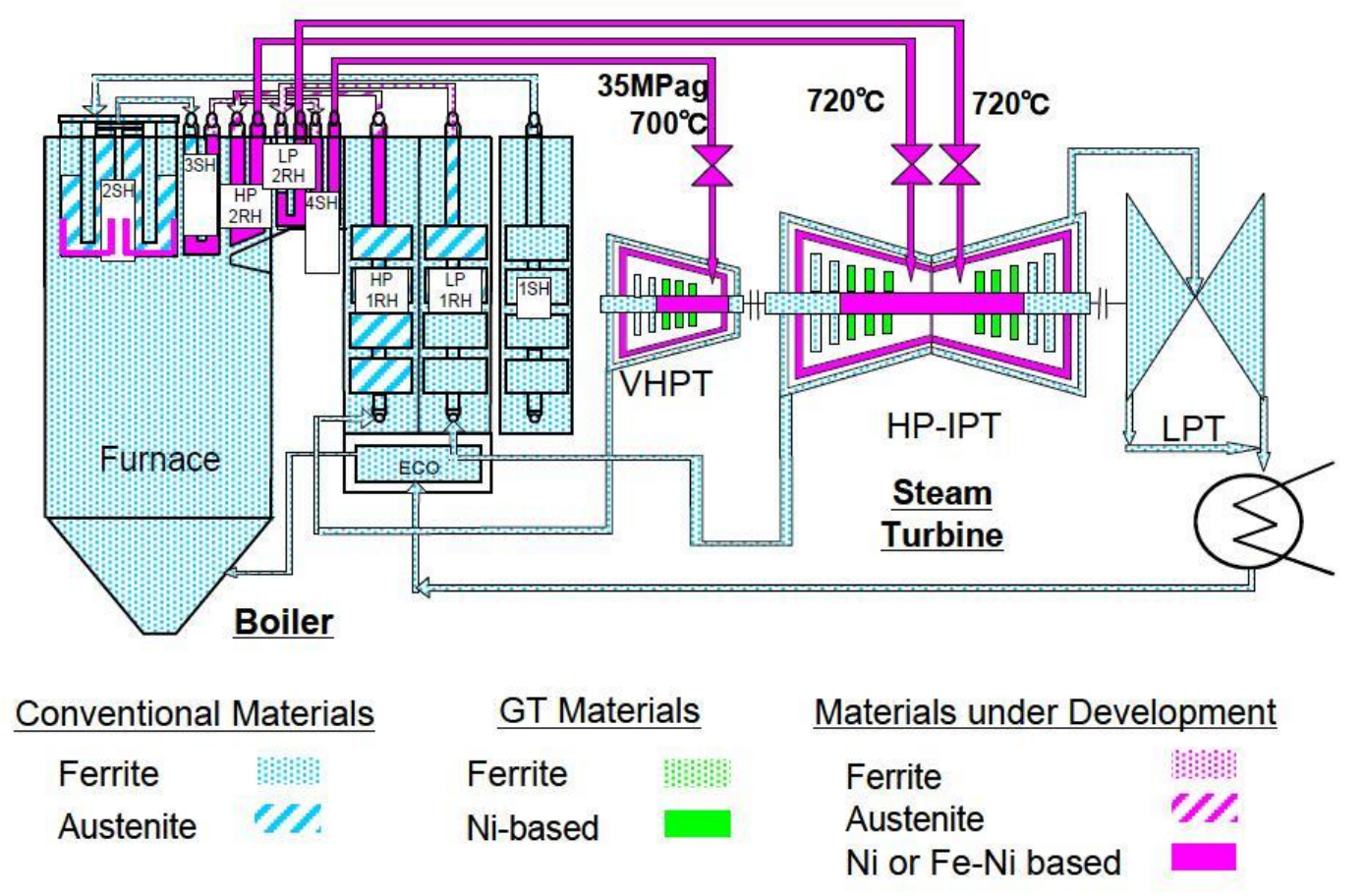
Data for hard coal-fired power plants from VGB 2007; data for lignite plants from C Henderson, IEA Clean Coal Centre; efficiencies are LHV,net

Energy Efficiency makes big change but deep cuts of CO_2 emission can be done only by Carbon Capture and Storage (CCS)

A-USC technology

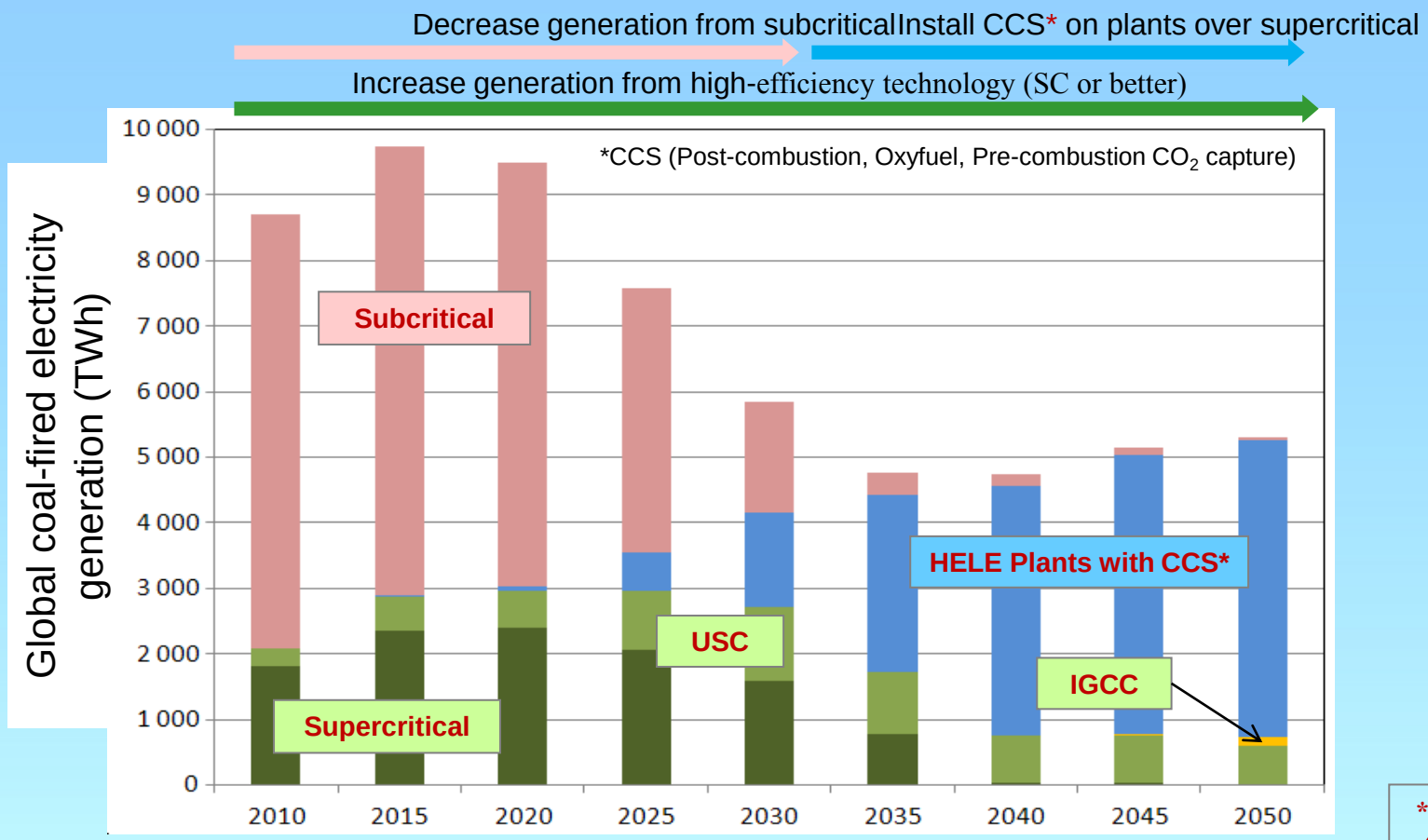
- Work is being undertaken in EU, Japan, USA, India and China to develop these high temperature (700˚C plus) systems to increase the efficiency of generation to around 50%, LHV basis, and so reduce CO_2 emissions
- You can access the papers given at the recent workshop indicated below. www.iea-coal.org.uk
- IEA CCC will also publish a review report on the topic in 2013

A-USC technology in Japan



Materials in Japanese double-reheat A-USC design *(Fukuda M, 9th Liege Conference: Materials for Advanced Power Engineering, 2010)*

Improve efficiency, then deploy CCS



* CCS fitted to SC (or better) units.

Source: IEA 2012

Drax Power Station

Drax is the last built of UK Coal Fired Power Stations, 30 years ago

6x660 Mwe Drax is the most efficient UK Coal Station but now some 7% points of efficiency behind international best practice

Drax Power in UK - 500MW Co-firing Facility

Drax is a pioneer in biomass direct injection technology

New 500MW co-firing facility is largest in the world

Capacity to co-fire >1.5m tonnes pellets per year

CLEAN COAL TECHNOLOGY?

The End – Thank you for your attention

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