

Foundation for Science and Technology
Dinner Debate on Carbon Abatement Technology
Royal Society
London
25th October 2005

Carbon Abatement Technology for Fossil Fuels

"The Transition towards Zero Emission Power Generation"

Nick Otter

Director of Technology and External Affairs, ALSTOM Power Ltd

ALSTOM



Contents of Presentation

ALSTOM

- **POSING A SERIES OF QUESTIONS FROM AN INDUSTRY POSITION**
 - **What are the key energy issues? Global aspects?**
 - **What is the role for Carbon Abatement Technologies for Fossil Fuels?**
 - **What should a CAT implementation strategy be?**
 - **What are the current CAT initiatives national and international?**
 - **What is the required timeframe and how can it be met?**
 - **What are the constraints to deployment?**

- **PROVIDING SOME THOUGHTS ON THE ROLE OF THE UK**



- **Energy Equipment/Systems Supply Company**
 - ALSTOM Power : world-wide supplier of power generation systems/services
- **UK Advanced Power Generation Sector**
 - UK Advanced Power Generation Technology Forum (APGTF)
 - UK DTI Advisory Committee on Carbon Abatement Technologies (ACCAT)
- **European and an International Context**
 - Advisor to EC : DG Research/Energy
 - Active in IEA Zero Emission and associated actions
 - UK representative on the Carbon Sequestration Leadership Forum (CSLF)



AN OVERALL PERSPECTIVE

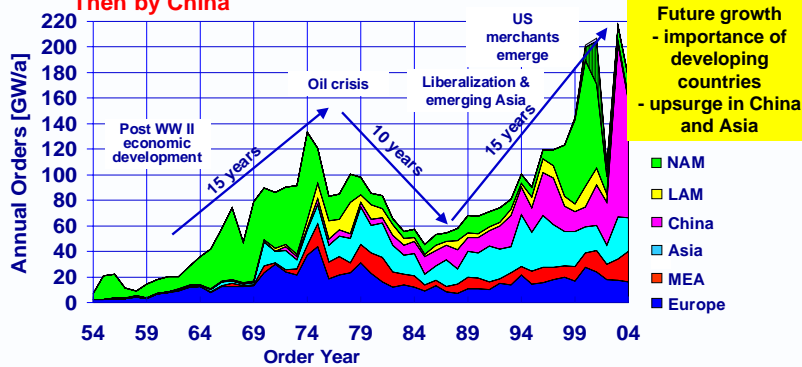


Near Term Global Position

ALSTOM

Market Development 50 Years of Order Volumes by Regions

Recent Power Investment Peak Led by North America
Then by China

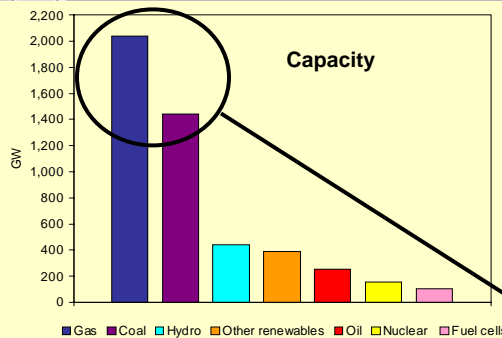


Significant market changesincreased liberalisation, de/re-regulation and privatisation



Long Term Energy Market

ALSTOM

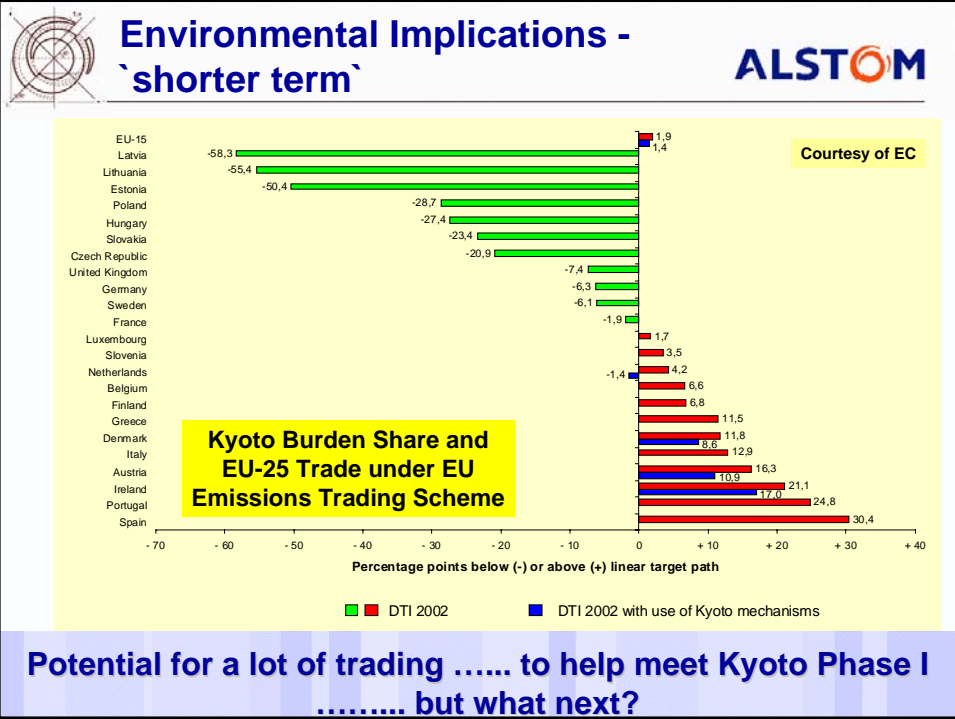
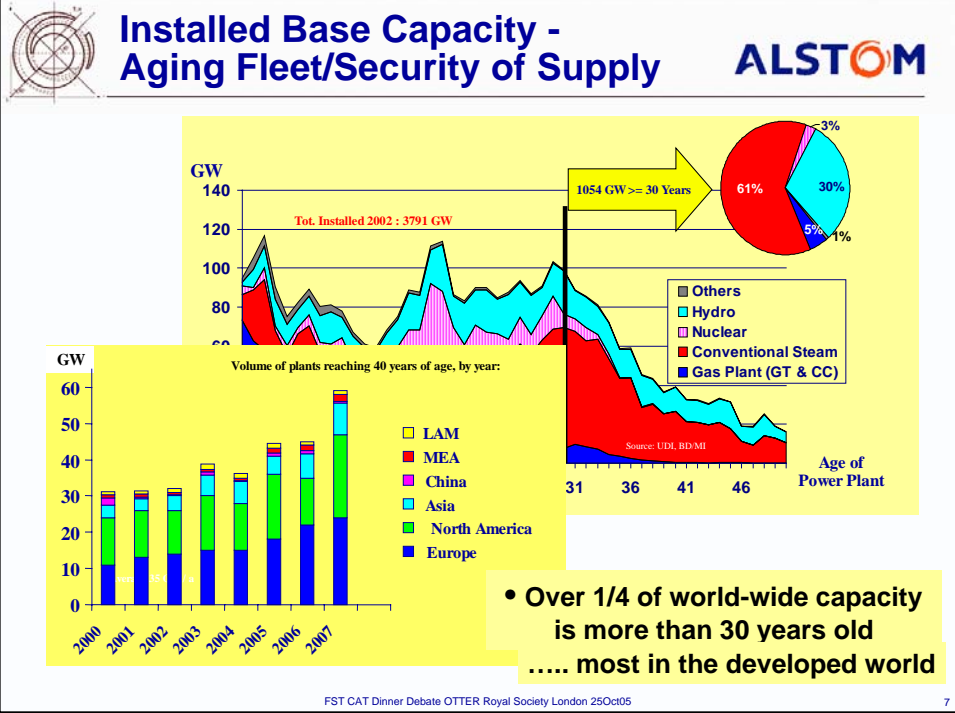


IEA projections of global power station build to 2030

IEA World Energy Outlook 2004

- Different needs world-wide
- uneven access to modern energy
- Growth of Renewable Energy but

Continuing reliance on fossil fuels
- especially likes of China and India





Environmental Implications - 'longer term'

ALSTOM

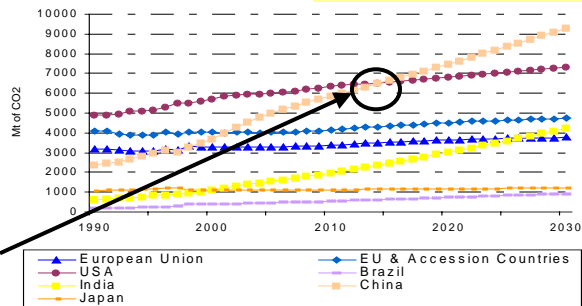
● Environment

- Longer term : 60% GHG reductions by 2050?



China will overtake US as biggest CO₂ emitter by 2015

Forecasted CO₂ Increases
Source: EC/EEA, 2004



importance of engaging Emerging Market Economies



Overall perspective

ALSTOM

Clean use of fossil fuels : a critical transition for decades yet in getting to a sustainable energy future a major issue alongside and complementary to other measures

- **UK especially active in 2005**
 - Launch of CAT Strategy : June 2005
 - Leadership of G8 : Clean Fossil Action Plan
 - Presidency of EU : Formulation of FP7
-also in EU and International Arena
 - Carbon Sequestration Leadership Forum CSLF
 - Basis of EU critical mass action established



A FORWARD LOOK IN THE UK



- **DTI/Carbon Abatement Technology (CAT) Strategy for Fossil Fuels**
 - Alongside and complementary to other measures
 - Power Generation but also Industrial Processes
 - Efficiency and fuel switch through to Carbon Capture and Storage (CCS)
 - Link to Fuel Cell/Hydrogen and Sustainable Issues



Launched 14th June 2005 with an associated programme

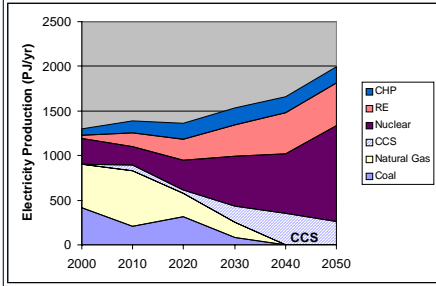


DTI UK Techno-economic Studies ALSTOM

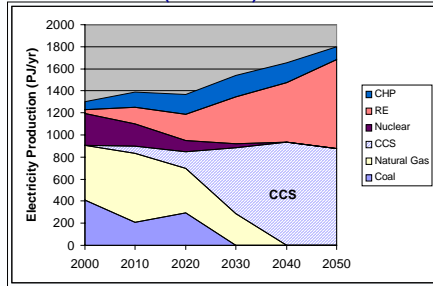
Exploring a range of possible futures covering both economic and social change

- World Markets (WM) : 3% GDP/year
- Global Sustainability (GS) : 2.25% GDP/year
- Baseline (BL) : 2.25% GDP/year

WM Scenario -60% CO₂ ESI



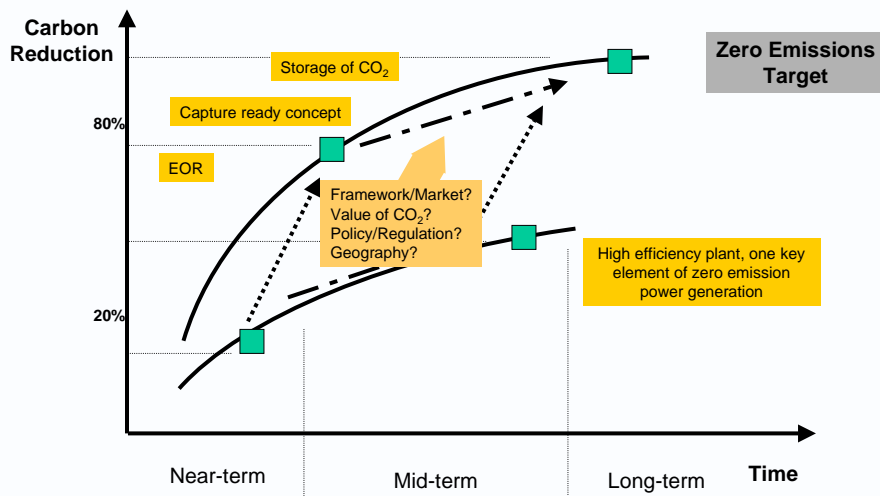
WM Scenario - 60% (No nuclear) ESI



Portfolio Approach including CCS in commercial size by 2020



Pathway to zero emission power for fossil fuels





Constraint to CAT implementation **ALSTOM**

- **Financial**

- Uncertainties over implementation of market-based instruments
 - No overall fiscal/environmental framework to reward investment
 - EU-ETS : CCS not ruled out but not in (yet)
- New commercial relationships required
 - Starting to appear : eg BP/DF1 Peterhead/Miller Project
 - Need encouragement/incentives

- **Regulatory**

- Legal and regulatory regimes : OSPAR/London convention
- Monitoring and verification of stored CO₂
- Long term ownership of CO₂
- Planning and authorisation : standards/permissions

- **Public Perception**

- **Technical**

- Cost reduction : need to get cost down and business benefit up

Address technical and non-technical issues in parallel



ALSTOM

STRATEGY FOR CLEAN FOSSIL FUELS

A full Carbon Abatement Technology approach and
the link to Europe



● **9 Major Themes in FP7**

- Health
- Food, Agriculture and Fisheries
- Information and Communication Technologies
- Nanosciences/technologies, Materials and New Production
- **Energy**
- **Environment and Climate Change**
- Transport
- Socio-economic Sciences and the Humanities
- Space and Security Technologies

7 year Energy programme of ~3b euro over 2007-2013 being sought

9 Key Topics

- Hydrogen and Fuels Cells
- Renewable Electricity Generation
- Renewable Fuel Production
- Renewables for Heating and Cooling
- CO2 Capture and Storage for ZEPG
- Clean Coal Technologies
- Smart Energy Networks
- Energy Savings and Efficiency
- Knowledge for Energy Policy Making



- **EC wish to align Themes with European Technology Platform approach**

● **ZEPG Scope**

To drastically reduce the environmental impact of fossil fuel use, particularly coal, aiming at highly efficient power generation plants with near zero emissions. This will include CO2 capture and storage, as well as clean conversion technologies leading to substantial improvement in plant efficiency, reliability and costs. .



Critical Mass European Action : 21 June 05

ALSTOM

- **ETP “Zero Emission Fossil Fuel Power Plants”**

- **Advisory Council** formed 21 Jun 05
- **6 Generators** : EoN, Endesa, ENEL, RWE, Vattenfall, Energie E2
- **6 Equipment suppliers** : Ansaldo, **ALSTOM**, Air Liquide, Foster Wheeler, **Mitsui Babcock**, **Siemens**
- **5 oil/gas companies** : **BP**, **Shell**, Statoil, Total, Schlumberger
- **4 researchers** : **BGS**, CIRCE, IFP, Polish CMI
- **3 NGOs** : Bellona, CAN Europe, WWF
- EU agenda setting out to 2030-2050
- Major input to EC FP7 (2006-2013)
 - **Strategic Research Agenda (SRA)**
 - **Deployment Plan (SDD)**

Vision Statement

To enable European fossil fuel power plants to have zero emission of CO₂ by 2020

Chair : Haege/Vattenfall (Germany)

Vice Chairs : Appert/IFP (France)
Hill/BP (UK)
Valero/CIRCE (Spain)
Soothill/ALSTOM (UK)

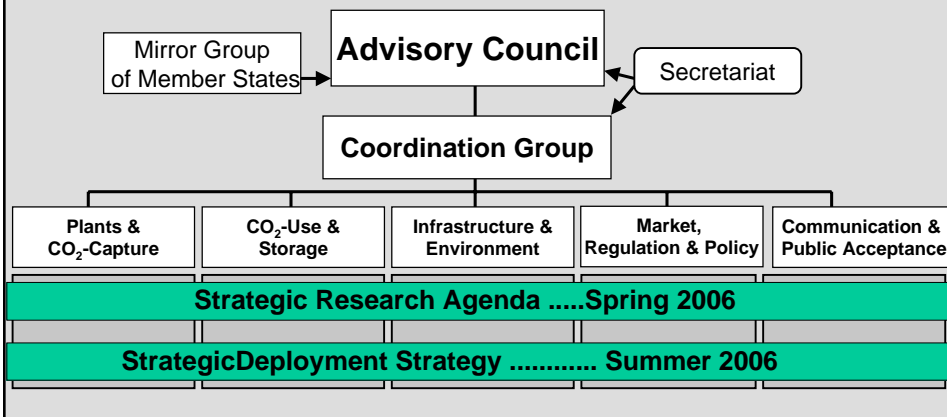
Good industry support, including UK



Critical Mass European Action : Organisational Structure

ALSTOM

Technology Platform Structure Zero Emission Fossil Fuel Power Plant





Critical Mass European Action : Immediate Timeframe

ALSTOM

Initial 18 months	2005			2006		
Consultation with main initiators and stakeholders	→→→					
Advisory Council and Terms of Reference.	→	21/June/05 →→→	10/Aug/05 →→→	9/Sept/05 →→	28/Oct/05 →	
Joint Vision		→	→→→	→→		
Launch the Technology Platform				→→	2/Dec/05 →→	
Strategy Research Agenda			→→→	→→→	→	
Implementation – synergy with Member State Actions		→→→	→→→	→→→	→→→	→→→

**Setting the future agenda for EU for next 30+ years
..... an active 2005 and a busy 2006**



ALSTOM

STRATEGY FOR CLEAN FOSSIL FUELS

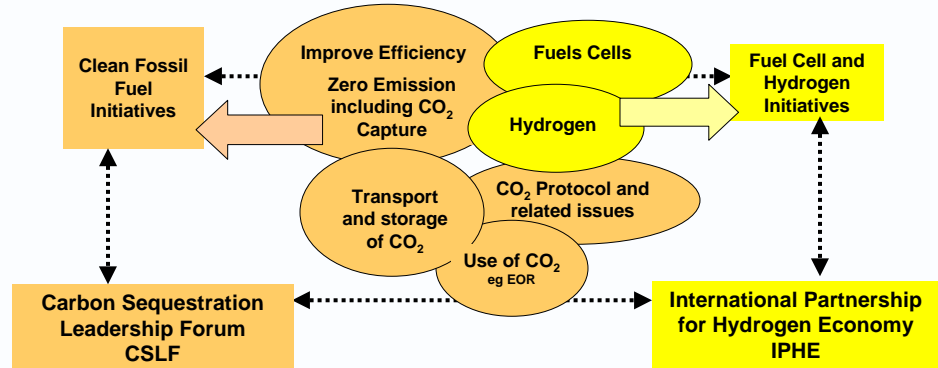
A full Carbon Abatement Technology approach and the link to Europe and internationally



International Strategic Fit

ALSTOM

- Part of an overall strategic framework addressing clean fossil fuels as a key element of a sustainable energy portfolio



FST CAT Dinner Debate OTTER Royal Society London 25Oct05

23



Worldwide Engagement

ALSTOM

- Carbon Sequestration Leadership Forum (CSLF)
 - Technology Route Map
 - Project Initiation and Review Panel
 - Stakeholder engagement through projects
- G8 Action Plan
 - Financial Mechanisms/World Bank
 - `Capture Ready` Technology/IEA
- EU/UK China Zero Emission Plant
 - DEFRA/DTI Initiative through EC
 - Feasibility study leading to demonstration of Near Zero Emissions Coal plant (NSEC)
- IPCC Report for Policy Makers on CCS
 - issued Sep05

Australia	Japan
Brazil	Mexico
Canada	Netherlands (new)
China	Norway
Colombia	Republic of Korea (new)
Denmark (new)	Russian Federation
European Commission	Saudi Arabia (new)
France (new)	South Africa (new)
Germany (new)	UK
India	USA
Italy	Greece (applied)

Thrust for co-ordination and interaction internationally



Some Concluding Thoughts



Final Concluding Thoughts

- **The need for clarity in the future**
 - difficult to forecast future; no one single winning technology; broad balanced portfolio approach
 - need for stable regulatory/fiscal framework to encourage investment
 - impact of ETS and value for CO₂ : visibility into the future

- **The need for clean fossil fuel technology**
 - will continue to play a major role for decades yet
 - clean use of fossil will be paramount
 - a global issue : UK action needs to work internationally

- **The need for continued action**
 - maintain the impetus of 2005
 - work towards an agreed post-2012 position as soon as possible

Robust CAT Action commensurate with the well articulated strategy

