



Doosan Babcock Energy

Supply chains: identifying and overcoming the constraints in clean energy technologies

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Director of Technology Policy Liaison

Accelerating Investment in Low Carbon Technology

Westminster Energy Forum

London 12 Dec 2007

Company update



Nuclear



Thermal



Turbine &
Generator



Desalination



Casting & Forging



Construction

- **Our new name is Doosan Babcock Energy Limited,**
- **We are now a subsidiary of Doosan Heavy Industries and Construction of South Korea, part of the Doosan Group – the oldest and one of the top 10 conglomerates in Korea**
- **Doosan Heavy is a market leader in gas, coal, nuclear power generation and desalination . Orders in 2007 to date total 5 Bn USD**
- **Doosan Babcock Energy remains committed to all forms of power generation, including clean coal, nuclear, gas and renewables**
- **Doosan Babcock Energy will be the Doosan global Centre of Excellence and global R+D Centre for Boilers (including Clean coal and Carbon dioxide capture)**
- **Doosan Babcock Energy's territory is Europe, USA, South Africa and China**

Content of Paper

- **Why accelerate?**
- **Big opportunities**
 - Clean fossil and CCS, Nuclear
- **UK scene**
 - Current build plans
 - Coal or gas?
- **Challenges to be faced by the supply chain**
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World Primary Energy Demand

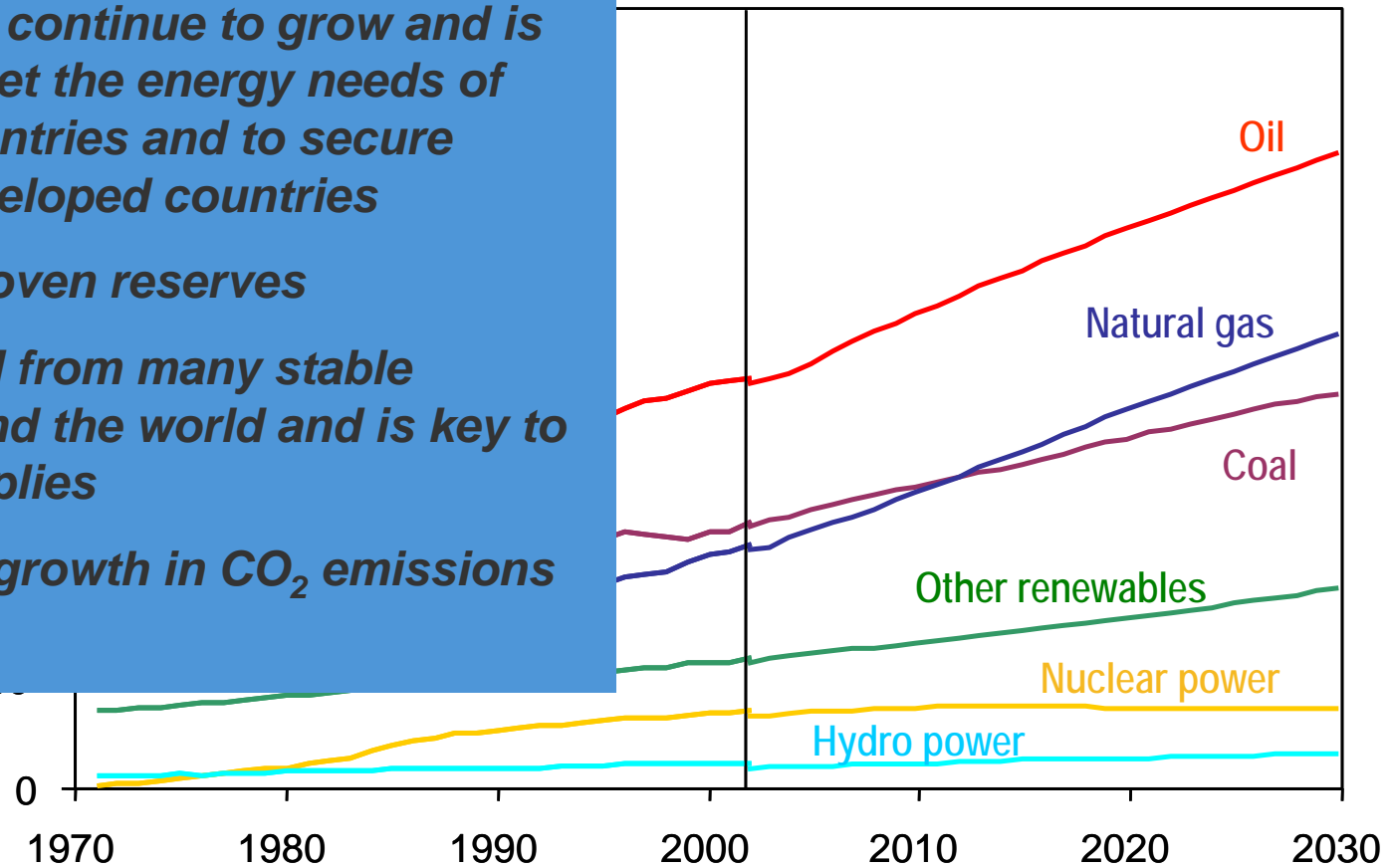
(Source: IEA – World Energy Outlook 2004)

Use of coal will continue to grow and is necessary to meet the energy needs of developing countries and to secure supplies of developed countries

200 years of proven reserves

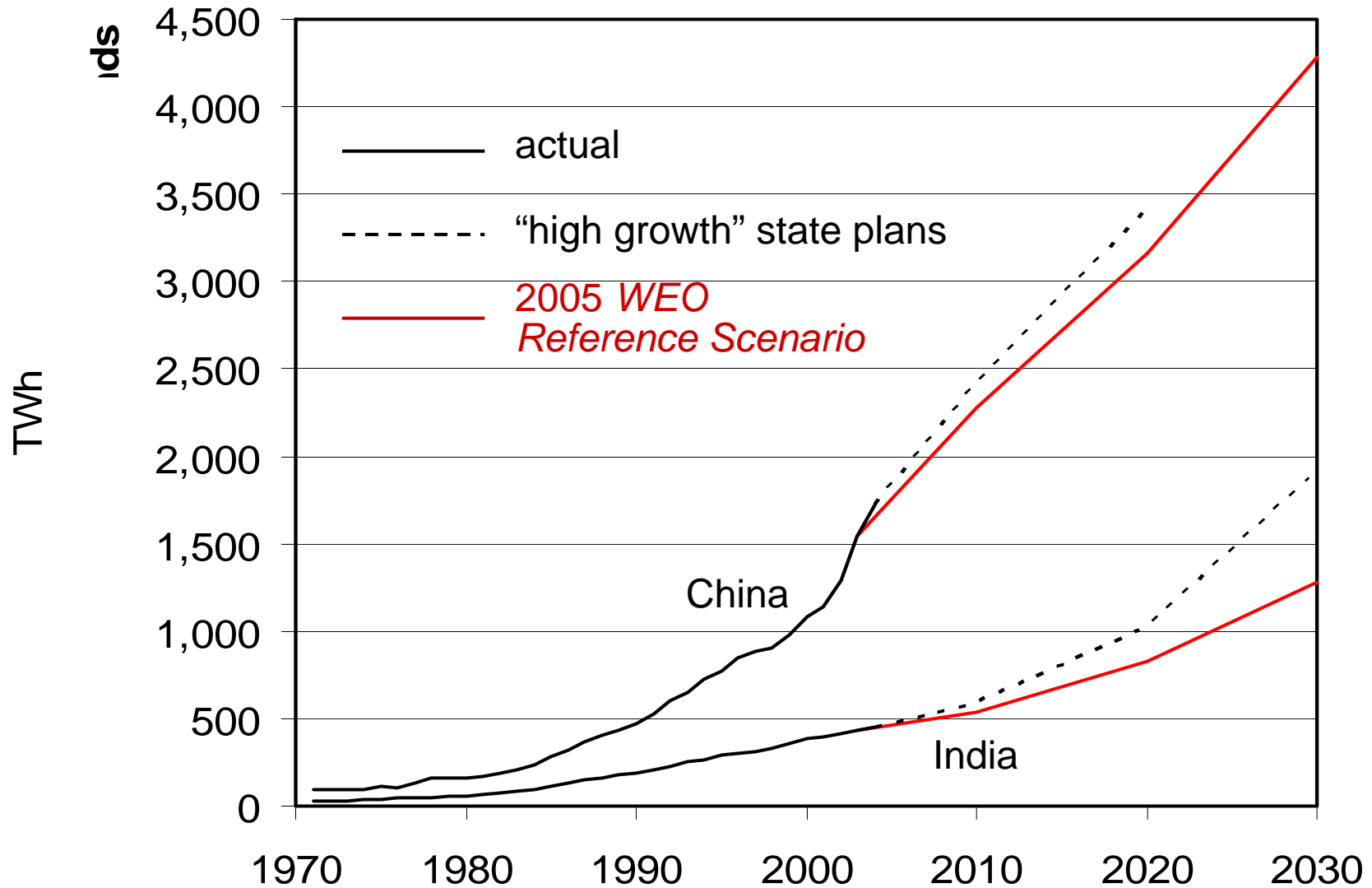
Coal is sourced from many stable countries around the world and is key to security of supplies

Consequential growth in CO₂ emissions



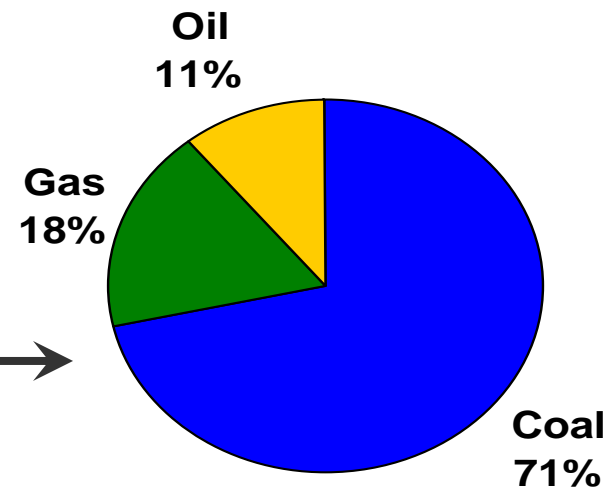
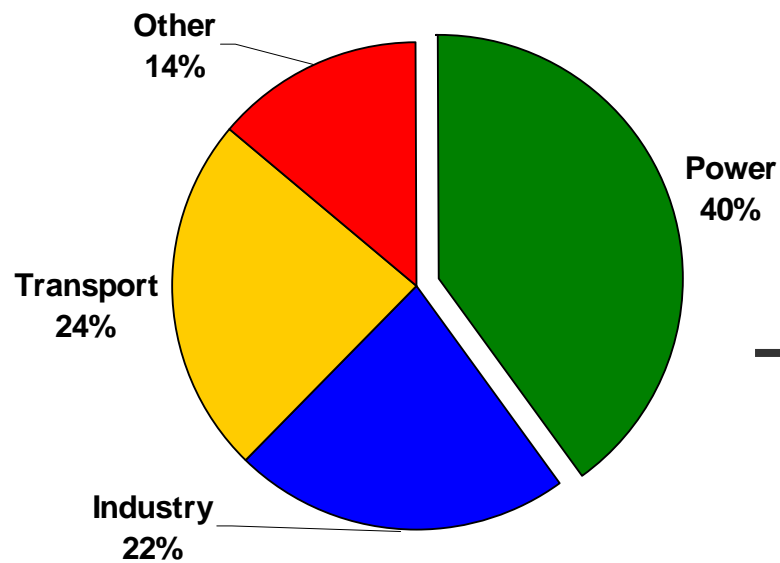
Fossil fuels account for almost 90% of the growth in energy demand between now and 2030

Coal-fired generation growth in China & India



Global CO₂ emissions

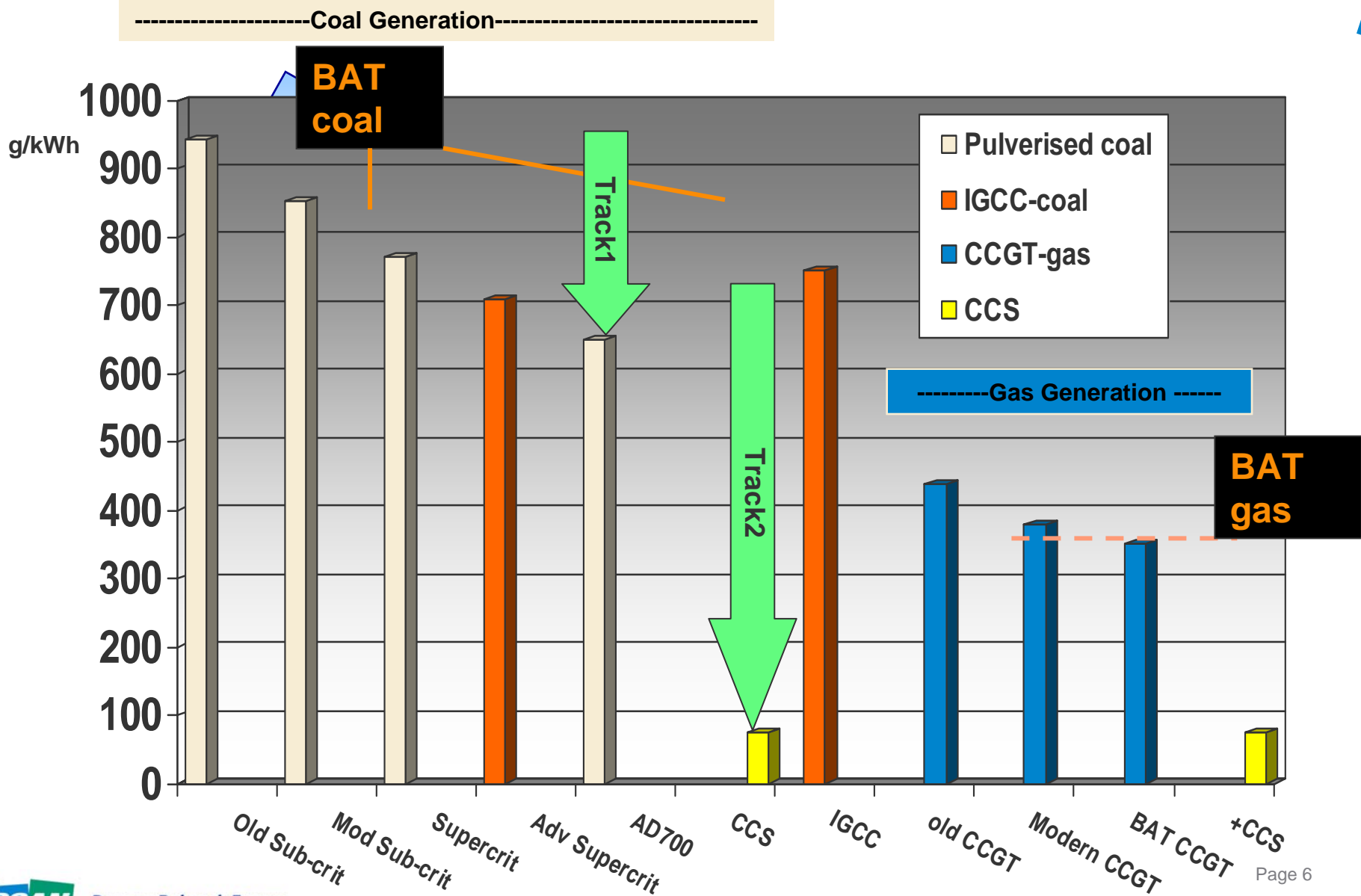
- Power sector is responsible for ~40% of global emissions
- Coal represents ~70% of emissions from power sector (higher carbon intensity)



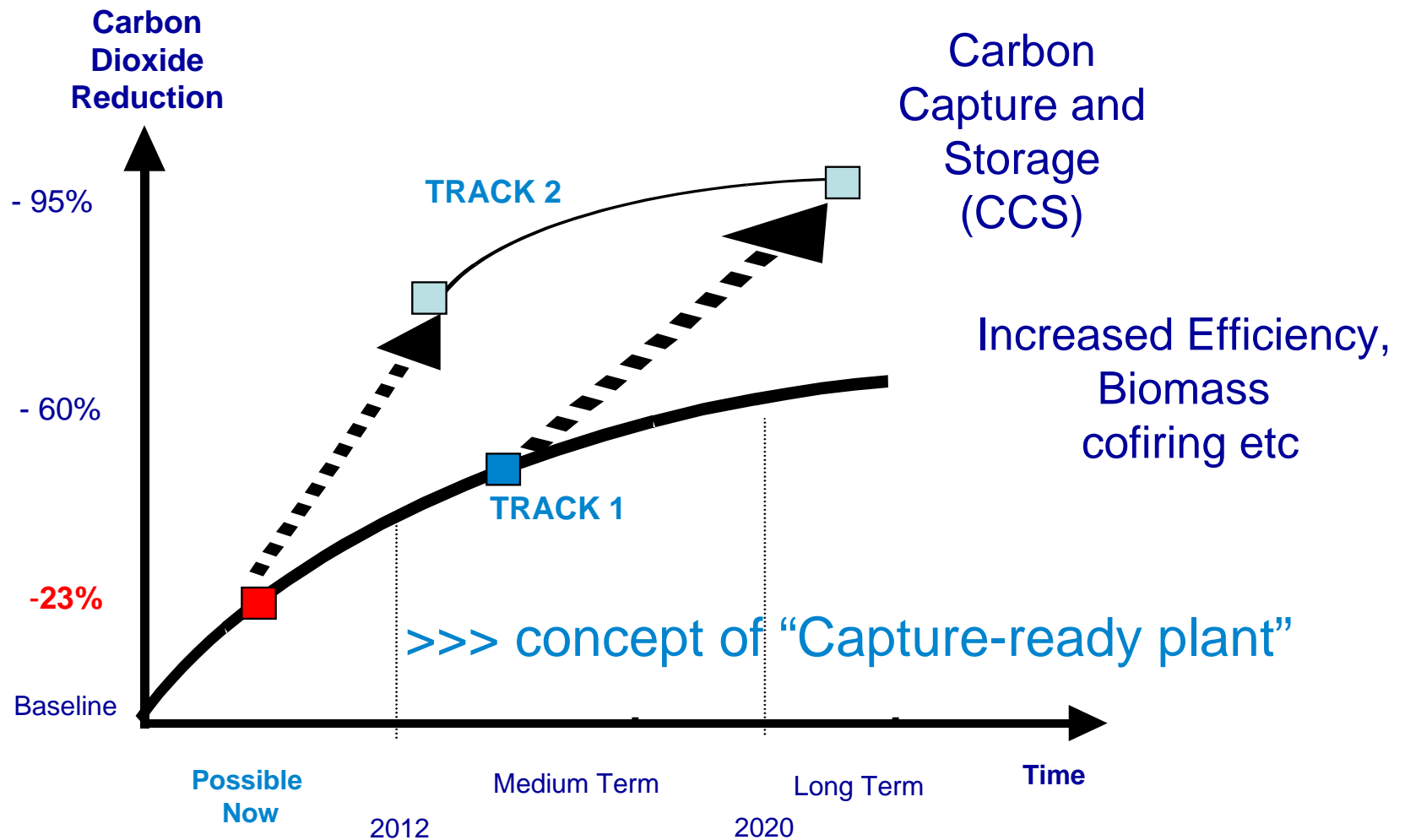
Global CO₂ Emissions : 21GtCO₂ p.a.

Global Power Emissions : 8.3GtCO₂ p.a.

CO₂ reduction on coal and gas power plant – huge opportunity



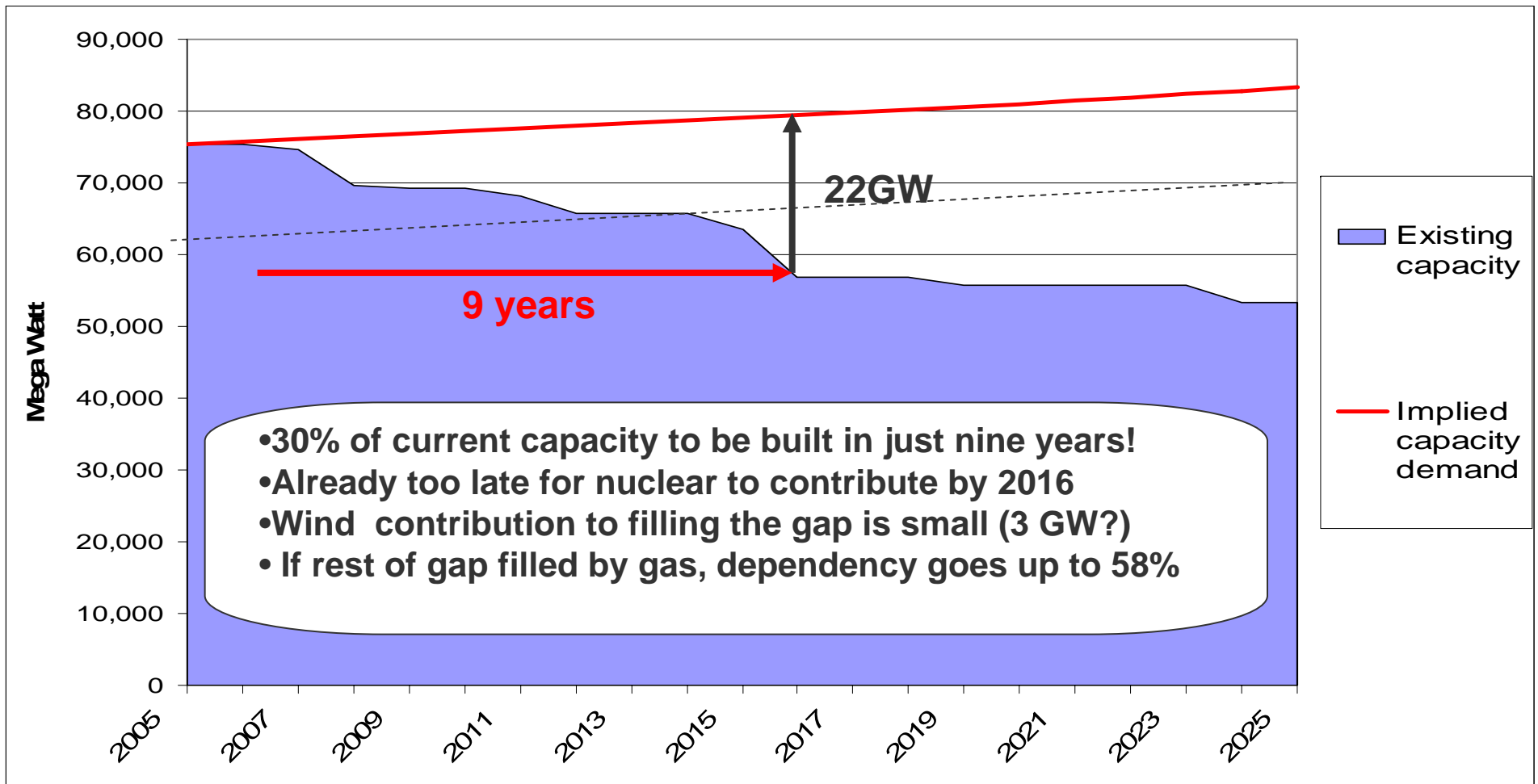
CO₂ Abatement from Fossil Fuels – Twin Track Approach



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22GW of new power plants need to be in operation in 9 years !



* Assuming an illustrative peak capacity margin of 20%

Coal or Gas ?

Coal Power Plant	Gas Power Plant
Lower fuel cost, plentiful supplies, can be stockpiled cheaply	Higher fuel cost, less certain supplies, also vital for domestic heating
Higher capital cost, longer planning and build time	Lower capital cost, shorter planning and build time
More suited to central power plant	Easier to use gas for CHP/ district heating
Meets modern emissions rules but CO₂ is 2x gas so needs twice the EAUs	
Can be fitted with CCS, lower cost per tonne of CO₂	Can be fitted with CCS, higher cost per tonne of CO₂

Scenarios considered by the Coal Forum

- **Zero Coal** **0 GW**
- **Low Coal** **5 GW**
- **Medium Coal** **10 GW**
- **High Coal** **15 GW**

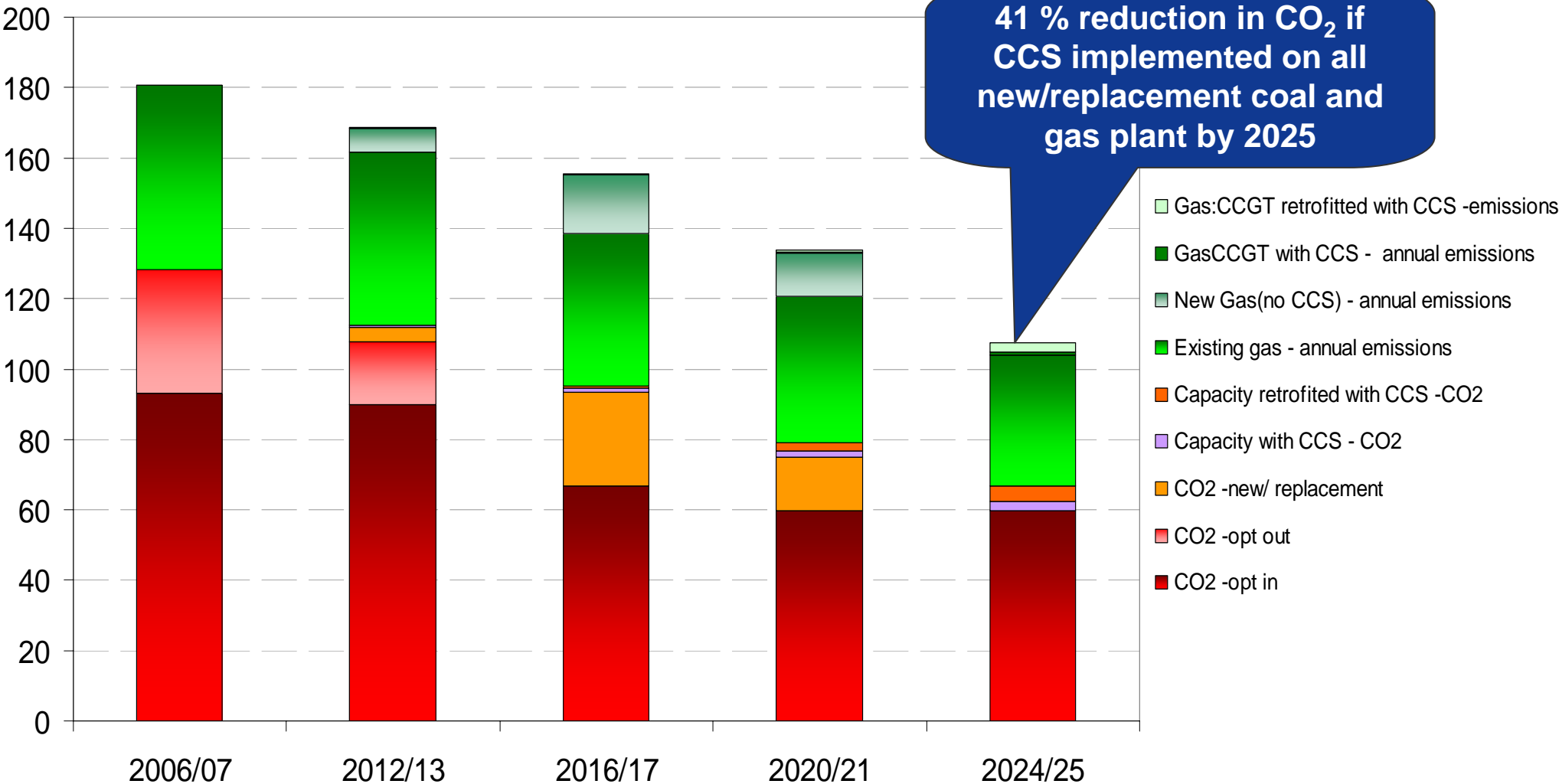
..... by 2016 with balance of 22GW being Gas

Leads to a 58% dependence on gas in 2016

Would maintain current capacity mix

All scenarios would give about 40% reduction in CO₂ emissions if fitted with CCS by 2025

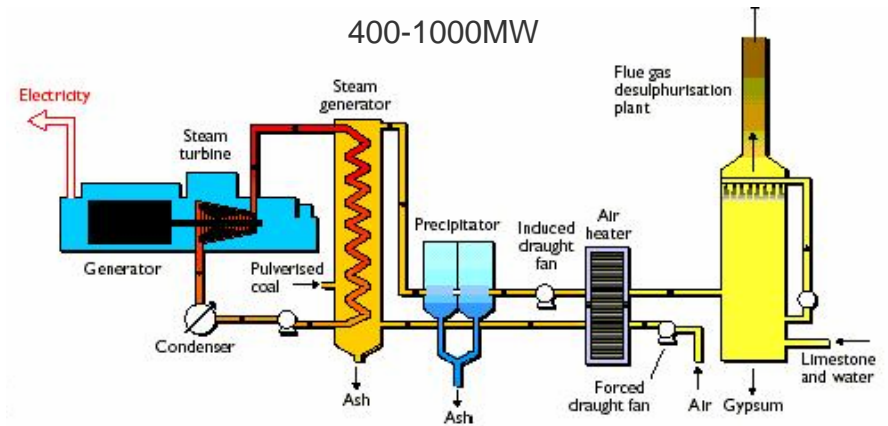
CO₂ Emissions – Medium Coal scenario



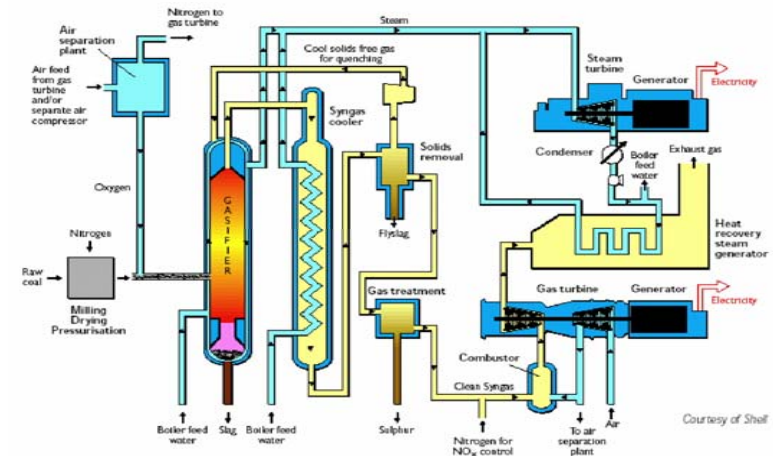
Clean Coal Technologies available now

- Higher efficiency / lower emissions than current coal, better than LCPD standards
- Lower cost electricity than gas or renewables
- Suitable for UK or imported coal
- Suitable for Carbon Capture and Storage (CCS)
- ASC PC offers Capture-Ready Retrofit options
- IGCC offers Hydrogen options and is especially suitable for Petcoke

Advanced Supercritical Pulverised Coal
Boiler/Steam Turbine
400-1000MW



Integrated Gasification Combined Cycle
250-900MW



Coal Fired Plants planned in the UK in May 2007

	Location	Size/Technology	Date	Status
New Capacity				
Powerfuel	Hatfield	2 x 430MW IGCC with Capture	2011	Section 36 consent. FEED study starting
E.ON	Killingholme	450-500MW IGCC with CCS	2012	Internal feasibility study underway
Centrica	Teesside	800 MW IGCC with CCS	2011	FEED study started
RWE npower	Blythe	New build ASC (Capture ready) 3x800 MW	2014	Scoping Report submitted 11/05/07
Replacement / Retrofit				
SSE	Ferrybridge	1 or 2 x 500MW ASC Retrofit (Capture Ready)	2011	FEED study well advanced
RWE npower	Tilbury	1600MW ASC (Capture Ready)	2013 + 14	Scoping Report submitted 13/3/07
E.ON	Kingsnorth	2 x 800MW ASC (Capture Ready)	2012	Section 36 applied for 11/12/06
Scottish Power	Longannet and Cockerzie	ASC retrofit (capture ready), up to 3390MW	2012 onwards	Feasibility study announced 17/05/07

BERR Energy Markets Outlook October 2007

Name	Owner	MW	Section 36	Operation	Status	
Langage	Centrica	890	Approved	2008/09	Under construction	
Immingham	Conocco	+450	Approved	2009		

Gas: 12 GW of CCGTs started or planned !!!

Coal: Only 1.6 GW (Kingsnorth) has reached the tender stage

Both: Latest Section 36 consents require plant to be designed to be capture ready

CCS: Government announced competition, focussed on pulverised coal, and that it will consider the possibility of making CCS compulsory for all new fossil power plants

Optimum programmes – Coal Power Plant

	Retrofit	New Plant
Planning , consents and FEED	1 year	2 - 3 years
Design and engineering	1 year	1 year
Manufacture	1 year	1 year
Construction and commissioning	1 year	2 years
Total	4 years	6 - 7 years

Huge risks if projects are delayed by Planning or Consents or further uncertainty

Limited resources for building plants in parallel

Content of Paper

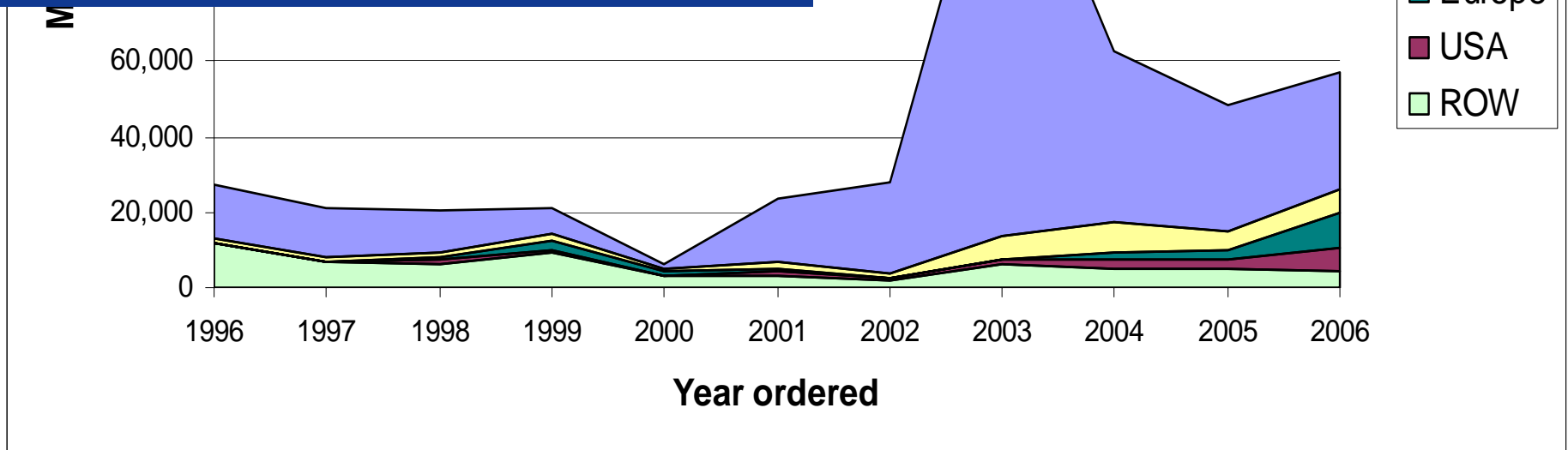
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Supply chain resources to build coal and gas power stations

- **Key specialist resources are**
 - Design and engineering in the Boiler and Turbo-generator OEMs
 - Procurement of materials and performance equipment
 - Construction labour
- **Current bottlenecks**
 - Steam turbine supply
 - Materials (turbine rotors and pipework)

New Build Coal Power Plants (>200MW)

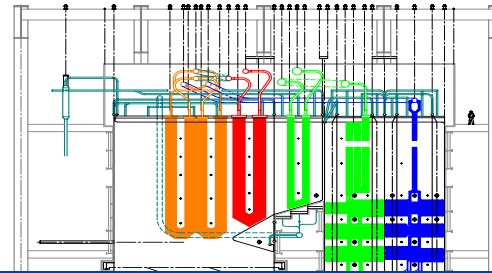
- Coal fired power plants planned around Europe
 - Germany – 21GW hard coal and 3.8 GW lignite by 2014
 - UK – up to 10.6GW by 2016
 - Poland – 8GW needed
 - Italy, Belgium, Holland, Spain....



Key capability maintained –Doosan Babcock



Changshu 3 x 600 MW supercritical boilers



Doosan Babcock has retained its skills through

- export sales of new boilers,
- construction of plant for others and
- boiler services/upgrade work in the UK

Manufacturing capacity recently enhanced through link to our new parent company



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Doosan Changwon works, Korea

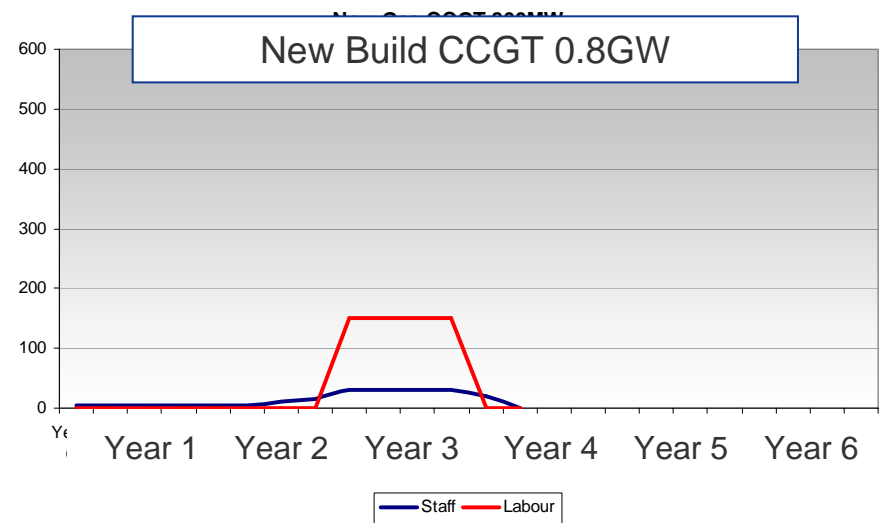
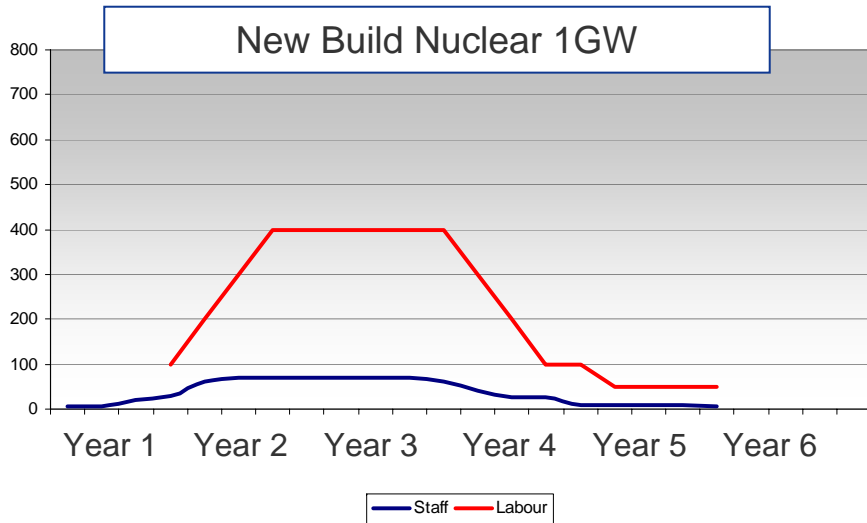
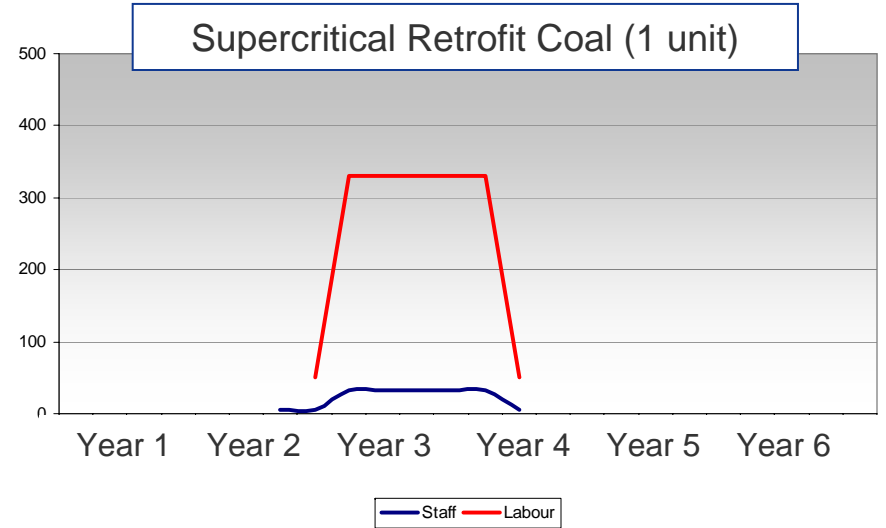
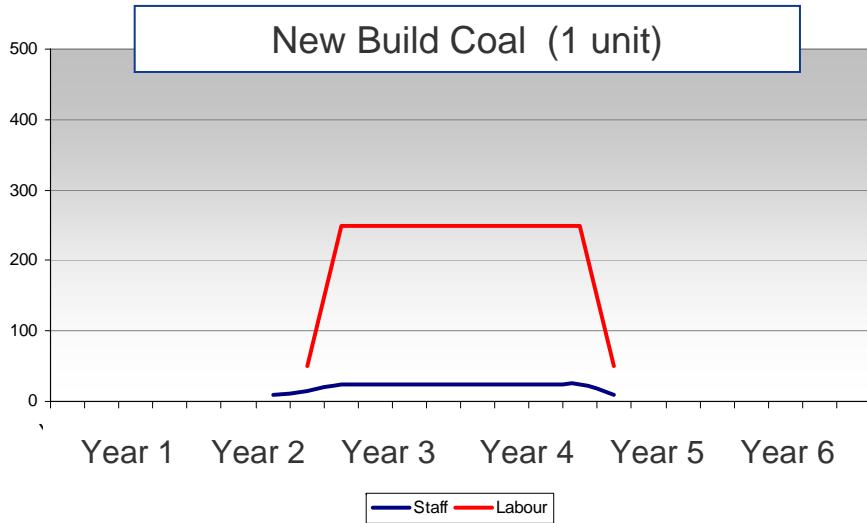
Supply chain resources to build nuclear power stations

- **Key specialist resources are**
 - Design and engineering in the Nuclear system vendors, and Turbo-generator OEMs
 - Procurement of materials and performance equipment
 - Construction labour
- **Current bottlenecks**
 - Large forgings for reactor vessel, and turbine rotors and pipework
 - Steam turbine supply
 - UK will have to take it's place in the queue after USA, China, France,

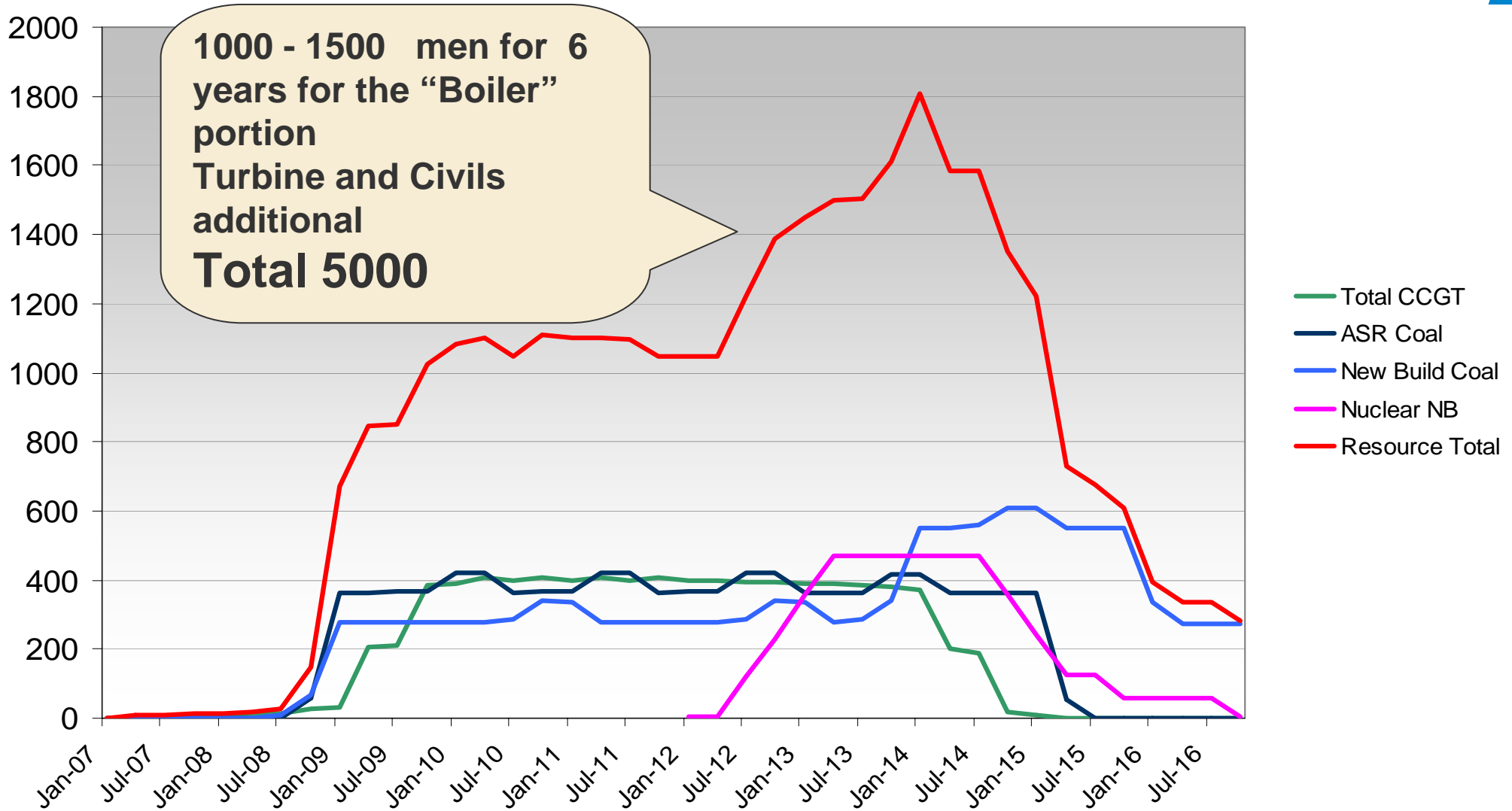
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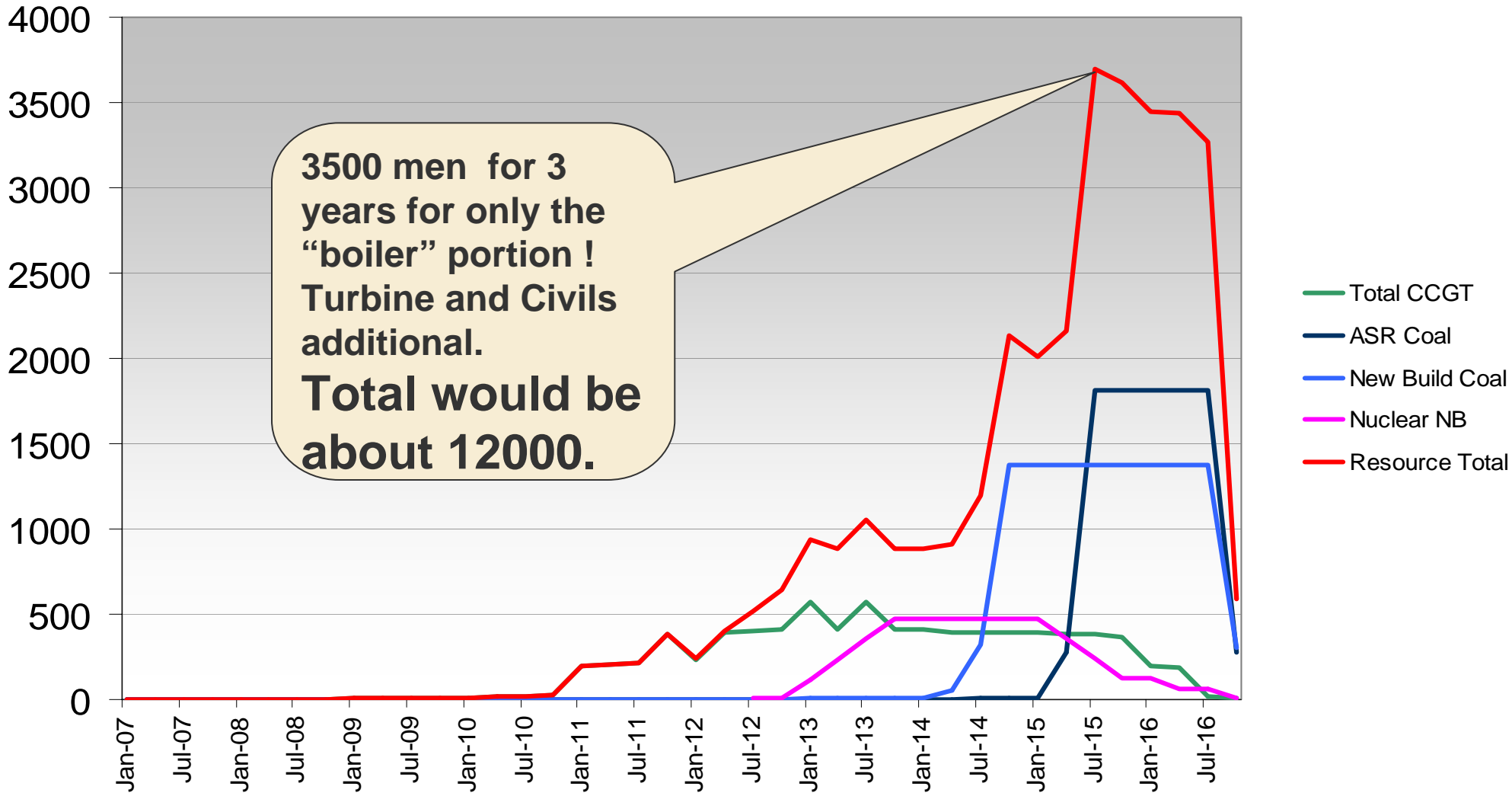
Construction resources depend on plant type (Boilermaker's portion)



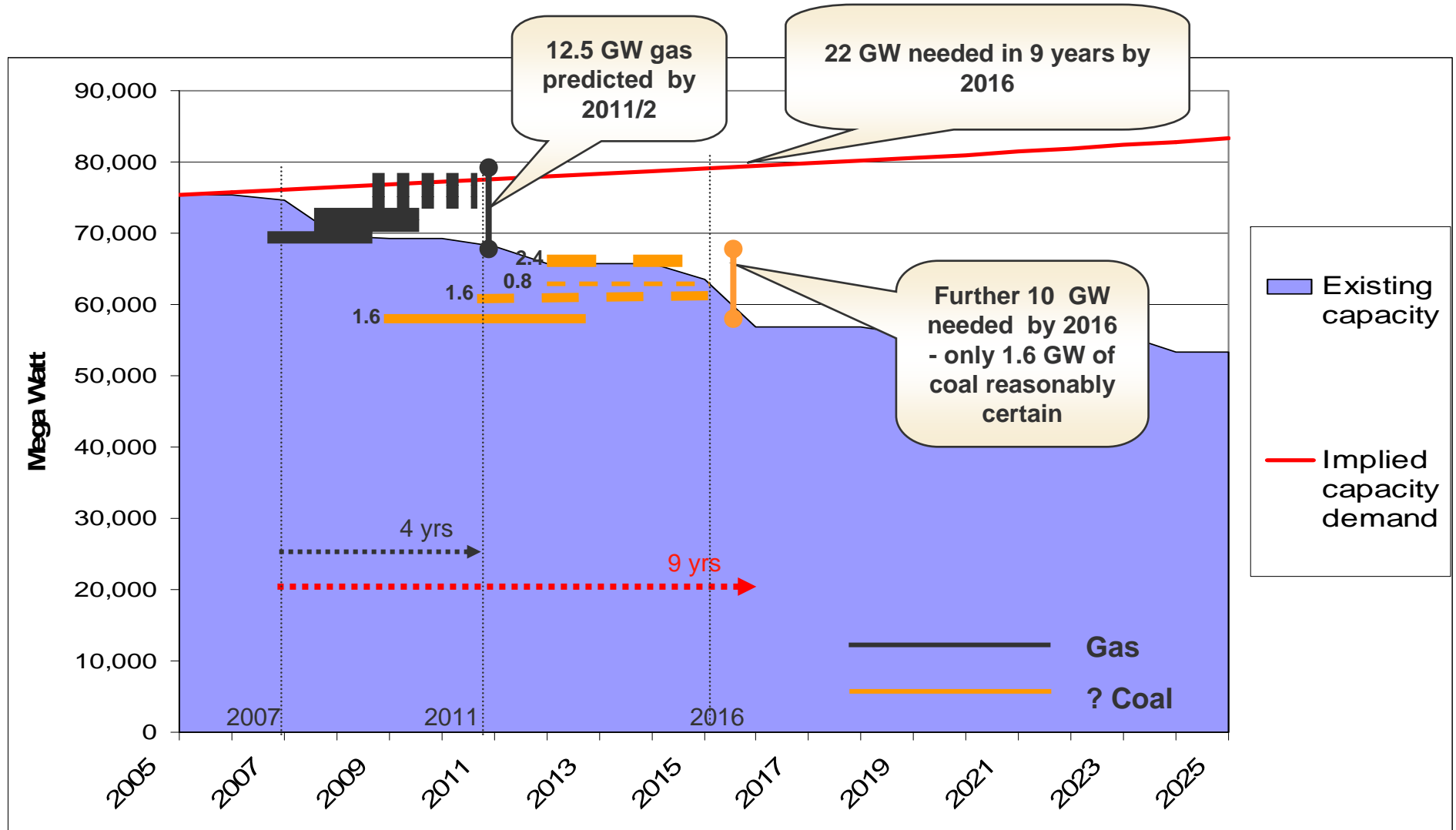
Construction labour resource ' Phased build' scenario (Boilermaker share)



Construction labour resource for 'Just In Time' scenario (Boilermaker share)



Current Situation based on BERR Energy Markets Outlook



Key resources needed for CCS

- **Need to develop capacity and experience across the *whole* supply chain**
 - **Capture (probably four technologies)**
 - **Transport (both pipelines and ships)**
 - **Storage (EOR, depleted gas fields, saline aquifers)**
 - **Includes prospecting, monitoring and regulation**
- **End game is an industry the size of the oil industry!**
- **Pace required is determined by GHG targets**
 - **the estimation of the IEA is that we need 630 CCS plants by 2030 (41% of those envisaged to be built in the period 2015 to 2030), ie average of 42/year!**
- **One CCS project supported by UK government through the BERR competition operational by 2014 is only the beginning. *Much more needed.***

Conclusions

- **Capture - ready clean coal and gas technology available now for New build and Retrofit**
- **Wide acceptance that 22GW of new coal or gas power generation needed by 2016**
- **Most of early orders have been for gas CCGTs - ie a second dash for gas**
- **Unless coal power plants are ordered soon, we will have a third dash for gas by default and >60% dependence on gas for power generation !!**
- **Government seems complacent, talks about security but seems oblivious to the current trend and continues to sanction new gas power plants**
- **Acceleration of building of new clean power plant is needed to meet generation gap, avoid overdependence on gas and to meet CO2 targets**
- **Acceleration of CCS development, demonstration and implementation is vital to meet global GHG targets. Present plan for one demonstration is not enough**

“We remain committed to development and global implementation of cleaner power plants - clean coal, clean gas, nuclear and renewables as rapidly as the market allows”

Thank you for your attention

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