



Corus and the Climate Change Challenge

British – French Flame Days, Lille, 9-10 March 2009

**John Massingham
Corus Corporate Environment**

Presentation



(1) Corus and steelmaking – introduction

(2) Climate change & the steel industry

(3) Tata Steel Group climate change strategy

- **Vision**
- **Improving current processes - short to medium term energy efficiency improvements & CO₂ emission reductions**
- **Longer term breakthrough technology developments**
- **Product development/sustainable solutions**

(4) Summary

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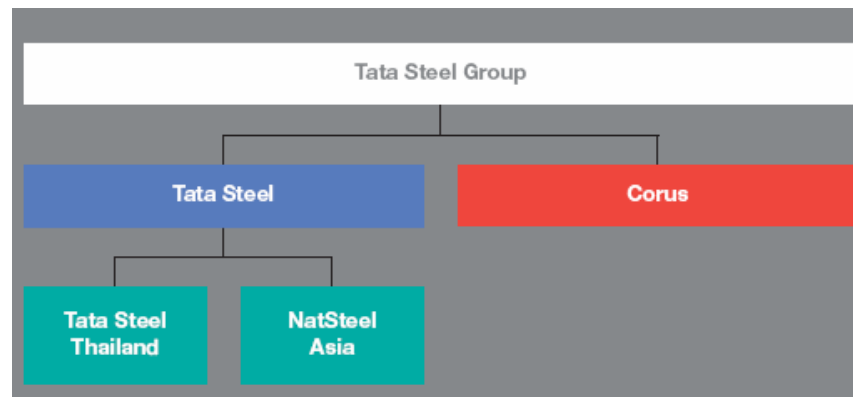
(4) Summary

Introduction

Corus Overview



- An international company, providing steel products and services to customers worldwide
- Corus is Europe's second largest steel producer with crude steel production > 18 m tonnes/year. Annual turnover c £11bn
- Approximately 42,000 employees worldwide
- **Corus is part of the Tata Steel Group:**



Corus Manufacturing Locations



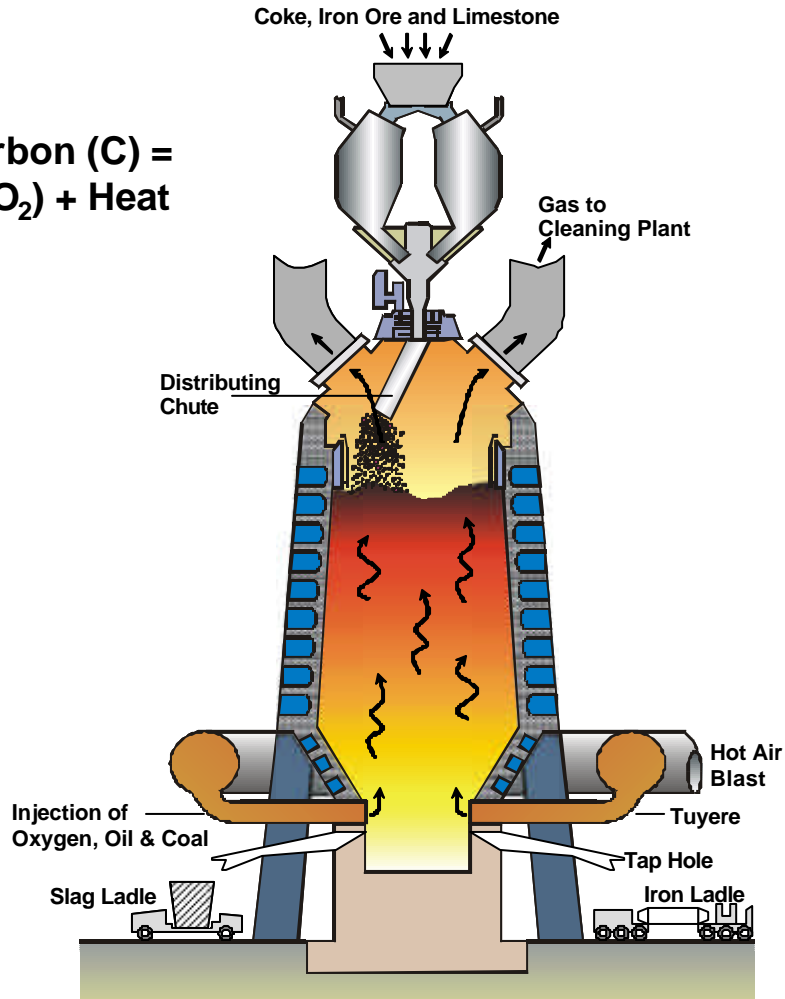
Ironmaking CO₂ emissions

Blast furnace

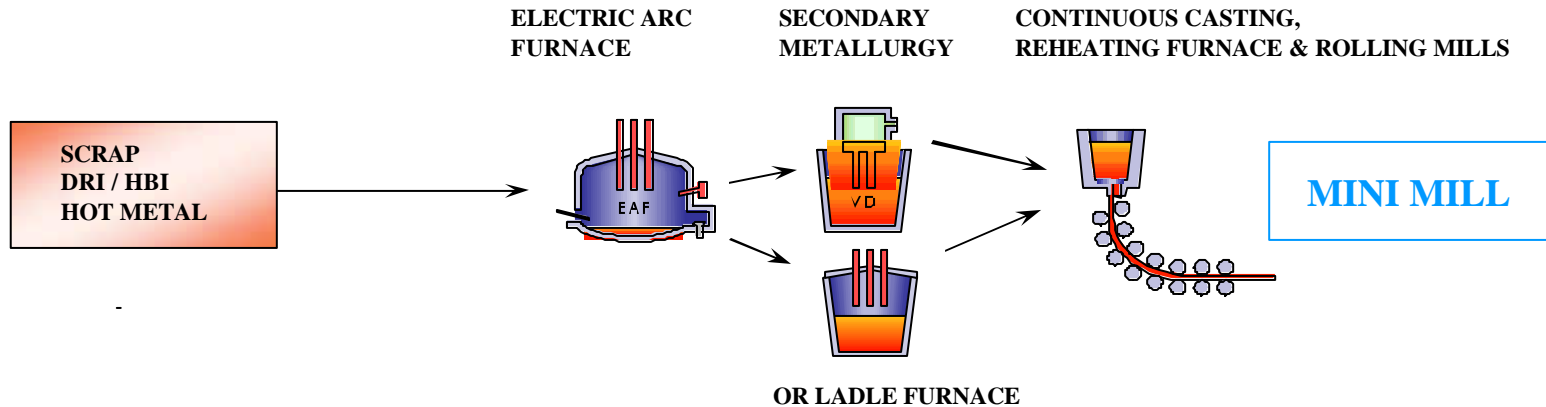
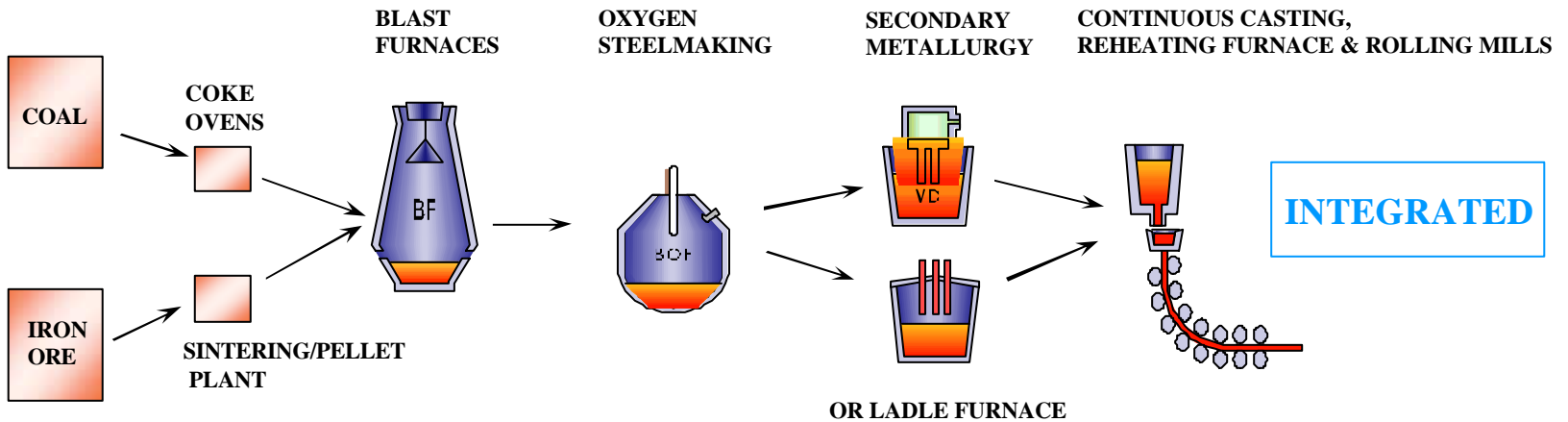


Iron Ore (Fe_2O_3 & Fe_3O_4) + Carbon (C) =
Iron (Fe) + Carbon Dioxide (CO_2) + Heat

The blast furnace (BF)
process route is dominant
in Corus



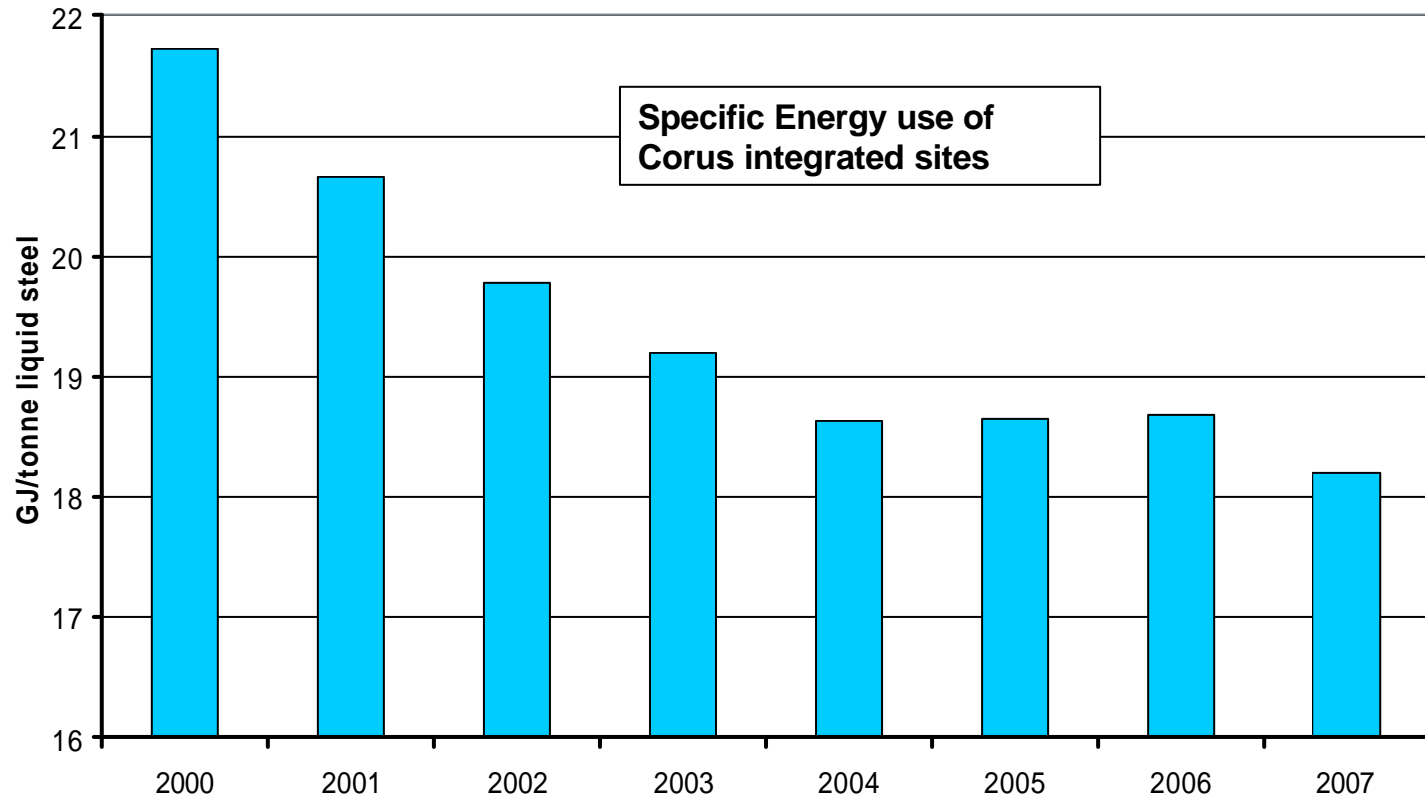
Iron and Steelmaking Routes



Reducing Energy Consumption



In the industry, energy consumption required to produce one tonne of steel has been reduced to ~50% of that needed 40 years ago

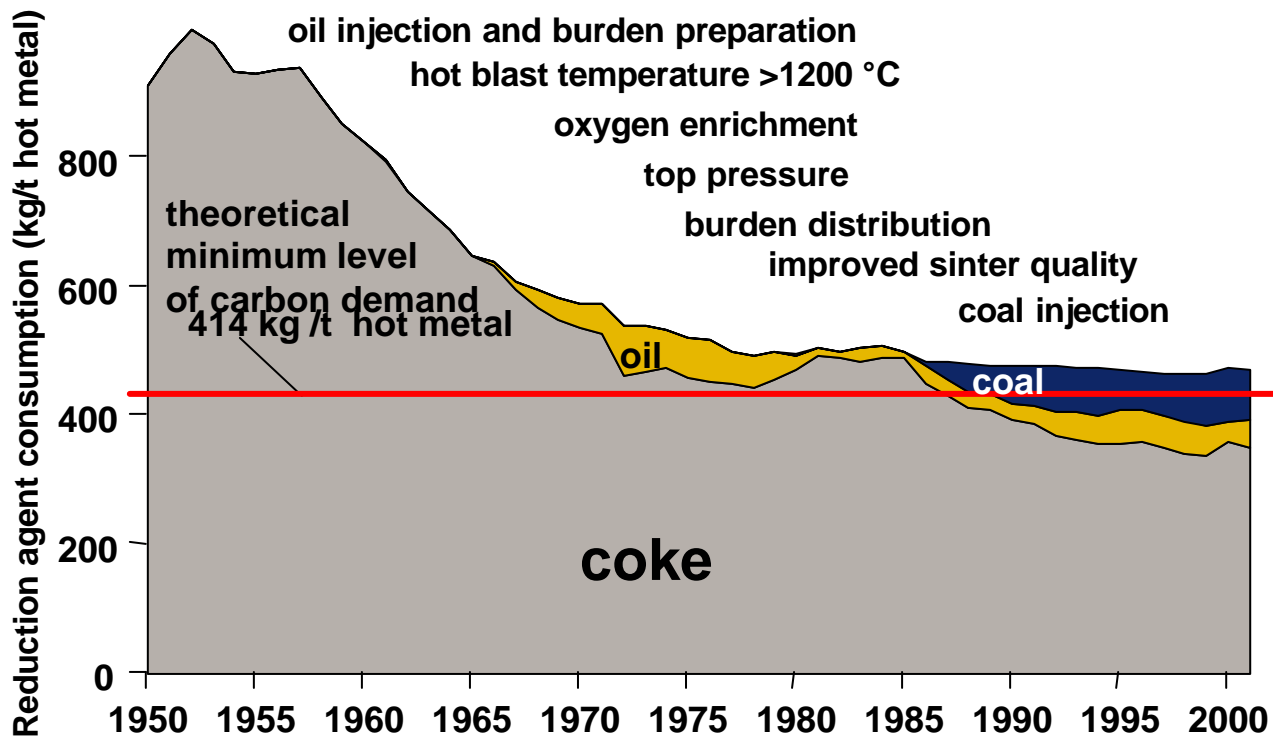


Ironmaking

Non-reduceable Process Emissions



High proportion of CO₂ unavoidable from carbon as a reductant



Source: Thyssen-Krupp presentation to CEPS 24 May 2005

Presentation



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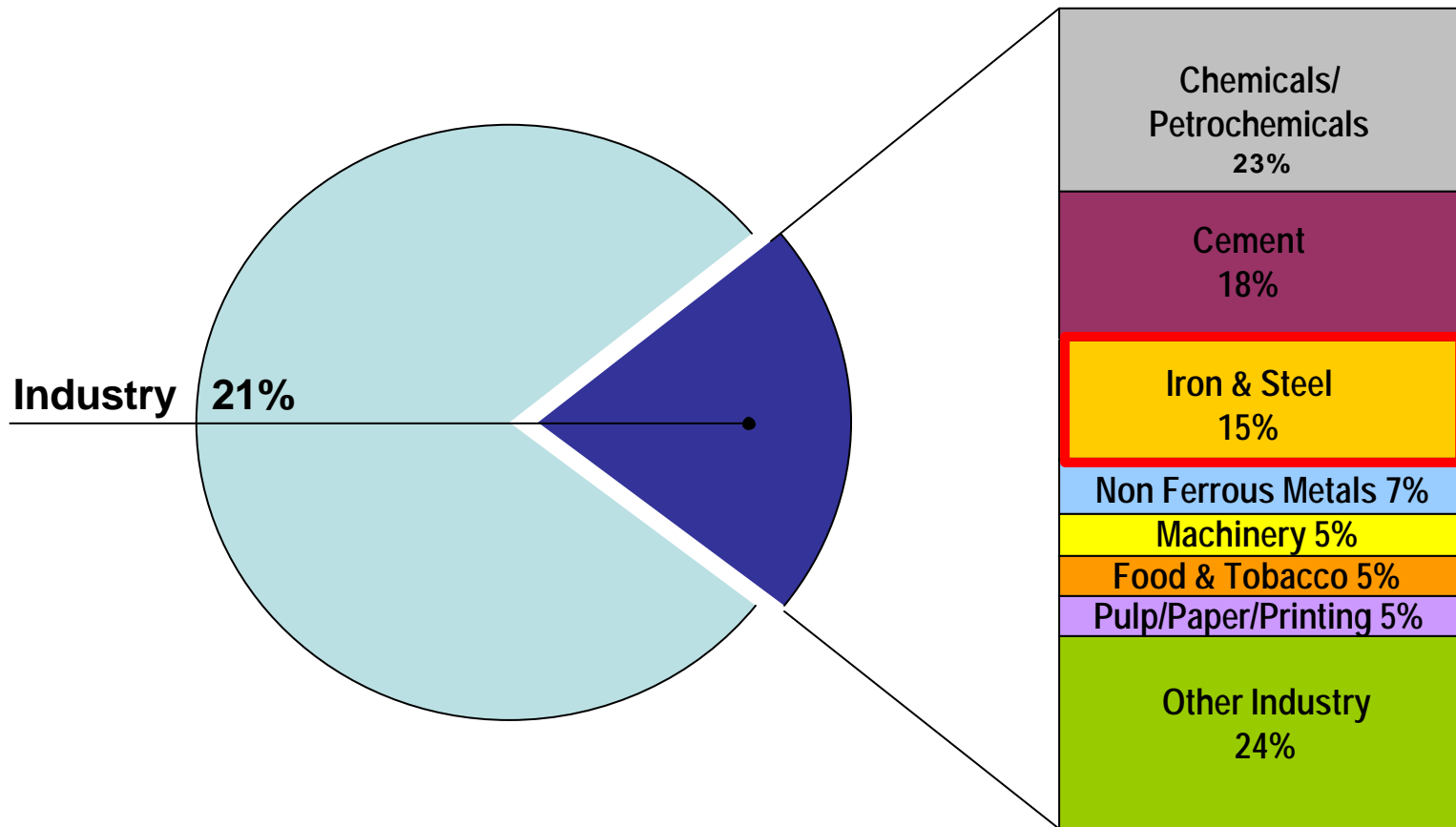
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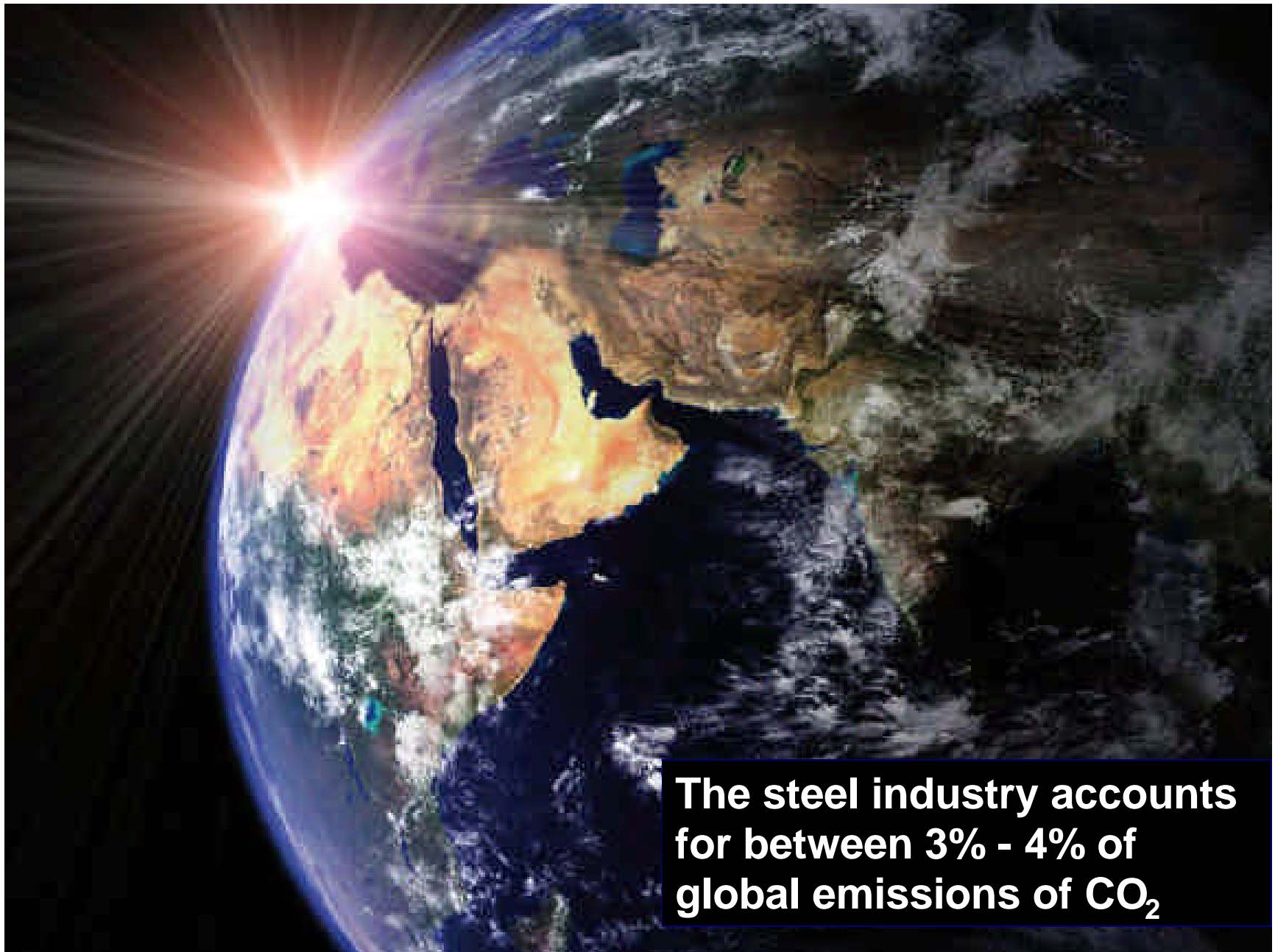
(4) Summary

Global Picture

Greenhouse Gas Emissions



Source: *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*; Baumert et al; World Resources Institute 2005



**The steel industry accounts
for between 3% - 4% of
global emissions of CO₂**

World CO₂ Emissions

Total Steel Industry Emissions are Rising



	1990	2006
Specific Emissions (tonnes CO₂/tonne steel)	1.8	1.7
Total Emissions (billion tonnes CO₂)	1.4	2.1

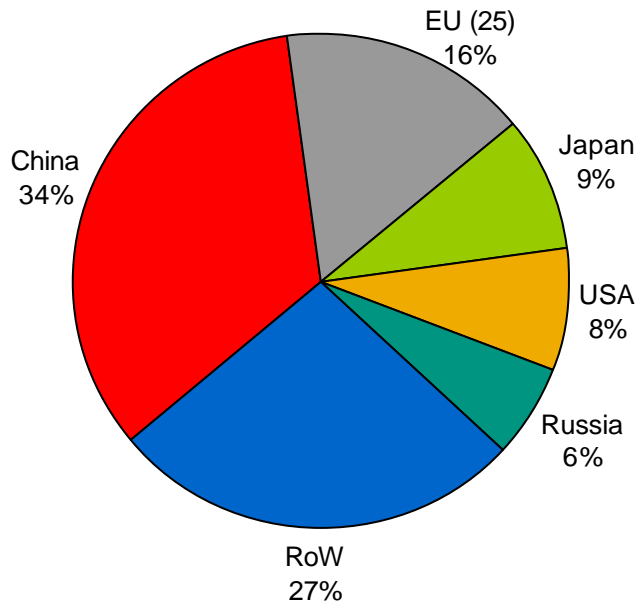
Source: Estimates from IISI Sustainability Index 2005

Climate Change

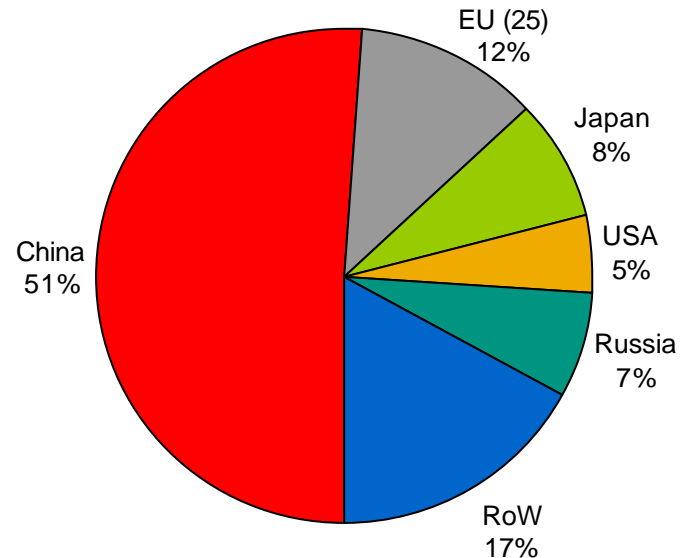
Steel Industry Production & CO₂ Emissions



Steel Production
(total = 1.3 billion tonnes/year)



CO₂ Emissions
(total = 2.1 billion tonnes/year)



Source: IISI

Business Environment

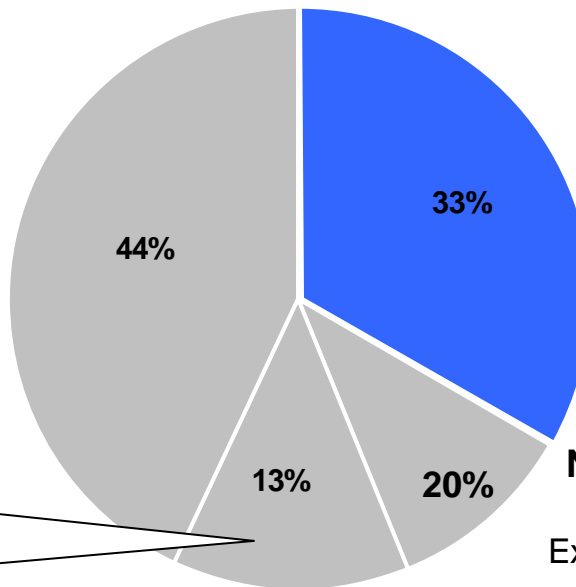
Unequal Regulatory Burden



Global steel production (2005) split by national obligations under Kyoto agreement

(100% = 1,129mt)

Not covered by Kyoto
Examples: China, India, Brazil, Korea



Kyoto covered
Examples: *Europe*, Japan, Canada

Kyoto covered – No obligation
Russian and Ukraine

Not ratified Kyoto
Examples: US, Turkey

Major growth and investment areas not covered by Kyoto

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TSG Climate Change Strategy

Vision



Climate change is one of the most pressing issues the world faces today.

In response to this challenge, **Tata Steel Group will be part of the solution** and will achieve a leading position within the steel industry* whilst creating value through:

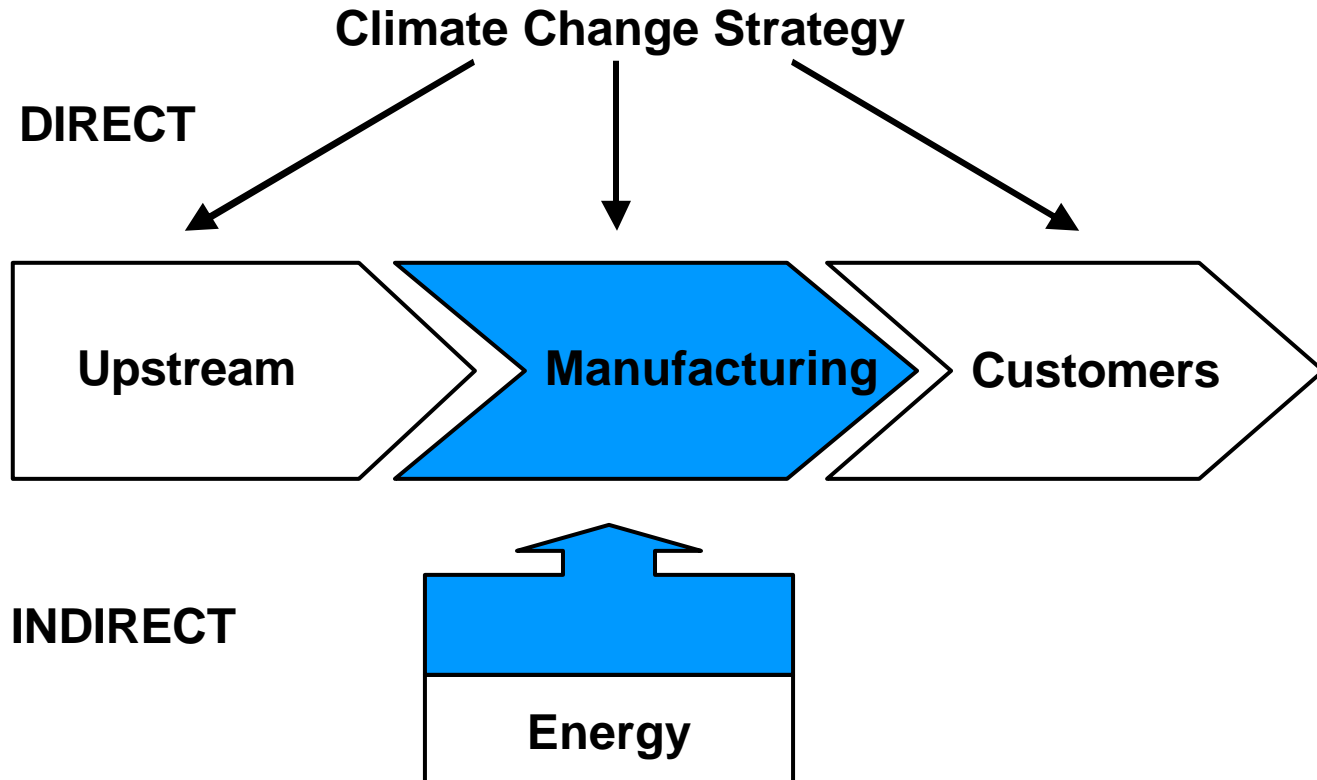
- continuing to **improve its current processes**, reducing emissions to <1.7 t CO₂/t steel by 2012 and to <1.5 t CO₂/t steel by 2020**
- **investing in breakthrough technologies**
- **developing new products and services** to reduce environmental impact over the product lifecycle, offsetting emissions in manufacture
- actively **engaging its workforce**
- further developing its **pro-active role in global steel sector initiatives.**

* Target percentile for 2020 to be determined upon publication of World Steel global benchmarking data

** Equivalent to a reduction of at least 20% compared to 1990

Climate Change Strategy

Looking at the Full Value Chain



- *Direct emissions are physical emissions from the site.*
- *Indirect emissions are caused by the site, but generated somewhere else, e.g. emissions related to purchased electricity.*

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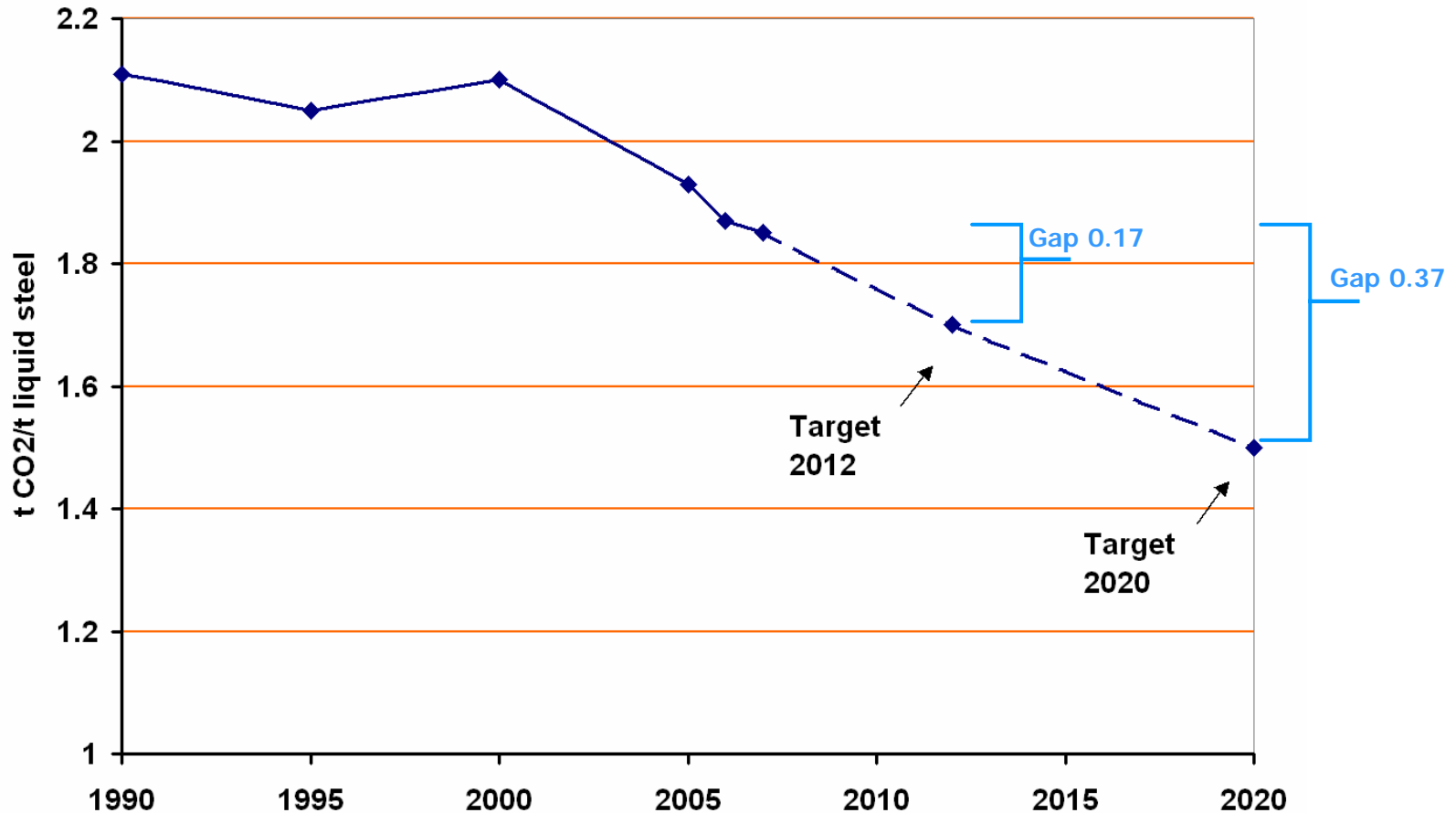
(4) Summary

Tata Steel Group Vision

Specific CO₂ Process Emissions



Tata Steel Group (consolidated, weighted average, integrated sites only)



Climate Change Strategy

How to Achieve the 2012 & 2020 Targets?



- Use **current technology and knowledge** to achieve current-best-practice performance by the year 2020 through continuous improvement.
- **Initial view** of how the CO₂ reductions will be achieved:
 - Capex projects (40%)
 - Increased BOS iron to scrap ratio (10%)
 - Burden changes e.g. increased coal injection & use of pellet, reduced slag volume (20%)
 - Improved housekeeping (15%)
 - To be defined (15%)
- **Support provided:**
 - **Task Team** to assist businesses in developing forward plans and schemes
 - **Energy Optimisation Platform** to facilitate sharing and learning
 - **System** to monitor CO₂ emissions and allow comparison and benchmarking

Climate Change Strategy

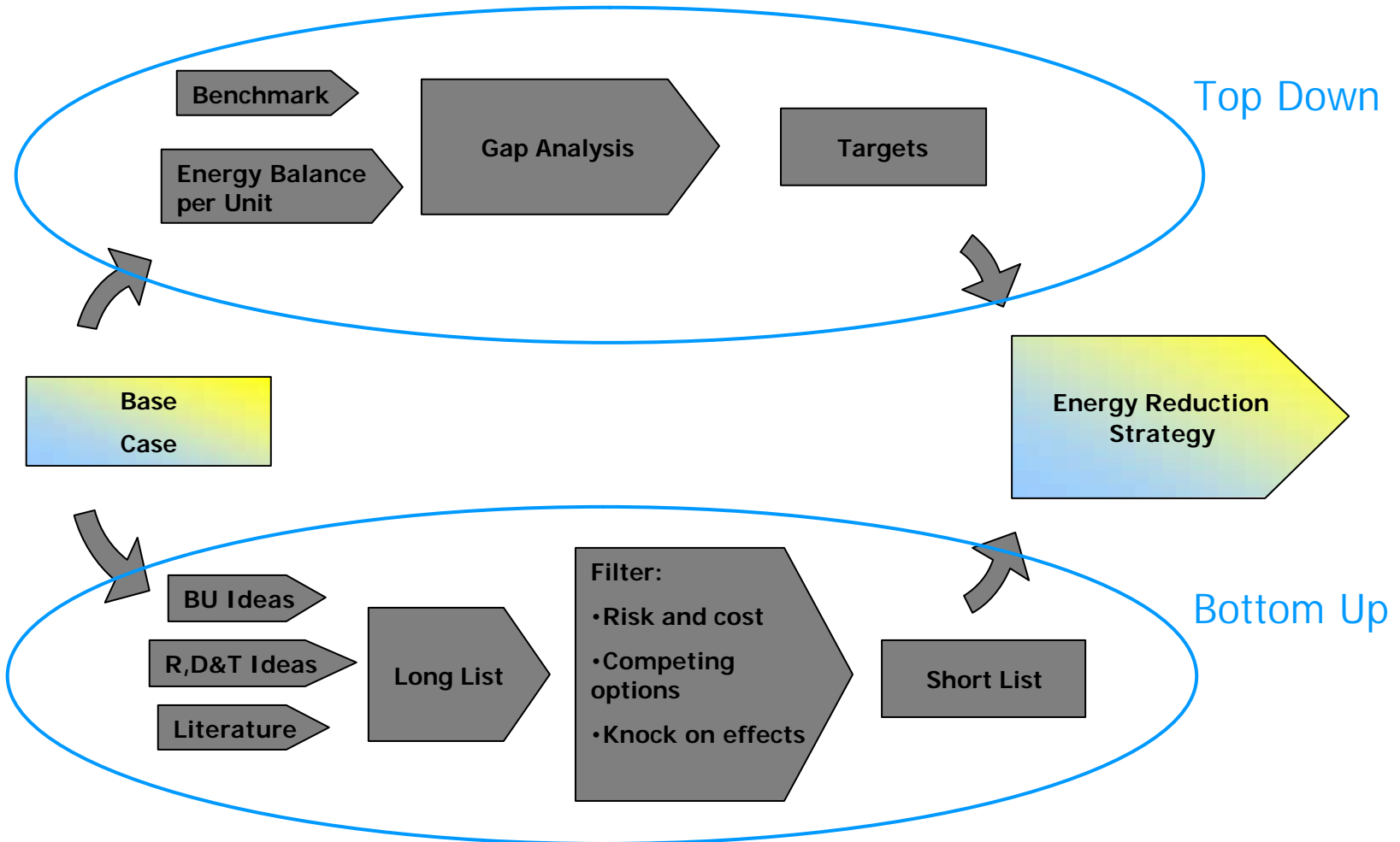
Identifying the Savings



- **Top-down approach:** benchmarking, gap analysis, target setting
 - gives the big picture
 - sets aspirational goals
 - difficulty comparing like for like e.g. ore quality, use of pellet
 - indicates where there are gaps rather than how they can be closed
- **Bottom-up approach:** identification of practical measures and projects to bridge the gap...

Climate Change Strategy

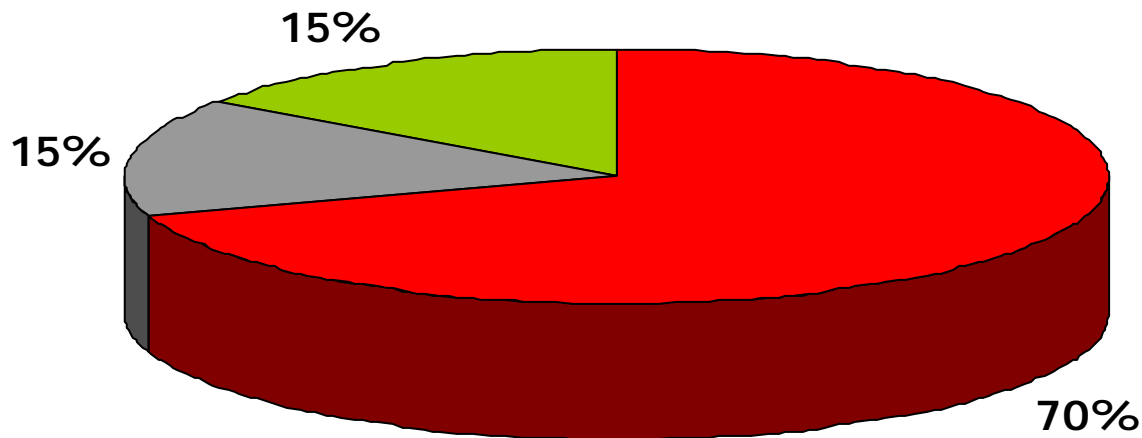
Complementary Approaches



Sources of Ideas for CO₂ Mitigation & Energy Saving



- Documented e.g. IISI, Ecofys, APP
- Plant Identified
- Specialists



Source: Hatch Beddows

Process Emission Reductions

Examples of Large Capital Projects



- Optimising collection and use of process gases
- High efficiency on-site power generation
- BF back pressure valves and top gas turbines
- Sensible heat recovery from process gases, sinter plant and BF stoves
- Increased blast furnace coal injection – reduced coke use
- Direct casting of sheet and small bloom, eliminating primary rolling
- Hot linking between caster and rolling mill
- Coke dry quenching and coal moisture control

Process Emission Reductions

Smaller Capital & 'Housekeeping' Projects



- Regenerative burner technology
- Variable speed drives and high efficiency motors
- Pumping systems optimisation
- High efficiency lighting schemes
- Voltage optimisation and base load reduction
- Yield improvement

Potential Areas for Saving Waste Heat Recovery



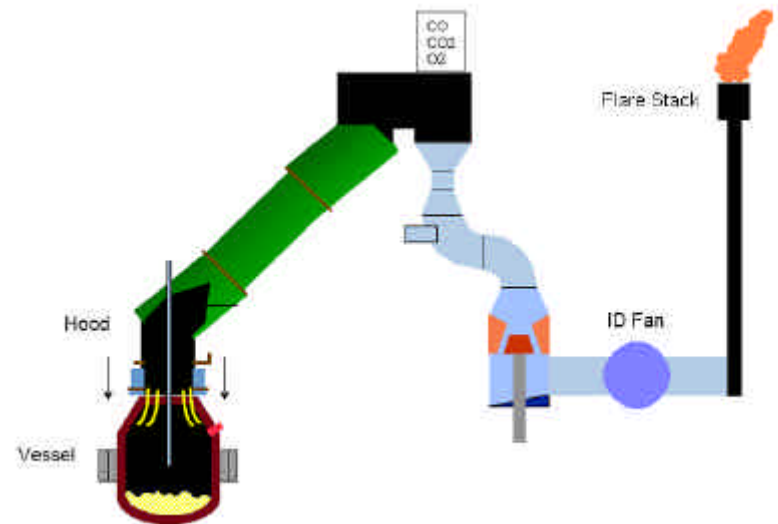
- Large quantities of waste heat generated, traditionally not recovered due to technical barriers and low rate of return
- Feasibility of recovery dependent on the nature of the heat stream:
 - Grade of heat (temperature)
 - Location/logistics
 - Moisture content – acidic condensate
 - Particulate matter/contaminants
- Several emerging technologies :
 - Kalina cycle
 - Organic Rankine Cycle (ORC)
 - Heat pumps
 - Biomass drying
 - High temperature filtration

Process Emission Reductions

Case Study - Port Talbot



- £60m investment for installation of a BOS gas recovery system, including ancillary schemes, at Port Talbot
- Overall scheme, to be commissioned July 2009, will deliver:
 - a 60% reduction in natural gas purchases
 - a 20% reduction in electricity imports
 - a reduction in direct carbon dioxide emissions of 240,000 tonnes CO₂ per annum
 - a reduction in indirect carbon dioxide emissions of approximately 57,000 tonnes CO₂ per annum



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Climate Change Strategy

Breakthrough technology development

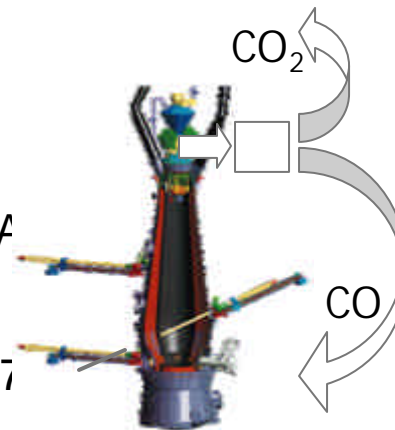


Ultra Low CO₂ Steelmaking

A groundbreaking €9m part EU funded multi-phased R&D project, advanced by 48 European companies and institutes, to identify and develop breakthrough technologies that could enable a significant (~50%) reduction in specific CO₂ emissions from ore-based steel production by 2050.

Example: Blast furnace gas capture & recycling – proven at pilot stage in ULCOS Phase 1

- MEFOS / LKAB (Sweden)
- Pilot blast furnace (Ø 1.2m)
- Top gas recycle
- Operation of CO₂ capture (VPSA)
- 8 M€
- Successful 1st campaign in 2007



Climate Change Strategy

Other ULCOS Technologies



ISARNA

- A combination of new iron making technologies (joint work with HISMELT)
- Coal preheating and partial pyrolysis in a reactor
- Melting cyclone for ore melting
- Smelter vessel for final ore reduction and iron production



Alkaline Electrolysis

- Process operates at only 110°C
- Negatively charged oxygen ions migrate to the anode where the oxygen is then captured.
- Remaining particles migrate to the cathode where they undergo reduction resulting in deposition of iron metal.



Advanced Direct Reduction

- Natural gas is treated with reactor off gases to produce reducing gases which are injected in the direct reduction vessel.
- The temperature in the vessel is below that needed to melt the iron but high enough to initiate the reduction of the iron ore.



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Climate Change Strategy

Sustainable Solutions



- Why is steel so sustainable?
- Reducing CO₂ emissions throughout a product's in-use phase and recycling at end-of-life, offsets production emissions
- Steel can be repeatedly re-used or recycled without any degradation in the quality of the material
- Current recovery rates in the UK are **99%** for structural steelwork and **94%** for all steel construction products
- Other materials are often recycled only once before downgrading and eventually find their way to landfill.

Climate Change Strategy

Sustainable Solutions



- A Corus' building, built in 1953, was demolished in 2004
- 100% of the 20,000 tonnes of scrap was recovered

- The recycled steel went into many applications, including:
 - Heavy structural beam and column sections for the Oval Cricket Ground and Heathrow T5
 - Lightweight steel framed houses
 - Strip steel for the Royal Mint!



Brit Oval, London

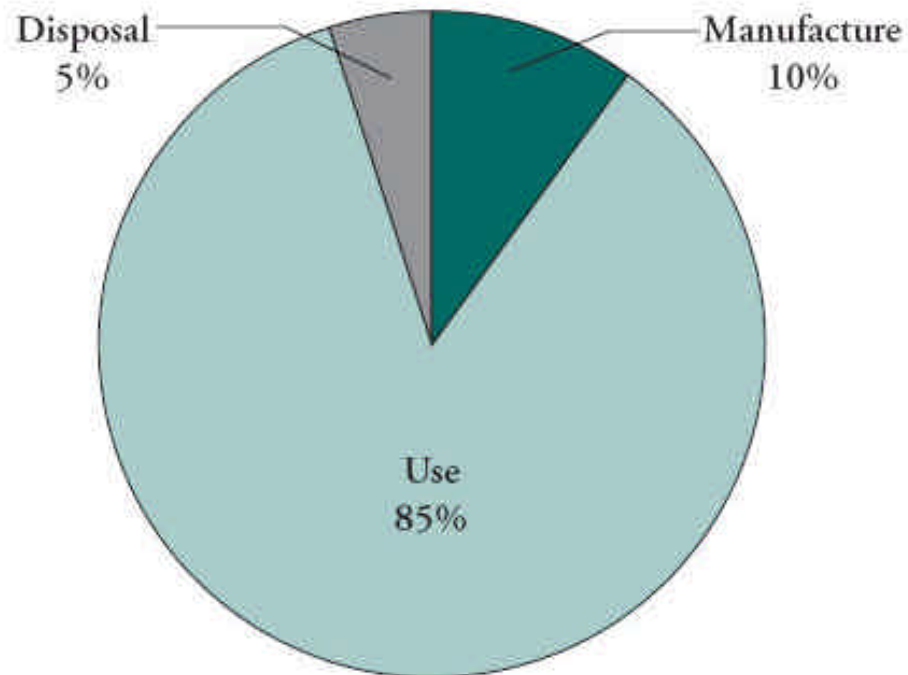
Heavy structural beam and column sections

Climate Change Strategy

CO₂ in Vehicle Life



Chart 2.1: CO₂ emissions through the vehicle life cycle



Source: SMMT (2007).

Climate Change Strategy

Sustainable Solutions



Automotive

- Advanced high strength steels & hydroforming for stronger lighter steels –25% weight saving vs mild steel (1kg AHSS saves 8kg CO₂ over vehicle lifecycle)
- Low friction engineering steels for gearboxes/engines

Power

- Steel is making a vital contribution to delivering the energy mix of the future:
 - Power station construction including nuclear
 - Offshore/onshore wind turbines, tidal generators
 - Photovoltaic coatings – big opportunity based on the surface area of coated steel cladding currently sold
 - Electrical steels in high efficiency transformers and motors



Climate Change Strategy

Sustainable Solutions



Construction

- Steel buildings are highly flexible and adaptable, being easily disassembled and the sections re-erected elsewhere, e.g. demountable stadium a key element of London's Olympics bid
- A steel-framed or clad building is a thermally efficient structure.
- Optimum thermal mass is available from the floor slab of a standard steel-framed building, without the extra environmental burden of a heavyweight structure and large foundations



Climate Change Strategy

Sustainable Solutions



It's not just our steel products making a difference....

- Ground granulated blast furnace slag, a well-controlled by-product of iron making, is used as a cement replacement by the concrete sector
- Corus estimates that the use of its GGBFS saved the construction sector over 2.6mt of CO₂ in 2007 alone



Summary (1)

Process Improvement



- World and UK steelmaking dominated by blast furnace ironmaking and basic oxygen steelmaking (BOS) :
 - CO₂ emissions a consequence of carbon as reductant
 - Close to theoretical minimum carbon input
- Sectoral agreements vital for a more level playing field and preventing carbon leakage
- Excellent progress to date in reducing emissions
- Challenging medium term targets set for CO₂ emissions, to be met by capital investment in best practice technologies, burden changes, improved iron/steel ratios and good housekeeping
- Substantial ongoing investment in step change technologies to achieve long term targets, e.g. ULCOS development of BF top gas recycling and ISARNA

Summary (2)

Sustainable Solutions



Steel will be part of the solution through:

- High levels of reuse and recycling
- Use of bi-products to offset CO₂ emissions elsewhere
- Product innovation resulting in reduced environmental impact in-use, for example:
 - vehicle light-weighting
 - energy efficient buildings
 - as an essential element in the energy mix of the future

Climate change is one of the most pressing issues the world faces today. For combustion engineers and energy specialists it presents an unrivalled opportunity to make a difference.

Any questions please....

