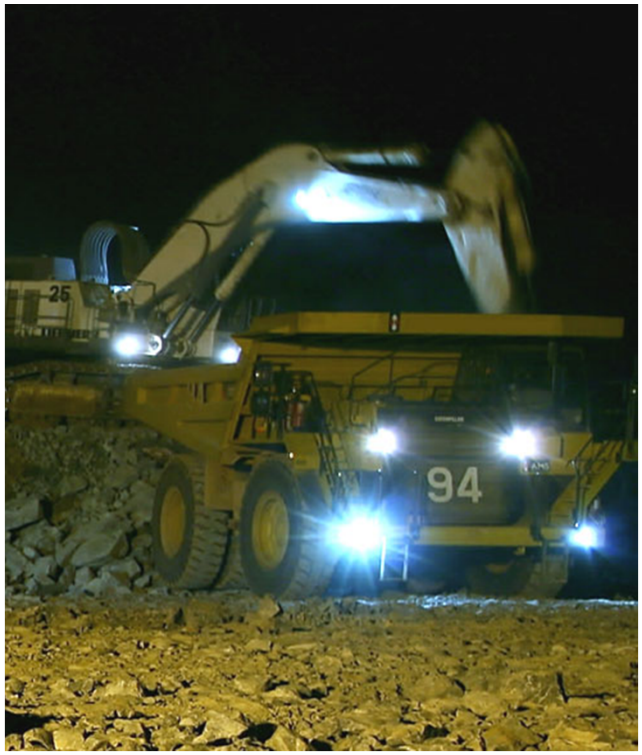
ICMM
International Council
on Mining & Metals

Contribution of Mining and metals towards a low carbon economy

International Council on Mining and Metals
Wednesday 28th November, 2012
UNFCCC, COP18, Side event room 5, Doha, Qatar




www.icmm.com

COP 18 - ICMM

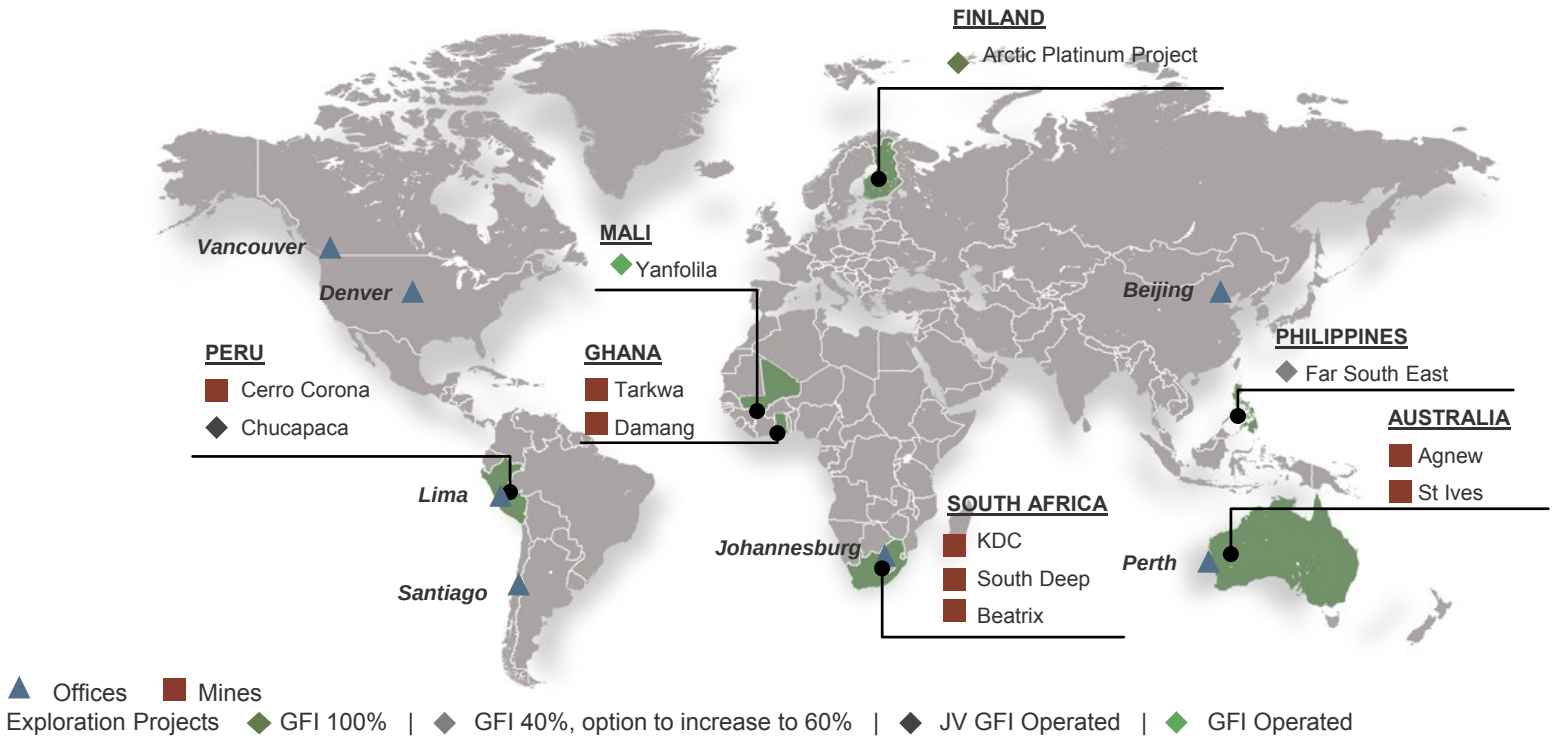
Energy Management and Emissions Mitigation in the Mining & Metals Industry

The Gold Fields Journey

28 November 2012

GOLD FIELDS

Gold Fields at a Glance



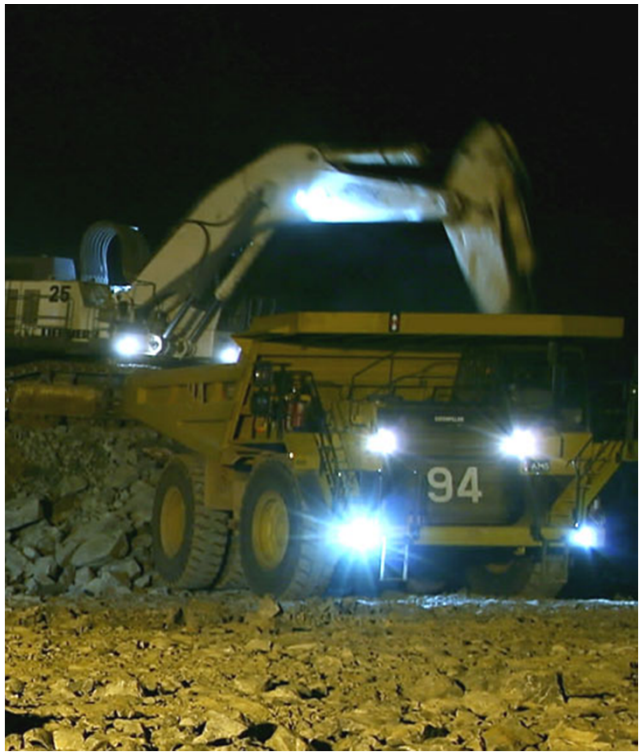
	South America	West Africa	South Africa	Australasia	Total
Resources[1]	7.7Moz	25.2Moz	160.2Moz	9.2Moz	234.4Moz[3]
Reserves[1]	6.1Moz	13.7Moz	61.1Moz	4.1Moz	85.1Moz
Production[2]	383koz	935koz	1.7Moz	659koz	3.7Moz
Number of mines	1	2	3	2	8

1. Managed gold equivalent Mineral Resources and Reserves as at 31 December 2011
2. Managed gold equivalent production for 2011
3. The total managed gold equivalent Mineral Resources as at 31 December 2011 includes the managed gold equivalent ounces of the growth projects

This is who we are

Our Identity

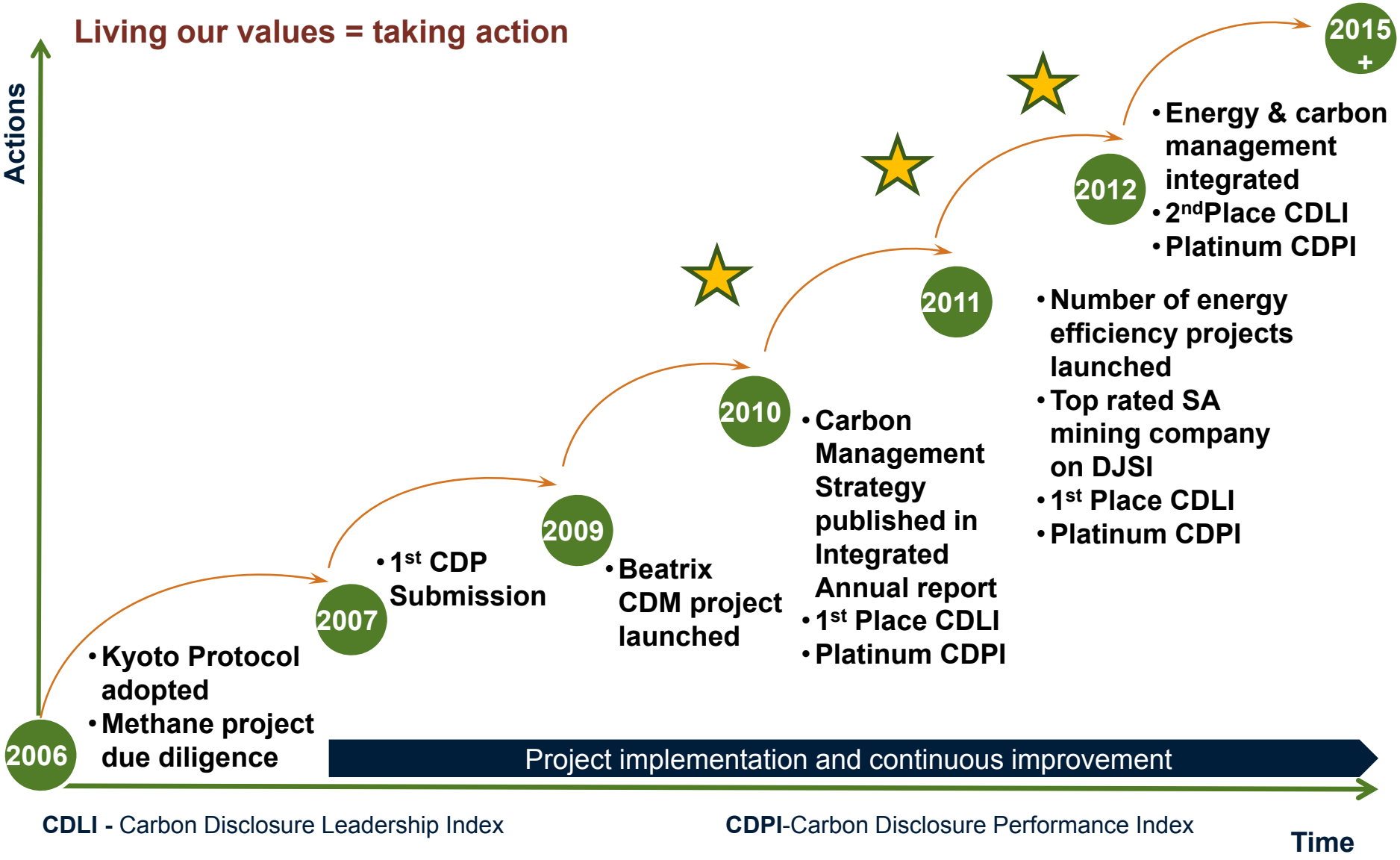
Vision	**To be the global leader in sustainable gold mining**	
Values	**Safety**	If we cannot mine safely, we will not mine
	Responsibility	We act responsibly and care for the environment, each other, and all of our stakeholders - our employees, our communities and our shareholders
	Honesty	We act with fairness, integrity, honesty and transparency
	Respect	We treat each other with trust, respect and dignity
	Innovation	We encourage innovation and entrepreneurship
	Delivery	We do what we say we will do
Goal	**Five million quality gold ounces within five years**	

The Gold Fields' climate change journey

GOLD FIELDS

Evolution of our carbon management strategy



Mining industry is responding to climate change

- The **ICMM** has launched a wide-ranging climate change programme
- **COP 17 in Durban** (2011) highlighted climate change issues in South Africa
- **Carbon taxes are or have been** introduced in many commodity producing countries
- **Best proxy for carbon in South Africa is electrical energy**
- Major companies participate in the **Carbon Disclosure Project**
- SA mining industry has supported energy efficiency initiatives through **Demand Side Management and Clean Development Mechanism** projects
- Gold Fields has a number of CDM projects in the pipeline
  - Dependent on successful registration

Energy & Carbon (E&C) management integration

Taking action = improved efficiencies + reduced carbon emissions

- In most operations **energy is a proxy for carbon emissions**
  - Electricity accounts for 75% of Group Energy (Scope 2 and only partly in our control)
  - Diesel almost accounts for the balance.
- Major initiatives under energy and carbon management integration:
  - **Clear targets** on energy consumption and carbon reduction at current operations
  - At least 20% of energy use at new operations to come from **alternative/renewable energy**
  - **Link to** social, reputational and environmental performance
  - Our budgets now include impact of **carbon taxes and carbon reduction projects**
  - Initiatives **take cognisance** of the regulatory landscape

E & C management integration - business case

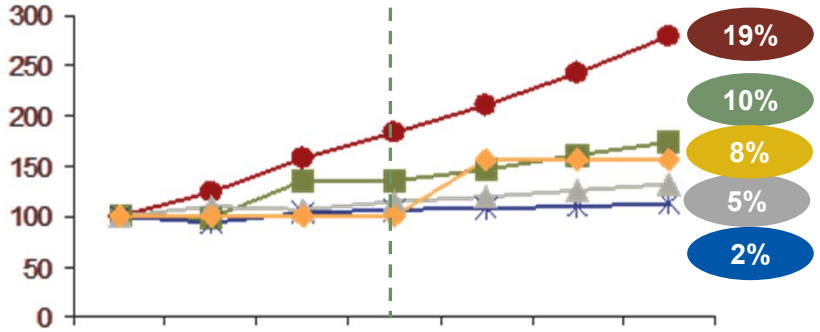
Taking action = Securing our future

- Security of Energy supply
- Security of future cost:
  - Spiralling energy cost base is off-setting / neutralising gold price improvements and driving ‘margin squeeze’.
  - In SA % Eskom power increase profile for next 5 years is going to severely impact all marginal shafts in the industry in SA.
- Energy management is now a vital KPI for the industry to protect mining cut-off grades and pay limits and to help in assisting and securing the future of the ore bodies

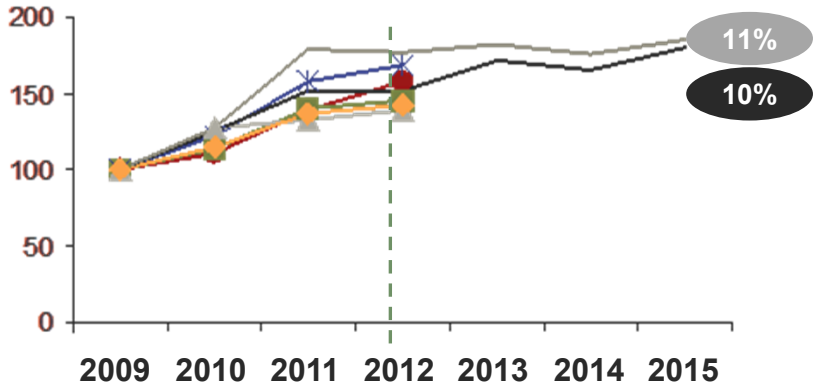
Gold Fields' energy landscape

Energy price development[1]

Electricity[1] (2009=100%)

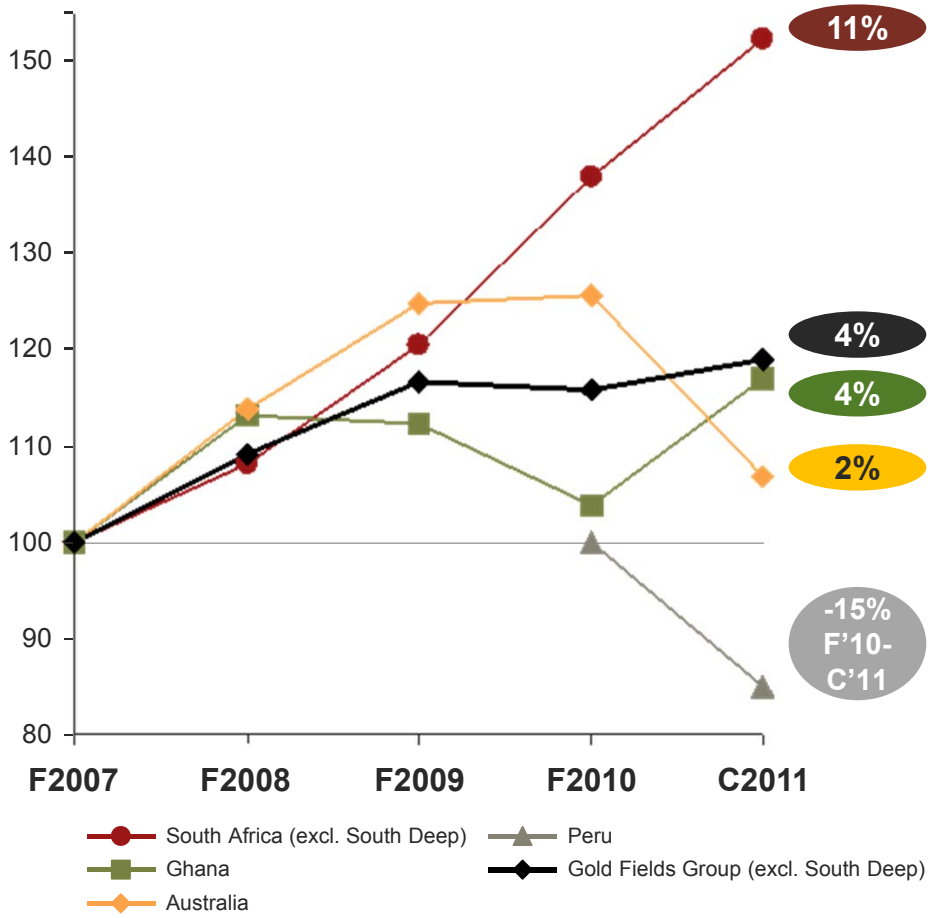


Diesel/Fuel (2009=100%)



Energy consumption[2]

TJ/kOz (F2007=100%, Peru F2010=100%)

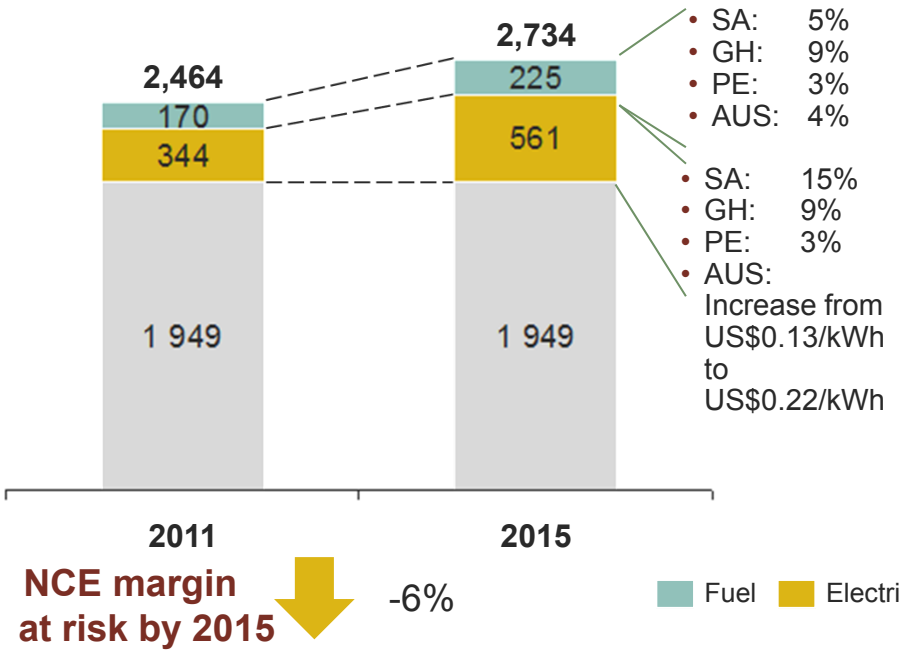


1. Forecasts for electricity based on historic growth rates or announced increases (SA, Australia); WTI (West Texas Intermediate)/Brent forecasts based on Bloomberg; CAGR – Compound Annual Growth Rate; Source: Bloomberg
2. Source: Short Form Technical Reports (Gold Produced F2008-C2011); Annual Report 2010 (Gold Production F2007); Carbon Disclosure Project (CDP) Reports (Energy Consumption F2009-C2011), GFL Energy Efficiency F2010.xlsx (Energy Consumption F2007-F2008), A.T. Kearney

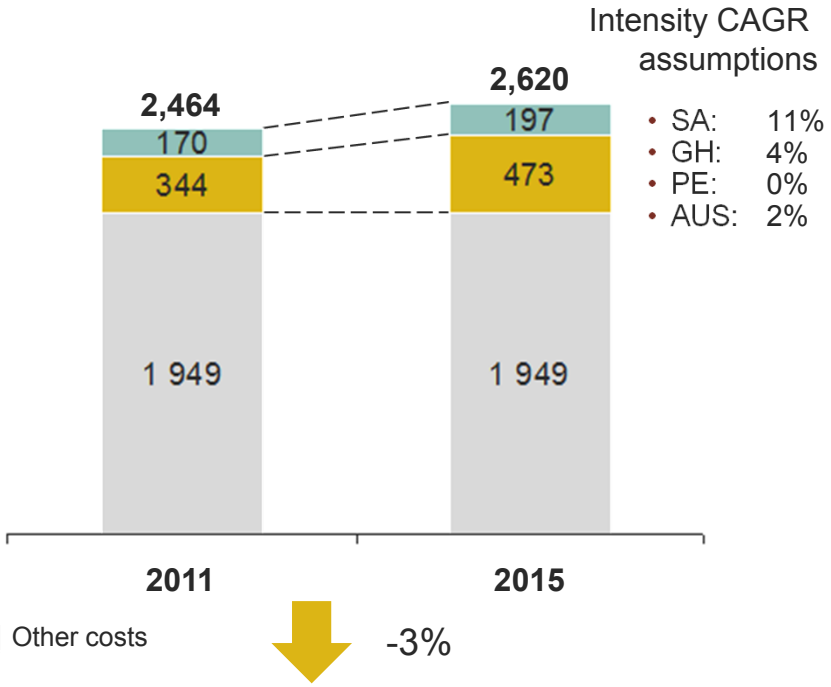
Operational margin at risk by 2015

Development of Gold Fields' cost base and NCE margin (in US$ mil, excl. South Deep)

Impact of price increases



Impact of intensity increases



NCE margin at risk by 2015

-6%

Fuel | Electricity | Other costs

-3%

- Revenue, capital expenditure, energy intensity and other operating expenses are assumed to remain constant

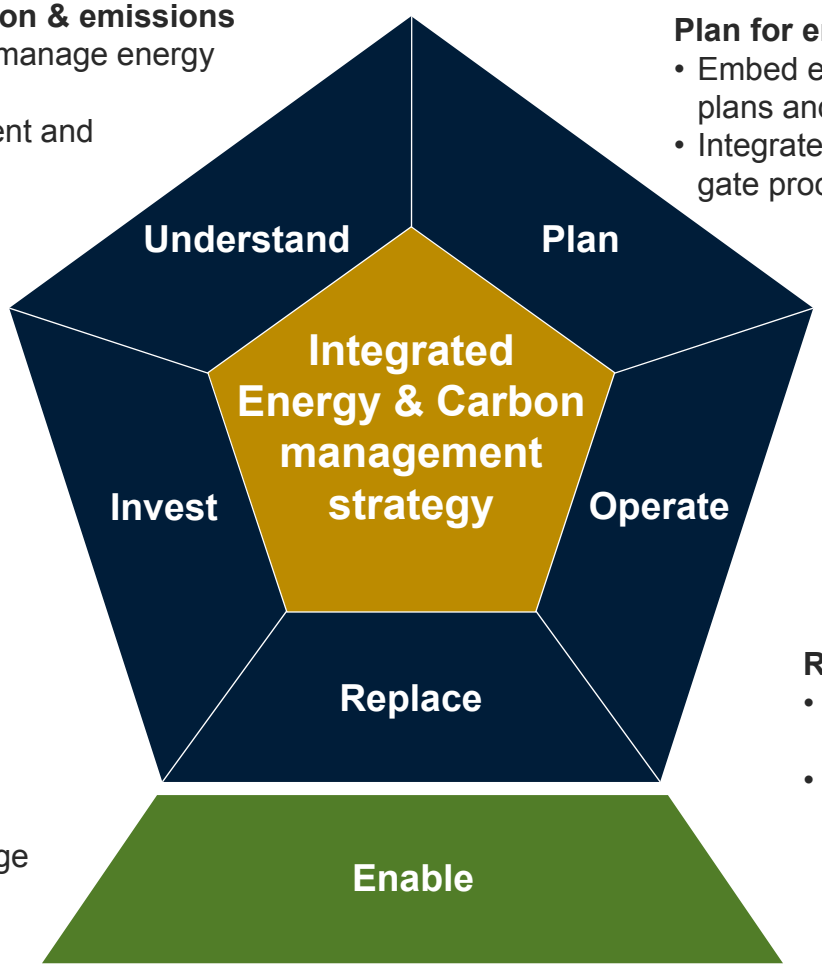
- Energy intensity can increase because of more consumption or less production
- Revenue, capital expenditure, energy prices and other operating expenses are assumed to remain constant

Note: Assessment focuses on impact of energy prices and energy intensity only; Production, Gold price, capital expenditure and other operating expenses are assumed to remain constant
Source: Gold Fields' financial data, annual report and CDP report, A.T. Kearney

Energy & Carbon Management Strategy - based on five strategic pillars and a set of enabling factors

Understand consumption & emissions
- Measure, monitor and manage energy and carbon
- Use energy management and information systems

Plan for energy and carbon
- Embed energy & carbon in all life of mine plans and other planning processes
- Integrate energy & carbon into the stage gate process



Invest in energy savings
- Invest in more efficient equipment
- Add new, energy saving measures

Operate assets efficiently
- Focus on long term asset performance
- Incentivise good asset management
- Reduce wastage through increased efficiency

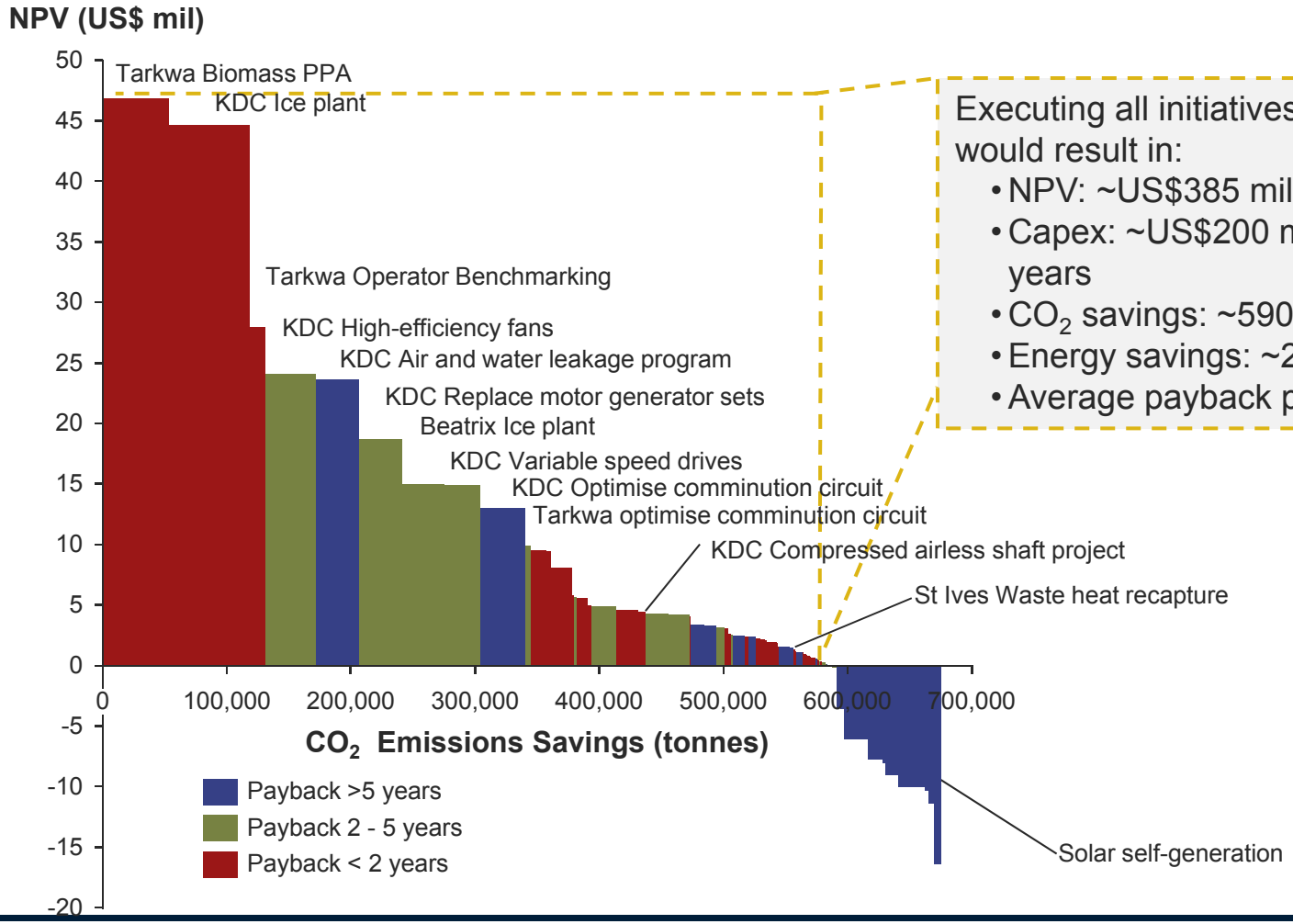
Enable our organisation
- Create an effective organisation and incentives
- Share knowledge and best practices
- Raise awareness and manage the change
- Improve the ability of staff

Replace CO_2-e intense energy
- Use renewable energy sources e.g. solar and wind
- Switch to alternative energy sources e.g. from coal to gas

Source: Energy & Carbon project analysis, A. T. Kearney

Initiatives could reduce CO_2 emissions by ~ 590k tonnes on a recurring basis by 2016

CO_2 emissions - NPV abatement curves (US$ '000, MT - consolidated)



Executing all initiatives with positive NPV would result in:

- NPV: ~US$385 mil
- Capex: ~US$200 mil over the next four years
- CO_2 savings: ~590k tonnes in 2016
- Energy savings: ~2,400 TJ in 2016
- Average payback period = 2.3 years[1]

1. Average of all prioritised initiatives' payback periods – not weighted for NPV or capex
2. All figures are based upon best estimates of the scale and likely investment requirements of initiatives.

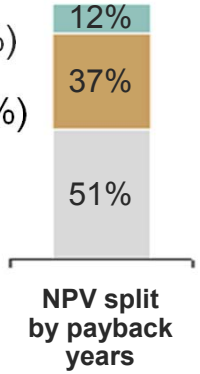
Source: Energy & Carbon strategy project team analysis

Regional Energy and Carbon impacts

Forecast energy and carbon project costs and benefits

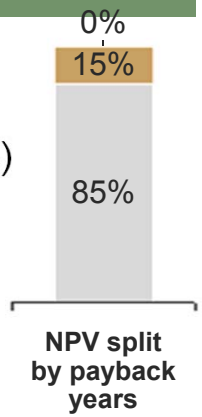
South Africa

- 2016 Energy savings: 1,574 TJ (11%)
- 2016 CO_2 savings: 430k tonnes (11%)
- NPV: $220 mil
- Capex: $107 mil



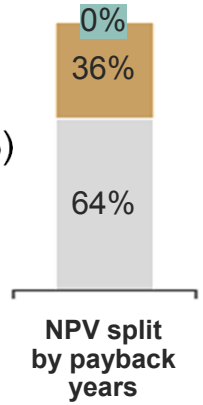
Ghana

- 2016 Energy savings: 507 TJ (7%)
- 2016 CO_2 savings: 90k tonnes (15%)
- NPV: $135 mil
- Capex: $32 mil



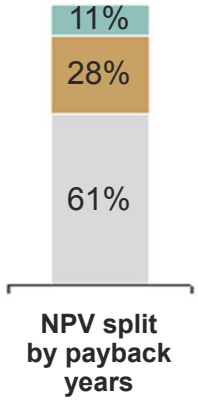
Australia

- 2016 Energy savings: 205 TJ (11%)
- 2016 CO_2 savings: 60k tonnes (34%)
- NPV: $30 mil
- Capex: $58mn[1]



Peru

- 2016 Energy savings: 81 TJ (8%)
- 2016 CO_2 savings: 6k tonnes (8%)
- NPV: $5 mil
- Capex:: $3 mil

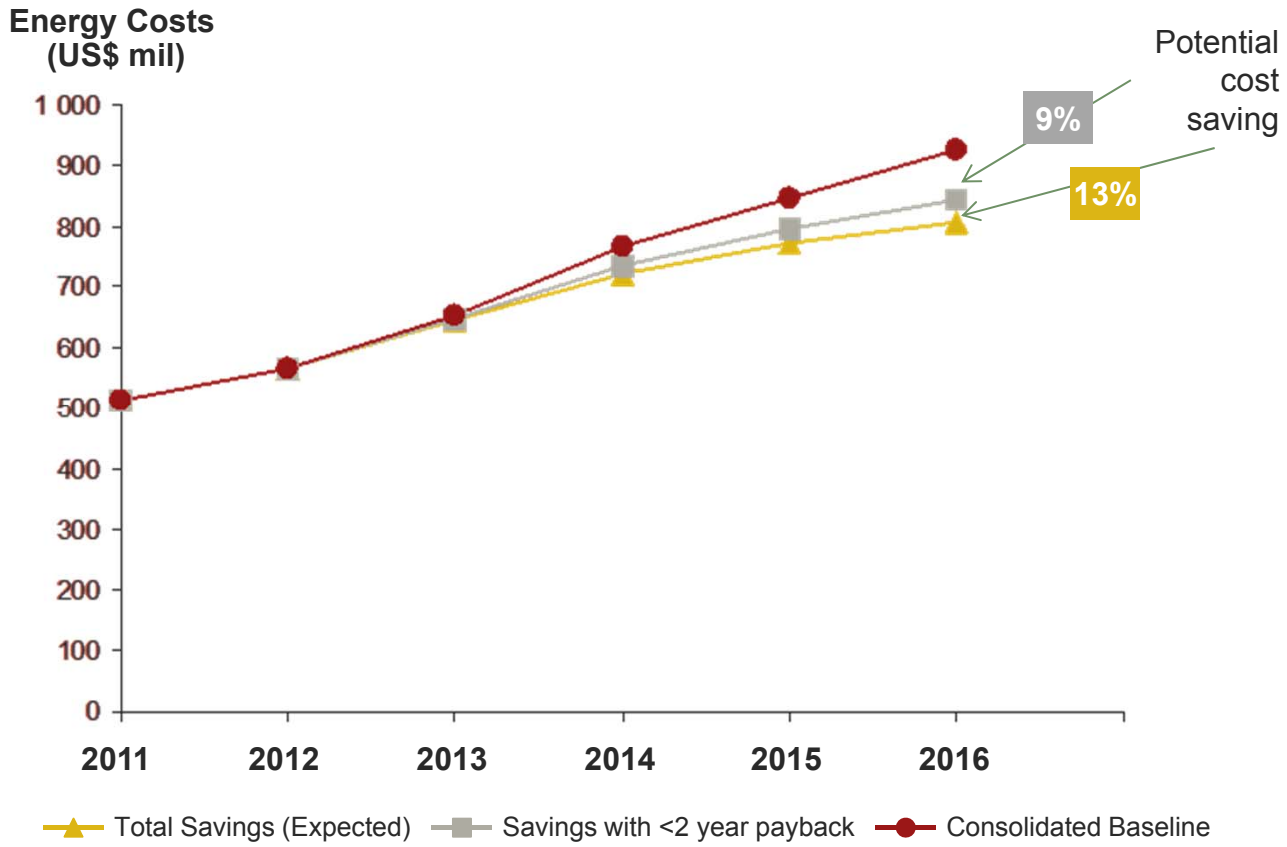


Payback > 5 years Payback 2 - 5 years Payback < 2 years

1. Note: High Australian capex driven by "wind generation" projects with US$4 mil NPV
Source: Energy & Carbon strategy project team analysis

Executing the strategy – reduces 13% energy and 16 % TCO_2e

Energy costs (US$ mil) - consolidated



Comments

- Overall, the strategy could save US$120 mil annually by 2016[1] or **13% of energy costs and 16% in TCO_2e**
- This is approximately equal to **3% points of NCE margin**
- Expected price increases in South Africa and Ghana largely outweigh potential consumption savings
- Signing the coal gasification PPA in Tarkwa will incur additional savings of ~US$3.9 mil annually

1. Assuming that the consumption split of electricity and fuel remains constant
Note: Only initiatives with positive NPV's included in to project the evolution; all figures are based upon best estimates of the scale and likely investment requirements of initiatives

Energy & Carbon strategic targets

Implications for group level targets

Current operations

Energy saving	10% embedded energy savings (TJ) by 2016
Alternative energy	A simple rule: No operation should go backwards to a more carbon intense source unless security of supply or price demands

New mine developments

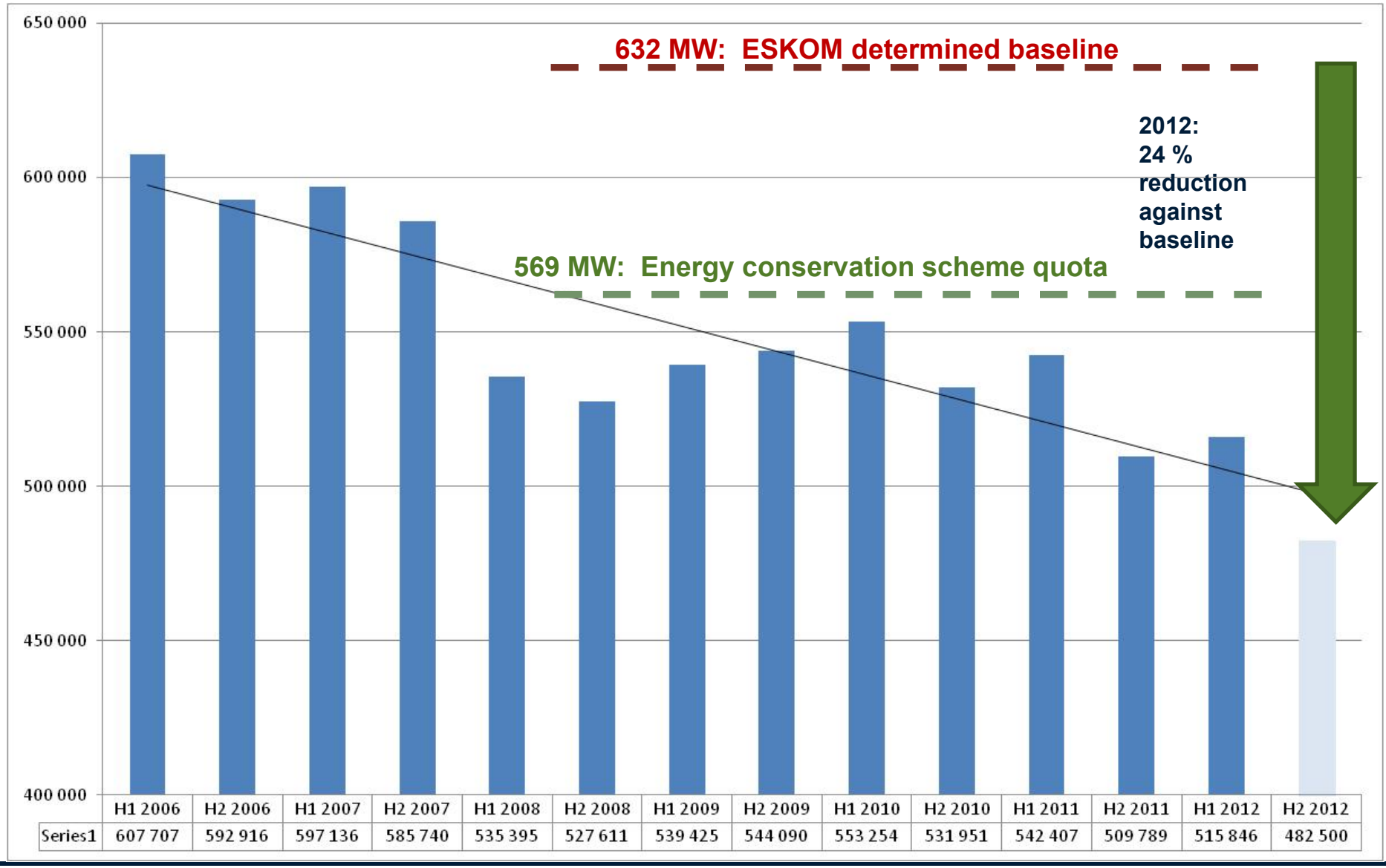
Energy saving	All new mine developments must meet the minimum energy and carbon requirements of the stage gate process
Renewable energy	20% of total energy consumption (electricity and fuels) for new projects should come from grid or own project renewable energy

Unacknowledged upside gives confidence in target setting

- **280 initiatives across the regions that were not prioritised**
- **The potential benefits of positive behavioural change**

Source: Energy & Carbon Strategy project team analysis

Gold Fields SA's electricity consumption



	H1 2006	H2 2006	H1 2007	H2 2007	H1 2008	H2 2008	H1 2009	H2 2009	H1 2010	H2 2010	H1 2011	H2 2011	H1 2012	H2 2012
Series1	607 707	592 916	597 136	585 740	535 395	527 611	539 425	544 090	553 254	531 951	542 407	509 789	515 846	482 500

GOLD FIELDS

Examples of energy efficiency projects (1)

Beatrix methane project - Alternative Energy…

Securing Our Future

- ✓ **Methane Extraction at Beatrix Gold Mine**
- ✓ **Underground and surface borehole methane extraction**
- ✓ **First hard rock project in the world registered under the Kyoto Protocol**

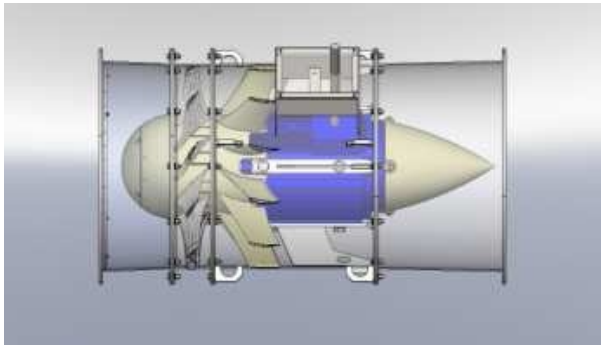
- The project supports our first value namely “Safety”
- By managing our carbon emissions and carbon footprint a reduction of approximately 250 000 ton CO_2 e per annum is possible
- It is planned to reduce 1,700 000 million tonnes of CO_2 e (CER’s) for the first 7 years
- A phased approach is taken
  - Methane flaring – stabilise flow from underground resources
  - Power generation (4 MW potential future electricity generation)
- CER’s will be sold into Europe
- Future potential at Beatrix West indicates that the amount of methane extracted will almost double, and similar electricity generation possibilities exist

Examples of energy efficiency projects (2)

Drawing down power consumption and operating cost…

Optimise Our Operations

- ✓ **Need to off-set impact of above inflation annual electricity increases in SA Region**
- ✓ **Main ventilation fans "Drop-in" impeller replacements**
- ✓ **Auxiliary in-line fan replacement**



- **Drop-in impeller** uses less power for the same air flow and improves the efficiency of the fan
  - Fans normally designed for the LoM peak demand and are inefficient when the ventilation requirement changes
  - Potential average 8 MW saving at KDC (already done at South Deep Twin Shaft)
  - R40 million annual saving in 2012 terms
- **Energy efficient fans** (33.5 kW fan provides the same airflow as a 45 kW fan)
  - 7 MW saving (About 600 fans being installed over the next 12 months.)
  - R 30 million annual saving in 2012 terms
  - Potential CER's of 60 000 tons CO_2e

Example of Renewable energy

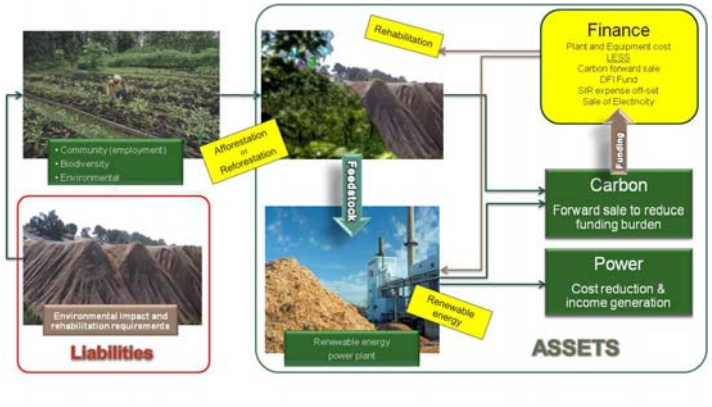
Renewable energy from biomass

Ghana

- Motivation
  - Reduce reliance on non-renewable energy
    - Internal target of 20 % alternative clean energy
  - Reduce reliance on external power supply
  - More stable electricity pricing
  - Potential to reduce electricity cost – real NPV
  - Improved security of electricity supply
  - Strengthening of “green credentials” as a sustainable gold miner
  - Community involvement in biomass supply
  - Potential mine rehabilitation benefit
- Technology considered included, Pyrolosis, Gasification, Fluidised bed and Traveling Grate boiler
- Review of technology and concluded financial feasibility
- Project to reduce Carbon footprint

Biomass supply in Ghana

Value cycle



Conclusion

Managing our energy and carbon footprint = Living our values

- The mining industry and Gold Fields is taking this seriously
- Climate change actions are now integrated into business processes and is embedded in our sustainable development journey
- Requires culture change to underpin the physical project initiatives –
  - energy and carbon management and conservation has to become part of the GFL DNA
- Affordability of investments remains a concern-
  - When it can provide short term returns then it is proactive to draw down future costs to sustain the business
- Importance of buying energy efficient equipment and machinery in the future
  - leveraging input from the OEM's to provide low carbon emission equipment etc.

Climate policy - Opportunities and challenges for the mining sector

ICMM Side Event: The contribution of the mining and metals industry to sustainable development and the low carbon economy

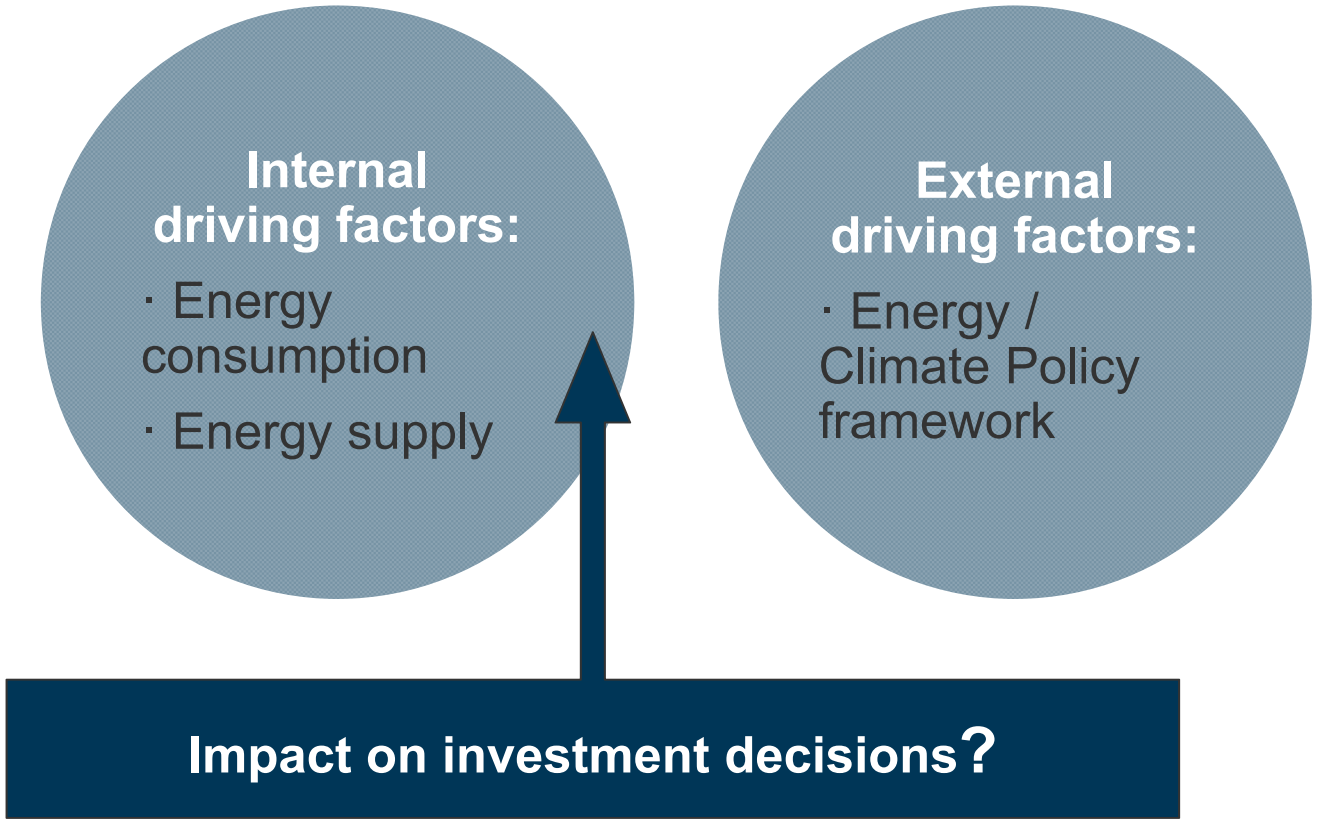
Doha, November 28, 2012

Axel Michaelowa
michaelowa@perspectives.cc
Perspectives GmbH, Zurich

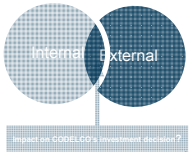
Topics

- Driving factors for investment decisions for future growth
- Impact on mining sector's investment decisions
- The need for an "Energy Strategy integrating Climate Policy (C-Strategy)"
- Opportunities for "learning-by-doing"

Driving factors for mining sector's investment decisions for future growth



Multiple reasons for (emerging) energy & climate policy frameworks in developing countries

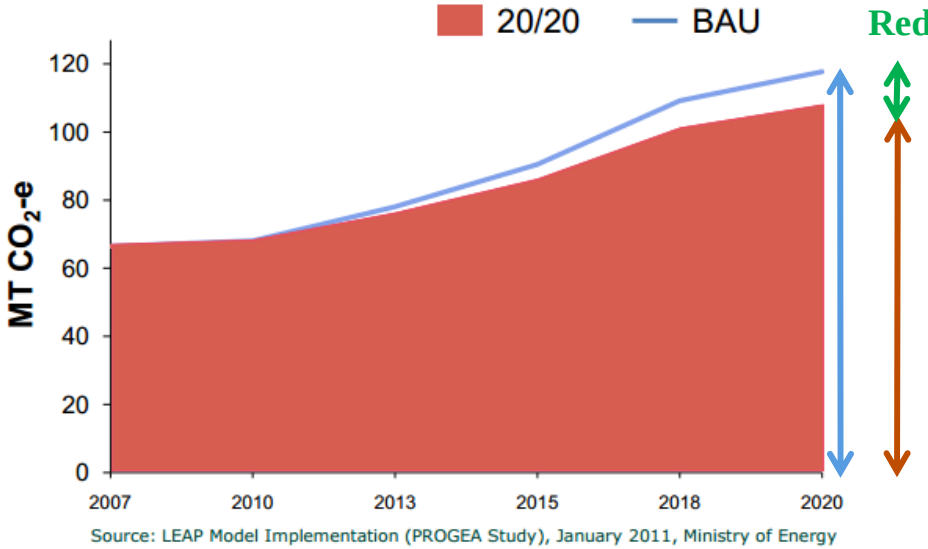


Energy

- Affordable energy supply
- Energy security
- Environmental friendly energy supply

Climate policy

- Long-term contribution to climate change: Achieving a deviation below the "business-as-usual" emissions growth trajectory (**example of Chile**):

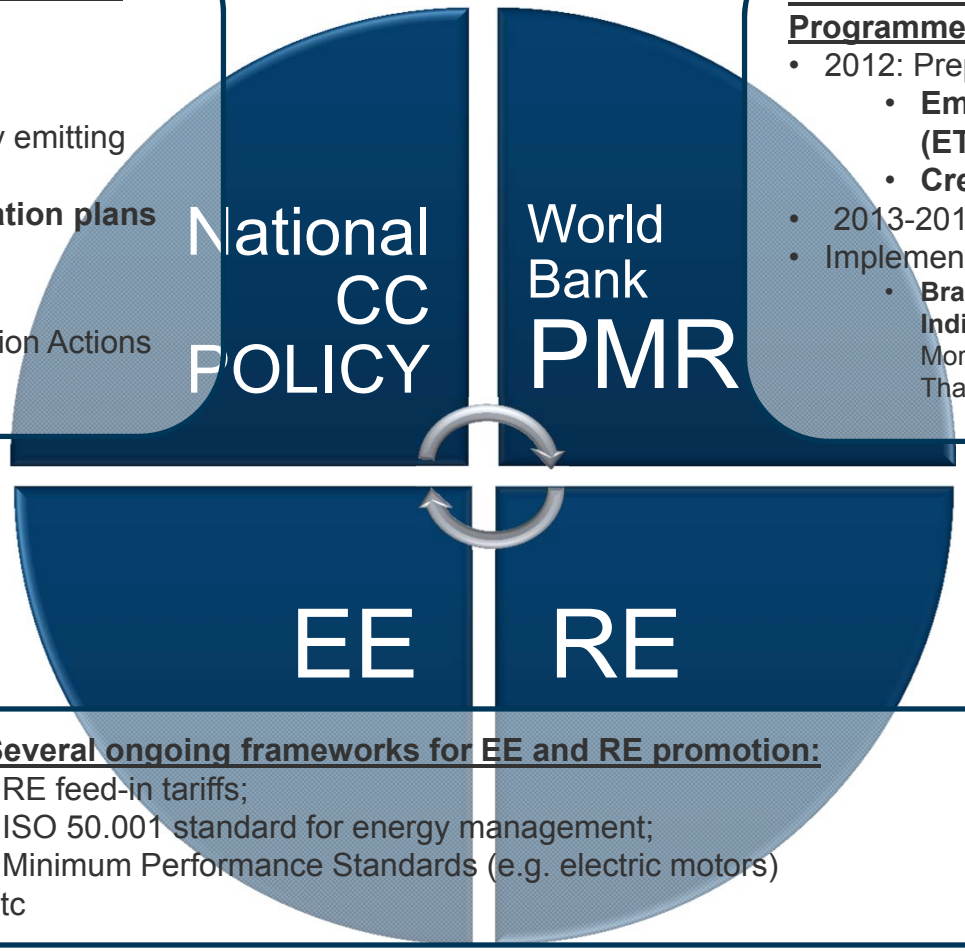


Chile will require financing for technology investments:

- Domestic sources
  - Private sector
  - Carbon markets
  - Public sector
- International sources
  - Nationally Appropriate Mitigation Actions (NAMAs)
  - Carbon markets

perspectives climate change

Which are the external driving factors?



Several ongoing national CC action plans

· GHG **inventories**;
· GHG **mitigation potential**;
· **Mitigation scenarios** in key emitting sectors;
· National and sectoral **mitigation plans**

2020: **UNFCCC's pledge?**

Nationally Appropriate Mitigation Actions (**NAMAs**) to achieve target?

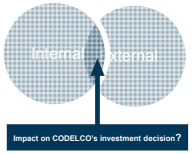
World Bank Carbon Market Readiness Programme (PMR)

- 2012: Preparation Phase Proposal
  - **Emissions Trading Scheme (ETS)**
  - **Crediting mechanisms**
- 2013-2015: Implementation phase
- Implementing countries:
  - **Brazil, Chile, China**, Costa Rica**, India, Indonesia**, Jordan, **Columbia**, Morocco, Mexico, **Peru**, **South Africa**, Thailand, and Vietnam.

Several ongoing frameworks for EE and RE promotion:

· RE feed-in tariffs;
· ISO 50.001 standard for energy management;
· Minimum Performance Standards (e.g. electric motors)
etc

Resulting questions for making investment decisions



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Nationally Appropriate Mitigation Actions (**NAMAs**) to achieve target?

CHILE's CC POLICY

PMR

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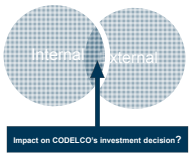
EE | RE

Several ongoing frameworks for EE and RE promotion:
- RE feed-in tariffs;
- ISO 50.001 standard for energy management;
- Minimum Performance Standards (e.g. electric motors)

etc

perspectives climate change

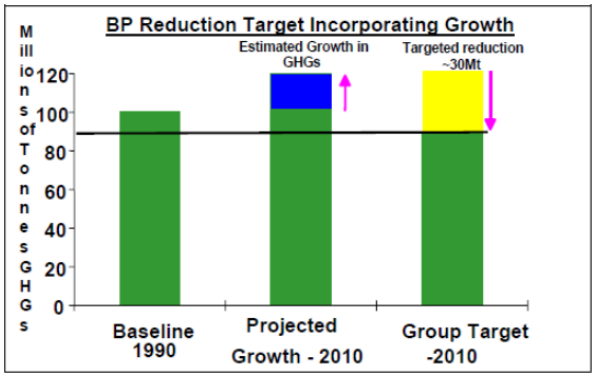
The need for "Energy Strategy integrating Climate Policy (C-Strategy)"

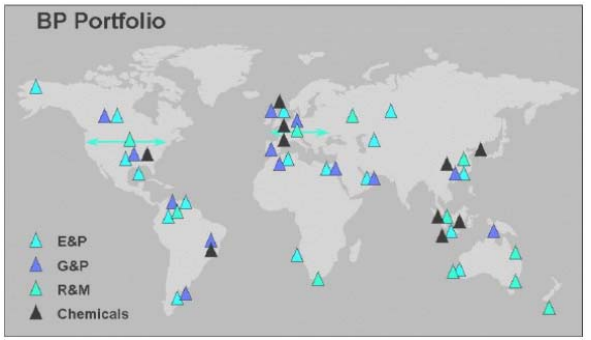


- **Anticipate how external driving factors impact investment decisions**
- **Understand how companies can position themselves towards the developing policy framework**
  - **What does this mean for competitiveness of the operations?**
  - **Which possibilities does it offer to leverage investments (e.g. carbon market and NAMAs)?**
- **Understand possibilities for …**
  - **…using carbon market instruments**
  - **…generating internal know-how that can be used to influence policy design, and participate in pilot activities with high reputational benefit**

Learning-by-doing: BP's Internal Emission Trading Scheme (1998-2001)

- **Goal: Reduce** its **GHG emissions 10% below 1990** levels **by 2010 → 30 $MtCO_2e$**
  - **25% of the business units, 80% of emissions**
  - **4 different business streams were involved**
  - **Built on BP's existing GHG Reporting Protocol (CO_2, CH_4)**
- **No money transfers (due to tax & accounting issues), but part of manager's performance contract**





Main results:

- **Emissions data quality is key**
- **Difficult to set single year targets.**
- **Allocation never perfect**
- **Price matters, but so does access to capital investment**
- **Importance of ensuring compliance**
- **Allowed entry preparations for UK ETS and EU ETS**

Learning-by-doing: MRV: VCS standardized methodology for the mining sector for product xyz

Standardization of baselines for enabling sectoral investments

- Industrial sectors have shown strong interest in standardized methods
  - Cement Sustainability Initiative
  - World Steel Association CO_2 emissions data collection for benchmarking

The VCS and standardization

- VCS is the most utilized standard in the voluntary carbon market (40 Mt CO_2e in 2011)
- ≈ 80% of VCS projects are energy-based
- A suite of regional and national governments promote the VCS domestically (inc. Chile)
- The VCS developed comprehensive rules and requirements for standardized meths.

Benefits of standardized methodology

- Possibility to “price carbon”
- Baseline determined at sector level
- Lower level of transaction costs
- Standardized monitoring

- Possibility to “price carbon”
- Voluntary carbon market
- NAMAs
- New market mechanisms

Summary: How to make the right steps

Elements of “Energy Strategy integrating Climate Policy (C-Strategy)”

1. Analyze the situation
2. Assess future trends
3. See impact on investment decisions
4. How to position the company?
5. How to influence emerging policy instrument design?
6. Screen possibilities to successfully utilize carbon market instruments

Thank you!

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ICMM
International Council on Mining & Metals

The role of mining and metals in a low carbon economy

A thought starter…

Simone Cooper, Senior Program Officer, ICMM
28th November 2012, UNFCCC COP18, Doha, Qatar




www.icmm.com

Industry Emissions Profile

Representing around 2% of emissions globally.

Approximately half of emissions from fuel use (Scope 1) and half from electricity use (Scope 2)

Emissions per tonne of ore extracted will be site specific.

- *The type, concentration and location of the mineral resource*
- *Accessibility and fuel mix of the grid*
- *Technology used in extraction*

Open pit mine (BHP Billiton) – copper mine

Underground mine (Anglo American) – platinum mine

Managing emissions in the industry…

ICMM members committed to:

- Developing greenhouse gas emission reduction strategies and implementing economic emissions reduction opportunities
- Ensure efficient use of natural resources (energy and water)
- Support R&D of low greenhouse gas emissions technologies that are appropriate to the industry
- Measure progress and report results.

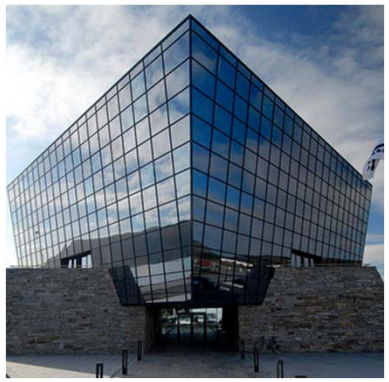
…is only half the story

Minerals and metals are critical inputs for a low carbon future

Demand for metals in a low carbon future compared to BAU projections?

Realising abatement potential in transport and buildings

- Advanced **aluminium** façade technologies in buildings to make them more energy efficient



- **Nickel** alloys used to increase efficiency of fuel combustion in jet engines

Realising abatement potential in transport and buildings

- Lighter, fuel efficient vehicles made of higher strength steels incorporating **niobium, molybdenum** or may be made of lightweight metals such as **aluminium**

Realising abatement potential in transport and buildings

- Electric vehicles will require supporting infrastructure for power distribution requiring metals including **copper, zinc, nickel and steel**

Creating low carbon power generation

- **Wind turbines** – copper, cobalt, bauxite, metallurgical coal, iron ore, molybdenum, zinc
- **Solar panels** – copper, molybdenum, bauxite, metallurgical coal, lead, iron ore
- **Nuclear** increases demand for uranium
- **Hydrogen fuel cells** requiring metal catalysts - zinc aluminium, magnesium and platinum.

We need to understand the change in the demand profile of minerals and metals.

- Exact proliferation of low carbon technologies unknown
- All require mineral and metal inputs
- All are critical
- Abatement pathways and technology roadmaps need to be feasible and sustainable from a material viewpoint.

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For further information please contact:

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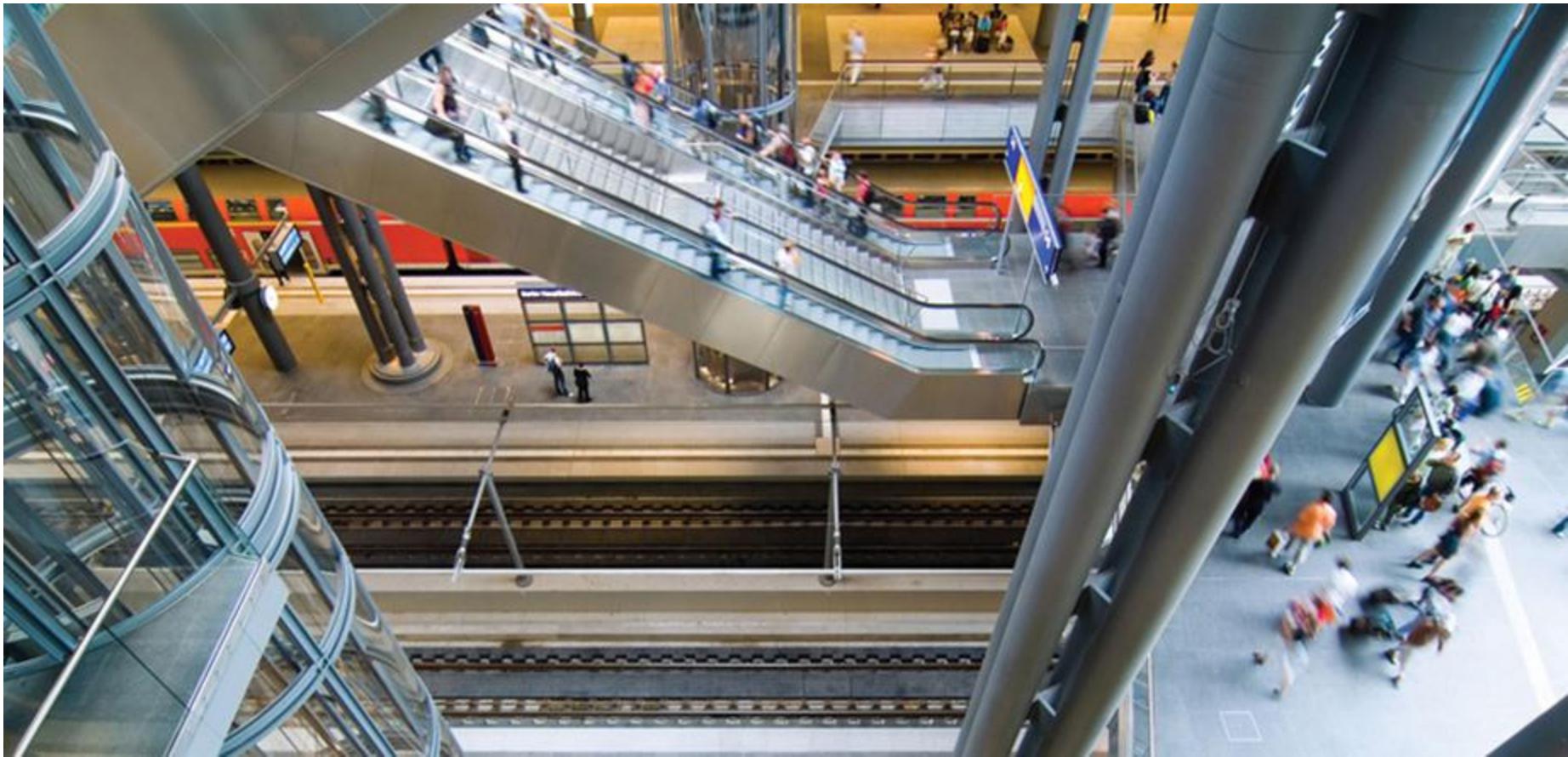
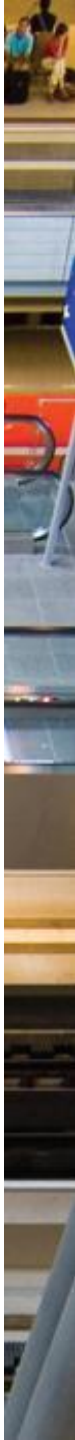
Sustainable Steel: At the core of a green economy

Åsa Ekdahl, World Steel Association, Doha November 2012





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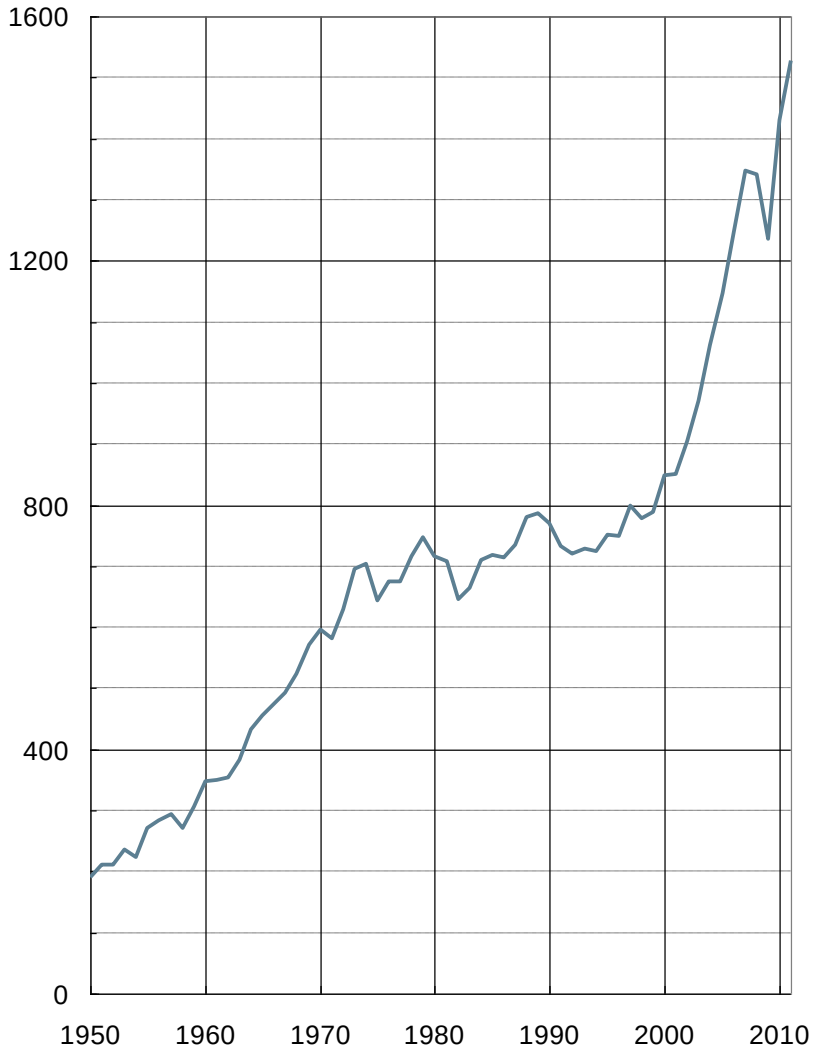
Steel is at the core of the green economy, in which economic growth and environmental responsibility work hand in hand.

Improved processes and new products

World crude steel production, 1950-2011



Source: worldsteel

- The amount of energy required to produce a tonne of steel has been reduced by 50% in the last 30 years.
- All steel can be recycled and used in new products and applications.
- On average 83% of steel in end of life products is recycled.
- New lightweight steel is dramatically changing the market.

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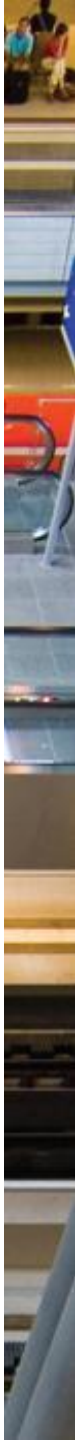
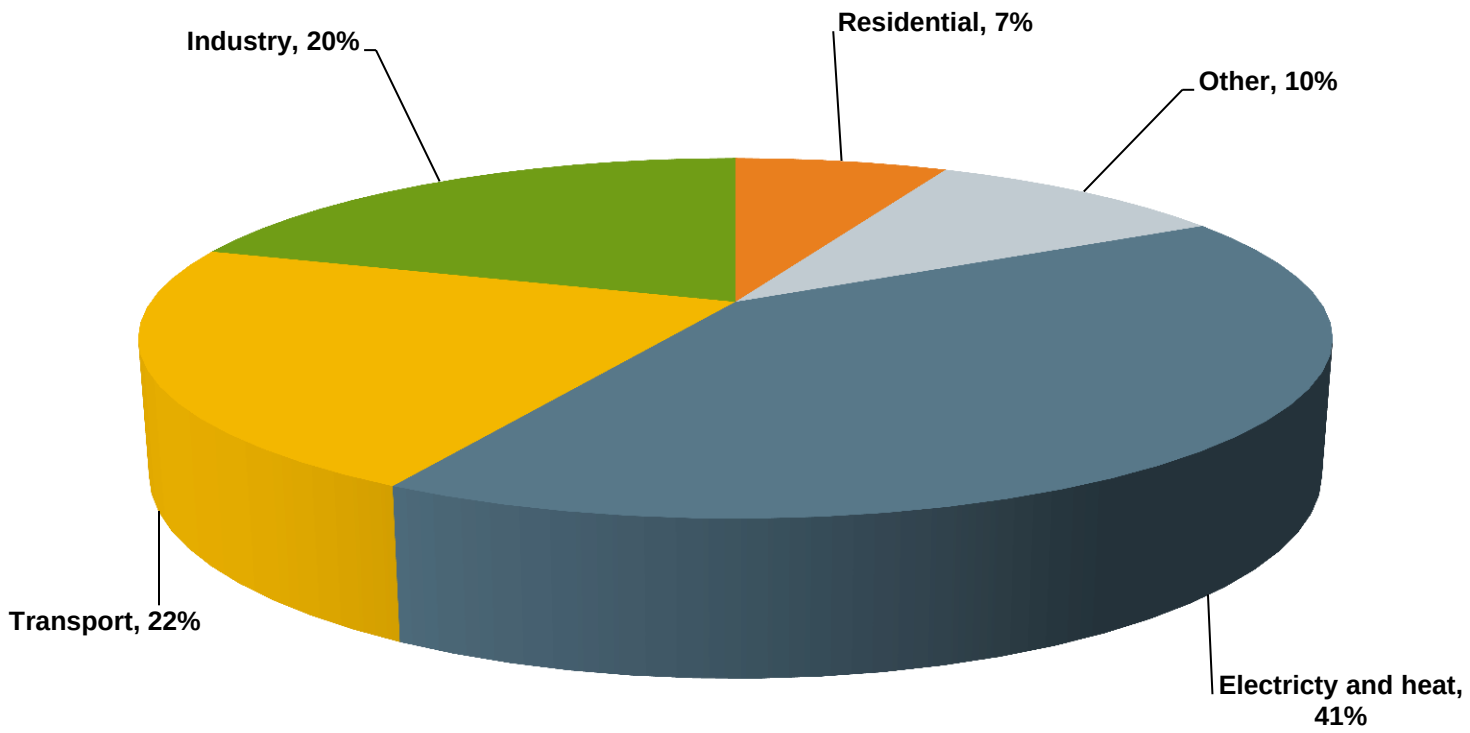


CO_2 emissions by sector

- Percentage of iron & steel in global CO_2 emissions is app. 6.5%



Source: IEA 2010 CO2 emissions from fuel combustion

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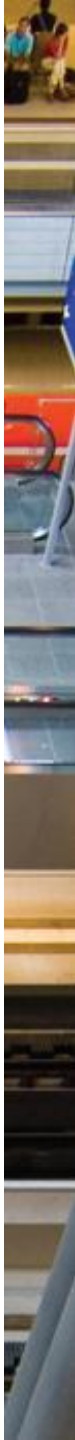
CO_2 breakthrough programme

- Tackling key programmes for reducing emissions for the industry
- Provides forum for sharing BAT, mitigation techniques and breakthrough programmes
- Work scope: focus on co-ordination of programmes
  - ULCOS - Top Gas Recycling, Hisarna, Ulcoreduction, Ulcowin, Ulcolysis
  - Course 50 Programme, Reduce emissions, Capture CO_2 from BF
  - POSCO – Finex emissions reduction, CCS, H2 steel making
  - Australian Programme – Biomass use, Heat recovery from Slag
  - CSC Taiwan – CO_2 concentration and separation from flue gas and CCS
  - AISI – Hydrogen Flash Melting, Molten Oxide Electrolysis
  - CCS promotion – required technique to make sufficient reduction > 50%



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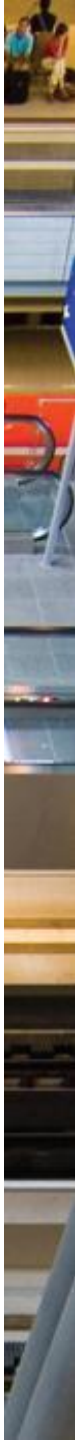
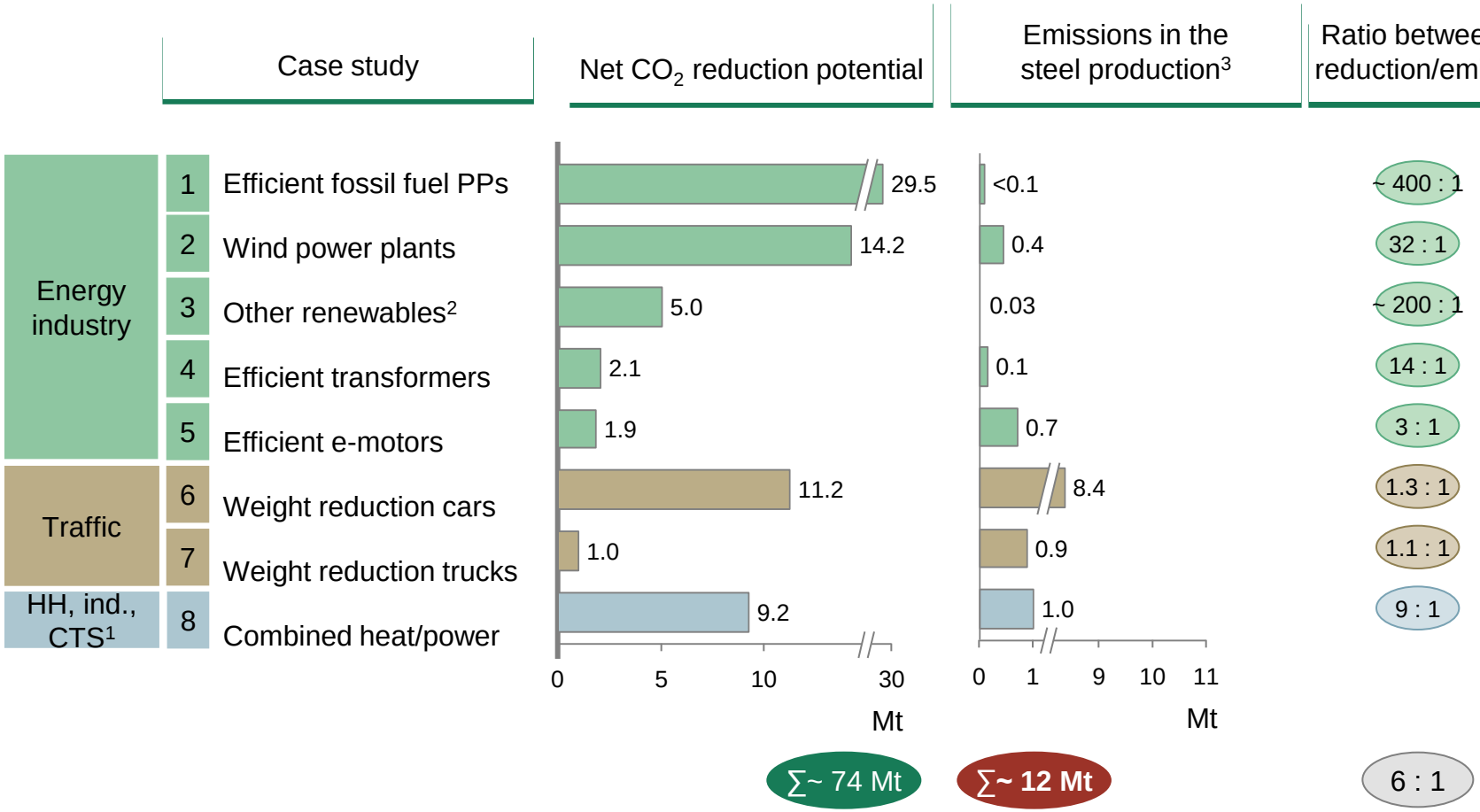
Climate Action

- It is important that every steel plant in the world actively measures its CO_2 emissions to be able to establish the correct priorities for improvement and to monitor progress in reducing its emissions.
- worldsteel therefore launched its Climate Action Recognition Programme in 2009
- The programme is based on a commonly agreed methodology that is currently going through the process of being recognised as an ISO-standard (likely publication 2Q 2013)
- The programme is open to both members and non-members
- Companies report their CO_2 emissions plant-by-plant
- Yearly collection and reporting on a confidential basis



Innovative use of steel saves six times as much CO_2 as is caused by the production of the steel



1.HH = households; CTS = commerce, trade, and service 2. Geothermal, biomass, hydro 3. CO_2 expenditure for other materials not examined; values are rounded 4. Ratio relates exclusively to the emissions

Source: BCG analysis

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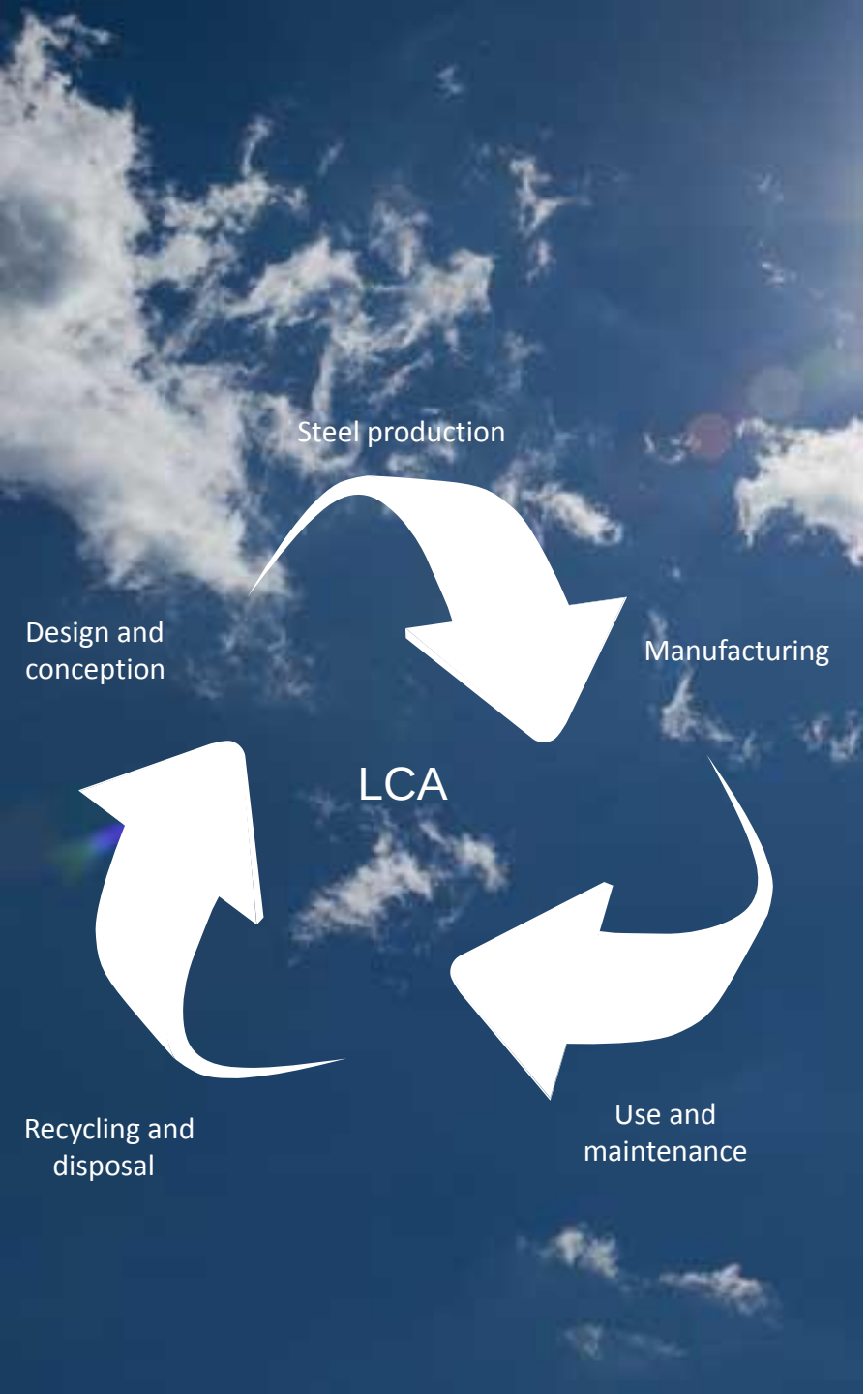

Life Cycle Assessment (LCA), new solutions for new times.

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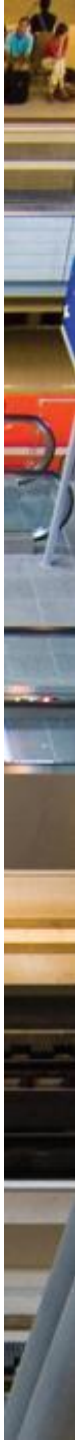
Importance of LCA for the steel industry

- worldsteel promotes life cycle thinking and LCA as it considers a products full life cycle and takes all environmental impacts into account
- Environmental regulations which only regulate one phase of a product's life cycle can create unintended consequences in another phase
- In the 1990s, worldsteel developed one of the first global sector databases for life cycle inventory data and invests to keep it current.
- LCA is a major tool used in material decision making in product design, considering the full value chain
- Increasingly being used in regulations and standards
- To determine the environmental impact of products, processes, sites
- To promote the recyclability of steel



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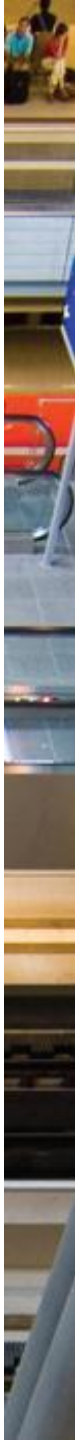
Governments and Industry in partnership

- Partnership between governments and the steel industry is key to the further reduction of carbon emissions and governments can help by
  - working actively with the industry and our customers in maximising the collection and recycling of end-of-life steel products.
  - using a life cycle approach when creating regulations and standards
  - providing significant financial contributions for the funding of the long term research and development of new technologies needed to radically reduce the steel industry's emissions.
- The steel industry believes it is very important that all steel companies and all major steelmaking countries are actively engaged in the search for a future low carbon society.
- Furthermore, policies must ensure that steel companies in any region are not put at a competitive disadvantage.



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