

CO₂ BREAKTHROUGH IN METAL PRODUCTION

- **Water Conservation in the Mining Industry – case study of gold mining and refining**
Goen Ho (Murdoch University)
- **Overview of the CO₂ Breakthrough Program and Linkage to IISI**
Sharif Jahanshahi (CSIRO) and John Mathieson (BlueScope Steel Research)
- **Survey of Sustainable Biomass Resources for Iron and Steel Industry**
Nawshad Haque (CSIRO Minerals)
- **Demonstration of Recarburisation of Liquid Steel Using Renewable Carbon at OneSteel**
Michael Somerville (CSIRO Minerals)
- **Piloting the Integrated Dry Granulation and Heat Recovery Process at CSIRO**
Dongsheng Xie (CSIRO Minerals)
- **Value of the Projects – Industry Perspective**
John Mathieson (BlueScope Steel Research) and Phillip Ridgeway (OneSteel)
- **Panel Discussion** (All session 2 speakers available for Q&A)



Centre for
Sustainable
Resource
Processing



onesteel

Overview of the CO₂ Breakthrough Program and Linkage to ISI (World Steel)

Sharif Jahanshahi

CSIRO – Minerals Down Under National Research Flagship

John Mathieson

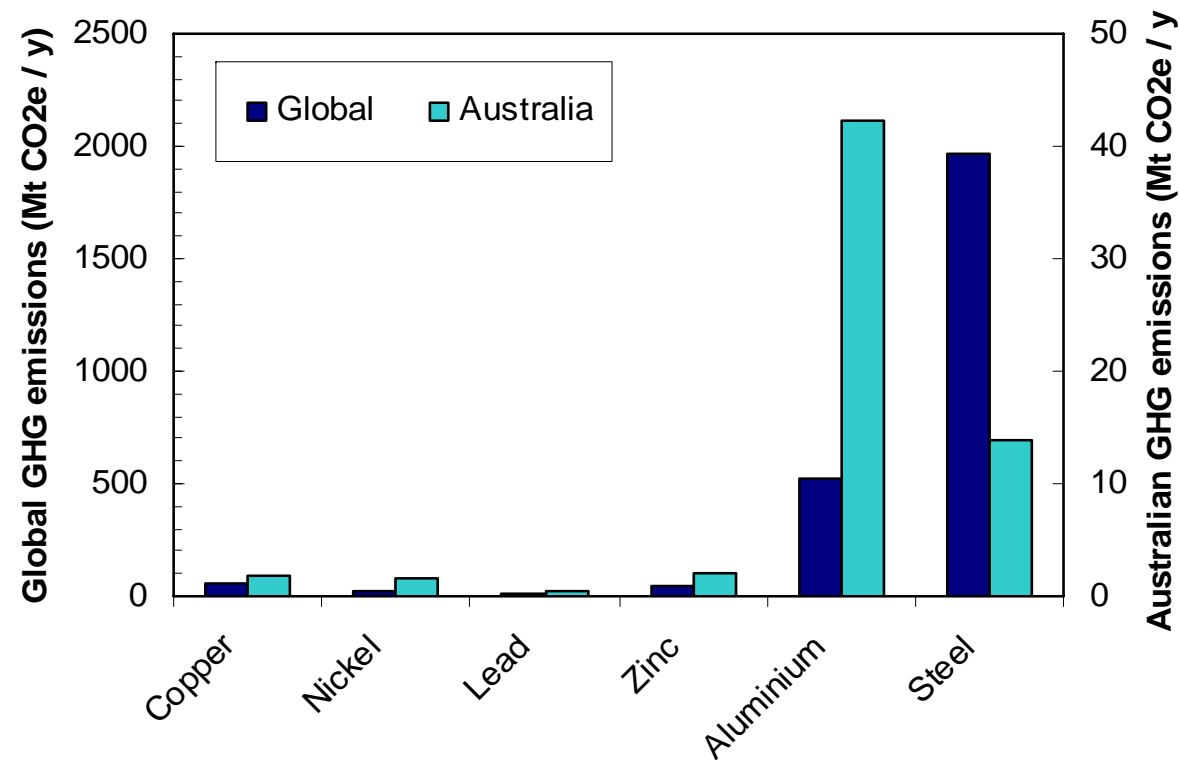
BlueScope Steel Research

CSR P'08 Conference • 18~19 November 2008 • Brisbane

File Reference: CSR P Conf 2008.ppt

Opportunities for Reducing GHG Emission in Mineral Industry

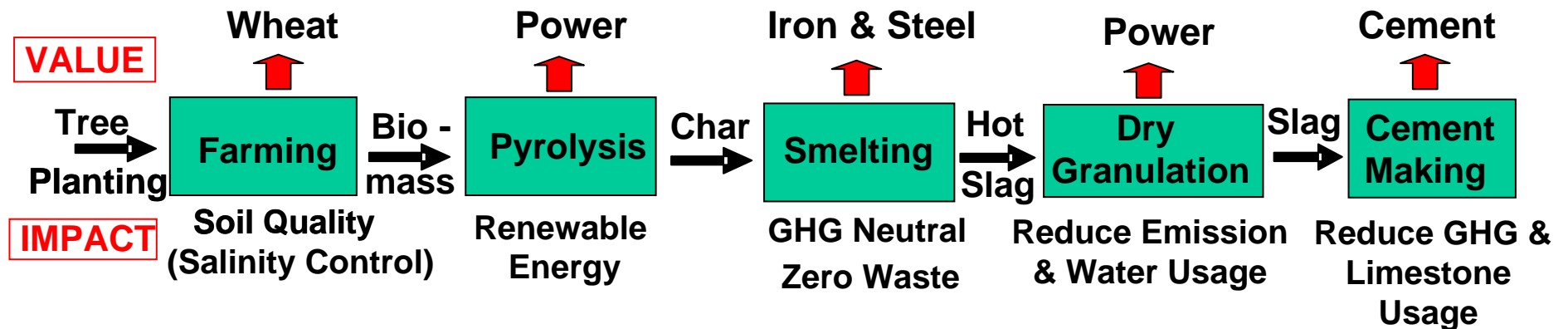
- Minerals/metals and cement industries account for >4 billion tonnes of GHG pa
~10% of global greenhouse gases (GHG) emission annually
- Reductive smelting of iron ore and alumina represent ~90% of GHG emission from mineral industry



T. Norgate et al Chemeca 2007, Melbourne.

Towards Carbon Neutral Metal & Cement Production

Vision: Reduce GHG Emissions, Fresh Water Usage and Salinity



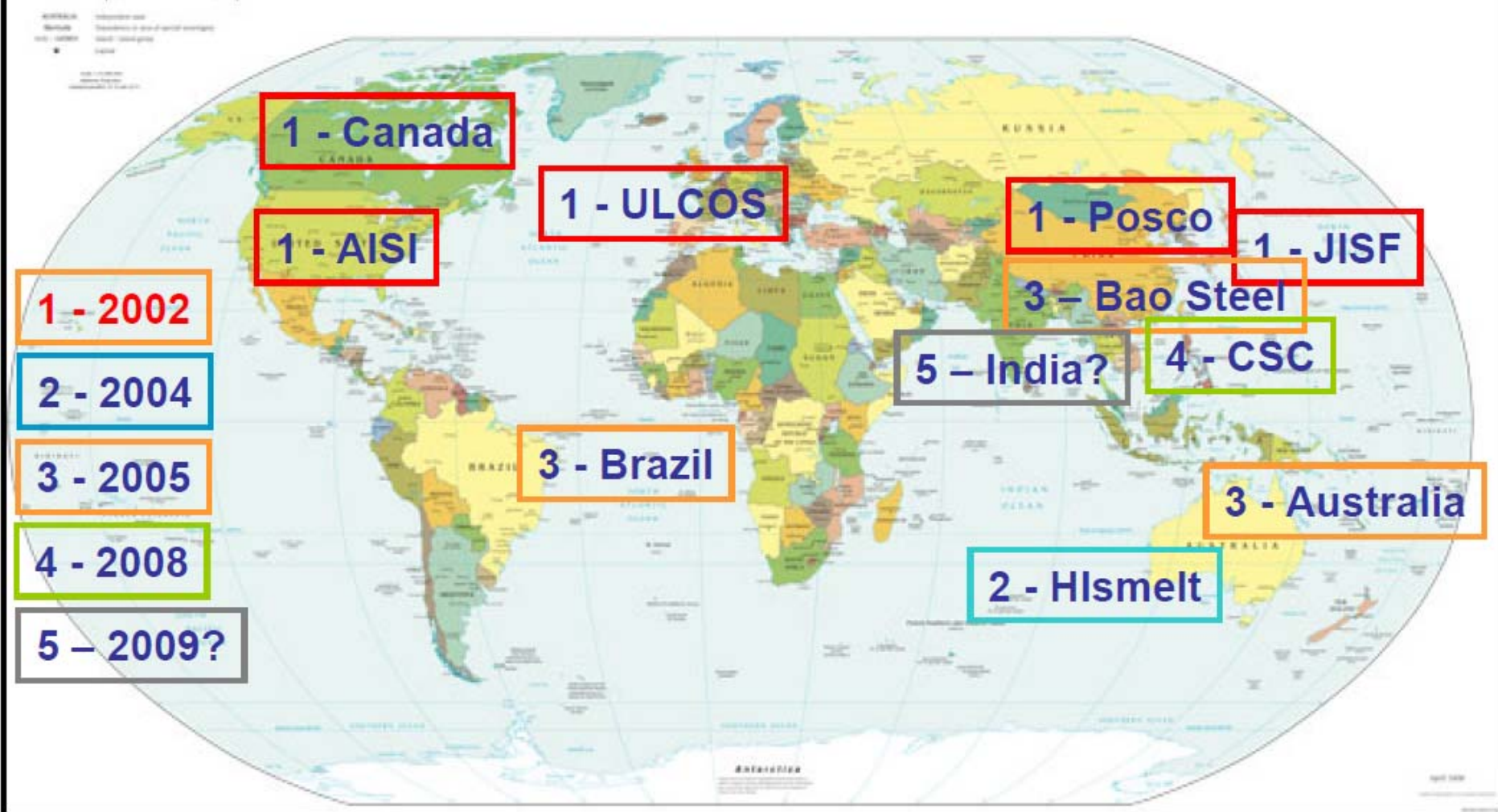
System innovation builds on industrial ecology, regional synergies, and collaboration across normal business boundaries

Contributing regional programs ...



International
Iron and
Steel
Institute

Political Map of the World, April 2008



7-10 September 2008

ENCO-46

Content of the Major Programs

- **ULCOS*** (Europe)
 - Nitrogen-free BF with top gas recycling
 - HISARNA – direct smelting-reduction of iron ore
 - Electrolysis based steelmaking
 - H₂ based pre-reduction for EAF
- **COURSE50**** (Japan)
 - CO₂ capture systems (CCS)
 - H₂ reduction based ironmaking
- **POSCO** (Korea)
 - Prereduction of, and heat recovery from hot sinter
 - CO₂ absorption using ammonia solution
 - CO₂ fixation using marine bio-slag
 - H₂ production and carbon-lean ironmaking process
- **AISI** (USA)
 - Flash smelting of iron ore using hydrogen reduction
 - Steelmaking by molten oxide electrolysis

* Ultra Low Carbon Dioxide Steelmaking

** CO₂ Ultimate Reduction in Steelmaking Process by Innovative technology for Cool Earth 50.

Australian Program: Project Identification



- Two Approaches:
- Incremental improvements to current technologies
 - Progressive adoption of "breakthrough" technologies

Criteria:

- Should be theoretically capable of decreasing net CO₂ by 50% in the application chosen, *or be* supporting analysis or modelling
- Should add to, and integrate well with, the IISI's "CO₂ Breakthrough Program"
- Portfolio initially weighted toward incremental transitional technologies

Current Australian Program

TWO PROJECTS

- **Project 1: Use of Biomass in the Iron and Steel Industry**

Commenced: October 2006

To Finish: December 2009 (may be extended)

Budget*: A\$2.1 million, 33% government investment

1a: General Aspects (CSIRO)

1b: Blast Furnace Injection (BlueScope Steel)

1c: Low-VM Charcoal as a Recarburiser for Liquid Steel
(CSIRO, OneSteel and BlueScope Steel)

- **Project 2: Heat Recovery from Molten Slags through Dry Granulation (CSIRO)**

Commenced: August 2006

To Finish: June 2010 (may be extended)

Budget*: A\$7.9 million, 67% government investment

* Budgets are actual to June 2008, and planned (not approved) in following years.