Overview of the CO_2 Breakthrough Program and Linkage to worldSteel (formerly IISI)

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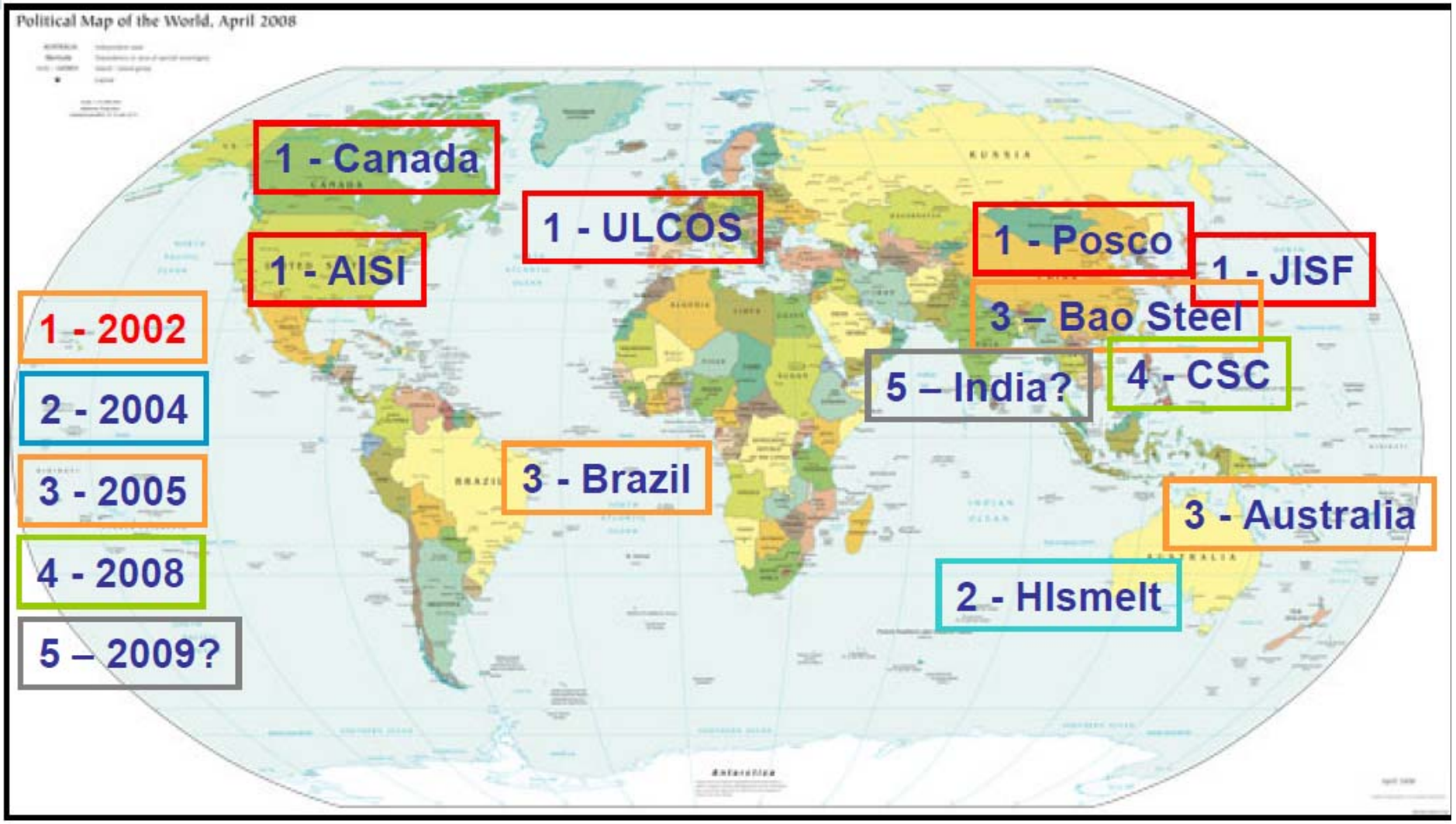
Contributing regional programs …



Content of the Major Programs

- ULCOS* (Europe)
  - Nitrogen-free BF with top gas recycling
  - HISARNA – direct smelting-reduction of iron ore
  - Electrolysis based steelmaking
  - H_2 based pre-reduction for EAF
- COURSE50** (Japan)
  - CO_2 capture systems (CCS)
  - H_2 reduction based ironmaking
- POSCO (Korea)
  - Prereduction of, and heat recovery from hot sinter
  - CO_2 absorption using ammonia solution
  - CO_2 fixation using marine bio-slag
  - H_2 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

** CO_2 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 CO_2 by 50% in the application chosen, *or b*e supporting analysis or modelling
- Should add to, and integrate well with, the IISI's "CO_2 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.

Value of the Projects

Industry Perspective

Phillip Ridgeway (OneSteel)

John Mathieson (BlueScope Steel)

Steel Industry Background

- BlueScope Steel and OneSteel
  - Employ over 20,000 people
  - Operate across several hundred sites
  - Annually contribute over $1.6 billion to exports
  - Service the manufacturing, infrastructure, agriculture and construction industries
  - Contribute around 3% of Australia's greenhouse emissions
  - Being trade-exposed, will be significantly affected by the Australian Carbon Pollution Reduction Scheme (CPRS)
- The Companies
  - Believe GHG emissions are a global problem, requiring a global solution
  - Recognise the role of the steel industry, locally and globally, in transitioning to a low emissions economy in a sustainable and responsible way
  - Understand that although some energy efficiencies can be gained in the short term, breakthrough technologies are currently in the R&D phase and are likely to be realised only in the longer term (10 years or more)

Specific Comments - Biomass

Biomass Project

- If 10% of the C used in the world steel industry could be replaced with biomass (*eg* charcoal), this would be equivalent to Australia's total emissions
- Each application (CO, SP, BFinj, recarb) can benefit from optimised properties, *ie* "designer chars"
- There is currently a "chicken and egg" problem. No tonnage supply, so applications cannot be proved at industrial scale
  - Even our simplest application (liquid steel recarburiser) has been difficult
- A versatile pyrolyser needs to be built in Australia at around the 25~50 t/day scale
- The steel companies are fully engaged and their in-kind commitment is very high
- Use of biomass represents probably the best opportunity to significantly decrease net CO_2 emissions using current iron/steelmaking technologies

Specific Comments – Dry Slag Granulation

- Very strong interest in Australia, mainly because of the large potential water savings
- Growing international interest, because of the significant commercial value if the R&D is successful
- The Australian steel companies are fully engaged and their in-kind commitments are likely to be very high in the coming years

Specific Comments - Future

OPPORTUNITIES

- Biomass work has a number of complexities, in both the supply and applications areas, and would benefit from longer term commitments
- Training of a next generation of researchers, familiar with iron and steelmaking technologies

CONCLUSION

- OneSteel and BlueScope Steel are greatly appreciative of our involvement with CSRP and look forward to continued excellent outcomes from our projects.