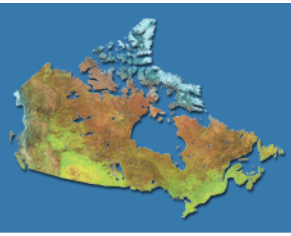


Metallurgical Processing Alternatives

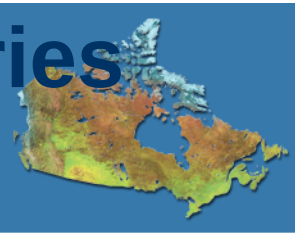
Mines Ministers' Conference
NRCan Workshop:
Solutions for Maintaining the Viability of Base Metal Mining Communities
St. Andrews, New Brunswick,
September 18, 2005

Jim Vance, John Dutrizac
CANMET Mining and Mineral Sciences Laboratories
Natural Resources Canada

Smelting and Refining Contributes to the Canadian Economy

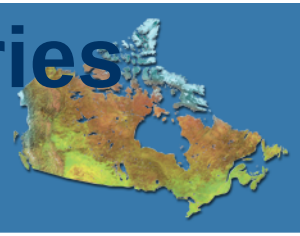
- The value of smelting and refining in Canada is $20 billion per year
- Over 50,000 are employed in the industry
- This industry plays a key role in recycling of base metals and precious metal-bearing electronic scrap
- Many communities are heavily supported by the smelting and refining industry

Canadian Smelters and Refineries are in jeopardy



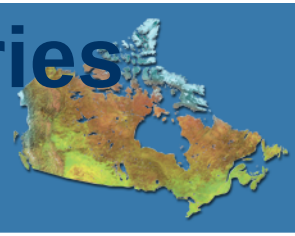
- Despite the current climate of high demand and high prices for base metals, the viability of Canadian base metal smelters is under threat
- Underlying problem is global cost competitiveness, with high international demands for concentrates, rising energy costs, and environmental compliance responsibilities

Canadian Smelters and Refineries are in jeopardy



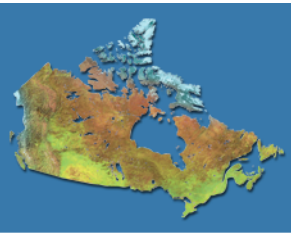
- Prices for raw materials are high
  - Worldwide competition for concentrates
  - Demand driven by capital expansion in Asia
  - Lack of new Canadian concentrate supplies
- Access to recyclable materials is not favourable in Canada
  - Do not have recycling incentives comparable to those in Europe and Asia
  - Hazardous waste regulations limit trans-boundary access

Canadian Smelters and Refineries are in jeopardy



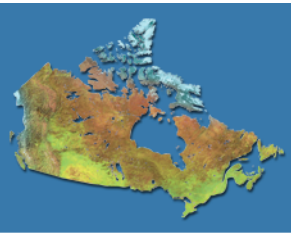
- Changing Environmental regulations
  - Cost to meet increasingly stringent federal and provincial emission standards and targets
  - Proposed new sulphur dioxide (SO_2) and metal particulate targets may not be economically achievable without new technologies
  - The key is sulphur containment; heavy metal emissions tend to follow SO_2 emissions
- Negative public perception will continue to drive regulators to tighten emission standards

Long term solution



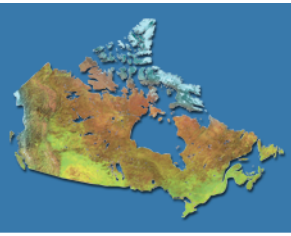
- In the long term, the only sustainable solution is development and application of new cost effective technologies that minimize environmental impacts

Metallurgical Alternatives



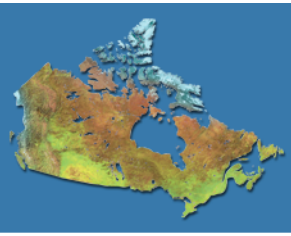
- Alternatives to existing smelting technologies are key to future primary metal processing in Canada
- Hydrometallurgical treatment (hydromet) offers the most promising alternative
- Hydromet options can complement existing smelting technologies and allow them to meet proposed regulations

Advantages to Canada of new hydromet process



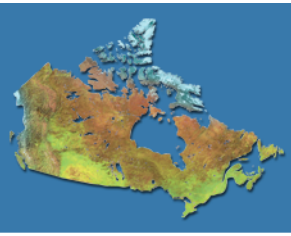
- Successful development of hydromet offers important advantages to Canada:
  - Provide an economically viable, clean technology for recovery of Canadian mineral resources
  - Enhance exploitation of Canadian ore deposits and ensure value added processing takes place in Canada
  - Preserve economic base of existing Canadian communities

Concept for an alternative processing project



- Replace conventional smelting with new hydrometallurgical processes
- Adapt metallurgical processes for the upgrading of recyclables
- Develop processes for treatment of impurity-rich concentrates
- Treat smelter dusts to remove impurities and reduce overall heavy metal emissions
- Improve the treatment and stabilization of toxic metals present in all concentrates

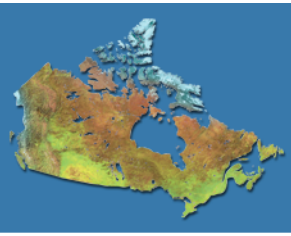
Research opportunities



With appropriate research, there is a potential to develop:

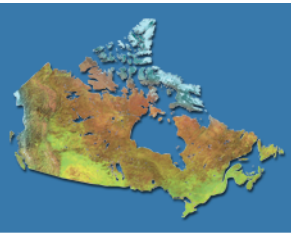
- Methods for metal recovery from Manitoba ores, and copper mattes from Quebec and Ontario, producing solid sulphur instead of SO_2 gas
- Technologies for Canada's four zinc smelters to better contain impurities, allowing greater treatment of secondary feeds
- Options for smelter dust processing to eliminate impurities, permitting greater treatment of low cost, impurity-rich concentrates

Research opportunities (cont)



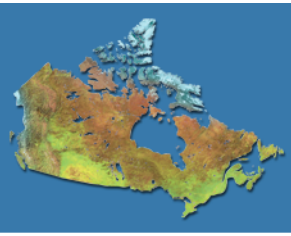
- Methods for disposal of leach residues and removal of sulphur for Voisey's Bay deposit, Newfoundland and Labrador
- Technologies to precipitate dissolved iron as hematite, and to maximize impurity removal in the precipitates

Expertise to carry out studies



- NRCan CANMET Mining and Mineral Sciences Laboratories in Ottawa has a base level of expertise to develop and manage the required research program
- NRCan has a demonstrated ability to coordinate with other research labs and partner with external institutions to build capacity and maximize efforts

Conclusions



- Smelters and refineries are important contributors to the Canadian economy and support a number of Canadian communities
- The continued viability of this industry is under threat
- New research is key to ensure the global competitiveness of the industry and will in turn help sustain the communities