

SAMANCOR MANGANESE

LIFE CYCLE ASSESSMENT CASE STUDY – SOUTH AFRICA



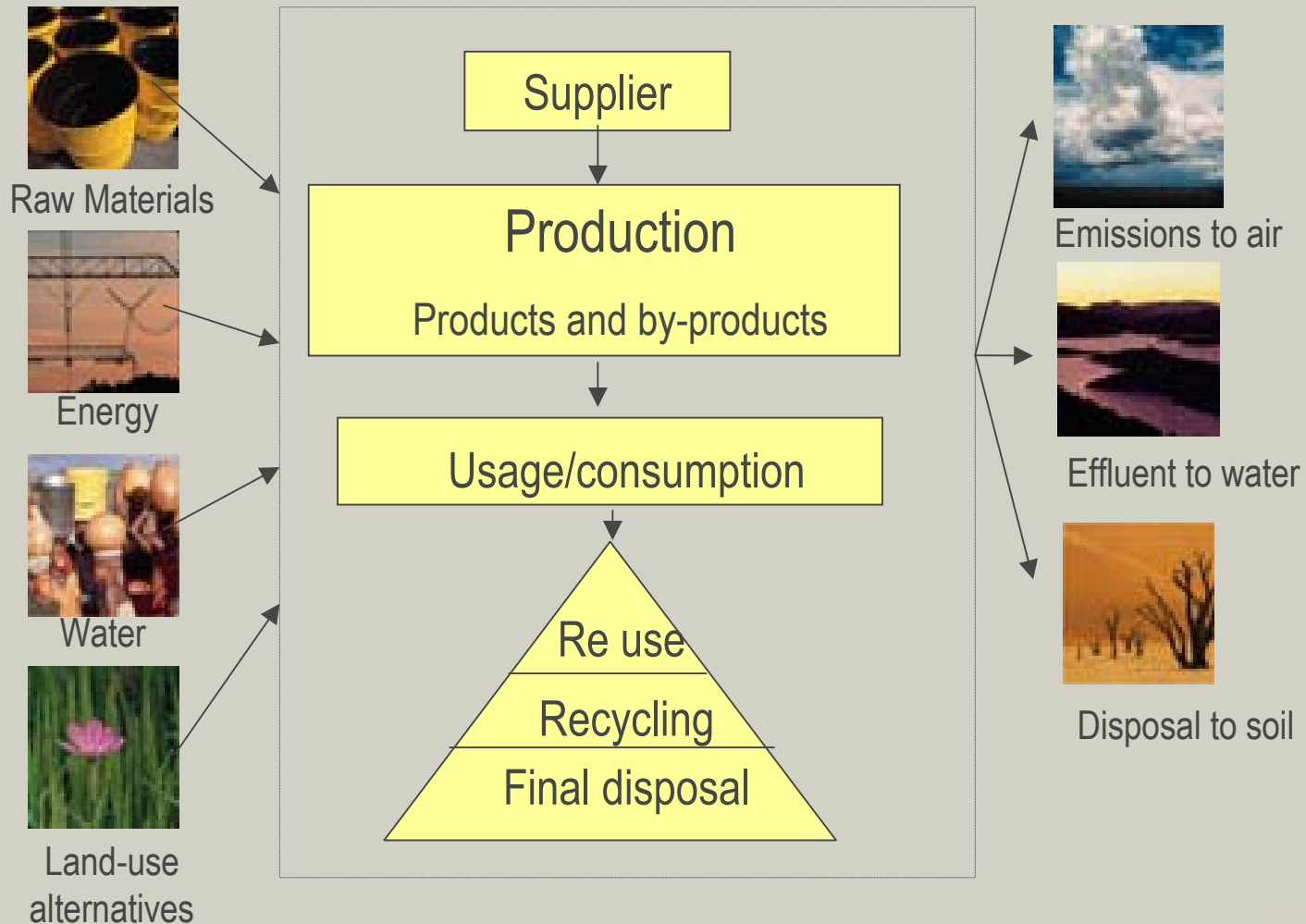
PRESENTATION STRUCTURE

Life Cycle Assessment Overview – General Principles

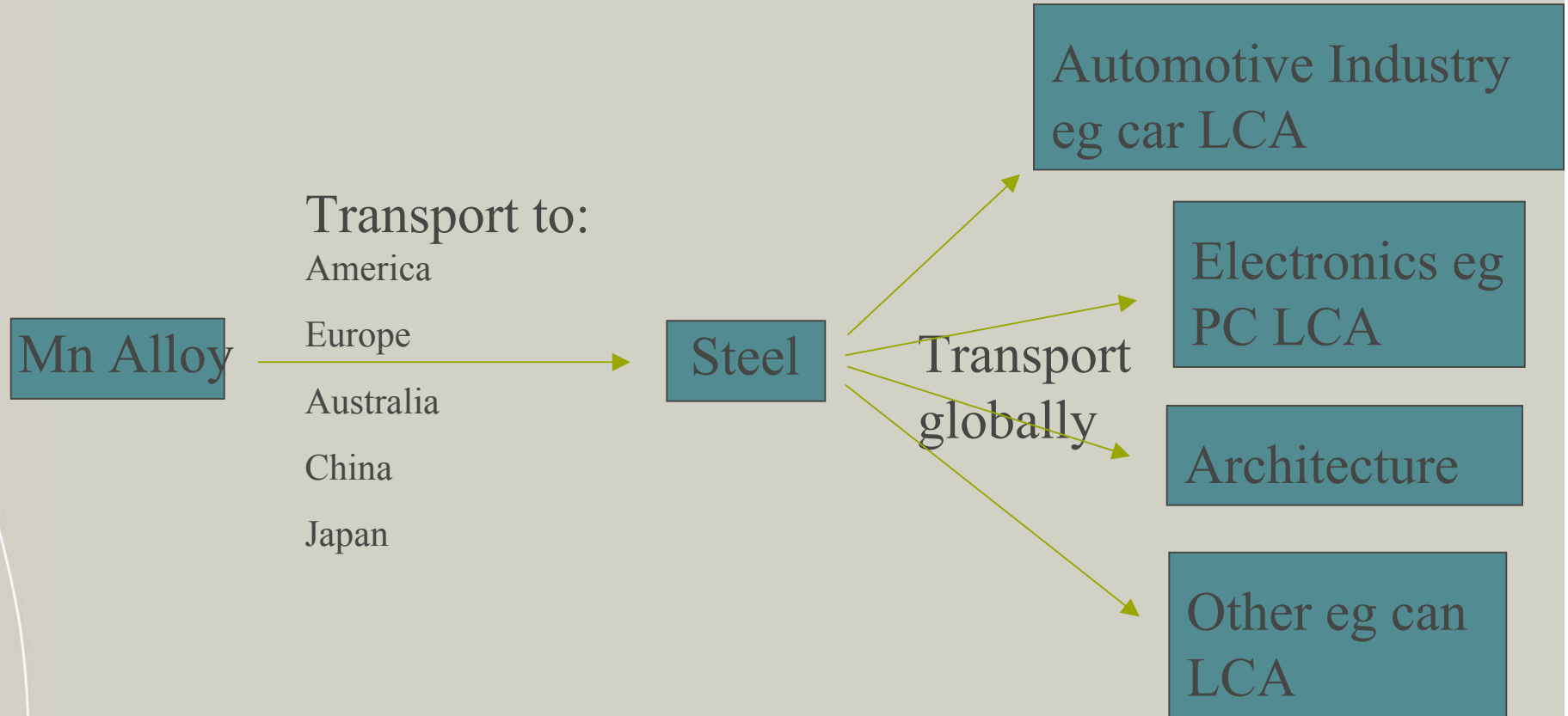
Approach and Result Discussions of a Case Study in South Africa

Summary and Conclusions

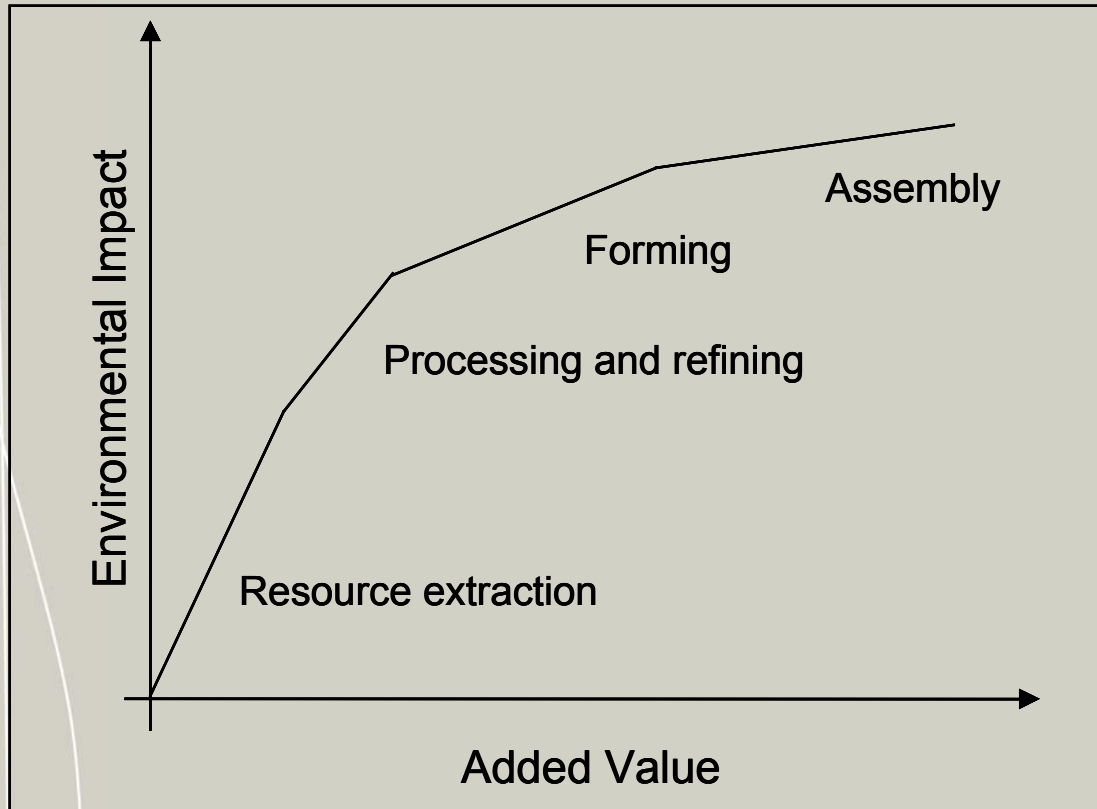
LIFE CYCLE ASSESSMENT OVERVIEW



CRADLE TO GRAVE CONCEPT



IMPACTS ALONG THE VALUE CHAIN



After Clift and Wright (2000)



INFORMATION GATHERING

- It is impossible and useless to record all the inputs of the process
- Decision rules restrict data collection to significant inputs
- The following three generic guidelines for inclusion of data:
 - All energy related inputs – incl electricity, steam, compressed air
 - 99.9% (w/w) of primary process stage inputs must be recorded.
 - The omitted inputs must not have a significant health, safety and environmental impact e.g. containing highly toxic compounds or high cost

DATA QUALITY

	High (h)	Medium (m)	Low (l)
Accuracy/precision (A)	Data that are derived from industry and compiled by LCA practitioners	Data from public databases	Data from non-LCA bibliographic references or featuring use of key assumptions due to the presence of data gaps.
Representativeness (R)	Recent (<5 years old) data with appropriate geographical/ technological scope.	Data of intermediate age (5-10 years old) based on an alternative geographical area/technology but which are applicable to this study.	Old data or representing a geographical/ technological coverage that is not relevant to this study
Consistency (C)	Study methodology consistently applied for each unit process comprising the system.	Study methodology applied consistently in key unit processes such that any variation in methodology not material.	Study methodology not applied consistently in the unit process with potential implications at the system level.
Reproducibility (P)	Data publicly available.	Some data confidential but only relating to minor parts of the process.	Data relating to significant parts of the process are confidential.

LIFE CYCLE ASSESSMENT CASE STUDY

SOUTH AFRICA

HOTAZEL MANGANESE MINES

&

METALLOYS



MOTIVATION

- Part of a Global Interest in Life Cycle Inventory Data in order to make informed decisions on products
- Internationally accredited body – Price Waterhouse Coopers
- Need for Environmental Information on Manganese
- 95 % of Manganese production used in desulphurization and strengthening of steel
- Timing of this study was synchronized with Steel Inventory Study
- 80 % of Known Economically mineable manganese ores are near Hotazel in the Northern Cape, SA
- Ore is exported from Samancor's Hotazel Manganese Mines and it's sold to Samancor's Metalloys alloy plant

BACKGROUND INFORMATION

- Hotazel Manganese Mines

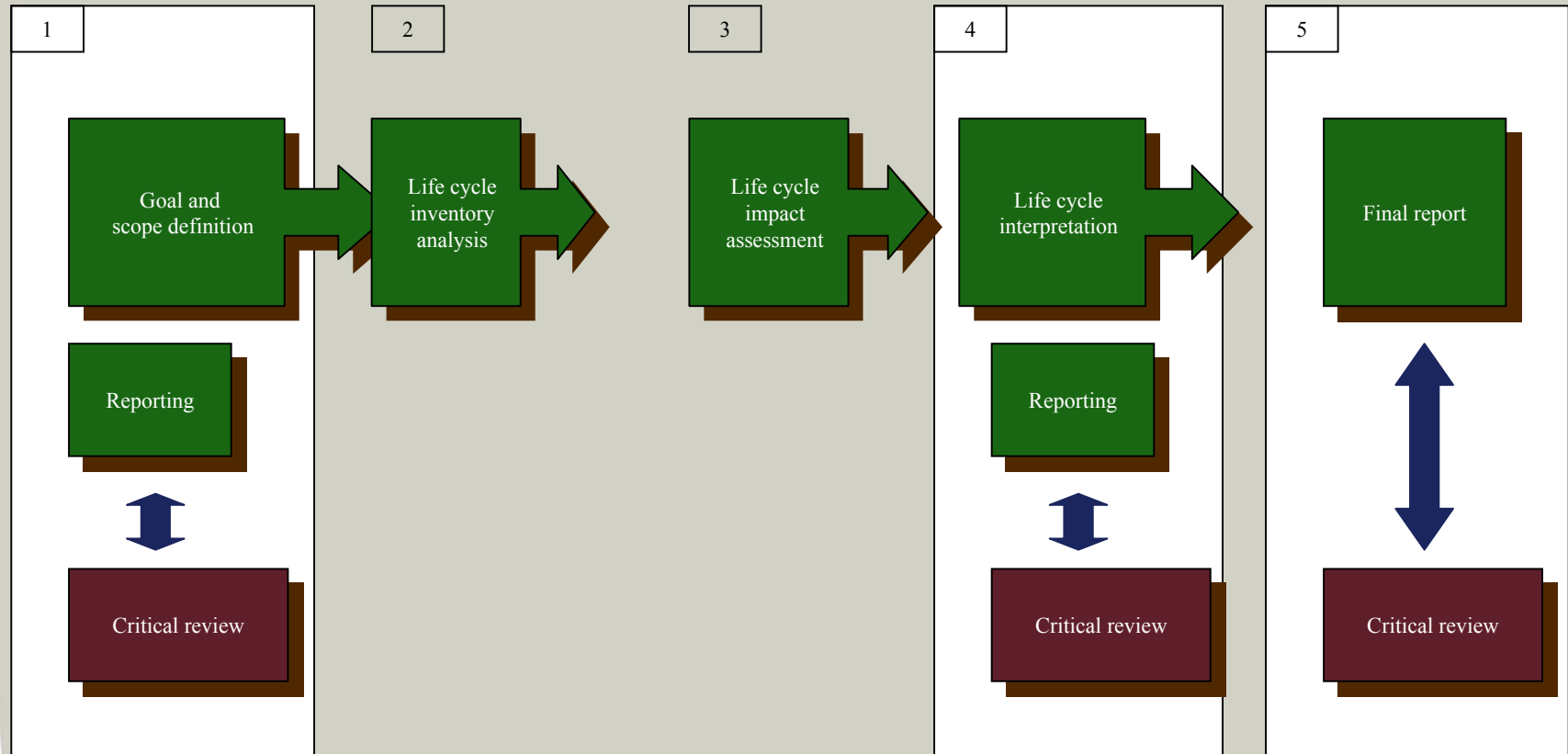
- Opencast and Underground mining sections
- Maximum depth of mining is 300m below surface
- ± 1.5 Mt saleable ore production per annum
- Some $\pm 21\ 000$ hectares in size
- Employs ± 600 (own) and ± 600 (contractors) people

- Metalloys

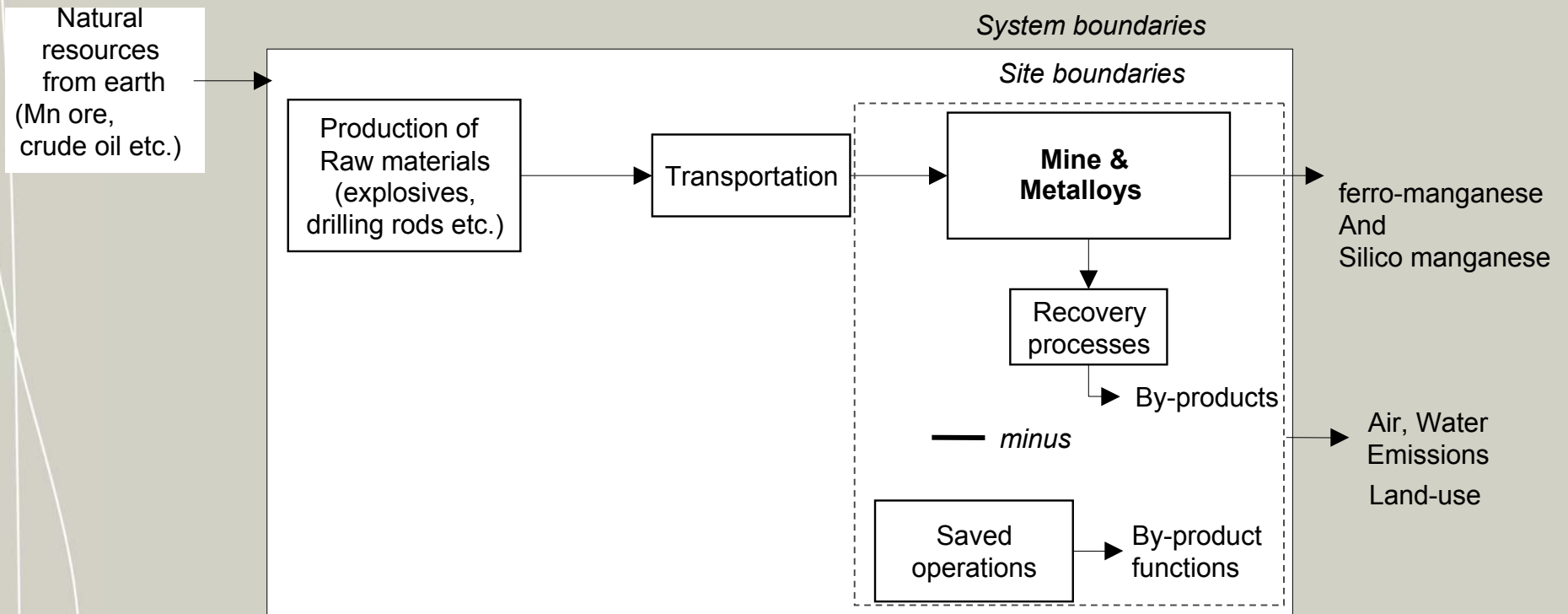
- Three submerged electric arc furnaces – amongst largest in the world
- Ferromanganese (FeMn) and Silicomanganese (SiMn)
- $\pm 500\ 000$ t saleable alloy production per annum
- Some 450 hectares in size
- Employs ± 400 (own) and ± 800 (contractors) people



METHODOLOGY

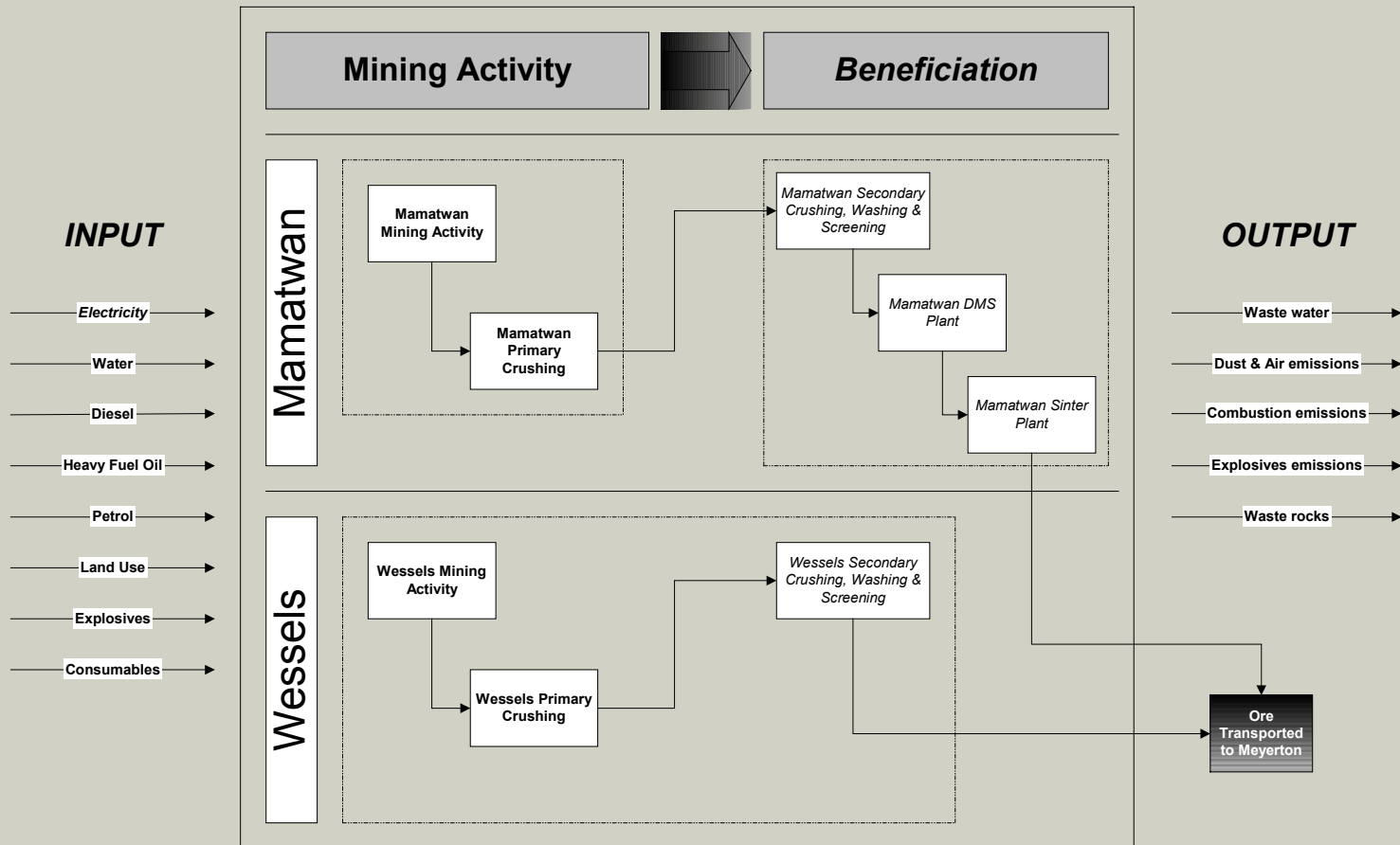


LCA SCOPE AND BOUNDARY DEFINITION



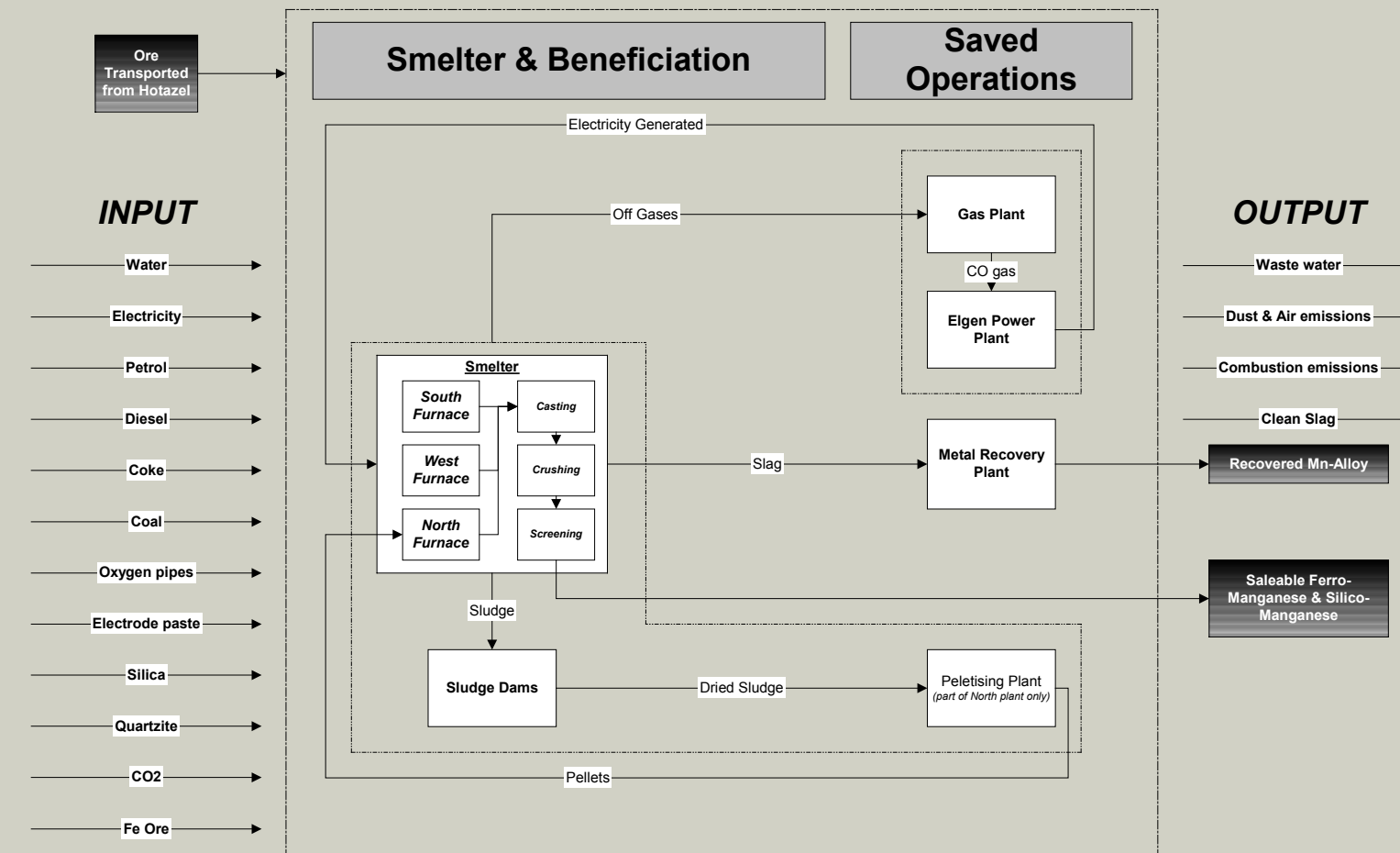
DETAILED PROCESS FLOW - MINE

Hotazel Manganese Mining (HMM)



DETAILED PROCESS FLOW - SMELTER

Metalloys Meyerton Smelter (MMS)



DATA GATHERING CRITERIA

- Functional units as 1kg of saleable FeMn and SiMn product
- Inclusions and exclusion based on mass and data quality
- Exclusions :
 - Human environmental inflows and outflows
 - Capital items
- Selection of impact categories benchmarked (SINTEF) against other studies and relevance to the region

DATA GATHERING - MODULES

- The whole process have been broken down into independent units or « modules ».
- Basically, for each module, the questionnaires ask for all the flows that go in (inputs) and all the flows which go out (outputs).
- A module inventory is made up of a quantified list of inputs and outputs.
- A module corresponds either to a process element, unit, stage or to a utility.

QUESTIONNAIRE MANAGEMENT

Button « Questionnaires »

Dialog Box « List of questionnaires »

Microsoft Excel - Ques..._Model manganese.xls

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Arial

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Princeton University and BHP Billiton Manganese LCI Database for Ferromanganese and silicomanganese

Site Name:	Meyerton Works
Date of the Information:	2001 - 2002

Check the information above and

Questionnaires

Warning: Before filling out the questionnaire, please read the manual.

List of Questionnaires

- Introduction
- (1) Mining and Beneficiation
- (2) Smelting
- Effluents
- Energy
- Transportation
- Flows (Fe, C, Mn Content)

Reach

Cancel

Introduction (1) Mining and Beneficiation (2) Smelting Effluents Energy Transportation

DATA BASE MANAGEMENT

Upper Left Pane

Upper Right Pane

Microsoft Excel - Quest_Model manganese.xls

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Main Material Input - (1) Mining and Beneficiation		Unit	Quantity / year	Quantity / ton product	Data quality			C content kg/ton	Fe content kg/ton	Mn content kg/ton
Flow Name					S	T	Y			
Excavated Rock		t								
Glycol		t								
FeSl		t						14	800	5
Rods and Balls (for beneficiation)		t								
Flocculating Agent (unspecified)		t								
Phosphoric Acid (H3PO4)		t								
Explosives		t								
Drilling Rods		t								
Salt		t								
Grease (from external supply)		t								
Grease (internal recovery)		t								
Hydraulic Oil (from external supply)		t								
Hydraulic Oil (internal recovery)		t								
Water: Public Network Supply		m3								
Water: Industrial Network Supply		m3								
Water: Sea		m3								
Water: Underground		m3								
Water: Lake		m3								
Water: River		m3								
Water: Distilled		m3								
Water: De-ionized		m3								
Water: Unspecified Origin		m3								
Water Used (total)		m3	0							
<i>Other significant material input, if any:</i>										

Ready

Lower left pane

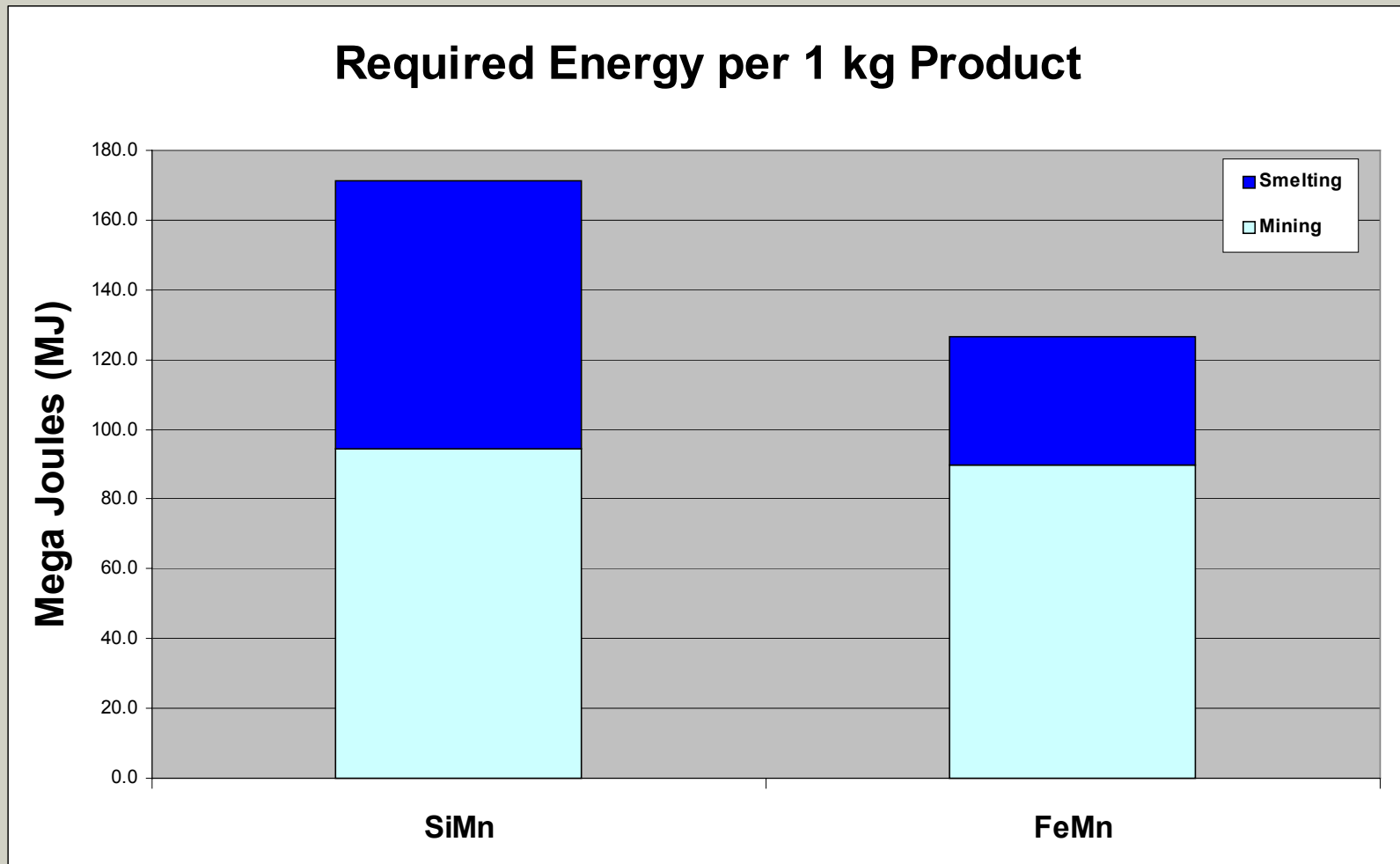
Lower Right Pane



DATA QUALITY

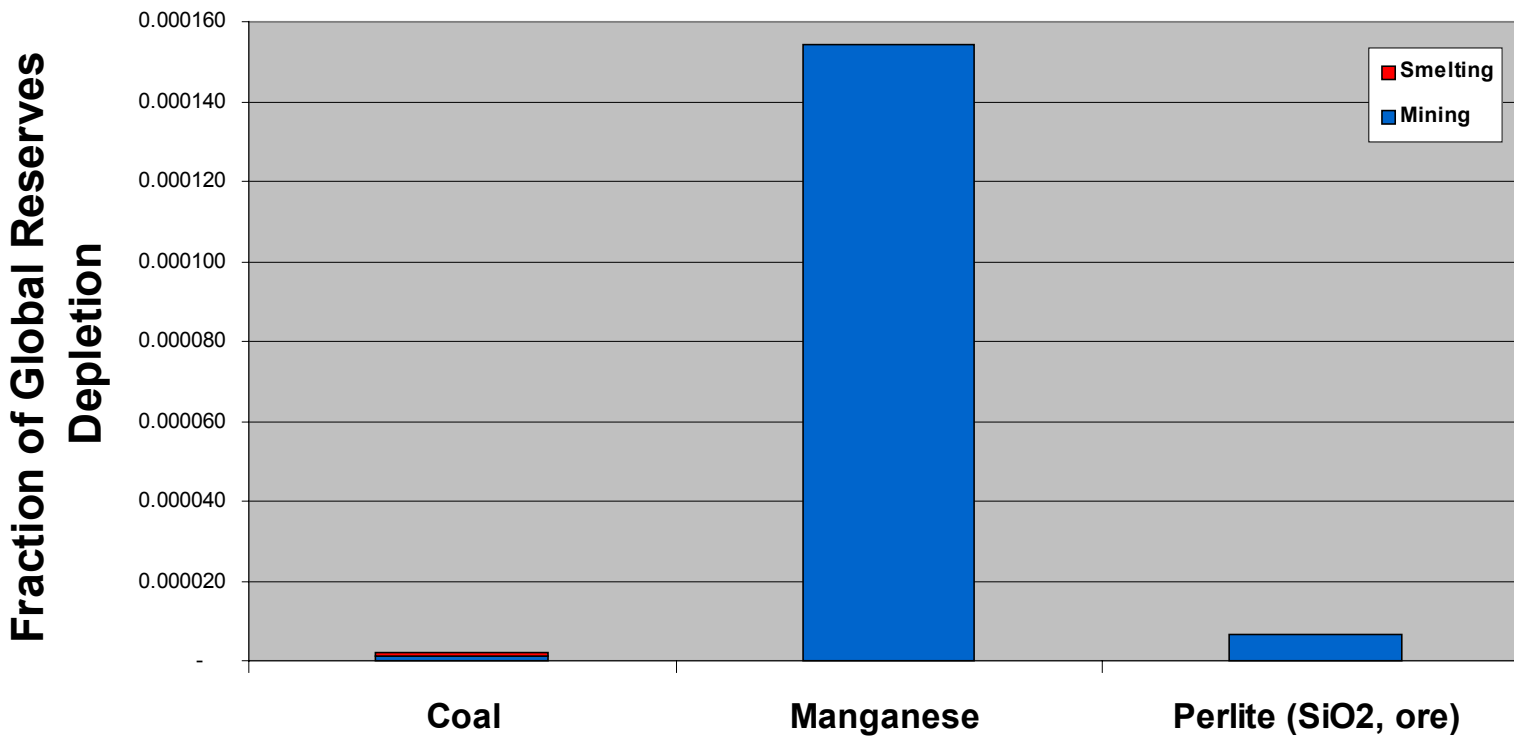
- Conformance to ISO 14040 standard
- Classified between Medium and High Quality
- Verification by local stakeholders and International experts
- Data gaps were filled by comparing it with – South African industry estimates and standard life cycle assessment modules (European academic origin)

ENERGY CONSUMPTION

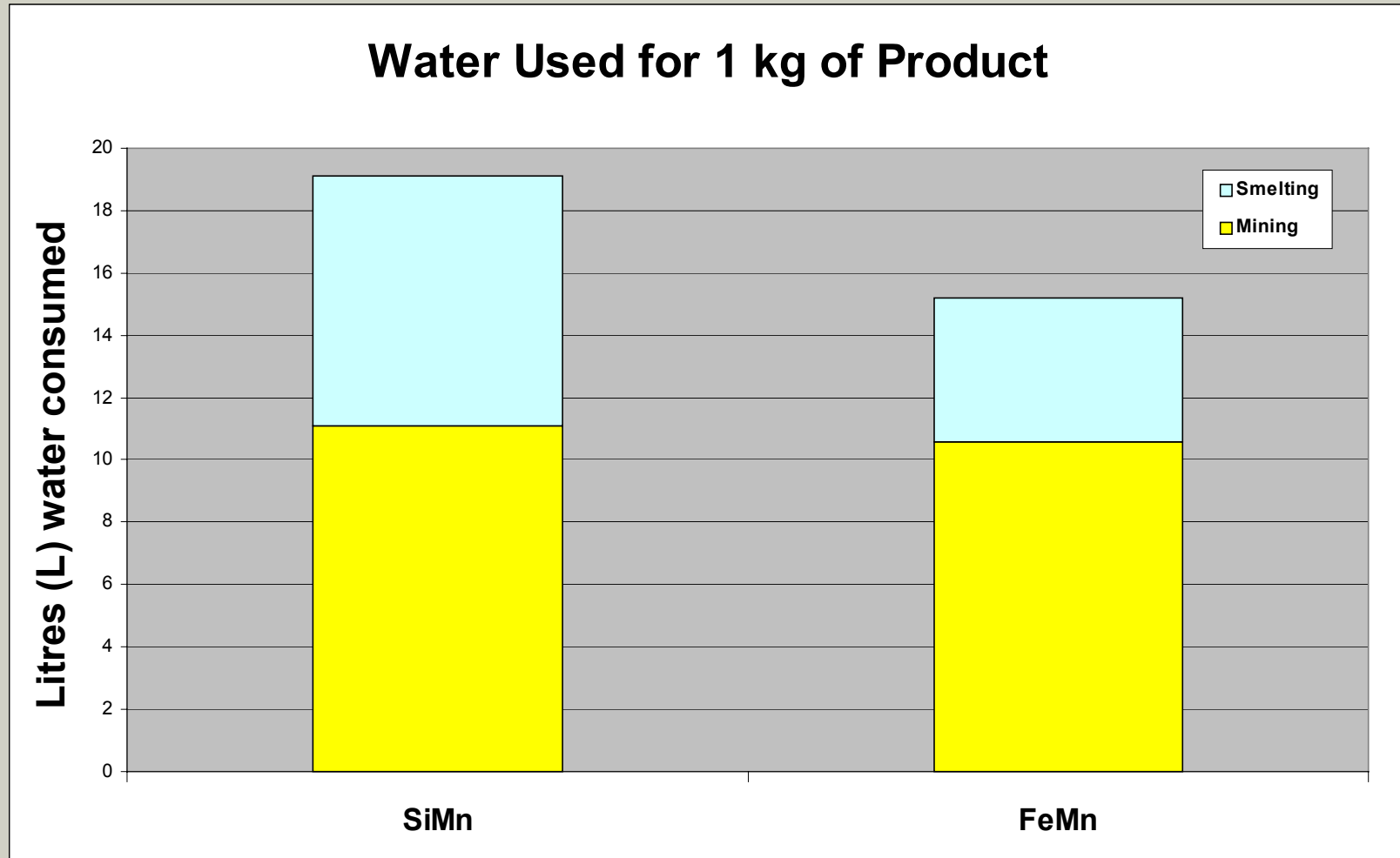


NATURAL RESOURCE DEPLETION

Depletion of Non-renewable Resources for Production of 1kg of FeMn

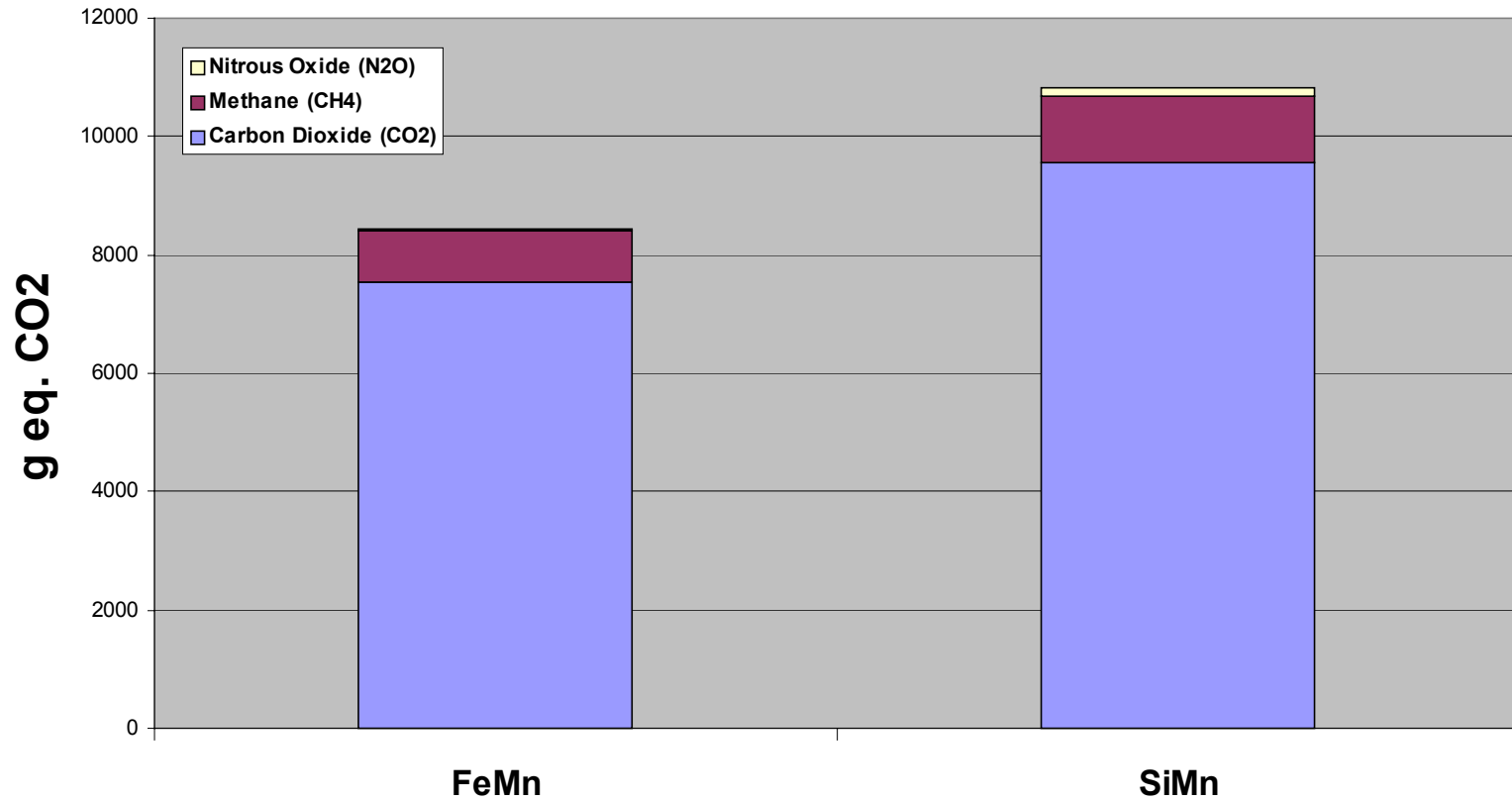


WATER CONSUMPTION

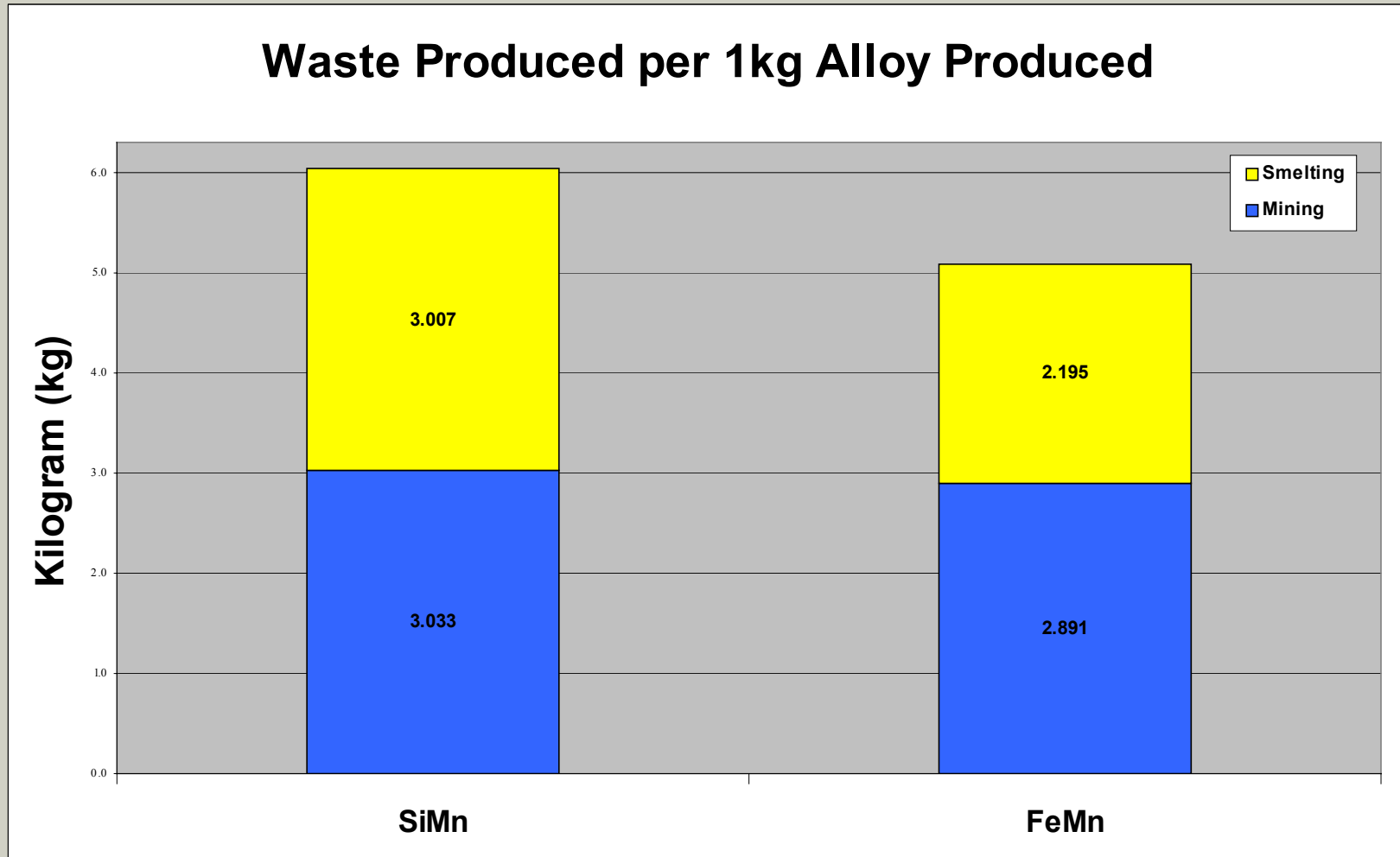


GHG's PRODUCED

Greenhouse Effect for Production of 1kg Product



WASTE RESULTS



LEARNING POINTS

- More initial focus on LCA methodology on Management as well as Operational level
- Allow sufficient time for data gathering process
- Data validation and verification at source level
- Site data format

CONCLUSIONS - GENERAL

- LCA is the dominant analytical tool for product focused assessments
- LCA presents an global impact profile along the supply chain of products.
- Over time environmental progress can be demonstrated



THE END

THANK YOU FOR LISTENING

