



Raw Material Supply

**SMART Decision making for
Technology Selection and
Infrastructure Development
supporting Decarbonization of
the Steel Supply-chain**

Introduction

- ♦ **For this topical area there are a number of areas of interest, including Iron Ore Extraction and Processing, Scrap Metal Collection and Processing, Raw Materials Transportation, and Raw Material Feedstock Integration (including blending).**
- ♦ **Given the focus of Session 4, in my presentation I will in turn focus on SMART criteria for decision making supporting Primary Technology Options and associated Infrastructure Development for Transportation.**
- ♦ “Using SMART criteria for decision-making begins with identifying your goal or problem (or risk). Ask yourself if it is specific, measurable, achievable, relevant, and time-bound. Be sure to use concrete and precise language to describe what you want to accomplish and how you will do it.” (LinkedIn)



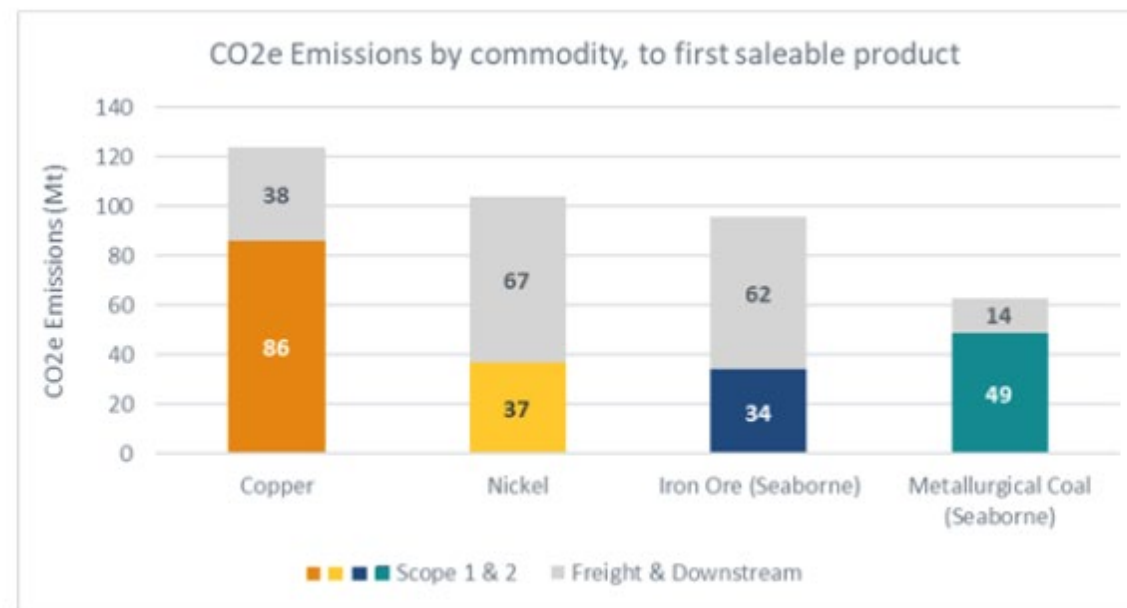
Introduction

- ◆ **We operate in a world where Global Participants have a drive and focus on Climate Change and associated Decarbonization Efforts.**
- ◆ **Recent contracts within the European Union for Green Hydrogen derived Steel have demonstrated both a Market Preference as well as a Premium (~20%) for a Decarbonized Option.**
- ◆ **Within the Raw Material Supply-Chain there are a number of decisions that will need to be made and infrastructure developed as an enabler to support Decarbonization.**



Introduction

- ◆ **A study of Raw Material Supply to the Steel Industry indicated that nearly two-thirds of the Carbon Footprint was associated with the Freight and Downstream (Transportation) components of the Supply-Chain.**



Source: Scarn Associates

<https://www.mining.com/carbon-emission-curves-for-iron-ore-copper-met-coal-and-nickel/>



Introduction

- ◆ **In the Transportation Sector, six primary technology paths have emerged as front runners for Decarbonizing this facet of Raw Material Supply - namely PEV/BEV, PHEV/HEV, FCEV, Hydrogen ICE, Ammonia ICE and LNG/CNG ICE.**
- ◆ **All of these options require equipment selection and refueling/recharging infrastructure development to support.**
- ◆ **So how do we choose which option(s) will support our facilities and operations best? This is neither a simple nor easy decision to make given the transition period we are currently in.**



Introduction

- ♦ **For Major Raw Material Supply Projects such as FERAAL in Algeria the base infrastructure, including highways, railways and ports will thankfully be the same irrespective of the energy source driving the vehicles, locomotives and vessels.**
- ♦ **Let us examine the transportation equipment energy source options and infrastructure considerations...**



Raw Material Supply

- ◆ **Iron Ore Mining (Loading/Hauling)**
- ◆ **Iron Ore Processing (Material Handling)**
- ◆ **Iron Ore Processing (Process Energy)**
- ◆ **Iron Ore Pellet Transportation (Loading/Hauling/Shipping)**
- ◆ **Scrap Steel Extraction (Loading/Hauling)**
- ◆ **Scrap Steel Processing (Material Handling)**
- ◆ **Scrap Steel Processing (Process Energy)**
- ◆ **Scrap Steel Transportation (Loading/Hauling/Shipping)**



Transportation Focus

- ◆ **Road Transportation**
- ◆ **Infrastructure**
- ◆ **Rail Transportation**
- ◆ **Infrastructure**
- ◆ **Ocean Transportation**
- ◆ **Infrastructure**



Road Transportation

- ◆ **Plug-in Electric Vehicles (PEV/BEV)**
- ◆ **Plug-in Hybrid Electric Vehicles (PHEV/HEV)**
- ◆ **Fuel Cell Electric Vehicles (FCEV)**
- ◆ **Hydrogen Internal Combustion Engines (H-ICE)**
- ◆ **Ammonia Internal Combustion Engines (A-ICE)**
- ◆ **LNG/CNG Internal Combustion Engines (NG-ICE)**



Road Transportation

- ♦ **PEV/BEV Suppliers – Tesla, Volvo, Freightliner, MAN, ...**
- ♦ **PHEV/HEV Suppliers – Scania, Hino, Mitsubishi, Volvo, MAN, ...**
- ♦ **FCEV Suppliers – Nikola, Iveco, Hyundai, Hino, Toyota, ...**
- ♦ **H-ICE Suppliers – Toyota, ...**
- ♦ **A-ICE Suppliers – Amogy, ...**
- ♦ **NG-ICE Suppliers – Peterbuilt, Kenworth, Freightliner, Iveco, ...**



Infrastructure

- ♦ **Diesel Fueling/Bunkering (Predominant Technology)**
- ♦ **Natural Gas Fueling/Bunkering (In-Process Technology)**
- ♦ <https://www.fortisbc.com/est/truck-fleets>
- ♦ **Electric Vehicle Recharging/Bunkering (In-Process Technology)**
- ♦ **Fuel Cell Fueling (Pending Technology)**
- ♦ **Hydrogen Fueling (Pending Technology)**
- ♦ **Ammonia Fueling (Pending Technology)**



Rail Transportation

- ◆ **NG-ICE Suppliers – TBD**



Infrastructure

- ♦ **Diesel Fueling/Bunkering (Predominant Technology)**
- ♦ **Natural Gas Fueling/Bunkering (In-Process Technology)**
- ♦ <https://www.fortisbc.com/est/locomotives>
- ♦ **Electric Vehicle Recharging/Bunkering (In-Process Technology)**
- ♦ **Fuel Cell Fueling (Pending Technology)**
- ♦ **Hydrogen Fueling (Pending Technology)**
- ♦ **Ammonia Fueling (Pending Technology)**



Ocean Transportation

- ◆ **NG-ICE Suppliers – TBD**



Infrastructure

- ♦ **Diesel Fueling/Bunkering (Predominant Technology)**
- ♦ **Natural Gas Fueling/Bunkering (In-Process Technology)**
- ♦ <https://www.fortisbc.com/est/marine>
- ♦ **Electric Vehicle Recharging/Bunkering (In-Process Technology)**
- ♦ **Fuel Cell Fueling (Pending Technology)**
- ♦ **Hydrogen Fueling (Pending Technology)**
- ♦ **Ammonia Fueling (Pending Technology)**



Q&A



Stolo Technical Advisors (STA)

- **35+ Mines Supported Globally {BHP, Rio Tinto, Anglo, DeBeers, Teck}**
- **15+ Steel Mills and Foundries Supported Globally**
- **500+ Operations Reviewed and Advised in 43 Countries**

- **Heavy Industrial Project Implementation Expertise (40+ Years)**
- **Enterprise Risk Management Expertise (30+ Years)**
- **Technical and Engineering Expertise [Civil, Chemical, Environmental, Mining and Mineral Processing, Marine, Industrial] (20+ Years)**
- **Corporate Governance and Advisement [ESG/Decarbonization] (20+ Years)**



Thank you



Stolo Technical Advisors

Sheikh / Si:yám / Head-of-Family
Terence C. Wells
 MBA, MEng, BBA, BSc, ACom, ASc

6179 HWY 3, PO Box 80,
 Hedley, BC, Canada

+1-250-809-1747
**Stolo.Technical.Advisors@
 gmail.com**

Corporate Governance

**Enterprise Risk Management
(ERM)**

Operational Excellence

**Environment, Social, and Governance
(ESG)**

**Technology Assessment and
Decarbonization**

حوكمة الشركات

إدارة المخاطر المؤسسية

التميز التشغيلي

البيئة والاجتماعية والحوكمة

تقييم التكنولوجيا وإزالة الكربون

