



Center for
Clean Air Policy

CO₂ Emissions Mitigation Opportunities in Mexico's Iron and Steel Sector

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“Proof of Concept” Study: Overview

- EU DG Enterprise: “Proof of Concept” of Sectoral Approaches
 - » Lead Partner: Center for Clean Air Policy – Europe
 - » Other Partners: CEPS, Climate Change Capital, IDDRI, ZEW
- Actions necessary for sectoral approaches to become a tool in the mitigation of GHG emissions and necessary links to the world carbon markets
- Encouraging contributions from developing countries
 - » Focus on major emitting sectors
 - » Efficiency and intensity improvements
 - » Incentives: technological and financial assistance; other?
 - » Ensure sustainable development
- All feeding into the Bali Roadmap, Poznan 2008, and

Focus of Efforts

- Four sectors
 - » Iron & Steel
 - » Aluminum
 - » Cement
 - » Electric Power
- Three countries: China, Brazil, Mexico
- Three primary sectoral approaches
 - » Transnational Sectoral Approach
 - » Sectoral Bottom-up Approach
 - » Sectoral Carbon Finance Approach
- Quantitative analysis
 - » Baseline forecasts
 - » Mitigation cost curves
 - » Technology benchmarks
 - » Financial analysis
 - » Int'l trade & competitiveness analysis

Overall Purpose of Analysis

Assessment of:

- mitigation opportunities in the iron and steel industry
- implementation barriers
- possible methods to realizing the opportunities

Analytical Steps

- BAU Steel Production (by route and sub-process)
 - » **BF-BOF** (Ore, Sinter, Pellets; Coke; Blast Furnace; Basic Oxygen Furnace)
 - » **DRI-EAF** (Ore, Pellets; Direct Reduced Iron (gas), Electric Arc Furnace)
 - » **Scrap-EAF** (Scrap; Electric Arc Furnace)
- BAU CO₂ Emissions (by route and sub-process)
- Mitigation Options (by route and sub-process)
 - » Emissions reduction potential
 - » Implementation costs and benefits
- Barriers to implementation of mitigation options
- Develop preliminary assessment of mitigation opportunities and targets
 - » Unilateral efforts
 - » Conditional no-lose goal and needed assistance
 - » Sectoral credit baselines

BAU Steel Production

- 4.8% Annual Growth in Steel Production 2006-2020
 - » 1.0% - **BF-BOF** (Ore, Sinter, Pellets; Coke; Blast Furnace; Basic Oxygen Furnace)
 - » 6.6% - **DRI-EAF** (Ore, Pellets; Direct Reduced Iron (gas), Electric Arc Furnace)
 - » 4.9% - **Scrap-EAF** (Scrap; Electric Arc Furnace)

	2006	2020	Increment 2006-2020
Total	16.4 Mt	32.0 Mt	15.6 Mt
Shares			
BF-BOF	26%	15%	4%
DRI-EAF	32%	42%	52%
Scrap-EAF	42%	43%	44%

- Constant sub-process materials mix and efficiency ratios within routes

BAU CO₂ Emissions

- Sub-process CO₂ emissions intensity factors
 - » Global values from IPCC
 - may not accurately reflect Mexico's current and future performance
 - » Static over time
 - does not accurately reflect likely efficiency gains
 - » Only to the Liquid Steel stage – no casting, rolling, processing

Emissions Intensity (tCO₂ / tSteel)

	Direct	Indirect	Total
BF-BOF	1.65	0.07	1.72
DRI-EAF	0.92	0.34	1.26
Scrap-EAF	0.08	0.25	0.33
Total 2006	0.75	0.23	0.99
Total 2020	0.67	0.26	0.93

BAU CO₂ Emissions

Emissions (MtCO₂)

	Direct	Indirect	Total
BF-BOF	6.9	0.3	7.2
DRI-EAF	4.9	1.8	6.7
Scrap-EAF	0.6	1.7	2.3
Total 2006	12.4	3.8	16.2
BF-BOF	8.0	0.3	8.3
DRI-EAF	12.3	4.6	16.9
Scrap-EAF	1.1	3.4	4.5
Total 2020	21.4	8.3	29.7



- **Biggest absolute increases from DRI-EAF route**

BAU Energy Use & Emissions

- Mexico Iron and Steel – (for corroboration)

	Coal	N Gas	Oil	Electricity	Total
2006 Total					
Energy units	2240 kt	143520 TJ	296 kt	8058 GWh	
Energy PJ	53.6	129.1	11.1	29.0	222.8
Emissions MtCO ₂	5.58	7.22	0.86	4.23	18.97*
2006 Intensity					
Energy units/tSteel	0.14 t/tSteel	8.72 MJ/tSteel	0.02 t/tSteel	489.95 kWh/tSteel	
Energy (GJ/tSteel)	3.26	7.85	0.67	1.76	13.54
Emissions (tCO ₂ /tSteel)	0.34	0.44	0.05	0.26	1.15*

Source: IEA Statistics

*includes estimate of process emissions

Mitigation Options

- To be developed subsequently

Barriers to implementation of mitigation options

- Capital costs and capital availability
- Availability of scrap
- Maximum amount of scrap (minimum amount of ore-based input) to maintain steel product quality
- Availability of coal for pulverized coal injection
- Informational barriers for smaller producers
- *Urgent need for more thorough expert review*

Conclusions 1

- Our data is not yet of sufficient quality to develop specific mitigation opportunities and their associated quantitative CO₂ emissions intensity targets
- There exist analytical issues requiring additional data, review and analysis

Conclusions 2

Assessment of:

- mitigation opportunities in the iron and steel industry
- implementation barriers
- possible methods to realizing the opportunities

Requires 6 part framework

- 3 part “Process Route” dimension
 - BF-BOF, DRI-EAF and Scrap-EAF
- 2 part “Timeframe” dimension -- Current capacity and future expansion capacity

Analytical Issues requiring Additional Data, Review and Analysis

- **BAU Steel production outlook**
 - » Overall growth rate?
 - » Structural shift?
 - Stable share of Scrap-EAF
 - Major shift from BF-BOF to DRI-EAF
- **BAU CO₂ Emission calculations**
 - » Mexico-specific sub-process CO₂ emissions and electricity intensity factors?
 - e.g., tCO₂/tPig Iron; tCO₂/tDRI; tCO₂/tPellets; tCO₂/tCoke
 - e.g., kWh/tEAFsteel from scrap; kWh/tEAFsteel from DRI

Analytical Issues requiring Additional Data, Review and Analysis

- **Mitigation options**
 - » Appropriate choices?
 - » Applicability rates?
 - » Effectiveness rates?
 - » Costs?

- **Barriers to implementation of mitigation options**
 - » Precisions and clarifications?
 - » Omissions?



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We look forward to working together
closely with the Mexican iron and
steel sector in this analysis

Thank you
for your attention!

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