The Impact of LCFS on Oil Sands Development: Hybrid LCA Methods

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Introduction

- Oil sands production is increasing rapidly and this development will have impacts on the economies, environments and politics of Alberta, Canada and beyond.
- The capital and energy intensity of oil sands operations requires a consideration of *all* upstream impacts.
- Canadian Oil Sands serve as a case study for unconventional sources of petroleum.

LCFS

- Reduce carbon intensity of fuel use by 10% by 2020
  - A declining standard
  - Unit of measure: “g of $CO_{2\ eq}$ per MJ of transportation fuel”
  - “full” life cycle
- Compliance flexibility
  - Sell fuel with lower carbon intensity
  - Use banked credits
  - Buy credits
- A challenge for oil sands development

Life Cycle Assessment of Oil Sands Technologies Kickoff Meeting: November 3rd, 2006

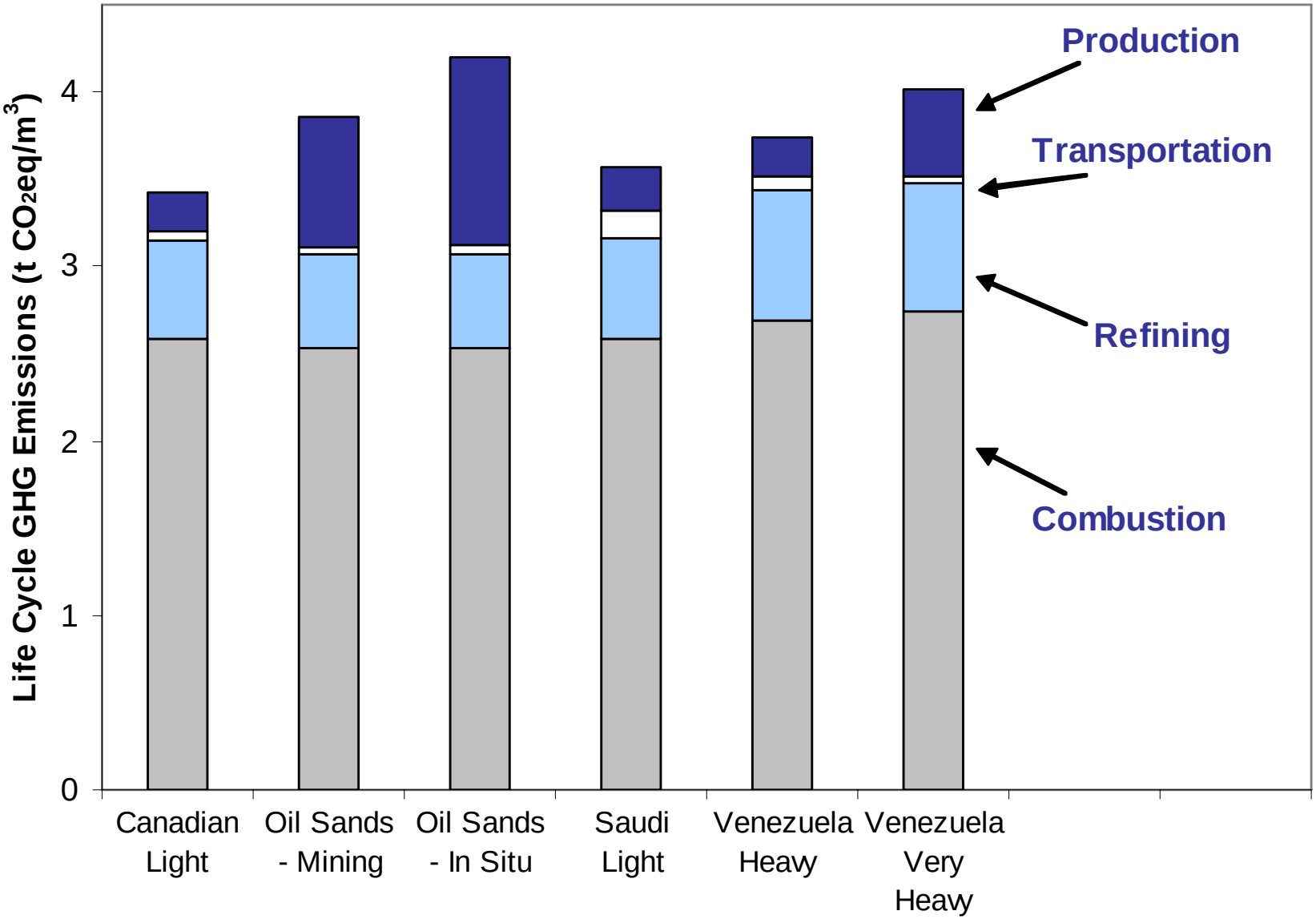
- 13 Industry
- 7 Government
- 11 Academic
- 9 Other (NGOs, Research Institutes etc.)

- Objective: Feedback
  - Applications – are we asking the correct questions of interest to the industry and policy makers?
  - Methods – are we employing the best tools to answer these questions?
  - Data

Previous LCA of Oil Sands

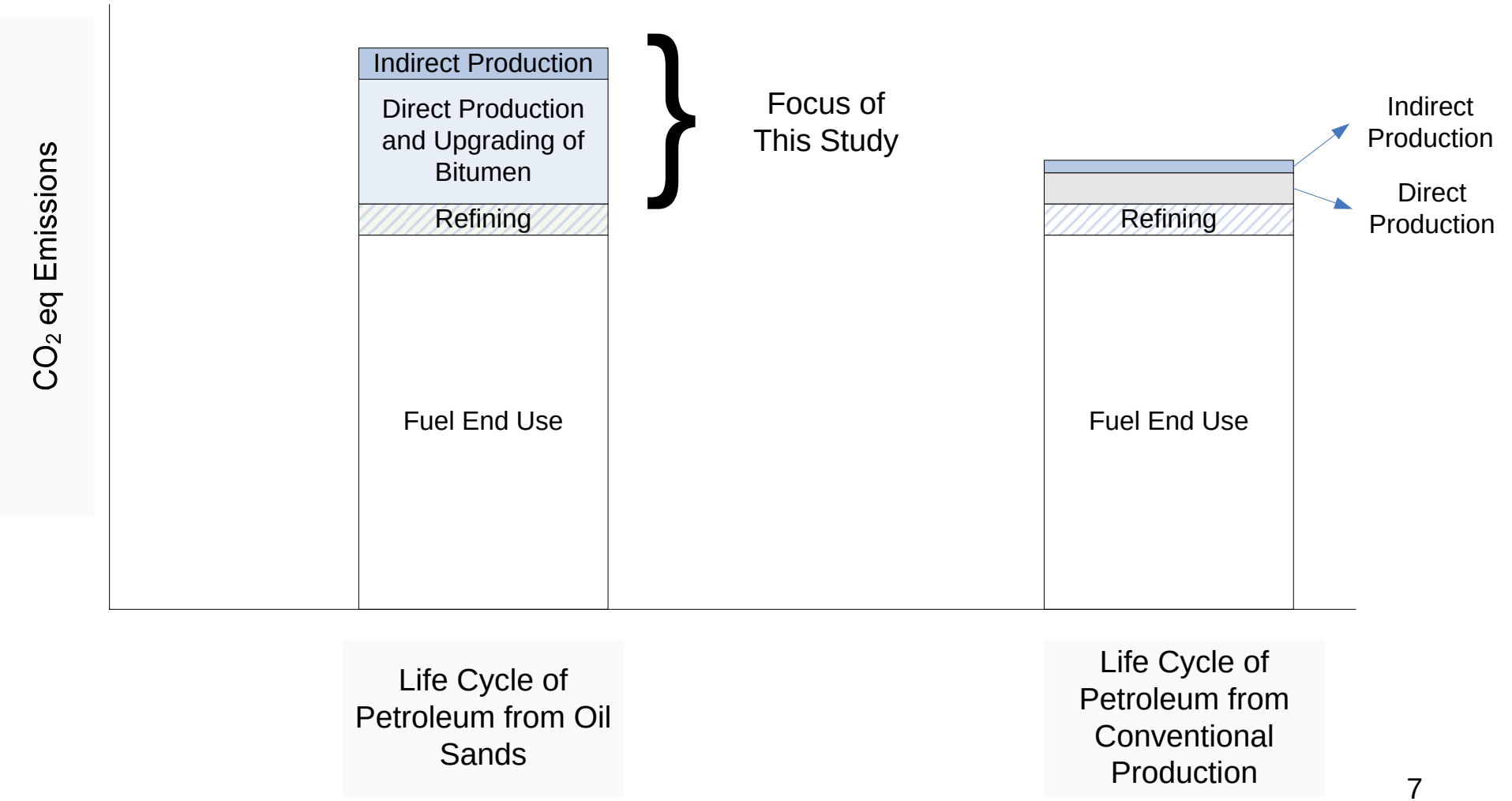
- McCann, 1999
  - Comparison of other liquid fuels (Saudi and N.A. light, Ven. etc.)
- Furmisky, 2003; Suncor,2005; Syncrude, 2005; Flint, 2005
- LCA Models - GREET, GHGenius etc.

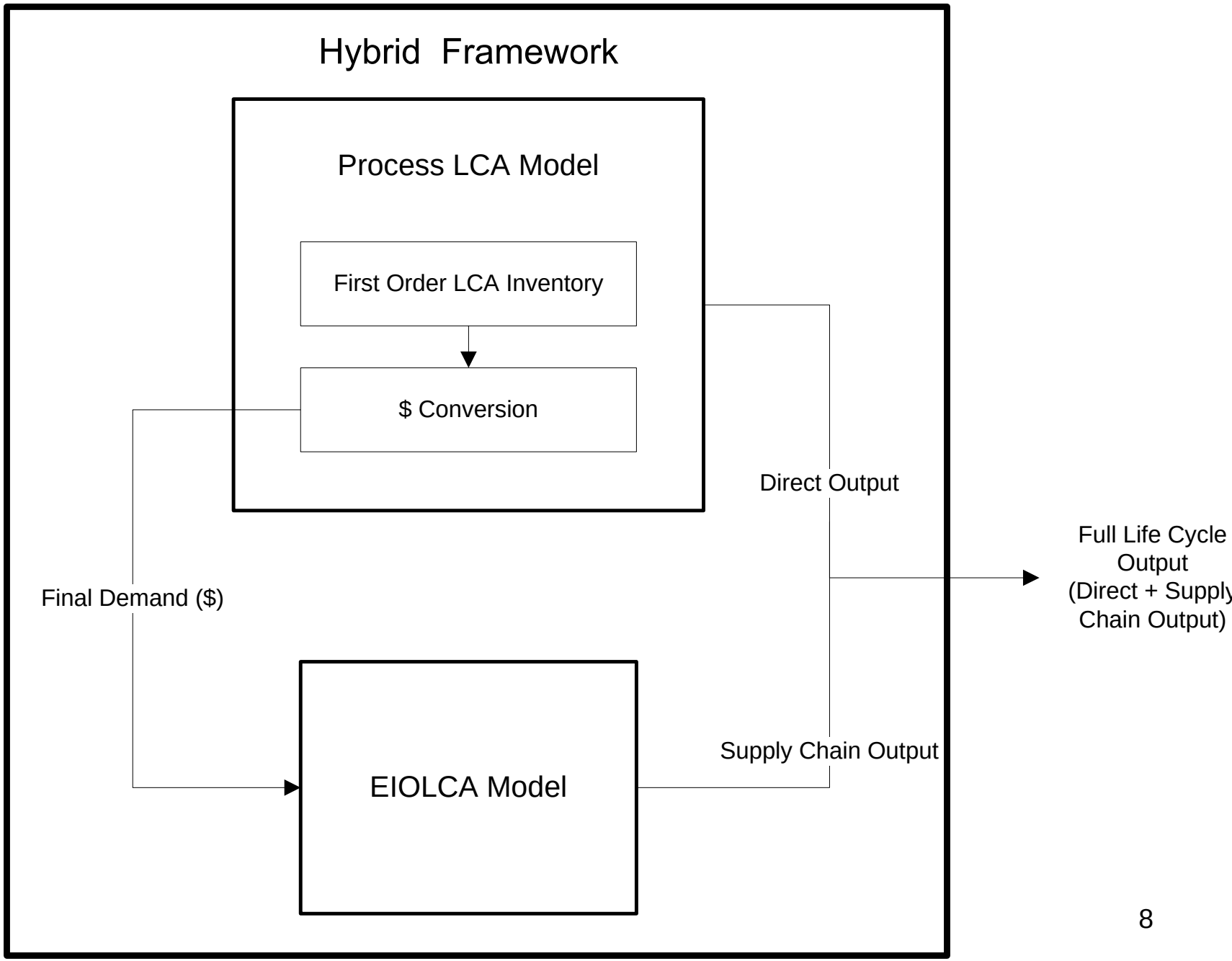
Results of Previous LCA Studies



Output is per m^3 of transport fuel used in central NA

Life Cycle CO_2 Emissions for Oil Sands and Conventional Oil Production




Hybrid Framework
Process LCA Model
First Order LCA Inventory
$ Conversion
Direct Output
Full Life Cycle Output (Direct + Supply Chain Output)
Final Demand ($)
EIOLCA Model
Supply Chain Output

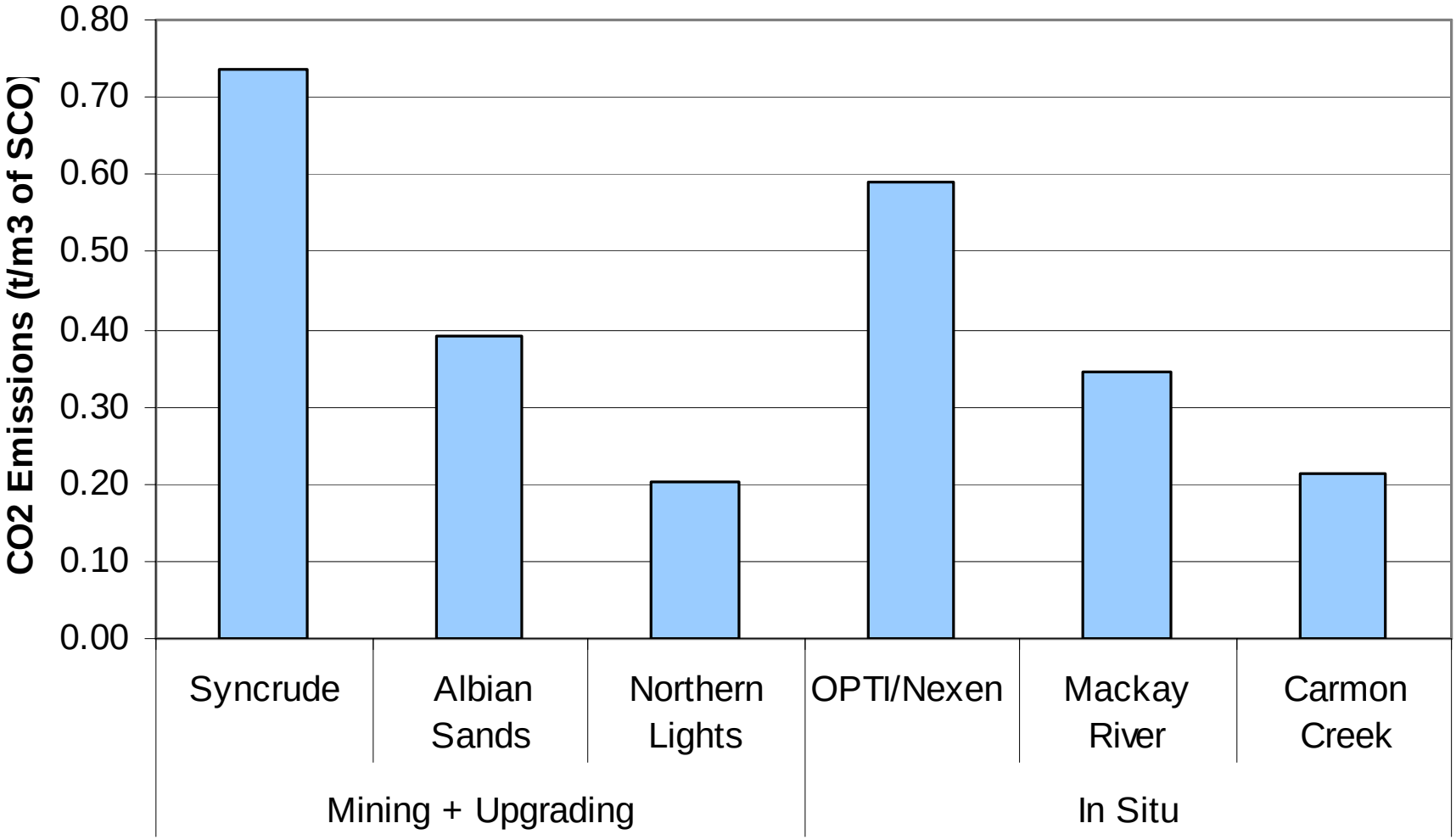
Need for “Full” Life Cycle Assessment

- A consistent, systematic process for evaluating the tradeoffs of the oil sands industry
- Need to understand the risks from suppliers
  - In a position to encourage environmental improvements upstream
  - Better understanding of upstream component could lead to savings
  - Industry decision-making, strategy and policy setting
  - Evaluation of technologies, product and process choices
  - Risk assessment
  - e.g. economy-wide carbon tax = increased material costs etc.

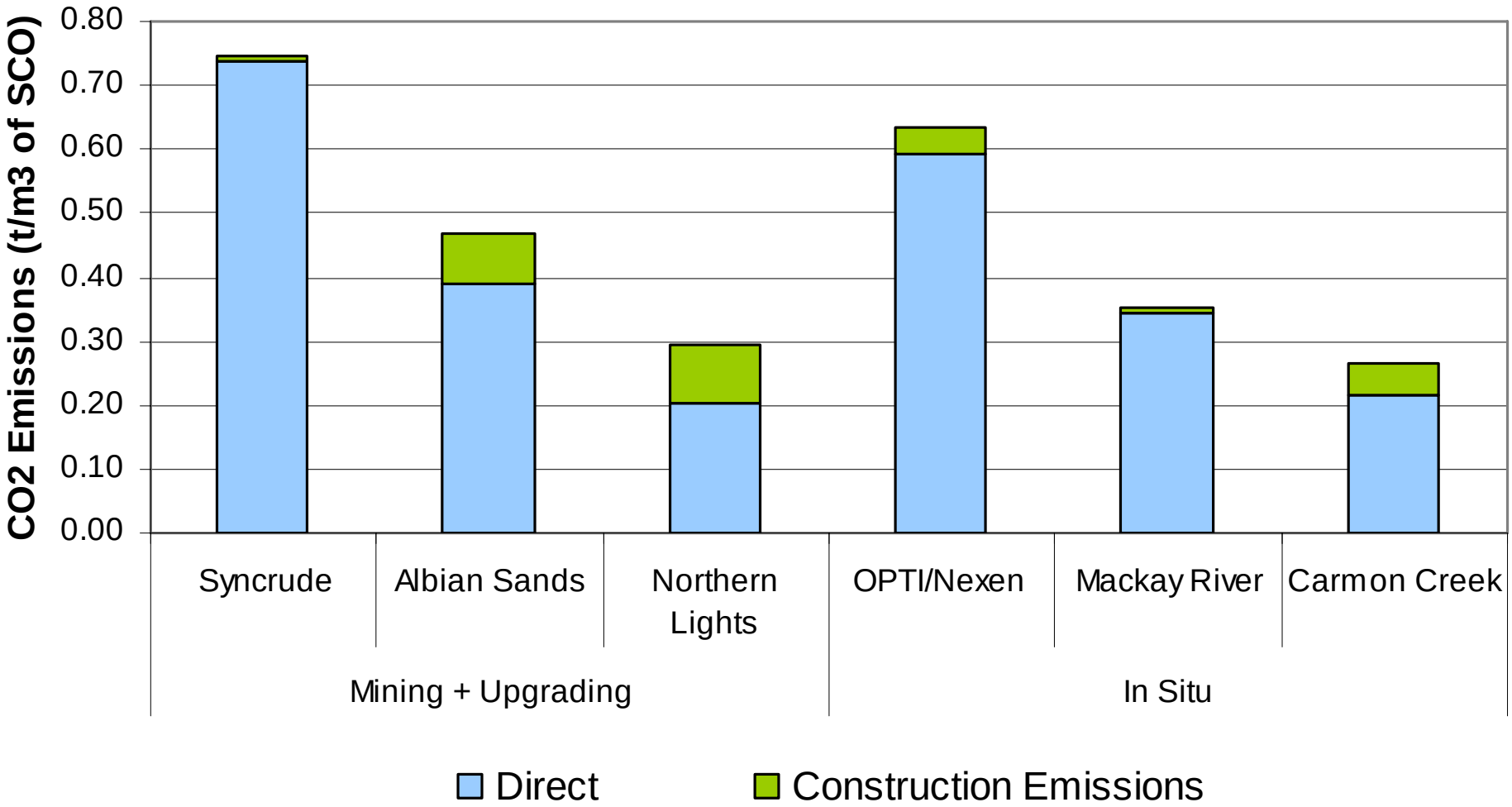
Company LCA Survey

	Physical Units		Financial Units	
	Value	Units	Value	Units
Equipment				
Large Construction Equipment		number		$
Mining Vehicles		number		$
Other Machinery		number		$
Materials				
Steel		tonnes		
Concrete		tonnes		
Plastics		tonnes		
Wood Products		tonnes		
Rubber		tonnes		
Other Metals		tonnes		
Other Materials		tonnes		
Chemicals				
Solvents		Litres		
Lubricants		Litres		
Other Chemicals		Litres		
Energy				
Natural Gas		mcf		
Diesel		gallons		
Electricity		kWh		$
Other Energy Consumed		btu		
Services				
Engineering Services				$
Legal				$
Waste Management				$
Financial Management				$
Other Services				$
Labour				
CNRL Employees				$
Contractors				$

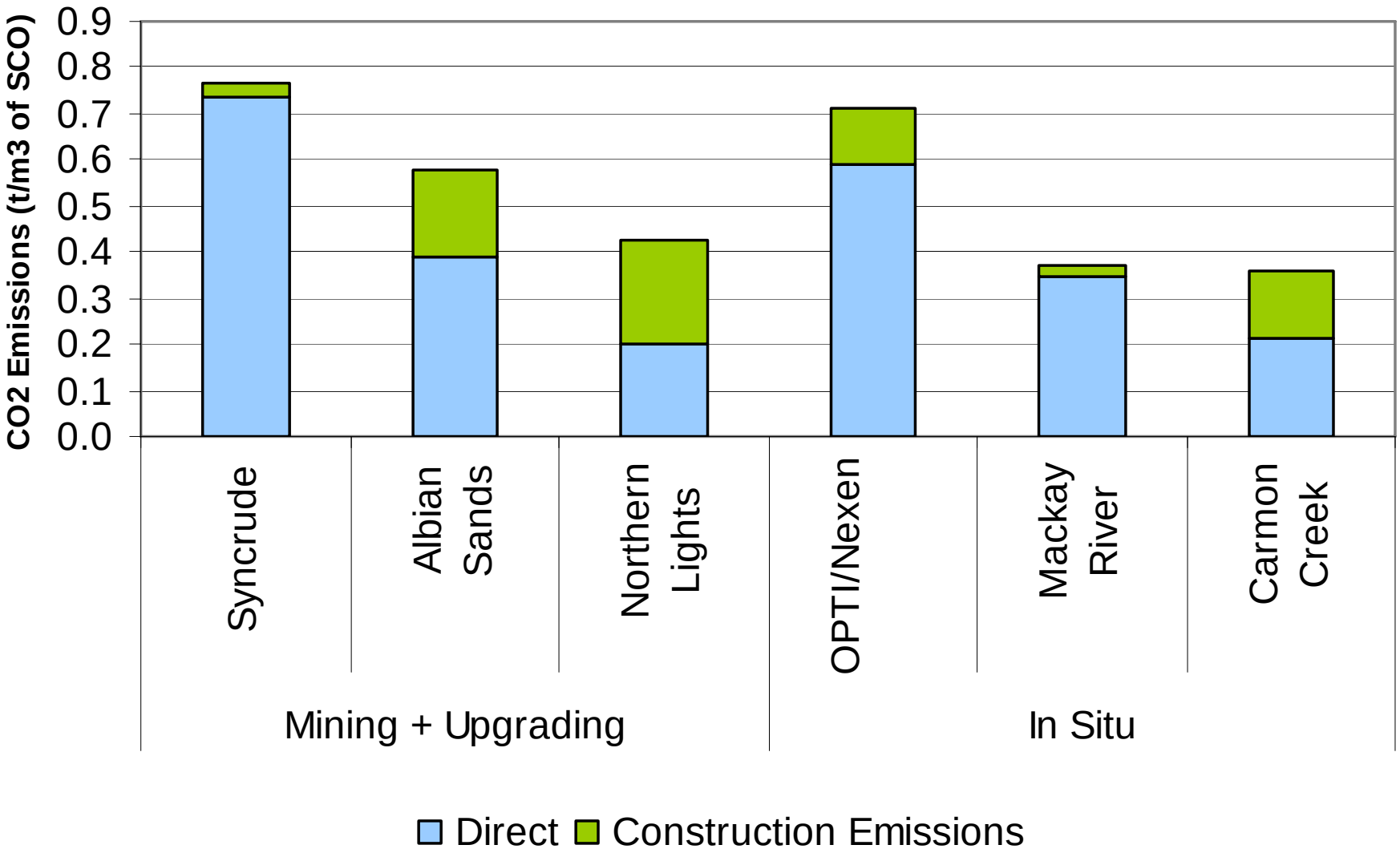
Direct Production Emissions



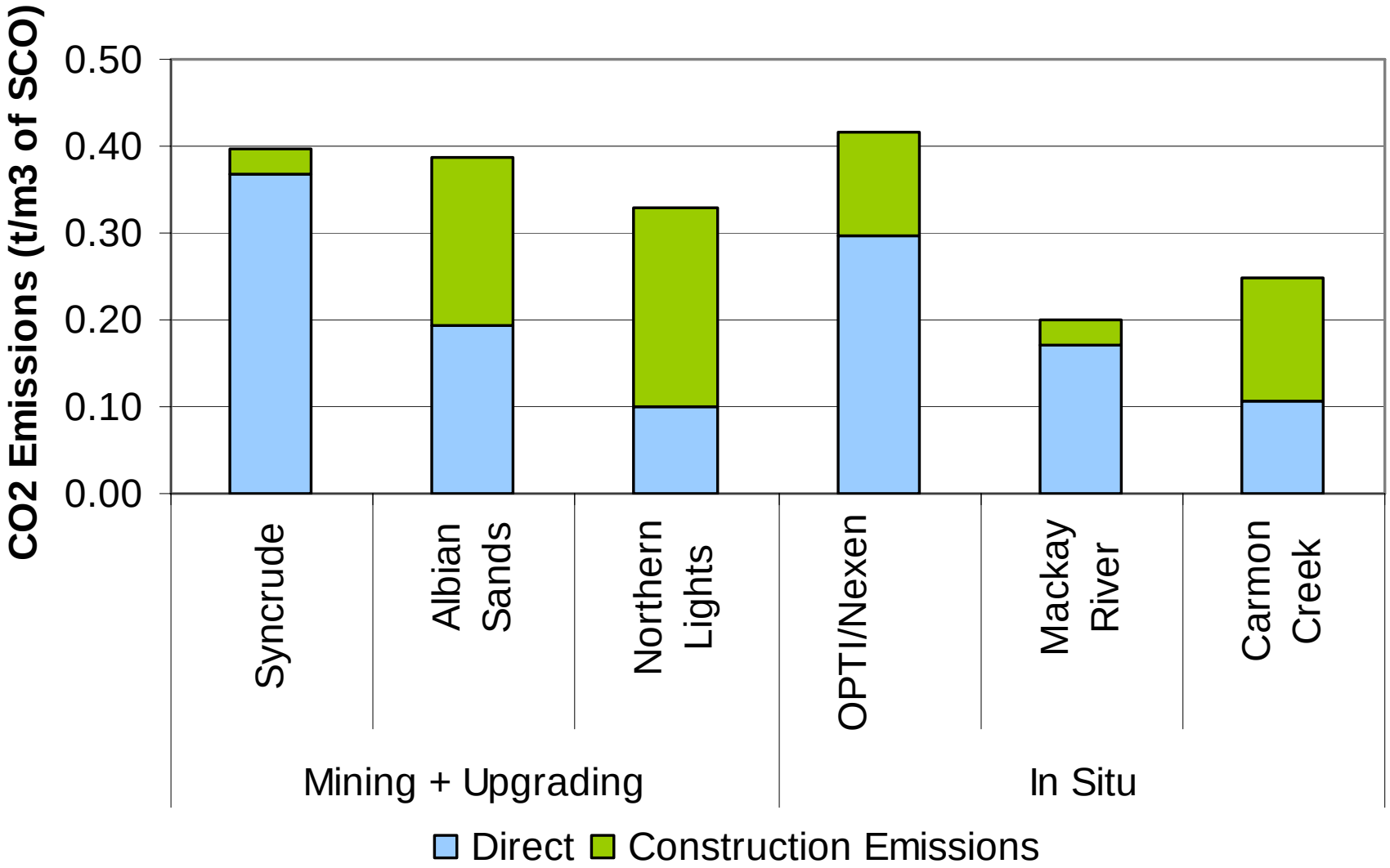
Inclusion of Construction Emissions (low estimate)



Inclusion of Construction Emissions (high estimate)



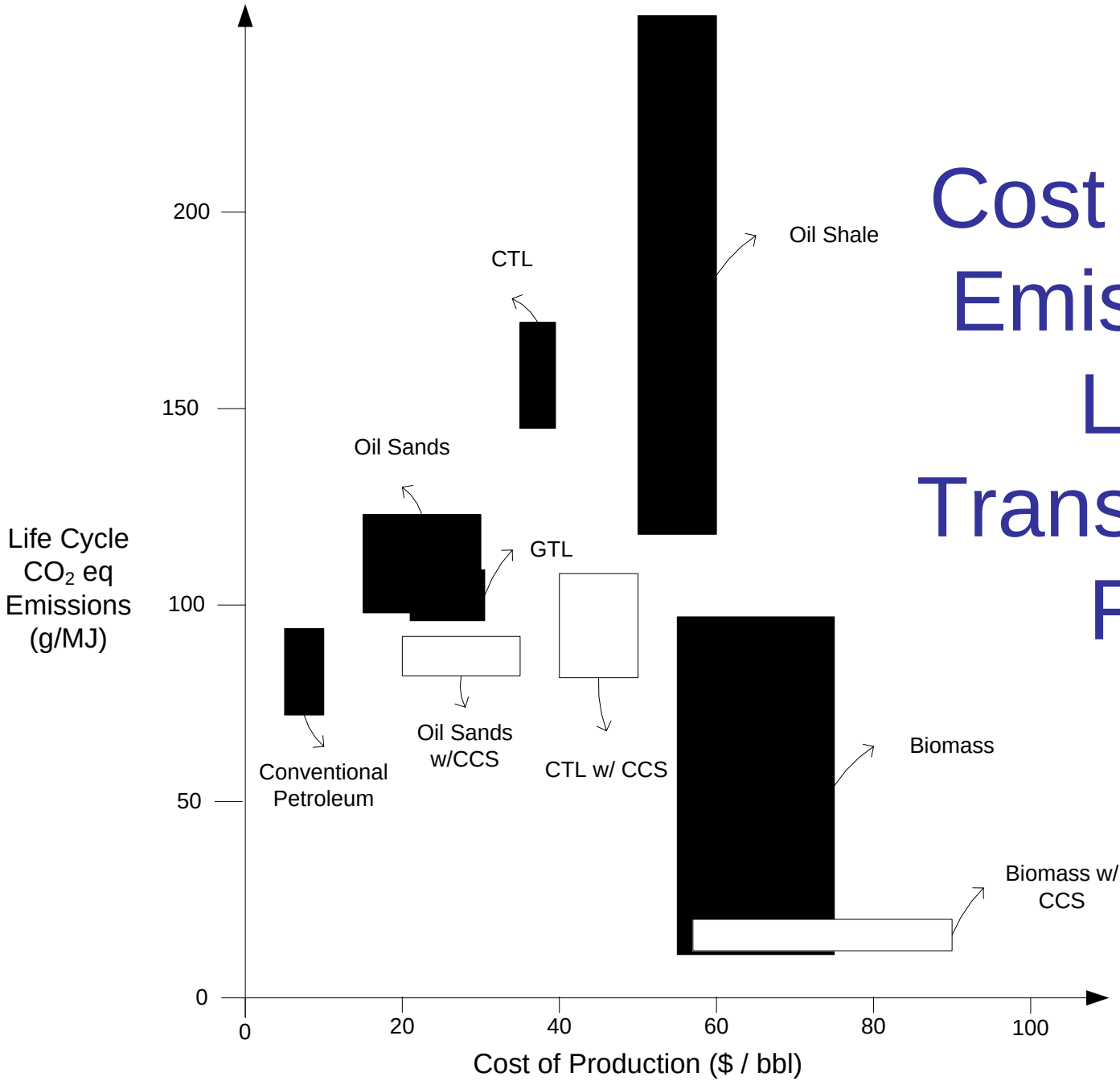
Future Production Emission Targets



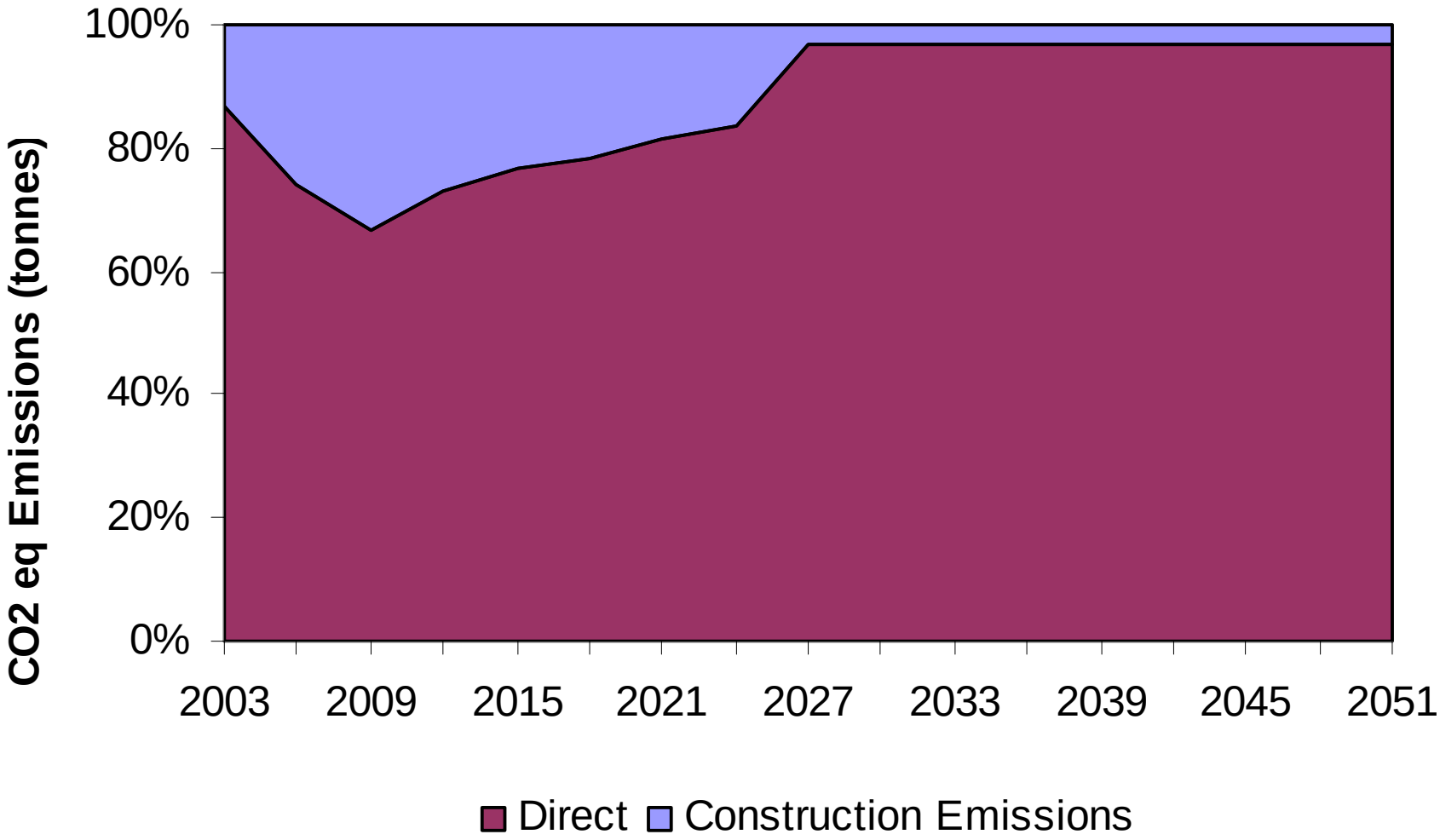
Applications of the Model

- LCA of existing operations
  - Comparison to other liquid transportation fuel
- Comparison of oil sands technologies
  - e.g. prospective technologies
- Substitutions for natural gas
  - e.g. “heavies”, biomass, coal, nuclear, geothermal
- Land Use

Cost and CO_2 Emissions of Liquid Transportation Fuels



Indirect Emissions Impact on Alberta



Concluding Remarks

- Developing the oil sands will continue to have significant economic and environmental impacts. Meeting LCFS requirements are one part of the challenge.
- The diversity of projects, technologies and timing of development complicate the ability to manage this industry through LCFS.
- Use of Hybrid LCA techniques and methods are critical to understanding the full impacts of these decisions.

Project Collaborators:

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Thank you

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