



Oil Sands Industry Energy, Hydrogen and Cogeneration

CogenCanada
Cogeneration, Gasification and Steam
Generation for the Oil Sands and
Other Applications
Calgary, Alberta
April 5, 2006


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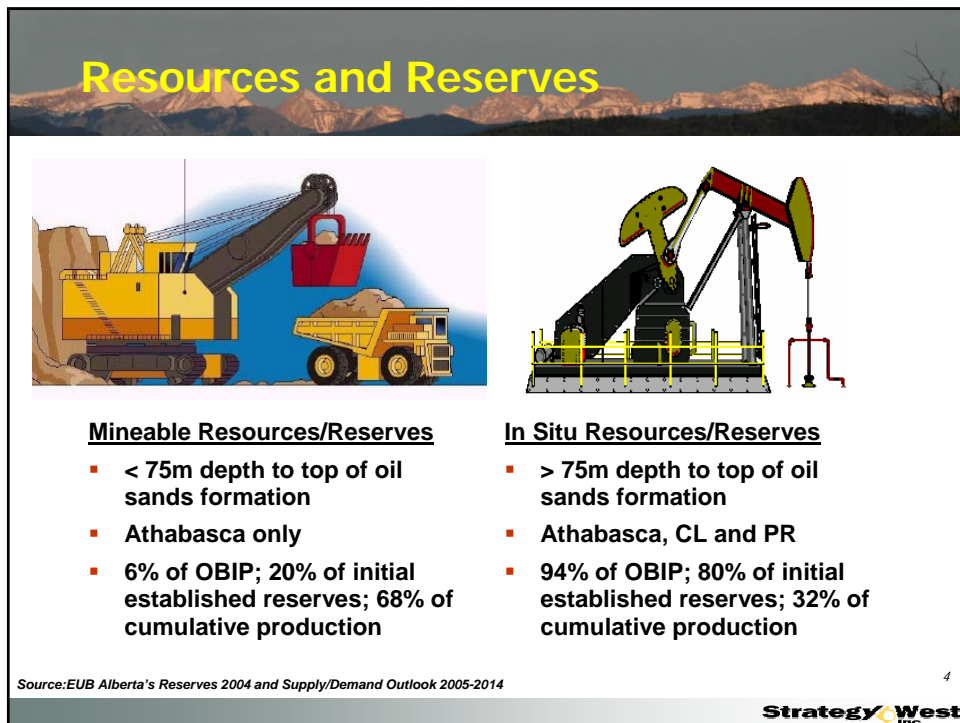
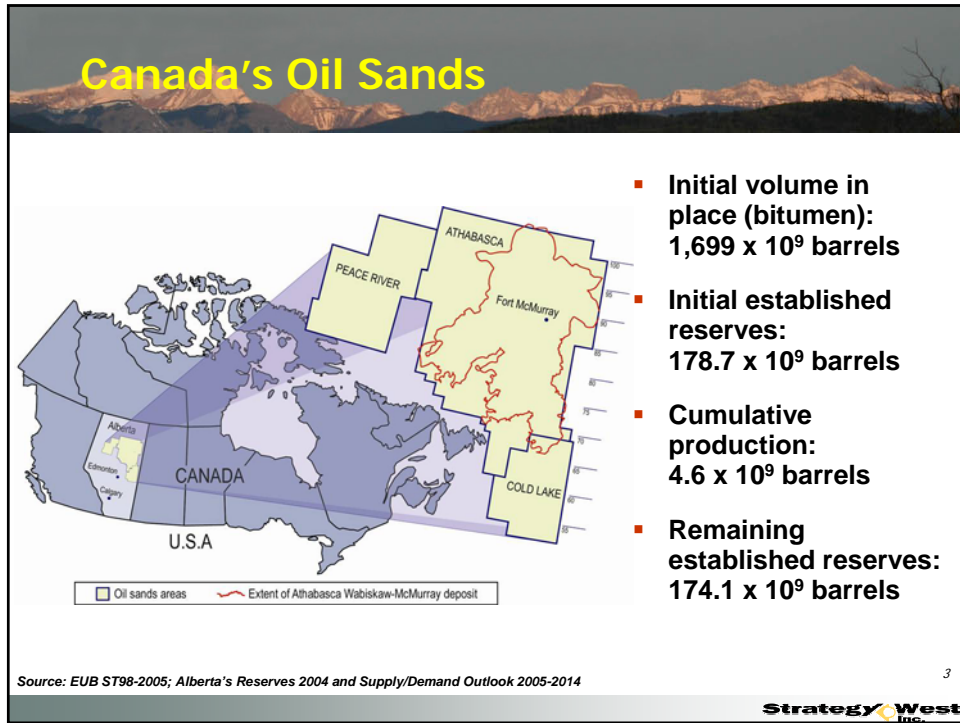


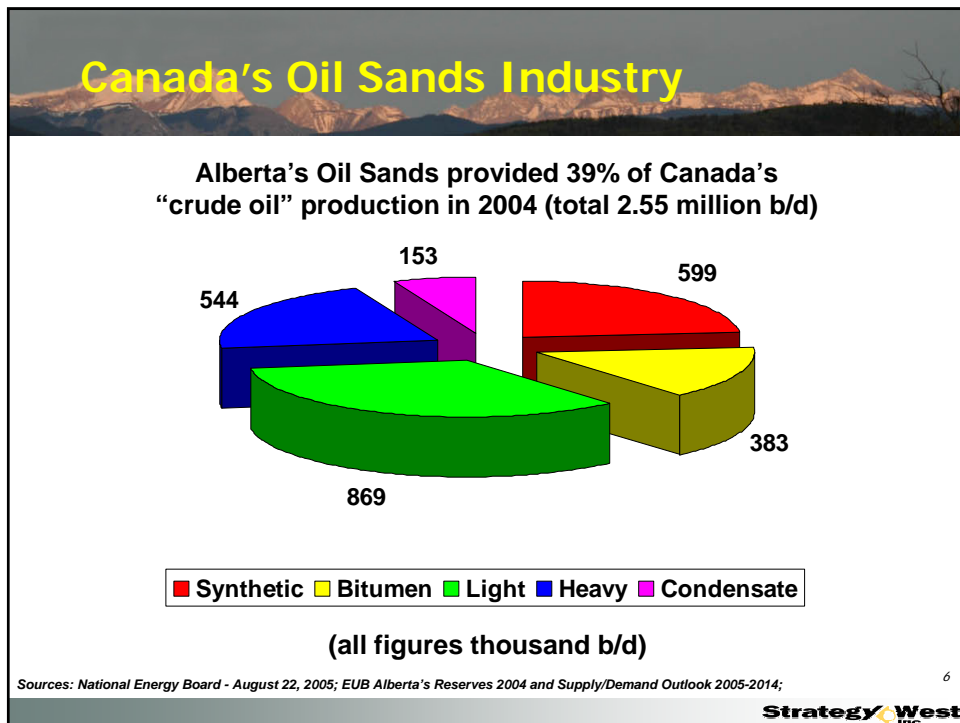
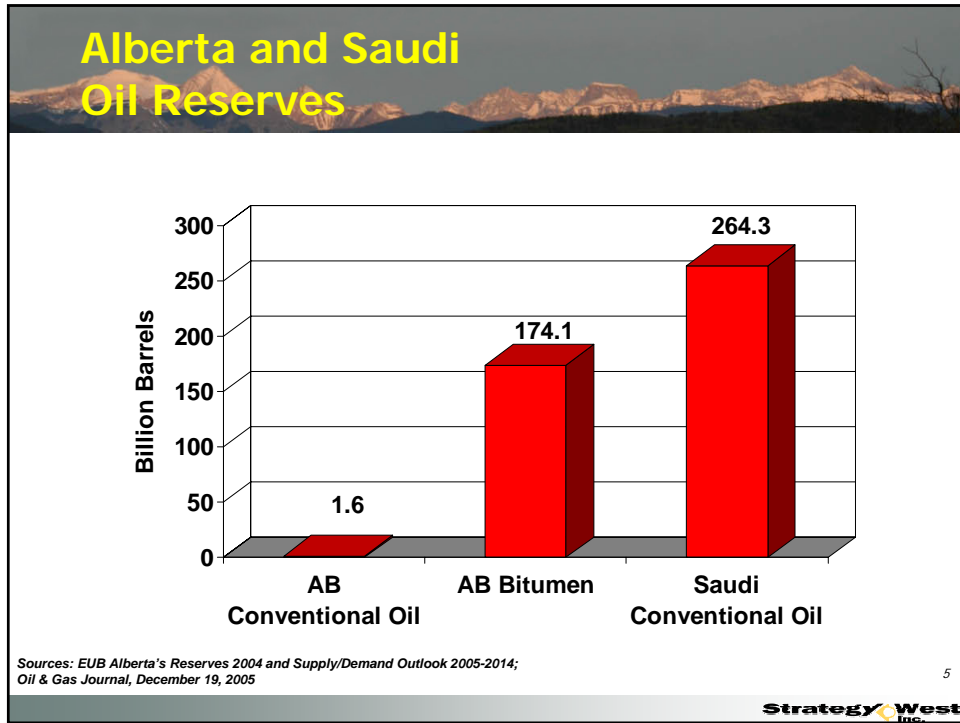
Presentation Outline

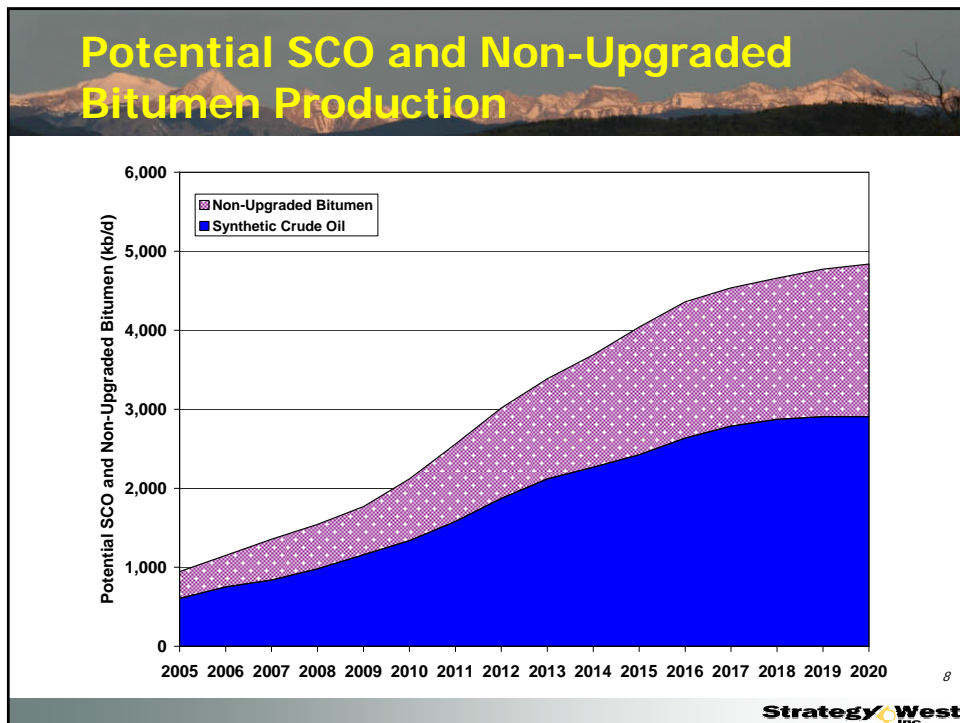
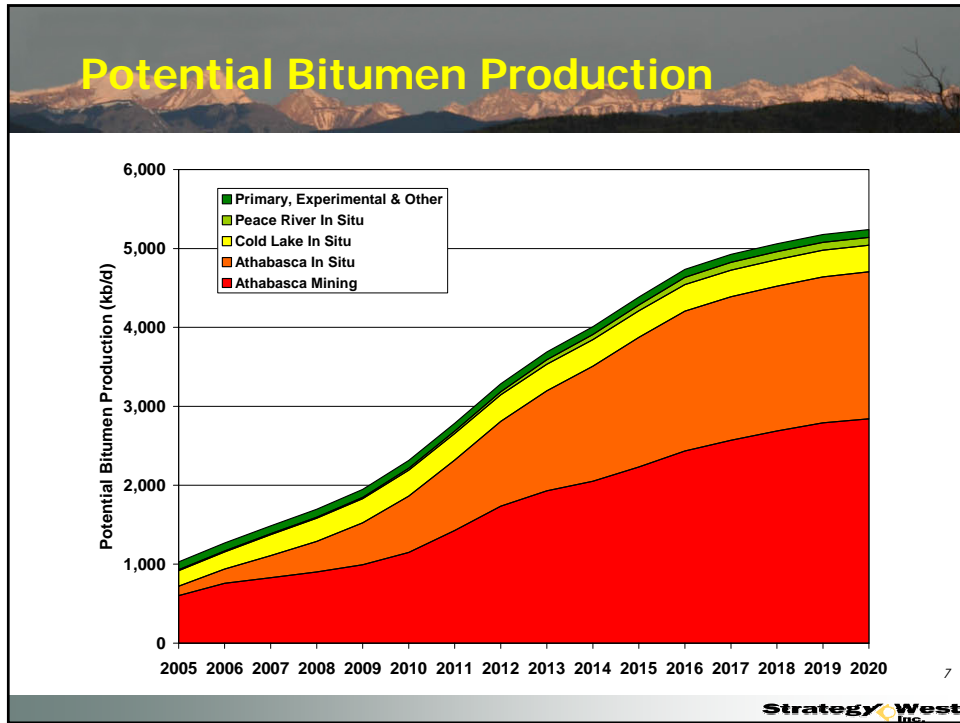
- Oil Sands Industry Overview
- Industry Outlook
- Oil Sands Energy and Hydrogen Requirements
- Oil Sands Energy and Hydrogen Supply Options
- Cogeneration in the Oil Sands Industry

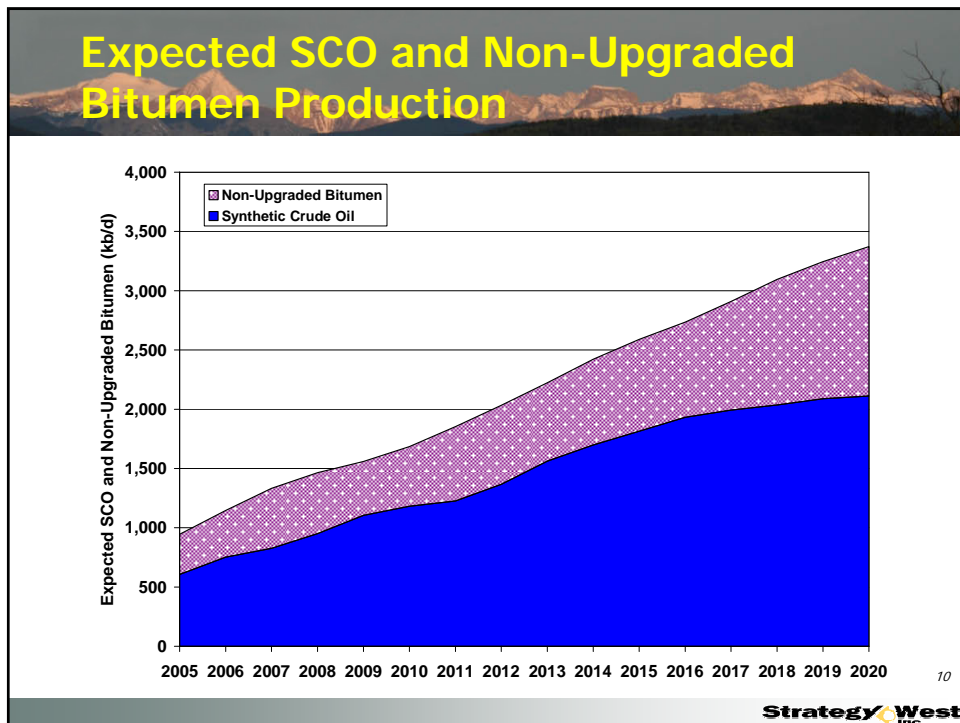
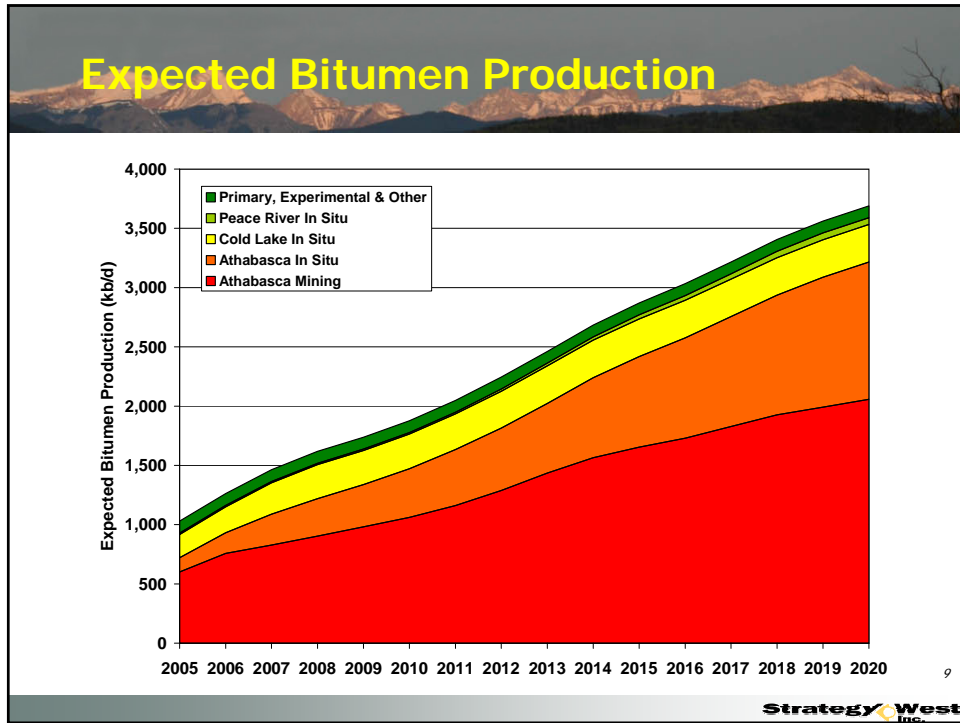
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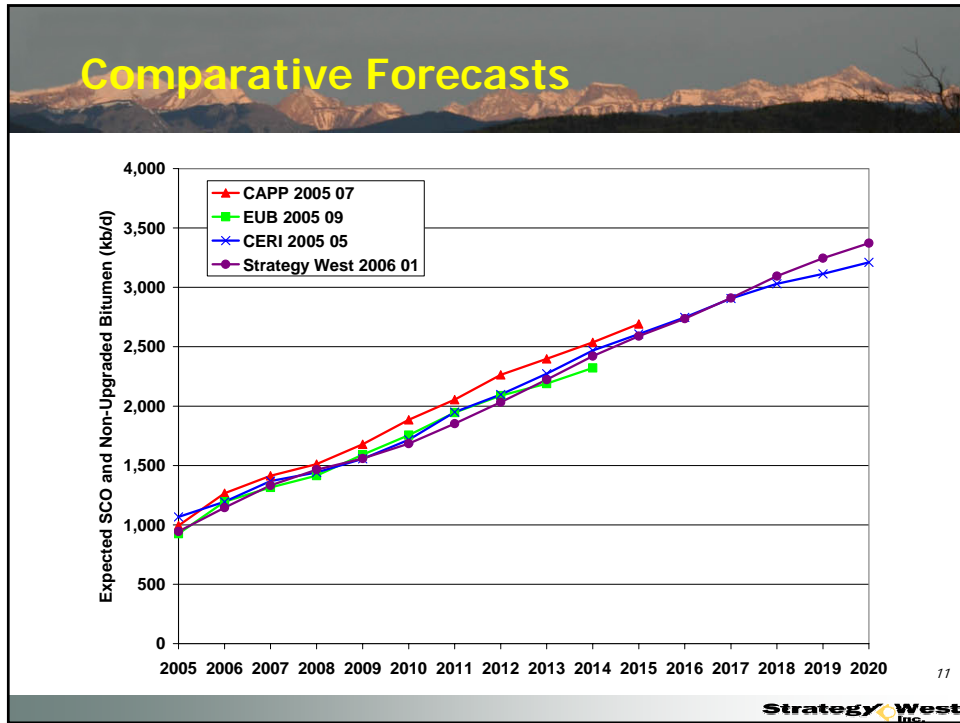












- ### In Situ Recovery Technologies
- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Current Thermal In Situ Recovery Technologies <ul style="list-style-type: none"> • Steam Assisted Gravity Drainage (SAGD) • Cyclic Steam Stimulation (CSS) ■ High Energy Use, Water Use and GHG Emissions | <ul style="list-style-type: none"> ■ Developing In Situ Recovery Technologies <ul style="list-style-type: none"> • VAPEX • Thermal-Solvent • Steam/Solvent Hybrid Processes • Toe-to-Heel Air Injection (THAI) ■ Reduced Energy Use, Water Use and GHG Emissions |
|---|---|
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Oil Sands Energy and Hydrogen Requirements

Energy	Hydrogen
<ul style="list-style-type: none"> • In situ steam • Mining/extraction process heat • Upgrading process heat • Electricity 	<ul style="list-style-type: none"> • Hydro-conversion processes (upgrading)

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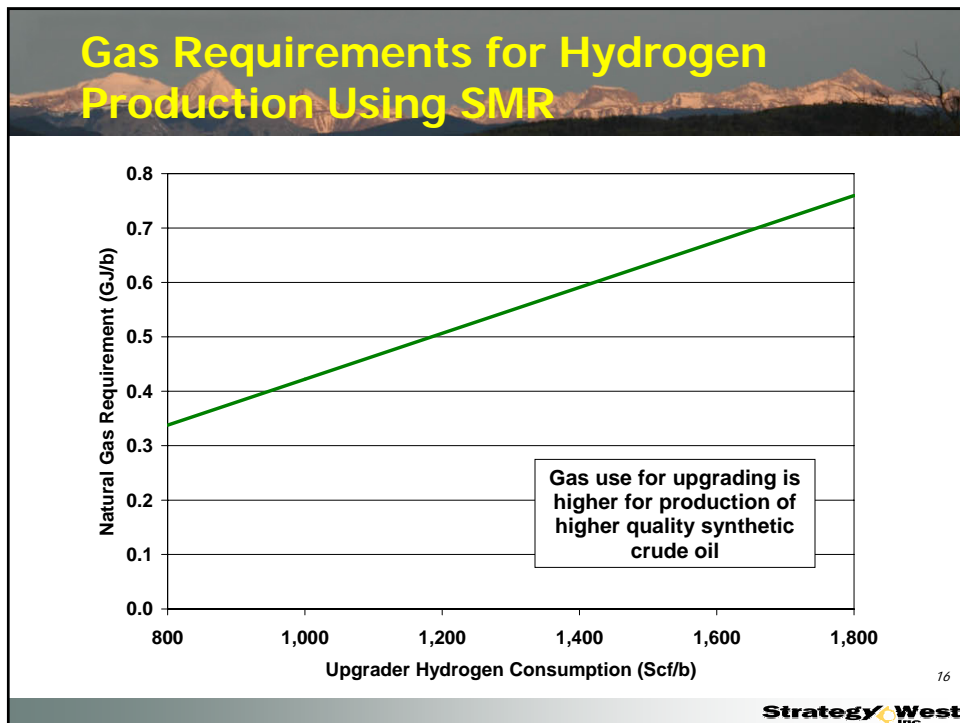
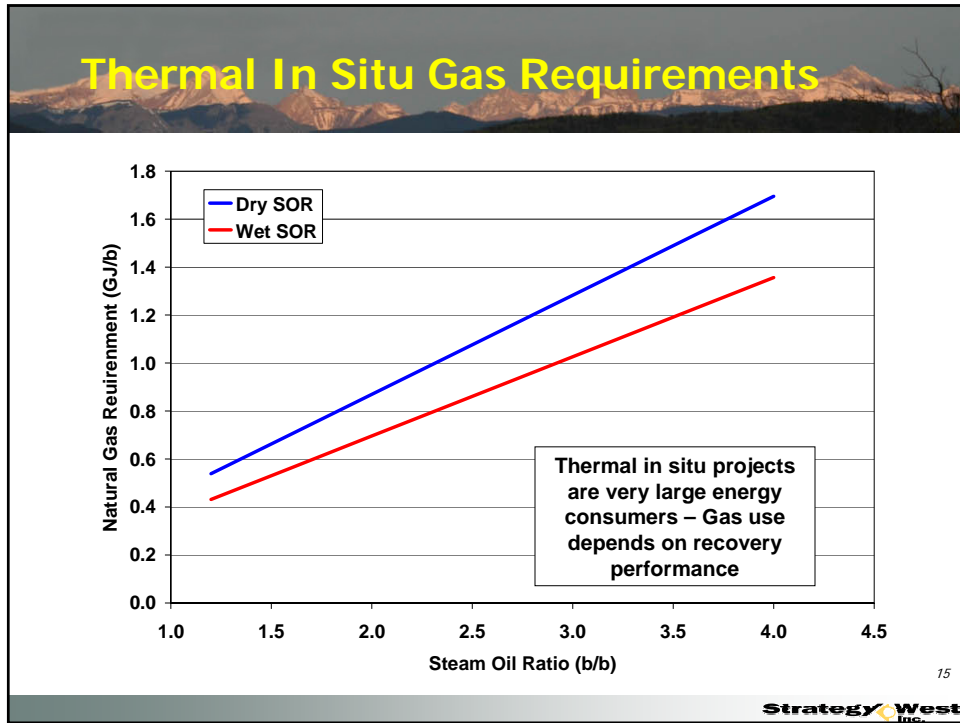
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Typical Natural Gas and Electricity Requirements

	Natural Gas (GJ/b)	Electricity (kWh/b)
Thermal In Situ	0.90 – 1.30	9
Mining and Extraction	0.25	13
Upgrading (Fuel)	0.10	12
Upgrading (Hydrogen)	0.30 – 0.70	2

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Current Sources of Thermal Energy, Hydrogen and Electricity

<ul style="list-style-type: none"> ■ Thermal Energy <ul style="list-style-type: none"> • Natural Gas • Produced Gases (in situ projects) • Process Gases (upgraders) • Coke (upgraders) • Liquid hydrocarbon fuels • Crude Bitumen 	<ul style="list-style-type: none"> ■ Hydrogen <ul style="list-style-type: none"> • Steam Methane Reforming (natural gas) ■ Electricity <ul style="list-style-type: none"> • On-site generation • Purchased electricity
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Potential Future Sources of Thermal Energy, Hydrogen and Electricity

Technology	Thermal Energy	Electricity	Hydrogen
Gasification	✓	✓	✓
Bitumen Combustion	✓	✓	
Nuclear	✓	✓	✓

Additionally, oil sands industry energy intensity will likely be reduced through further efficiency improvements and application of new technologies

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Oil Sands Gasification Projects

Project	Status
OPTI/Nexen Long Lake	Under Construction
Suncor Voyageur 2	Application
North West Upgrading	Application
Synenco Northern Lights	Disclosure
CNRL Horizon	Under Consideration
CNRL Primrose	Under Consideration
Others?	

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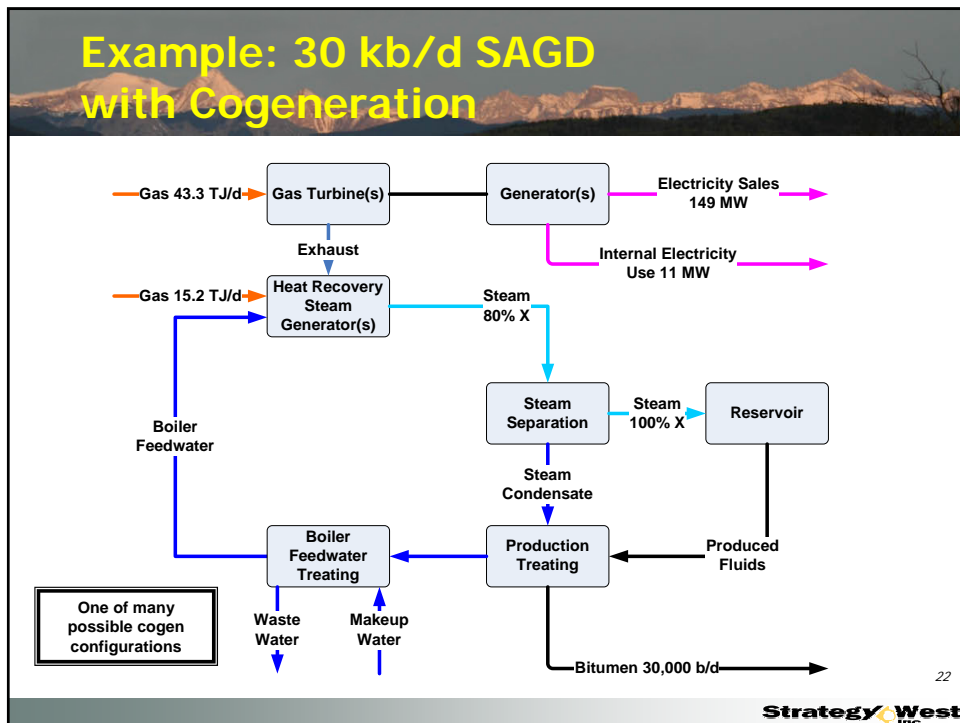
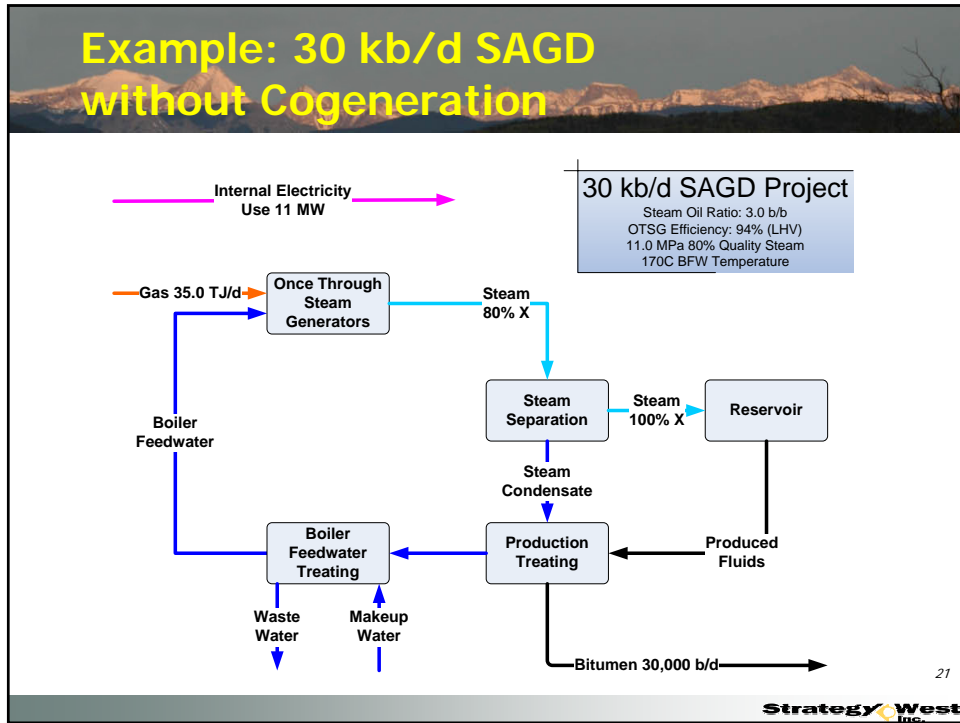
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The Oil Sands Cogeneration Opportunity

	Thermal (kWh/b)	Electricity (kWh/b)	Ratio
Thermal In Situ	250 - 360	9	28 – 40
Mining & Extraction	69	13	5
Upgrading (Fuel)	28	12	2

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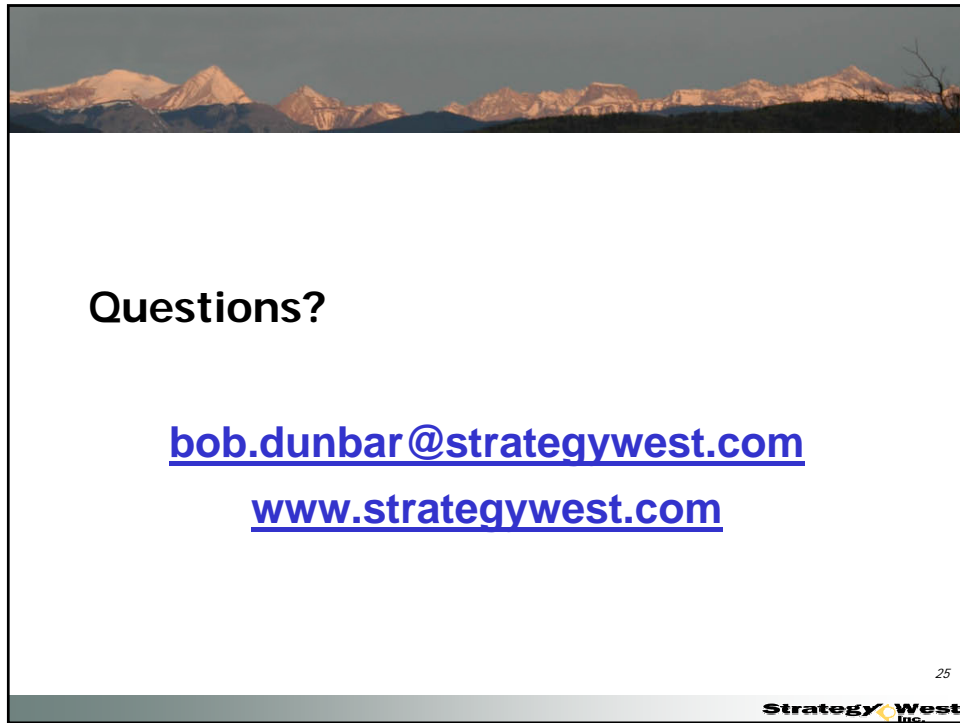
Incremental Energy Balance

	Natural Gas Consumption (TJ/d)	Electricity Sales (MWh/d)
Without Cogeneration	35.0	(264)
<u>With Cogeneration</u>	<u>58.5</u>	<u>3,576</u>
Increase	23.5	3,840

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- ## Cogeneration Conclusions
- Oil sands projects have large thermal energy needs and relatively small electricity needs
 - There is an opportunity for cogeneration and sale of surplus electricity, particularly for thermal in situ and mining & extraction projects
 - Economic cogeneration will occur when the cash flow from electricity sales is sufficient to:
 - Cover additional fuel costs
 - Cover other additional O&M and G&A costs
 - Provide payout and an adequate return on invested capital
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Questions?

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