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***The Alberta Energy Research  
Strategy: An Integrated Approach***

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ASRA Retreat – June 2002



# ***Serious Threats to Future Revenue***

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- Maturing Western Canadian Sedimentary Basin
  - Conventional crude production decline
  - Conventional natural gas production near peak
- Energy costs are rising
- Emission control costs high
  - $\text{SO}_x$ ,  $\text{NO}_x$ , PM, Hg,  $\text{CO}_2$



## ***Serious Threats to Future Revenue***

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- Volatile electricity and gas prices
- High gas prices and tight supplies threaten
  - Oil sands upgrading
  - Thermal recovery
  - Petrochemical manufacturing
- Bitumen and synthetic crude market limitations
- GHG emissions – additional business risks

# Alberta's Energy Resources

- Natural Gas
- Conventional Oil
- Oil Sands
- Heavy Oil
- Coal
- Coal Bed Methane
- CO2

**Leading us  
to a C, H  
and N  
strategy**

**From** Oil, gas  
and coal



**To**

**Multi-product  
pollution-free energy**

# ***AERI's Strategic Business Plan (2002 – 05)***

## **Outline**

- The Urgency
- The Intent
- The Vision
- The Mission
- The Role
- The Strategic Plan
- The Process
- The Prize

**Goal 1:  
Clean Coal**

**Goal 5  
Fuel cells &  
Hydrogen**

**Goal 2  
Upgrading**

**Goal 4  
Improved  
Recovery**

**Goal 3  
Carbon  
Management**

# The Priority Areas

**Oil Sands**

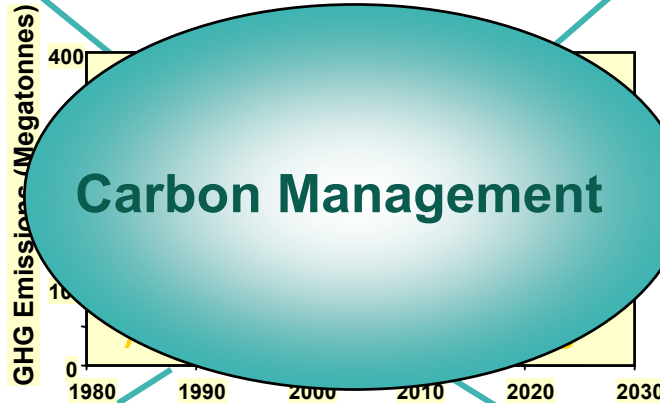
**UPGRADING**

- Higher acceptance
- Value added

**Clean Coal**

- Alberta Niche
- Integration with "opportunity" feedstocks

**Carbon Management**



- Hydrocarbons to hydrogen
- Fuels cells tuned to Alberta resources

**Recovery**

- Conventional oil
- Coal Bed methane
- Bitumen

**Hydrogen**



# *The Probable Future (to 2020)*

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- **OIL SANDS – 3 x increase in production**
  - **Upgrading**
    - Customized synthetic products
    - Less intensity processes
  - **Recovery**
    - Lower temperature processes (e.g. VAPEX)
    - Water management
  - **Integrated operations**
    - Bitumen bottoms (with coal and biomass) feedstock for gasification providing hydrogen, power and steam
  - **Carbon capture**
    - From hydrogen plants for enhanced recovery operations



# *The Probable Future (to 2020)*

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## ■ **Conventional Oil - Maintaining the supply**

### ■ **Enhanced oil recovery (EOR)**

- CO<sub>2</sub>
- Solvent
- Advanced seismic

### ■ **Carbon capture**

- Characterization of basin suitability
- Monitoring and verification for storage of CO<sub>2</sub>
- Safety and reliability



# ***The Probable Future (to 2020)***

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- **Natural Gas - Maintaining the supply**

- **Natural gas from coal beds**

- Characterization of unique Alberta coal beds for gas
- Adapting and developing new production technologies for coal bed methane (CBM)
- *In situ* gas separation
- CBM produced water for agriculture use

- **Carbon capture**

- From oil sands, petrochemical, fertilizer plants and power plants for enhanced coal bed methane (ECBM)



## ***The Probable Future (to 2020)***

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### **■ Hydrogen: Fuel of the Future**

- Hydrogen storage
- Efficiency of hydrogen production
- Fuel cells designed to use excess hydrogen supply
  - Edmonton refinery hub
  - Fort Saskatchewan hub
  - Red Deer petrochemical hub
- Demonstration of “Green Corridor” concept



## *The Probable Future (to 2020)*

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### **■ Power Generation in Canada**

- Continuing presence of nuclear but no major resurgence
- Hydroelectric generation remains relatively constant
- Wind, solar and geothermal increase share of the market
- Fuel cells, distributed generation, microturbines gain a share of the market
- Bulk of new generation will be coal (natural gas too valuable to burn)

# *The Probable Future (to 2020)*

## **COAL – Technology Evolution**

- Advanced emissions control, efficiency improvements, and waste utilization
- Existing coal plants retrofitted with integrated gas combined cycle (IGCC) or Pressurized Fluidized Bed Combustion
- IGCC plants flexible feed and multi-products
- Anaerobic hydro-gasification technology (ZECA concept)
- Synthesis gas (coal gas) direct to fuel cell → high efficiency
- Near zero emission power plant

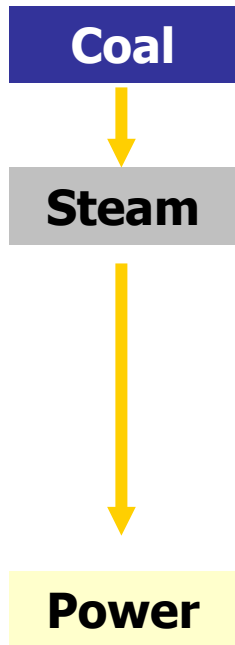
## **Alberta niche -**

- adapt and demonstrate unique Alberta opportunities
  - integrate with oil sands
  - integrate with petrochemicals
  - utilize CO<sub>2</sub>
  - coal to fuel cells
- **Pay-to-play**

# Example of an Integration Strategy

## Gasification – Emission Solutions & Economic Plants

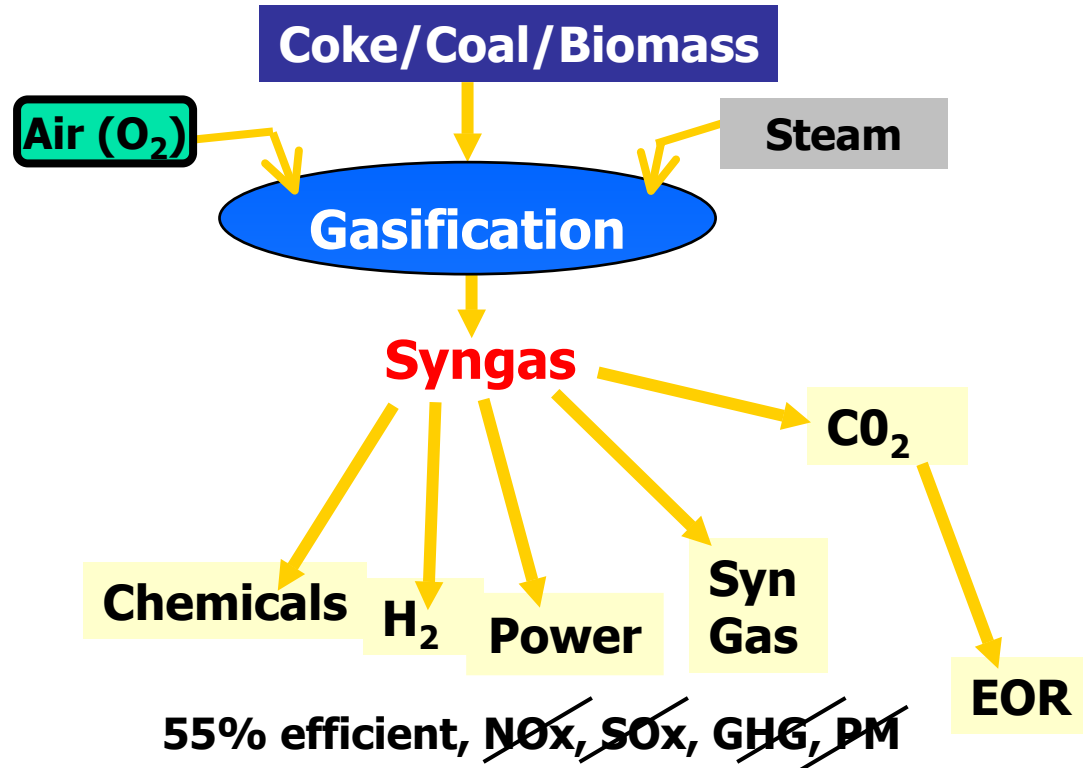
### Traditional Coal Stovepipe



40% efficient, NO<sub>x</sub>, SO<sub>x</sub>, GHG, PM

Reducing emissions is largely uneconomic

### Multi Fuel / Multi Product = Flexibility & Commercial Viability



55% efficient, ~~NO<sub>x</sub>~~, ~~SO<sub>x</sub>~~, ~~GHG~~, ~~PM~~

Integral emissions control & favorable economics at healthy natural gases prices



# ***Portfolio Management***

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## ***Portfolio Principle and Goals***

- Secure maximum value for Albertans from all energy resources
  - Stimulate economic development
  - Increase development of clean energy
  - Increase efficiency of energy usage
  - Reduce environmental impacts
  - Bridge from hydrocarbon to hydrogen economy
  - Partnership with industry, federal government and R&D providers.