



# ***An Overview of the SkyMine™ Process***

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# *“Houston, we have a problem.”*

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***Worsening  
Climate Change,  
Acid Rain,  
Water Pollution***



***Increasing  
Pollution***

- Carbon Dioxide (CO<sub>2</sub>)
- Nitrous Oxide (NO<sub>x</sub>)
- Oxides of Sulfur (SO<sub>x</sub>)
- Mercury and other metals



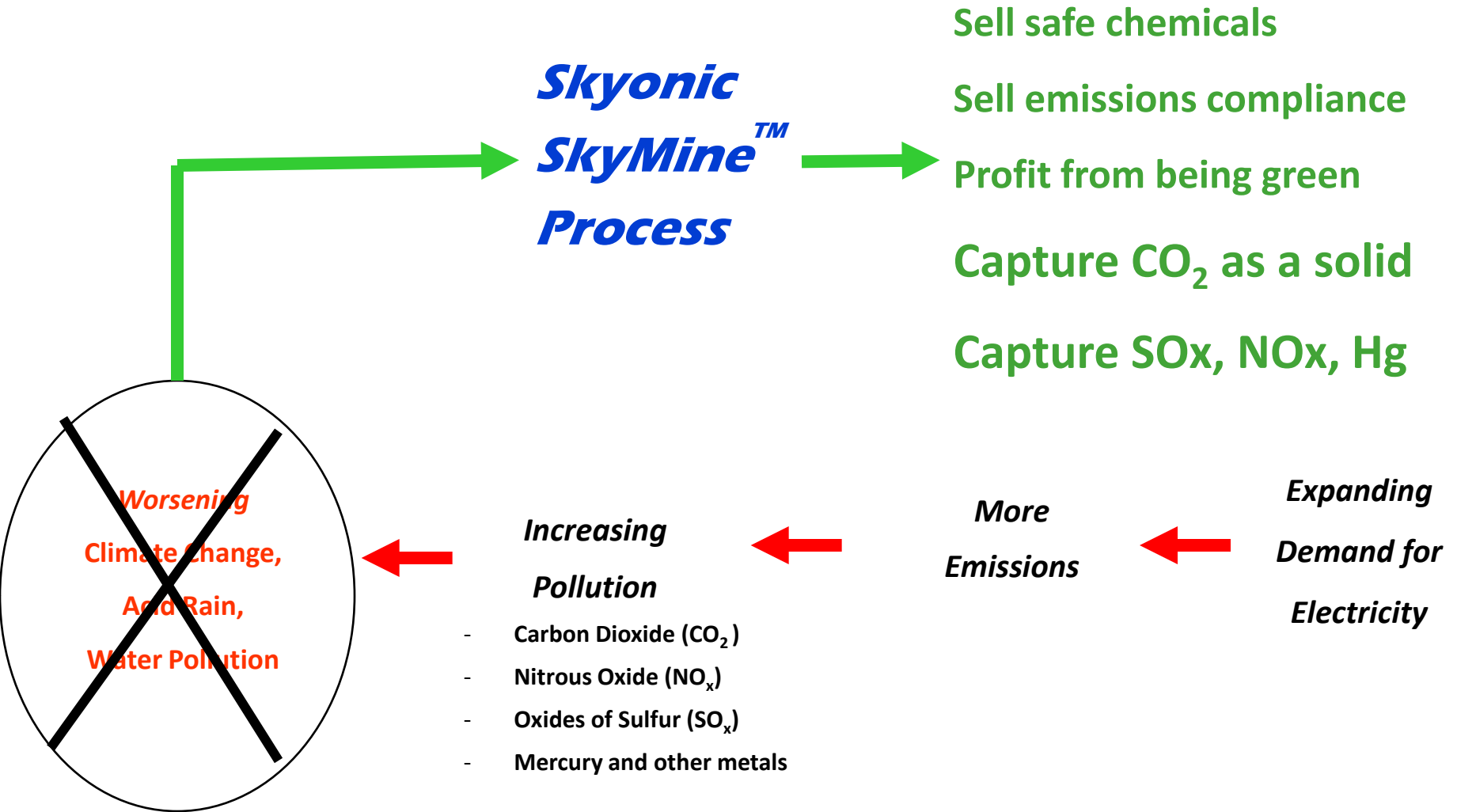
***More  
Emissions***



***Expanding  
Demand for  
Electricity***

*“Actually, Houston ...cancel that.  
Capitalism is coming to the rescue.”*

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# Other Ways of Reducing Greenhouse CO<sub>2</sub>

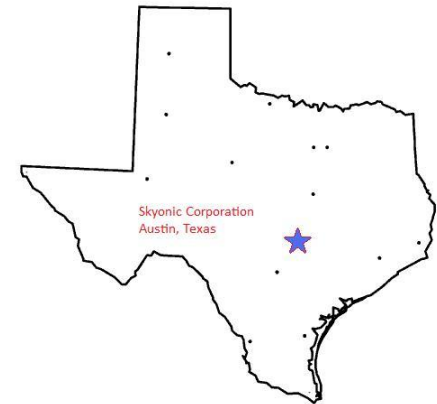
	<b>Improved Combustion</b>	<b>Absorption + Gaseous Sequestration</b>
<b>Strategy</b>	<p><b>Improve Combustion Efficiency</b></p> <p>i.e. produce less carbon monoxide and carbon dioxide per BTU</p>	<p>“Scrubbing” the sulfur and nitrous oxides has been largely implemented.”</p> <p>Experimenting with other fluids to absorb CO<sub>2</sub></p> <p>(Amines, Chilled NH<sub>3</sub>)</p> <p>Compress CO<sub>2</sub>; transport and inject into wells, ocean floors, etc.</p>
<b>Status</b>	<p>Achieved a 20% increase in BTU efficiency in 25 years</p> <p>It’s all played out</p> <p>And the world is moving to crummier fuels</p>	<p><b>Can be 100% effective, but:</b></p> <ul style="list-style-type: none"> <li>• Increase electric generation costs 84%</li> <li>• Raise plant capital costs 90%</li> <li>• Works only in certain locations</li> <li>• Difficult retrofit</li> </ul>

*Source: EPA Survey 2002*

# About Skyonic

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- Founded and Incorporated in 2005 by Joe David Jones
- Headquartered in Austin, Texas
- Developed SkyMine™ to capture & sequester CO<sub>2</sub> in solid form
- Development partner – Southwest Research Institute
- Process Development with
  - LCRA – Fayette - 2006
  - TXU / Luminant – Big Brown - 2007
- Goal was to develop and deploy a technology that is:
  - Retrofitable
  - Repeatable
  - Deployable
  - Profitable



# Big Brown SES

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# *What does SkyMine™ do?*

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- Captures carbon dioxide (CO<sub>2</sub>) in solid form
- Captures acid gasses (SO<sub>2</sub>, NO<sub>2</sub>)
- Captures heavy metals such as mercury
- Produces electrolytic grade hydrogen
  - Sale
  - Clean energy
- Produces electrolytic grade chlorine
  - Plastics
  - Drinking water
- Eliminates hundreds of millions of dollars in CapEx and ongoing expense for additional scrubber technologies.  
*“Three-fer”*



# Process Overview

Solid Sequestration

Sale or Peak Power Generation

Sale

Clean Plant

Green Hydrogen

Green Chlorine

Removes mercury & heavy metals  
Se, As, Cr, etc

Removes acid gasses, SO<sub>2</sub>, NO<sub>2</sub>

Converts CO<sub>2</sub> to sodium bicarbonate (edible baking soda)

Energy that can be transferred from **off-peak to on-peak**

\$66B domestic hydrogen market

**Replaces methane as source for hydrogen**

Can be sold to \$7B domestic chlorine market

Displaces high-energy chlorine production





# *Impact*

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- Minimally invasive – requires access to flue gas
- Onsite footprint dependent on design factors.
- Chemical production can be operated off-peak to “bank” chemicals for use during peak times.
- Sell hydrogen and increase methane availability
- Sodium bicarbonate disposal in landfill or mine fill.
- Chemicals ( $H_2$ ,  $Cl_2$ ) sold through a chemical partner.

# Benefits

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- Sequesters as a solid.
  - Simplifies disposal
  - No long term liability from gaseous injection
- Environmental responsibility
  - Leadership in environment
  - Positions for future requirements
- Retrofittable to existing plants
  - Not dependent on new plants or designs.
- Profitable
  - On-peak hydrogen return has greater value, off-peak power used
  - Chemical sales generate cash flow to pay for investment and operation
  - Is a profit center!
  - Enables fly-ash sales
- Uses established unit operations and chemistry “*Edisonian*”

# Results

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- Achieved > 80%-92% CO<sub>2</sub> solid conversion
- SO<sub>x</sub> removal “100%” & NO<sub>2</sub> 99.x%
- Mercury capture > 97%
- Produced electrolytic grade H<sub>2</sub> and Cl<sub>2</sub>
- Unified Process Demonstration (GE Intellution)
- Confirmed mass and energy balances
- Waste heat used for anolyte and catholyte heating