Wyoming Trona Industry Overview

[Images of various trona industry sites and logos]
Wyoming Trona

- About fifty to sixty million years ago, a shallow, expansive body of water called Lake Gosiuete covered the Green River Basin in southwestern Wyoming.
- Lake Gosiuete existed for about 4 million years. Trona was deposited during the 2nd million years while the climate was arid and the lake stopped overflowing and became saline.
- Exactly how it formed and what were the sources of carbon dioxide and high concentration of sodium, both of which are required to create Trona, is still somewhat of a mystery.
- The Trona reserve in southwestern Wyoming is the largest and purest in the world. The total reserve contains over 100 billion tons of trona, 40 billion tons are minable with conventional methods.
Wyoming Trona Industry

- Trona was discovered in Sweetwater County in 1938 during oil and gas exploration.
- The first mine shaft was sunk in 1946, and commercial soda ash production began in 1948. Up until that time, all soda ash in the United States was produced synthetically.
- Today the four Wyoming producers mine over 18 million tons of trona each year and directly employ over 2,300 people.
- The trona is brought to the surface where it is refined into soda ash. The soda ash is then shipped by trucks, trains and ships to markets across the United States and the world.
- About 50% of the almost 12 million tons of soda ash produced in Wyoming is now exported to markets overseas. It is Wyoming’s top export and the largest inorganic chemical exported from the USA.
- The Wyoming trona industry contributes approximately $100 million each year to state taxes and royalties.
Trona

- Trona (ore that contains sodium sesquicarbonate) is a relatively rare sodium-rich mineral found in the United States, Africa, China, Turkey, and Mexico.

- Chemically, Trona is a double salt
  - Sodium Carbonate + Sodium Bicarbonate + 2 Waters
  - Or symbolically: $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3 \cdot 2\text{H}_2\text{O}$

- Full utilization of U.S. effective capacity is expected to continue in 2017.
- Exports account for >55% of demand, driving the majority of the growth.

- US domestic demand was ~ 5.1 m MT in 2016, expecting to grow ~1-2% in 2017.
- Demand in Flat Glass, Fiber Glass and Chemicals markets are growing with recovery of construction.
- Container glass demand flat.
Wyoming Trona Industry – Key Statistics

- Worlds largest concentration of Soda Ash facilities
  - Over 90% of the domestic Soda Ash is produced in Wyoming, over 2300 direct employees
  - Worlds largest reserves for mechanical mining
    - Wyoming Trona mines have operated for more than 60 years
    - Decades of operations remaining if we can maintain our competitive edge in a global economy
  - U.S. producers are running at full utilization due to strong global demand for natural soda ash

- Major Exporter of US Manufactured Products
  - Wyoming is the world's largest single exporter of soda ash, greater than 50% of our production is exported
  - Largest US exporter of inorganic chemicals, over $1 billion

- Investments in Employees/Technology/Sustainability
  - Incremental expansions at Tata, Tronox in 2011
  - Tata, 7shaft installation – 2015
  - Tronox Solution Mine Pilot - 2015
  - Solvay, Boiler and Heat Exchanger Debottleneck – 2015
  - Solvay, Vent Shaft Addition - 2017
  - Ciner, Rail Yard Expansion
  - Sage grouse CCA’S and other conservation measures
  - Partnerships with Western Wyoming Community College
# The Value of Trona to the State of Wyoming

## Estimated Value in 2016

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production in tons of trona</td>
<td>17,507,981</td>
</tr>
<tr>
<td>Severance Tax</td>
<td>$ 18,537,921</td>
</tr>
<tr>
<td>Ad Valorem Tax on Production</td>
<td>$ 32,900,869</td>
</tr>
<tr>
<td>Federal Mineral Royalty (Wyoming share)</td>
<td>$ 29,539,487</td>
</tr>
<tr>
<td>Ad Valorem Tax on Real and Pers. Prop.</td>
<td>$ 7,761,680</td>
</tr>
<tr>
<td>State Royalties</td>
<td>$ 17,416,364</td>
</tr>
<tr>
<td>Sales Tax</td>
<td>$ 7,178,558</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$ 113,334,879</strong></td>
</tr>
<tr>
<td>Payroll Including Benefits</td>
<td>$356,022,909</td>
</tr>
<tr>
<td>No. of Employees</td>
<td>2328</td>
</tr>
<tr>
<td>Contract Employees</td>
<td>264</td>
</tr>
</tbody>
</table>

Source: Wyoming Mining Association
Owners of Wyoming trona facilities have a long history of investment to insure sustainable operations and regularly expand capacity when conditions are conducive.

- 15% volume growth from 2000 to 2016

Source: Wyoming Mining Association
Although global demand is growing, from 2000-2016 US domestic consumption decreased 1.4% annually.

US exports grew 3.5% annually.

The health of the Wyoming trona industry is dependent on the ability to export competitively.

* Includes non-Wyoming production

Source: USGS
Global demand is estimated to grow by ~ 2% in 2017 (~ 1 million MT/yr)

Higher growth rates are in developing economies: Latin America, Southeast Asia and Indian sub-continent

*Other includes mining, oil & gas, flue gas desulfurization, etc;

MEA includes Middle East and Africa, ISC = Indian sub-continent

Sources: IHS, Tronox Estimates
Soda Ash - One of Wyoming’s Most Valuable Products
From 2007 - 2016, US exports grew annually by 3% to Latin America, 5% to Asia (excluding China), and 6% to the Middle East & Africa.

In 2016, 46% of US export volume went to Latin America, 34% to Asia, 7% to Middle East & Africa, and 6% to Western Europe.

Source: US Customs/ITC
Export Competition – China Remains Oversupplied

- Chinese soda ash industry has a significant amount of excess nameplate capacity available
- Export VAT rebate (9%) remains in place as Chinese government encourages export growth
- Exports from China remain a competitive threat US exports in the Asian region

Source: IHS, NBS and China customs
Turkey is bringing on over 3 million tons of annual capacity of Natural soda ash between 2017 and 2018.

Low cost production from Turkey will increase competition with US natural soda ash and global synthetic producers for share of the importing regions of the world in Europe, Latin America and Southeast Asia.

Source: IHS
Trona/Soda Ash Industry - Current Concerns

- Increasing difficulty in maintaining competitiveness in the export market
  - China VAT Rebate on exports
  - Turkey capacity
  - Exchange Rates
  - Limited logistics options
  - Royalty Payments
- Uncertainty over Trade Agreements
  - NAFTA
  - Asia-Pacific without USA
- Meeting the School Funding Challenge
  - Must lessen the over-reliance on minerals
- Federal Energy Regulation and Strategy
  - Stable low cost energy critical to allow natural soda ash to be competitive against higher carbon footprint synthetic ash
- Human Resources: Attract and retain quality personnel:
  - Key positions open from 9-12+ months
  - Not only professional but also mechanics, electricians, other trades
  - Demographics driving attrition rate that is higher than recruitment and graduation rates
  - Challenging to recruit talent to small town lifestyle
Wyoming Trona Industry – Summary

- Although demand for soda ash is declining in the US, it is increasing globally with the majority of the growth in developing countries.

- U.S. producers are running at full utilization due to strong global demand for natural soda ash:
  - Cost
  - Carbon Footprint

- Wyoming Producers are investing to maintain their competitive advantage:
  - Technology & Sustainability
  - Capacity Expansions/ Jobs

- Wyoming, the largest natural soda ash producer in the world, remains focused on a reliable supply to the U.S. market and strategic exports for growth.
Community Contributions

Green River Wyoming Chamber
Cowboys Against Cancer
Sweetwater County, Wyoming
United Way Live United
University of Wyoming
Wyoming Breast Cancer Initiative
Rock Springs Chamber
Western Wyoming Community College
Wyoming Congressional Award for Youth
Boys & Girls Club of Sweetwater County
Wyoming Wildlife Foundation
Back Up Slides
Developing economies present stronger growth potential over next 5 years

<table>
<thead>
<tr>
<th>Soda Ash per Capita Consumption (kg/person)</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>16.0</td>
<td>17.4</td>
<td>18.3</td>
</tr>
<tr>
<td>U.S.</td>
<td>16.5</td>
<td>16.1</td>
<td>16.3</td>
</tr>
<tr>
<td>W. Europe</td>
<td>15.5</td>
<td>14.8</td>
<td>15.1</td>
</tr>
<tr>
<td>C. Europe</td>
<td>11.9</td>
<td>12.5</td>
<td>13.7</td>
</tr>
<tr>
<td>CIS</td>
<td>12.7</td>
<td>11.8</td>
<td>13.0</td>
</tr>
<tr>
<td>Middle East</td>
<td>6.6</td>
<td>6.6</td>
<td>7.1</td>
</tr>
<tr>
<td>S. America</td>
<td>4.6</td>
<td>5.1</td>
<td>5.5</td>
</tr>
<tr>
<td>India</td>
<td>2.2</td>
<td>2.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Africa</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>World</td>
<td>7.5</td>
<td>7.6</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Source: IHS
US Natural Soda Ash Life Cycle Assessment

• US Natural Soda Ash has a Greenhouse Gas (GHS) footprint 37 percent less than Chinese synthetic soda ash when leaving their respective manufacturing sites and its GHG footprint is less than Chinese synthetic soda ash even when delivered to customers around the world.

• Increased utilization of US Natural Soda Ash will mean lower greenhouse gas emissions globally and lower overall environmental impact compared to utilization of Chinese synthetic soda ash.

Source: The Industrial Minerals Association – North America (IMA-NA). The study was conducted in compliance with international standards on LCA (ISO 14040 series). The LCA study was conducted independently by Sustainable Solutions Corporation. The study is a “cradle to gate” study, examining the soda ash from its extraction as trona in an underground mine or solution mine through its processing into a final product and preparation for shipping.
# Soda Ash Applications

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Typical End Uses</th>
<th>End Use Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Glass</td>
<td>• windshields</td>
<td>• lowers glass production energy use</td>
</tr>
<tr>
<td></td>
<td>• residential windows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• commercial construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• furniture / home furnishing</td>
<td></td>
</tr>
<tr>
<td>Container Glass</td>
<td>• beer &amp; beverages</td>
<td>• lowers viscosity of molten glass providing increased flexibility in molding</td>
</tr>
<tr>
<td></td>
<td>• wine and spirits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• perfume</td>
<td></td>
</tr>
<tr>
<td>Other Glass</td>
<td>• fiberglass insulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• light bulbs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tableware</td>
<td></td>
</tr>
<tr>
<td>Detergents</td>
<td>• soda ash directly in powdered detergent box (home laundry, dishwashers, institutional)</td>
<td>• alkalinity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• surfactant carrier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• filler</td>
</tr>
<tr>
<td>Chemicals</td>
<td>• sodium silicates</td>
<td>• sodium source</td>
</tr>
<tr>
<td></td>
<td>• sodium phosphates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sodium bicarbonate</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>• mining</td>
<td>• alkalinity</td>
</tr>
<tr>
<td></td>
<td>• water treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• flue gas desulfurization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• oil and gas</td>
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</tr>
</tbody>
</table>

Sources: Industry information