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Industrial Minerals: The Building Blocks of Civilization

Issue

Why are Industrial Minerals Important? Industrial minerals are fundamental to the U.S. economy, contributing to the real gross domestic product (GDP), including mining, processing, and manufacturing. They are valuable components within an array of products, from dinner plates to medication. Industrial minerals are also essential to the technologies employed in defense, agriculture, and renewable energy industries.

Background - Uses of Industrial Minerals

What are Industrial Minerals? Industrial minerals are any rock or mineral with economic value that is not used as a source for metal, gemstones, or energy.[1] Industrial minerals are also classified as non-fuel minerals and differ from construction aggregates like sand, gravel, and crushed stone. Many different types of industrial minerals serve multiple uses, some of which are considered critical minerals essential to our nation's economic and national security. The most widely used industrial minerals include limestone, clays, sand, gravel, diatomite, kaolin, bentonite, silica, barite, gypsum, potash, pumice, and talc.[2]

Americans need 24 tons of industrial minerals annually - The Industrial Minerals Association reports that the average American consumes 24 tons of industrial minerals annually. *Talc*, for example, is used in cosmetics, paper, and plastics. *Silica sand* is used to make glass, ceramics, and abrasives. While industrial minerals are defined as non-metallic, there are a few that have metallurgical properties, such as *bauxite*, which is the primary source of aluminum ore and is also used to make cement and abrasives.[3] *Bentonite and barite* are non-fuel industrial minerals used as components in drilling fluids for oil and gas extraction, test borings for construction projects, water wells and groundwater monitoring wells. Bentonite is also used in manufacturing products ranging from molds for iron and steel to pet absorbent products, like cat litter.

Kaolin serves as a paper coating that improves appearance by contributing to brightness, smoothness, and gloss. *Gypsum* is used in the construction of wallboard in homes and buildings. *Magnesia* promotes both plant and livestock health.

Industrial Minerals Protect the Environment – Industrial minerals serve as asbestos substitutes for insulation and as absorbents for oil and chemical clean-ups. They even treat and purify the water we drink (*lime and zeolite*)[4] while also helping landscaped and reclamation areas absorb and hold water, reducing the amount of water used.[5] Industrial sand is used in the filtration of drinking water, the processing of wastewater and the production of water from wells.[6]

Industrial Minerals and Renewable Energy - Industrial minerals are essential to developing renewable energy technologies. A 3 MW wind turbine contains 1,200 *tons of concrete, from limestone and aggregates.*[7] A single wind turbine can contain 13 tons of fiberglass (*limestone, silica sand, and soda ash*)[8], and 3 tons of *aluminum (bauxite*).[9] According to the U.S. Geological Survey (USGS), aluminum plays a particularly important role in the nacelle, where the transfer of

wind power to electricity occurs. The U.S. was 50% dependent on foreign sources of aluminum in 2018.[10]

Batteries – Batteries, as the USGS also notes, play an important supporting role for both wind and solar energy, allowing for the storage of excess power. *Manganese* serves as an electrode in many lithium batteries. The U.S. was 100% reliant on foreign sources for manganese in 2018.

National Defense – *Manganese* is also one of the many minerals essential to U.S. national defense, in the manufacture of high strength steel for use in armored vehicles. *Aluminum* from *bauxite* provides unique strength to weight ratio capabilities in military aircraft.[11]

Medicine - From active ingredients to fillers, many modern pharmaceuticals which cure disease and relieve ailments could not be possible without industrial minerals. B*entonite,* for example, is used as an antidote for particular types of poisons. Industrial minerals play a vital role in the production of life-saving medical devices. In particular, a variety of industrial minerals are used as components in prosthetic devices, dental amalgams, and ceramic surgical instruments.[12]

Our Dependence on Imports of Industrial Minerals is Growing

Although the U.S. has significant deposits of essential industrial minerals, our dependence on imports of minerals is growing. The U.S. is more than 50% import dependent on 46 minerals.[13] And many of the nations from which these products are obtained are economic and political rivals of the U.S. SME's Industrial Minerals Review for 2019 concluded, based on data from the U.S. Geological Survey (USGS), that "the U.S. had an import reliance of greater than 20% for some 28 industrial minerals, 23 of which the U.S. was greater than 50% import-reliant. The majority of those were imported from China, 16 of which the U.S. was more than 50% import-reliant. These include minerals, and some termed critical minerals, on which the U.S. is 100 % reliant: bauxite, fluorspar, graphite, mica, rare earths, scandium and yttrium."[14]

Economic Contributions

The National Mining Association reports that mining has a direct economic impact of about $700 billion annually, or about three percent of the U.S. gross domestic product (GDP), which is a

measure of the market value of goods, services and structures produced in a country during a given time period. Mining activity occurs in all 50 states; and the U.S. has significant deposits of 78 minerals (including many industrial minerals) and major commodities - the most of any nation.[15]

The National Mining Association reports that U.S. mining in 2017, directly and indirectly, generated more than 1.5 million U.S. jobs, $95 billion in U.S. labor income, and $217 billion of U.S. GDP.[16] Of that total, the non-metallic mineral mining segment of U.S. mining accounted for 825,273 jobs, $47.0 billion in labor compensation and $109.2 billion of U.S. GDP. Annual wages and salaries in the non-metallic mining sector averaged $64,600. Non-metallic mineral mining – which includes industrial minerals - represented 54 percent of U.S. mining employment, 49 percent of labor income, and 50 percent of its contribution to GDP.[17]

According to the United States Geological Survey, in 2019, the estimated total value of non-fuel mineral production in the U.S. was $86.3 billion. The total value of industrial minerals production, including construction minerals, was $58.2 billion. Of this total, $27.7 billion was construction aggregates production (construction sand and gravel and crushed stone), and over $30.5 billion represented production of industrial minerals described in this paper, or nearly 52% of the total mineral production economy.[18]

SME Statement of Technical Position

• Industrial minerals are important, but often overlooked, commodities essential to our daily lives.
• The U.S. is 100 percent dependent on imports for 17 minerals and more than 50 percent import-dependent on 46 minerals – many of which are industrial minerals.
• In light of this dependency, the U.S. must examine and develop technological and policy solutions to increase domestic mining of industrial minerals, especially for those that may be sourced locally.
• For the minerals that can be produced in the U.S., reliance on imports results in increased natural resource demand associated with the transportation of these commodities (including greenhouse gas emissions from fuel combustion), with a negative impact on the environment.
• Increased domestic production of industrial minerals will benefit manufacturing, construction and agriculture; thus fueling the domestic engine of growth, and protect the environment.

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[1] Source: Advances in the Characterization of Industrial Minerals: University Textbook. United Kingdom, European Mineralogical Union, 2011. Page 2-3

[2] A. Somarin, Ubiquitous Industrial Minerals: Nature's Most Popular Raw Materials; https://www.thermofisher.com/blog/mining/ubiquitous-industrial-minerals-natures-most-popular-raw-materials/

[3] https://www.ima-na.org/ Industrial Minerals Association of North America (If there is difficulty connecting from this hyperlink, please google Industrial Minerals Association of North America and go to the web site).

[4] https://www.indmin.com/Stub.aspx?StubID=2852

[5] Industrial Minerals Association North America; https://www.ima-na.org/page/essential

[6] https://www.ima-na.org/page/what_is_ind_sand

[7] https://www.americanexperiment.org/2018/04/mines-or-windmills/#:~:text=For%20example%2C%20a%20single%20wind,pounds%20of%20rare%20earth%20minerals.

[8] The basic raw materials for fiberglass products are a variety of natural minerals and manufactured chemicals. The major ingredients are silica sand, limestone, and soda ash. Other ingredients may include calcined alumina, borax, feldspar, nepheline syenite, magnesite, and kaolin clay, among others. Silica sand is used as the glass former, and soda ash and limestone help primarily to lower the melting temperature. Other ingredients are used to improve certain properties, such as borax for chemical resistance. http://www.madehow.com/Volume-2/Fiberglass.html#ixzz6iq2Dy6yJ

[9] A wind turbine may also contain up to 335 tons of steel containing molybdenum and up to 1.7 tons of copper. National Mining Association *Facts About Coal and Minerals (2020), https://nma.org/wp-content/uploads/2016/11/factbook2020.pdf*

[10] USGS Report, Critical Minerals in Renewable Energy; https://www.usgs.gov/media/images/critical-mineral-commodities-renewable-energy

[11] https://mineralsmakelife.org/resources/minerals-make-security/
[12] https://www.ima-na.org/page/essential
[13] USGS *Mineral Commodity Summaries 2020* at 7. See also, https://www.americanexperiment.org/2018/04/mines-or-windmills/#:~:text=For%20example%2C%20a%20single%20wind,pounds%20of%20rare%20earth%20minerals.
[14] M. O'Driscoll, SME Industrial Minerals Review 2019, SME Mining Engineering Magazine (July 2020) at 30.
[15] National Mining Association *Facts About Coal and Minerals (2020), https://nma.org/wp-content/uploads/2016/11/factbook2020.pdf*

[16] National Mining Association *Economic Contributions of Mining 2017 https://nma.org/wp-content/uploads/2017/09/economic-contributions_2018_onepager.pdf*

[17] National Mining Association *Economic Contributions of Mining 2018 (2017 Update)*, https://nma.org/wp-content/uploads/2016/09/Economic_Contributions_of_Mining_2017_Update.pdf

[18] USGS *Mineral Commodity Summaries 2020* at 5, https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf