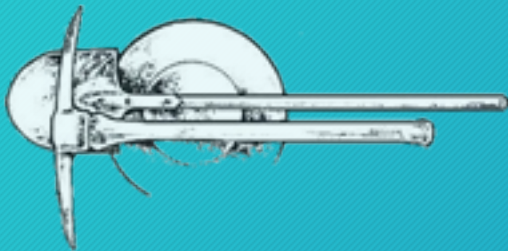


Economics of Mining



Montana Mining Association

Presentation for PNWER 2019 Summit, Saskatoon, SK, July 23, 2019

Research Method

- These findings are based on an analysis of the hardrock mining industry's economic contributions conducted by the University of Montana's Bureau of Business and Economic Research (BBER).
- The analysis makes use of the BBER's policy analysis model of the Montana economy, leased from Regional Economic Models, Inc. (REMI), which has been designed and calibrated expressly for this purpose.
- The REMI model (www.remi.com) has been thoroughly documented, tested, and evaluated in dozens of peer-reviewed research journals, and the BBER's adaptation of the model for this study follows the state-of-the-art practices in conducting policy research.

Impacts Summary

Category	Units	Impacts
Total Employment	Jobs	12,304
Personal Income	\$ Millions	1,154.5
Disposable Pers. Income	\$ Millions	1,005.3
Selected State Revenues	\$ Millions	199.4
Output	\$ Millions	2,721
Population	People	20,293

The Economic Impact of Mining in Montana

Impacts Summary

Category	Units	Impacts by Year		
		2020	2025	2030
Total Employment	Jobs	3,257	3,531	3,102
Personal Income	\$ Millions	186.1	228.6	227.0
Disposable Pers. Income	\$ Millions	159.9	196.6	195.7
Selected State Revenues	\$ Millions	25.9	37.5	38.9
Output	\$ Millions	407.8	450.3	460.8
Population	People	886	3,233	3,775

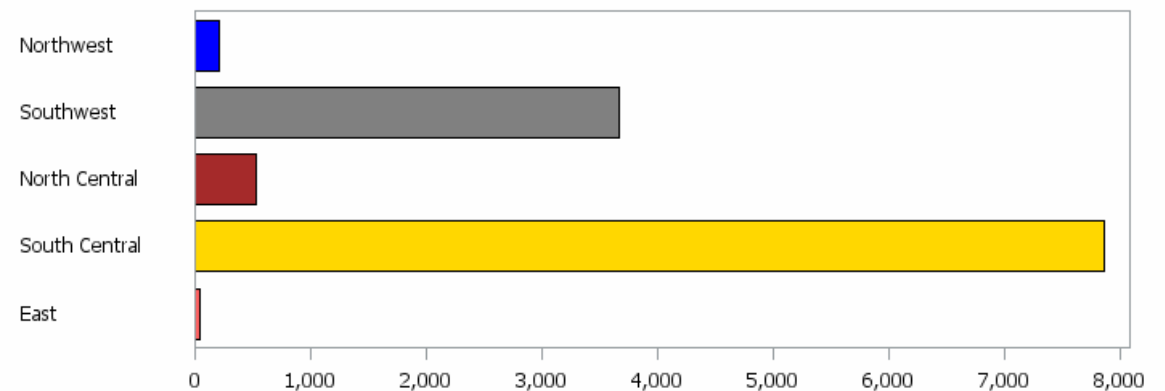
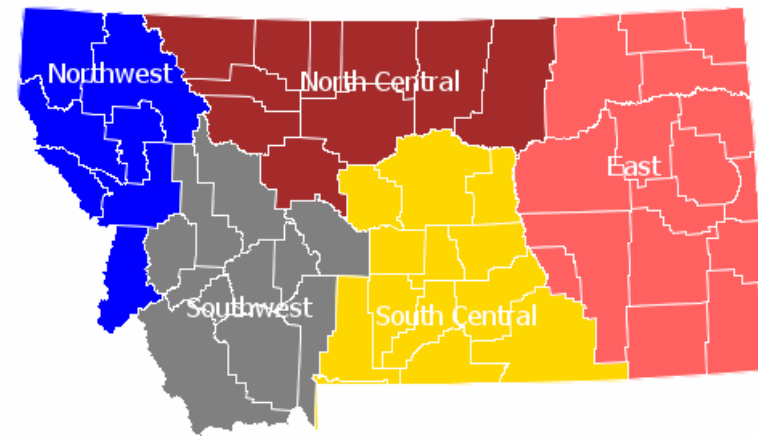
The Economic Impact of Proposed New Mining in Montana

The Economic Impact of Mining in Montana

Employment Impacts	
Industry	Jobs
Mining	2,849
Construction	860
Manufacturing	275
Wholesale Trade	310
Retail Trade	1,607
Transportation and Warehousing	95
Professional and Technical Services	824
Administrative and Waste Services	291
Health Care and Social Assistance	878
Arts, Entertainment, and Recreation	117
Accommodation and Food Services	866
Other Services, except Public Administration	440
Other Private	798
Government	2,095
TOTAL	12,304

The Economic Impact of Mining in Montana

Employment Impacts by Region



Compensation Impacts

Category	Units	Impact
Wages and Salaries	\$ Millions	781.7
Compensation	\$ Millions	995.5
Earnings	\$ Millions	1058.5
Earnings per Job, New Jobs	\$ Dollars	\$86,030

The Economic Impact of Mining in Montana

The Economic Impact of Mining in Montana

Output Impacts, \$ Millions	
Category	Impact
Mining	1847.1
Construction	78.8
Manufacturing	73.1
Wholesale Trade	62.2
Retail Trade	106.6
Transportation and Warehousing	7.4
Professional and Technical Services	85.0
Administrative and Waste Services	18.4
Health Care and Social Assistance	70.1
Arts, Entertainment, and Recreation	2.6
Accommodation and Food Services	30.7
Other Services, except Public Administration	19.2
Other Private	171.7
Government	147.8
TOTAL	2720.7

The Economic Impact of Mining in Montana

State Revenue Impacts, \$ Millions	
Category	Impact
Intergovernmental Revenue	48.3
Selective Sales Tax	26.1
License Taxes	6.9
Individual Income Tax	30.6
Corporate Income Tax	11.0
Other Taxes	15.1
Current Charges	16.4
Miscellaneous General Revenue	14.5
Utility Revenue	1.6
Liquor Store Revenue	2.5
Insurance Trust Revenue	26.4
TOTAL	199.4

Population Impacts

Age Cohort	Population Impact
Ages 0-14	5,379
Ages 15-24	2,421
Ages 25-64	11,492
Ages 65+	1,001
TOTAL	20,293

The Economic Impact of Mining in Montana

The Economic Impact of Proposed New Mining in Montana

Employment Impacts			
Industry	Jobs Impact by Year		
	2020	2025	2030
Mining	931	885	888
Construction	572	641	357
Manufacturing	47	39	26
Wholesale Trade	43	45	40
Retail Trade	358	394	354
Transportation and Warehousing	28	18	11
Professional and Technical Services	106	165	175
Administrative and Waste Services	62	64	57
Health Care and Social Assistance	176	175	167
Arts, Entertainment, and Recreation	30	22	18
Accommodation and Food Services	133	158	151
Other Services, except Public Administration	137	113	93
Other Private	164	158	132
Government	471	654	632
TOTAL	3,257	3,531	3,102

The Economic Impact of Proposed New Mining in Montana

Output Impacts, \$ Millions			
Category	Impacts by Year		
	2020	2025	2030
Mining	248.3	255.0	287.4
Construction	37.8	47.0	28.8
Manufacturing	4.9	4.4	3.2
Wholesale Trade	6.9	8.2	8.1
Retail Trade	17.6	22.3	22.6
Transportation and Warehousing	2.0	1.0	0.3
Professional and Technical Services	8.2	13.9	15.7
Administrative and Waste Services	3.5	4.0	4.0
Health Care and Social Assistance	12.0	13.1	13.3
Arts, Entertainment, & Recreation	0.9	0.6	0.5
Accommodation and Food Services	4.3	5.1	5.0
Other Services, except Public Administration			
Other Private	4.6	4.2	3.7
Government	26.2	27.1	23.5
TOTAL	30.5	44.3	44.8
	407.8	450.3	460.8

Compensation Impacts

Category	Units	Impacts by Year		
		2020	2025	2030
Wages and Salaries	\$ Millions	145.4	164.1	153.6
Compensation	\$ Millions	180.4	208.5	197.3
Earnings	\$ Millions	210.3	237.7	217.4
Earnings per Job, New Jobs	\$ Dollars	\$64,548	\$67,318	\$70,098

The Economic Impact of Proposed New Mines in Montana

Conclusion - Mining Punches Above Its Weight

- The hardrock mining industry in Montana is an important source of jobs, income, sales revenue and tax revenue for Montana workers, households, businesses and governments. The eight largest producers of metals, talc, and concrete products today ultimately support more than 12,000 jobs statewide with average annual earnings of over \$86,030.
- Additionally, if three mines currently under consideration were to be successfully developed and operated, the economy would stand to gain more than 3,000 jobs and \$450 million per year in personal income.

Critical Minerals

Presidential Executive Order

On December 20, 2017, President Trump Signed Executive Order 13817
A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals

Administration of Donald J. Trump, 2017

Executive Order 13817—A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals December 20, 2017

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Findings. The United States is heavily reliant on imports of certain mineral commodities that are vital to the Nation's security and economic prosperity. This dependency of the United States on foreign sources creates a strategic vulnerability for both its economy and military to adverse foreign government action, natural disaster, and other events that can disrupt supply of these key minerals. Despite the presence of significant deposits of some of these minerals across the United States, our miners and producers are currently limited by a lack of comprehensive, machine-readable data concerning topographical, geological, and geophysical surveys; permitting delays; and the potential for protracted litigation regarding permits that are issued. An increase in private-sector domestic exploration, production, recycling, and reprocessing of critical minerals, and support for efforts to identify more commonly available technological alternatives to these minerals, will reduce our dependence on imports, preserve our leadership in technological innovation, support job creation, improve our national security and balance of trade, and enhance the technological superiority and readiness of our Armed Forces, which are among the Nation's most significant consumers of critical minerals.

Sec. 2. Definition. (a) A "critical mineral" is a mineral identified by the Secretary of the Interior pursuant to subsection (b) of this section to be (i) a non-fuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security.

(b) The Secretary of the Interior, in coordination with the Secretary of Defense and in consultation with the heads of other relevant executive departments and agencies (agencies), shall publish a list of critical minerals in the Federal Register not later than 60 days after the date of this order, and disseminate such list to the appropriate agencies.

Sec. 3. Policy. It shall be the policy of the Federal Government to reduce the Nation's vulnerability to disruptions in the supply of critical minerals, which constitutes a strategic vulnerability for the security and prosperity of the United States. The United States will further this policy for the benefit of the American people and in a safe and environmentally responsible manner, by:

- (a) identifying new sources of critical minerals;
- (b) increasing activity at all levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing critical minerals;
- (c) ensuring that our miners and producers have electronic access to the most advanced topographic, geologic, and geophysical data within U.S. territory to the extent permitted by law and subject to appropriate limitations for purposes of privacy and security, including

Final List of Critical Minerals

1. Aluminum (bauxite)
2. Antimony
3. Arsenic
4. Barite
5. Beryllium
6. Bismuth
7. Cesium
8. Chromium
9. Cobalt
10. Fluorspar
11. Gallium
12. Germanium
13. Graphite (natural)
14. Hafnium
15. Helium
16. Indium
17. Lithium
18. Magnesium
19. Manganese
20. Niobium
21. Platinum group metals
22. Potash
23. Rare earth elements group
24. Rhenium
25. Rubidium
26. Scandium
27. Strontium
28. Tantalum
29. Tellurium
30. Tin
31. Titanium
32. Tungsten
33. Uranium
34. Vanadium
35. Zirconium

Mineral Dependency

USGS



- U.S. is 100 percent import reliant for 18 minerals, 14 of which have been deemed “Critical” by the Secretaries of Defense and the Interior.
- In total, the U.S. is more than 50 percent import reliant for 29 of the 35 minerals designated as “critical.”

U.S. Department of Defense

On April 30, 2019, the Department of Defense (DoD) published a new interim rule that will prohibit contractors from importing certain high-powered rare-earth and tungsten components produced in North Korea, China, Russia, and Iran for use in DoD systems. The rule is vital to securing our defense industrial base.

FY19 National Defense Authorization Act and 10 U.S.C. 2533c

National Mining Association

OUR NATIONAL SECURITY IS AT RISK



The Department of Defense uses 750k tons of minerals each year



920 lbs. of rare earths are used to make a single F-35 Joint Strike fighter jet



90% of manufacturing executives say they are concerned about access to minerals

62%

OF VOTERS

Support U.S. government action to encourage the use of domestic resources and decrease our import reliance

Rare Earth Elements

Rare-Earth Elements

Originally produced for the October 2011 issue of *Scientific American*

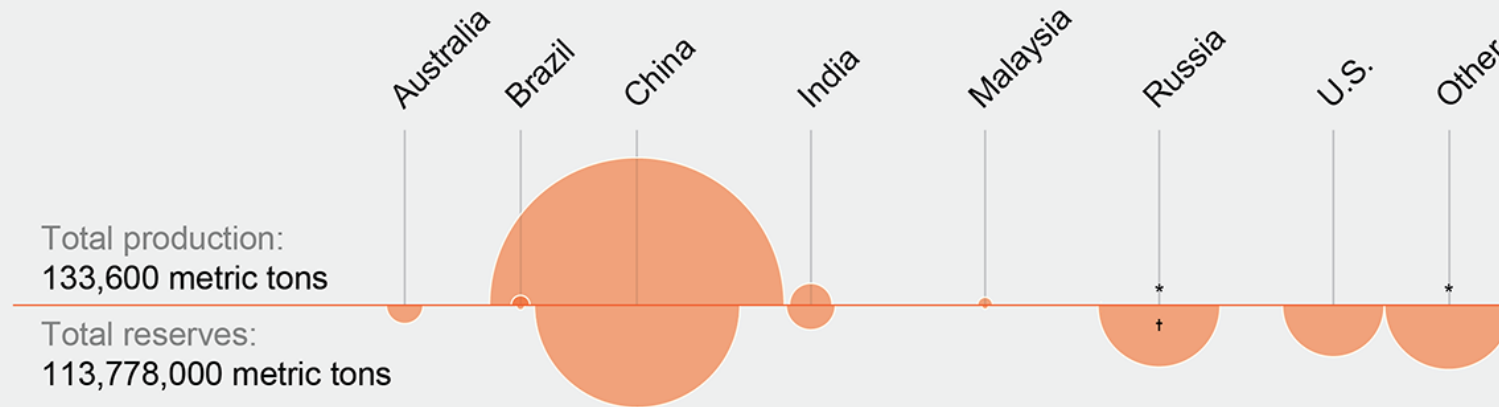
What Are They Used For?

Scandium	Aerospace components, aluminum alloys
Yttrium	Lasers, TV and computer displays, microwave filters
Lanthanum	Oil refining, hybrid-car batteries, camera lenses
Cerium	Catalytic converters, oil refining, glass-lens production
Praseodymium	Aircraft engines, carbon arc lights
Neodymium	Computer hard drives, cell phones, high-power magnets
Promethium	Portable x-ray machines, nuclear batteries
Samarium	High-power magnets, ethanol, PCB cleansers
Europium	TV and computer displays, lasers, optical electronics
Gadolinium	Cancer therapy, MRI contrast agent
Terbium	Solid-state electronics, sonar systems
Dysprosium	Lasers, nuclear-reactor control rods, high-power magnets
Holmium	High-power magnets, lasers
Erbium	Fiber optics, nuclear-reactor control rods
Thulium	X-ray machines, superconductors
Ytterbium	Portable x-ray machines, lasers
Lutetium	Chemical processing, LED lightbulbs

Rare Earth Elements

Who Has Them?

Percent of World Production and Known Reserves (2010)



* Estimate not available

† Includes certain former Soviet republics

Rare Earth Elements

How Dependent Is the U.S.?



China

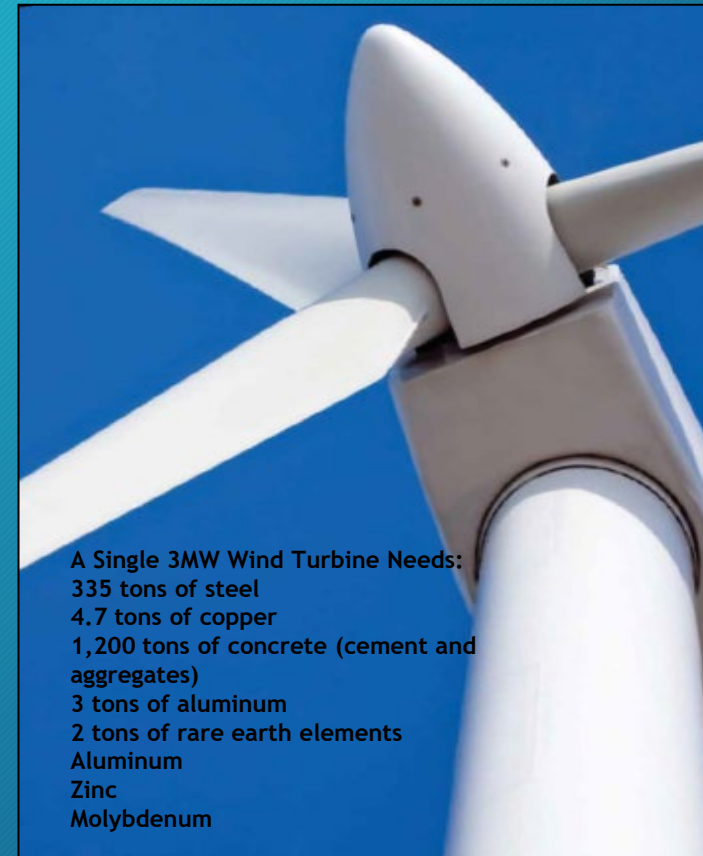
- In 2015, one of the Chinese military's official propaganda arms published an article declaring rare earths to be “strategic mining resources, especially important for protecting state security and winning modern warfare.”
- The article went on to call rare earths “the lifeblood of national defense” and stated darkly that: “Now the struggle between nations for these strategic resources is becoming increasingly fierce. So we must . . . strengthen our protection and control over these strategic mining resources.”



Green Future



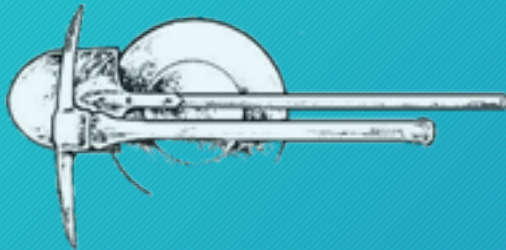
Minerals in a Solar Panel Includes:
Steel
Copper
Rare Earths
Quartzite Gravel
Silicon
Titanium
Phosphorus
Lead
Aluminum



A Single 3MW Wind Turbine Needs:
335 tons of steel
4.7 tons of copper
1,200 tons of concrete (cement and aggregates)
3 tons of aluminum
2 tons of rare earth elements
Aluminum
Zinc
Molybdenum

Thank You For Your Kind Attention!!

Montana Mining Association



Tammy Johnson
Executive Director
P.O. Box 1026
Whitehall, MT 59759
(406) 287-3012
tjohnson@montanamining.org