The WMC thanks the Minerals Council of Australia for their generosity in permitting our use of their copyrighted materials in the presentation.
Everyday things mining makes possible

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Note: Interspersed information provided on periodic table elements is provided in order of Z to A.
Everything comes from somewhere.

If it didn’t grow, it was mined.
Mining makes powering the world possible

Electricity

The amount of energy Google requires to conduct 100 searches is as much as a standard light bulb burning for 28 minutes.*

https://www.electricchoice.com/blog/50-surprising-facts-on-energy-consumption/

U.S. is a net Energy Producer
For the first time since 1957, in 2019, the annual U.S. energy production exceeded energy consumption -- producing 01.0 quads of energy while only consuming 100.2 quads.*

https://www.eia.gov/energyexplained/us-energy-facts/
Did you know?
Soviet scientists discovered they could create cubic zirconias (zirconium combined with dioxide) in a laboratory in the 1970s. They faceted the stone, named the crystals ‘Djevalite’ and began marketing them as simulated diamonds in 1976.

We can find zirconium in the essential ceramics, knives, and interior design items in our lives. We can also find zirconium in the surrounding buildings, even the military, and nuclear power fields.

https://www.refractorymetals.org/facts-about-zirconium/

Australia and South Africa have the largest share of zirconium reserves globally. Florida produces zirconium from coastal aggregate deposits.

Zirconium is used as an ingredient to increase the strength of magnesium alloys. Zirconia ceramics provide an ultra-thin, diamond-like coating for jet engine blades, protecting the metal alloy of the blades and allowing them to withstand significantly higher temperatures.

Headquartered in Lake Forest, California, Advanced Refractory Metals is a leading manufacturer and supplier of refractory metals such as tungsten, molybdenum, tantalum, rhenium, titanium, and zirconium across the world - providing customers with high-quality refractory metal products.
Sustainable coffee pods
Rio Tinto has partnered with coffee giant Nespresso to supply sustainable aluminum for its coffee capsules after becoming the world’s first company to be certified by the Aluminum Stewardship Initiative (ASI). Certification reflects the highest environmental, social and governance practices across the aluminum lifecycle.

Machinery used to process and manufacture food

- Aluminum (Al): Foil packets, Drink cans
- Iron (Fe): Cans
- Carbon (C): Cans
- Chromium (Cr): Blender blades, Machinery plating
- Molybdenum (Mo): Cans
- Manganese (Mn): Cans
- Nickel (Ni): Cans
- Copper (Cu): Alloys reduce food contamination
- Tin (Sn): Canning (tin-coated steel)
- Sodium (Na): Flavor enhancer, Preservative
- Carbon (C): Machinery used to process and manufacture food

Coca-Cola uses 300,000 tons of aluminum every year in the U.S. - 17.4% of total U.S. aluminum production.

Mining makes the preservation of food possible.
Zinc

**Did you know?**

Oysters contain more zinc than any food - one reason they are believed to be an aphrodisiac. Zinc is crucial to hormone production. Casanova believed in the power of the mollusk - the 18th-century lover would breakfast on 50 oysters.
Gold nanoparticle technology

The nanotechnology boom has opened up a new frontier of early detection, diagnosis and treatment of diseases. Gold nanoparticle technology is being used to target and deliver antibodies directly into cancerous tumors as well as being engineered to attach to cancer-related proteins to aid earlier detection.

Metal-based compounds are crucial to the diagnosis and treatment of disease.

03

Health care
Did you know?
As a power source, uranium is practically infinite. Enriched uranium can produce 3.7 million times the energy of coal. It can also be reused multiple times. A golfball-sized amount of nuclear material provides a lifetime of energy for one person.
Mining makes holding the world in your hand possible.

More than 40 mined metals and rare earths are used to produce a single smartphone.

Modern day gold mine

One ton of mobile phones yields more gold than one ton of gold ore. Tech companies are cashing in on this gold mine by rolling out recycling programs. Apple’s recycling program reaped almost a ton of gold in 2015. In 2018, Apple debuted a robot called ‘Daisy’ that can disassemble up to 200 iPhones an hour.
The USGS National Minerals Information Center reported that there was no commercial production of tungsten in the United States between 2015 and 2019.


Scientists devised a ‘Sock Loss Index’ in 2016 to find out why socks go missing in the wash. This formula \((L(p \times f) + C(t \times s)) - (P \times A)\) explains why Americans lose on average 1.3 socks a month. Unsurprisingly it’s down to the complexity and care taken while doing laundry. The research was clever marketing by an appliance company.

The exterior of your refrigerator is made of sheet metal and the cooling system relies on copper which is soft enough to wrap into small spaces.

Lost Sock Index

Steel used to build appliances

Paint and some finishes

Mining makes the products that make every day possible

05 Appliances
Did you know?
The Academy Award’s Oscar statuette is made primarily of tin. The figure, a stylised knight holding a crusader’s sword and standing on a film reel, is made of Britannia metal (93% tin, 5% antimony, 2% copper) and plated with 24 carat gold.
London inventor Thomas Parker designed and built the first practical electric car in 1884. In the 19th and early 20th centuries, electric cars fueled by high-capacity rechargeable batteries were the most popular cars on the road. It wasn’t until a more advanced combustion engine and the expansion of highways that sales dropped off.

Electric cars aren’t new

Mining makes the cars of today and tomorrow possible.

In 1899, 90% of New York City’s taxi cabs were electric vehicles.

Car body and chassis made from strengthened steel and aluminum alloys

Ev batteries

Magnet in EV motors

Electric cars
Did you know?
Humans can overdose on salt. A 19-year-old man accepted a dare to chug a bottle of soy sauce in 2013. The flood of excess sodium caused his brain to lose water, landing him in a coma. Doctors flushed the salt from his system, saving his life.
Mining makes protecting our nation possible

**Defense**

Fighter pilot futuristic tech
American fighter pilots will wear custom-made, augmented reality helmets worth $400,000 each. Made of Kevlar and carbon fiber, the helmets are packed with electronics that project data inside the visor. Vision from sensors located around the aircraft allow pilots to effectively see ‘through’ the jet.

The maximum speed without external stores of the Lockheed Martin F-22 Raptor is approximately Mach 1.8 at military power and greater than Mach with after burners.
Did you know?
Silver has been used for centuries in medicine because of its antibacterial properties. It remains a wound management agent today, especially for burn patients. Unlike manufactured antibiotics, bacteria do not develop an immunity to silver.
Mining makes renewable energy generation possible. Solar power accounts for approximately 2.3% of America’s total electricity generation.

Solar energy powering mining

From a spotlight on the American flag to powering data monitoring at a Colorado mine remediation site, solar power energy combines with battery storage applications with PV modules that have a 25-30 year life-span.
Did you know?
Silicon is never found in its natural state, but rather in combination with oxygen as the silicate ion. Silica sand or quartz sand is made of silicon dioxide (SiO2). Sand is plentiful, easy to mine and relatively easy to process -- it is the primary ore source of silicon. The metamorphic rock, quartzite, is another source.
Mining makes building your dream home possible

Your house

Besides cement and gypsum, bricks and tiles, your house requires metals for nuts and bolts, nails and screws, pipes and wiring which all come from mined metals.

2021 Single-family home sales in the U.S. are up over 4% since December 2020 and 19% since January 2020.
Did you know?
Modern rare earth separation processes used today were developed around the time of WWII. The Manhattan Project drove the development of the ion exchange method which made it possible to extract plutonium for atomic bombs.
Mining makes getting where you need to go possible.

Aircraft
- Aluminum (Al)
- Scandium (Sc)
- Niobium (Nb)
- Titanium (Ti)

Air conditioning
- Iron (Fe)
- Silicon (Si)
- Copper (Cu)
- Aluminum (Al)

GPS and electronics
- Copper (Cu)
- Gold (Au)
- Tin (Sn)

Trains, trams, buses and taxis
- Iron (Fe)
- Manganese (Mn)
- Aluminum (Al)
- Molybdenum (Mo)
- Lead (Pb)
- Magnesium (Mg)
- Tantalum (Ta)

The New York City Subway System covers 245 miles. The Chicago "L" has about 222 miles of track and 147 stations. The D.C. Metro system which began operations in 1976, operates over a network of six lines, 91 stations, and 117 miles of track. Five U.S. cities including New York, Boston, Washington, D.C., and San Francisco have the largest, most extensive public transit systems in the country.
Did you know?

Potassium is radioactive and at the same time, vital to good health. Loaded with potassium, bananas are among the most radioactive foods. Background radiation is naturally occurring and small amounts are not harmful to humans.
Natural products

Salt has been used as a natural scourer since medieval times. Natural acids can keep your metal pots and pans shining.
Did you know?

Platinum is among the most prized metals in the world, but that wasn’t always the case. When the Spaniards first found the grey-white metal in Colombia in the 18th century they derided it as impure and named it ‘platina’, which means ‘little silver’.
Mining makes American landmarks possible

High pressure sodium vapor lamps illuminate the bridge. They are made from an amalgam of metallic sodium and mercury.

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The Golden Gate Bridge

Building the bridge
Steel for the Golden Gate Bridge, constructed from 1933-1937, was fabricated by Bethlehem Steel at its foundries in Pennsylvania and New Jersey. Galvanized cable was manufactured by Roeblings in Trenton, New Jersey. Materials were shipped through the Panama Canal.
Did you know?

A bottle of Coca-Cola could be bought for a nickel in the United States between 1885 until well into the 1950s. The company was committed to the fixed five cent price, largely because its vending machines only accepted nickels.
Almost all components of an iPad are extracted from the earth by mining. The natural resources that are mined from the earth are: Graphite, Lithium, Gold, Silver, Copper, and Nickel.
Did you know?

Molybdenum gives steel strength, but did you also know it is an important crime fighter? Some fingerprint powders contain molybdenum. Combined with other chemicals, the powder works by adhering to the oil and moisture of a latent print.
Ancient cosmetics

Humans have been enhancing their appearance for thousands of years. In ancient Egypt, women lined their eyes with kohl (antimony sulphide). In Greece, women sought out lead carbonate to make their complexion pale. By 3000 B.C., men and women in China stained their fingernails. Well manicured nails reflected status.

Interestingly, Americans spend the most money on hair and skin care products and the least on oral hygiene products.
Did you know?

Titanium mineral production comes from mineral sands. Named after the Greek Titans, titanium is twice as strong as steel but 45% lighter. Resistant to corrosion, titanium is widely used in the aeronautics and aerospace industries.
Making Money
U.S. coins are made from a variety of metals including copper, nickel, and zinc. Silver-colored coins, the quarter, nickel and dime are made using a copper-nickel combination. In the past, only the faces of the coins were plated, which caused the coins to rust. Today steel is added in the making of all coins.
Did you know?

Manganese is important for good health and exists in some of the foods we eat. Too much environmental manganese can have a negative impact however, causing body tremors, aggression and delusions known as ‘manganese madness’.
Batteries

Alkaline batteries e.g. toys and electronics

- **Zn** (30): Zinc
- **Mn** (25): Manganese
- **K** (19): Potassium

Silver-oxide batteries for watches, calculators

- **Ag** (47): Silver
- **Zn** (30): Zinc
- **K** (19): Potassium

Electric vehicle batteries

- **Li** (3): Lithium
- **Co** (27): Cobalt
- **Ni** (28): Nickel

Lithium-ion batteries for mobile phones

- **Li** (3): Lithium
- **Co** (27): Cobalt
- **C** (6): Carbon

Lithium batteries can be composed of:
- Lithium Iron Phosphate
- Lithium Manganese Oxide
- Lithium Cobalt Aluminum Oxide, Lithium Titanate

Mining makes emerging technologies possible

Battery-powered telephone

French scientist Georges Leclanché invented a battery consisting of a zinc anode encompassed by a magnesium dioxide cathode which was used to power early telephones. The dry cell battery was good for intermittent use – long conversations would run the battery down and the conversation would become inaudible.
Did you know?
Epsom Salts originated from natural springs discovered in 1618 by cow-herd Henry Wicker in Epsom, England. The water's healing properties led physician and botanist Nehemiah Grew to extract the magnesium sulfate for medicinal purposes in 1695.
Commercial printing

Mining makes printed products possible

Ink pigment

- Carbon (6, C): Black
- Chromium (24, Cr): Green
- Iron (26, Fe): Blue
- Cadmium (48, Cd): Yellow
- Bromine (35, Br): Red
- Osmium (76, Os): Pen tips

Paper and cardboard

- Sodium (11, Na)
- Magnesium (12, Mg)
- Calcium (20, Ca)

3D printing

- Chromium (24, Cr)
- Silicon (14, Si)
- Nickel (28, Ni)
- Silver (47, Ag)

- Carbon (6, C)
- Nitrogen (7, N)
- Manganese (25, Mn)
- Titanium (22, Ti)

Times New Roman font uses 27 percent less ink than Arial font

Printing Presses

Handlever printing presses by the J.F.W. Dorman Co. of Baltimore, Maryland were built in the 1880s from cast iron and steel.
Did you know?
An Australian POW discovered the medicinal power of lithium in 1949. Dr. John Cade survived three and a half years at Changi before returning to his work in Australia where he successfully treated patients after noting the calming effects on guinea pigs.
18 Dentistry

Mining makes good dental health possible

Crows and bridges
Gold
Silver
Palladium
Platinum
Dental implants
Titanium
Zirconium

Dental amalgam (fillings)
Silver
Copper
Tin
Mercury

Dental drills and instruments (also stainless steel)
Tungsten
Carbon
Cobalt
Nickel
Rhodium
Titanium

Tooth extraction with a shave?
Barbers were just as likely to pull a rotten tooth as offer a shave or a hair cut during the Middle Ages. Tooth extractions were performed by ‘barber surgeons’ as part of routine hygenic services. The red and white barber’s pole even represented bloodletting – the white stripe represented the bandage used to stem the blood.

Almost 19 tons of gold were used by dentists globally in 2017.
Did you know?
Queen Elizabeth I of England was a famous proponent of Venice Ceruse, a vinegar and lead cosmetic used to achieve the white-faced look popular in the 16th century. Lead poisoning no doubt contributed to her hair loss and bad skin.
Mining makes every stage of life possible

High temperature refractory cremator bricks

Coffins and urns

Stainless steel used in crematoriums

Cryogenic procedures

Funerals

Over 1 million joint replacements occur annually in the U.S.

Titanium, gold, silver and platinum are some of the metals from dental work and artificial joints not destroyed during a cremation. Crematoriums can choose to recycle these metals, shipping them free of charge to a company in the Netherlands. Local crematoriums then receive a percentage of the revenue, which they usually donate to charity.
Did you know?

A deep-sea snail has evolved a suit of armor made from iron sulfide – the only animal on earth that uses iron this way. The scaly-foot gastropod was discovered in 2001 and lives in the hydrothermal vent fields of the Indian Ocean.
The U.S. could not manufacture TVs without importing minerals. At least six of the necessary minerals are 100% imported: Tantalum, Strontium, Noibium, Mica, Manganese, and Indium.

The Avengers: End Game was the highest grossing movie in the U.S. for 2019. Bad Boys for Life topped the list for 2020.
Did you know?

After a century of near obscurity, indium is having its moment. Indium tin oxide is the material used for touch and flat screen tech and solar panels. Soft enough to cut with a knife, indium is also notable for the high pitched ‘cry’ it gives off when bent.
Mineral makes healthy living possible

Vegetable storage and distribution

Around 20-40% of ‘ugly’ fruit and vegetables is rejected before it reaches the supermarket.

Stock feed nutrients

Made fresh in America

Today’s refrigerated trucks, trailers and rail cars are equipped with microprocessors programmed to control the operation of the unit so that both refrigeration and fuel efficiency are maximized.
Did you know?

Ecuador’s Jivaro tribe were so excessively taxed by the Spanish governor in 1599 they poured molten gold down his throat. The Romans and enforcers in the Spanish Inquisition are also believed to have killed using molten gold – an effective, albeit brutal, means of execution.
Automatic Fire Sprinklers work quickly to get a fire under control and prevent the spread of deadly smoke and gases, such as carbon monoxide. One activated sprinkler can extinguish a residential fire in less than a minute. The best piping material for a residential sprinkler system is the same reliable copper tubing that has been used in plumbing for more than 70 years.

Homes without a security system are 300% more likely to be broken into and burglarized (Alarms.org). 46.9% of people don't have a security system installed in their homes (TheZebra.com).
Did you know?

Scientists discovered a planet made of diamond in 2004. Orbiting a star in the Milky Way, 55 Cancri e is believed to be composed of diamond and graphite. Twice the size of earth, the planet moves so fast, a year there lasts just 18 hours.
Environmental solutions

Mining makes science to save the planet possible.

Metal-organic frameworks
Researchers from CSIRO, Monash University and the University of Texas have developed a desalination membrane that separates salt and lithium from seawater. Metal-organic frameworks (MOFs) are a next generation material that filters chemical compounds, making seawater safe to drink and recovering lithium for use in batteries.

Nonoscale metal blends area used to break down contaminants in groundwater.
Did you know?
Copper is considered to be humankind’s oldest metal. It is thought that Neolithic communities used copper as an alternative to stone tools during 8000 BC. Ancient Egyptians believed copper was sacred and gave its wearer magical powers.
Metals to Medals
The gold, silver, and bronze medals for the Vancouver 2010 Olympic and Paralympic Games were the first Olympic medals to contain recovered e-waste!

Gold medals are not made of solid gold -- they are made by placing a layer of gold (7.5%) on a silver base (92.5%).

Silver medals contain 7.5% copper because pure silver is too soft for the medals.

Bronze (an alloy of copper and tin) medals are made mostly of copper.

Nearly one ton of copper was used in the production of all 2010 Olympic medals.

24 Sports Championships
Did you know?
Cobalt was named after the German word for goblin, *kobold*, by superstitious miners who believed it was responsible for mysterious deaths. They were right. Toxic vapors during smelting made this a dangerous ore for medieval miners.
According to the United Nations, approximately 385,000 babies are born world-wide every day.

Humidicrib invention
Tasmanian brothers Edward and Don Both invented the humidicrib in the late 1930s. Poliomyelitis was at epidemic levels and the portable device was an inexpensive alternative to the ‘iron lung’. Today the humidicrib is used in hospitals across the globe and has helped save the lives of millions of premature babies.
Did you know?
The energy we get from coal today comes from giant swamp plants that lived before the dinosaurs. Sound far-fetched? All living plants store solar energy. Coal is the product of decaying plant matter that millions of years ago locked in this energy.
A short history of bottling

Commercial bottling is believed to have started in the latter part of the 17th century, but it wasn’t until after World War I that demand for bottled beer soared. Early manufacturers struggled making glass bottles strong enough to withstand the carbonation. Producers eventually worked out that longneck beer bottles were the solution.
Did you know?

Chrome plating might be synonymous with the modern era, but it was also used as early as the Qin Dynasty in China. Archaeologists discovered swords tipped with chromium oxide during the unearthing of the Terracotta Army in the 1970s.
Mining makes reaching for the stars possible.

Optical glass in telescopes, microscopes, binoculars and camera lenses:
- Silicon (Si; 14)
- Boron (B; 5)
- Sodium (Na; 11)
- Potassium (K; 19)
- Tantalum (Ta; 73)

Lenses & telescopes: mirrors and hardware components:
- Silicon (Si; 14)
- Boron (B; 5)
- Aluminum (Al; 13)
- Manganese (Mg; 12)
- Fluorine (F; 9)
- Teslium (Tu; 124)

Digital camera batteries:
- Nickel (Ni; 28)
- Lithium (Li; 3)
- Silicon (Si; 14)

Hubble Telescope: The Hubble Space Telescope orbits around 340 miles above Earth, traveling more than 3.7 billion miles since it launched in 1990. It has recorded more than 1.3 million observations for astronomers and moves at a speed of 16,950 mph. After years of amazing photographs, the Hubble Telescope will soon be retired.
Did you know?
Boron compounds have been used for thousands of years. Borax (a composite of boron, sodium, oxygen and water) was mined from salt lakes in Tibet and Kashmir as early as 2000 B.C. It was used by gold and silversmiths and pottery makers.
Mining makes travelling by road and rail possible.

Golden Spike Historic Site
Authorized in 1965, the Golden Spike Historic Site (located in northern Utah) is the completion site for the first transcontinental railroad. Bernice Gibbs Anderson, a correspondent for the Salt Lake City Tribune and a mother of six, wrote almost 3,000 articles from the 1920s to 1960s - in addition to press releases and letters to U.S. Park Service officials, members of Congress and the President encouraging that the site be preserved. In 2019, a couple of months before the 150th anniversary of the railroad completion, the site was redesignated as a national historical park.
Did you know?
Antimony was a popular remedy in the 19th century for the chronically constipated. Ingested as a small metal ball, it became known as the everlasting pill and would be collected and reused, sometimes passed down through generations.
In addition to the minerals required for individual components, wind turbines also require the use of steel, which requires more than 240 tons of coal during its own manufacturing process.

In 1980 the world’s first wind farm, consisting of twenty 30 kW wind turbines was installed at Crotched Mountain, in New Hampshire. From 1974 through the mid-1980s, the U.S. government worked with industry to advance the technology and enable large commercial wind turbines.
Did you know?
Life Savers and Toblerone chocolate bars were among the first commercial uses of aluminum foil. Swiss chocolatier Tobler began wrapping bars in rolled foil in 1911. In the United States, aluminum replaced tin foil Life Saver wrappers in 1925.
Mining makes space exploration possible. Some key materials include:

- **Aluminum (Al)** for the shuttle body.
- **Titanium (Ti)** for the shuttle body.
- **Copper (Cu)** and **Niobium (Nb)** for rocket engines.
- **Silicon (Si)** and **Germanium (Ge)** for control systems.
- **Tungsten (W)** and **Tantalum (Ta)** for radiation reflectors.
- **Gold (Au)** for astronaut visors.
- **Uranium (U)** for energy sources.

**Golden Records of life on earth**

NASA launched the Voyager Golden Records - two gold-plated copper phonograph records containing sounds and images from Earth - into space in 1977. Intended for future spacefarers or intelligent lifeforms, the records contained greetings in 55 languages and sounds ranging from rain and thunder to birds, frogs, laughter and children.

The International Space Station orbits Earth every 92 minutes. That’s 15-16 sunrises and sunsets a day.