DATA 608 - Story - 7 : Where Do Strategic Minerals Come From?

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https://www.usgs.gov/news/national-news-release/us-geological-survey-releases-2022-list-critical-minerals https://www.visualcapitalist.com/the-50-minerals-critical-to-u-s-security/ https://www.sciencebase.gov/catalog/item/61ead2cad34e8b818ad9f384 https://pubs.usgs.gov/periodicals/mcs2022/mcs2022.pdf https://www.gao.gov/blog/critical-mineral-shortages-could-disrupt-global-supply-chains

```
minerals = read.csv("https://raw.githubusercontent.com/enidroman/Data_608_Knowledge_and_Visual_Analytics
minerals
```

```
##                                      Commodity
## 1                          ARSENIC, all forms
## 2                                    ASBESTOS
## 3                                      CESIUM
## 4                                    FLUORSPAR
## 5                                     GALLIUM
## 6                          GRAPHITE (NATURAL)
## 7                                     INDIUM
## 8                                    MANGANESE
## 9                       MICA (NATURAL), sheet
## 10                          NEPHELINE SYENITE
## 11                        NIOBIUM (COLUMBIUM)
## 12                                   RUBIDIUM
## 13                                   SCANDIUM
## 14                                  STRONTIUM
## 15                                   TANTALUM
## 16                                   VANADIUM
## 17                                    YTTRIUM
## 18                                  GEMSTONES
## 19                                  TELLURIUM
## 20                                     POTASH
## 21 IRON OXIDE PIGMENTS, natural and synthetic
## 22        RARE EARTHS,3 compounds and metals
## 23                       TITANIUM, sponge
## 24                                    BISMUTH
## 25          TITANIUM MINERAL CONCENTRATES
## 26              ANTIMONY, metal and oxide
## 27                      STONE (DIMENSION)
## 28                               CHROMIUM
## 29                                   PEAT
## 30                                 SILVER
## 31                       TIN, refined
## 32                                 COBALT
```

```
## 33                       DIAMOND (INDUSTRIAL), stones
## 34                                     ZINC, refined
## 35               ABRASIVES, crude fused aluminum oxide
## 36                                             BARITE
## 37                                             BAUXITE
## 38                                            SELENIUM
## 39                                             RHENIUM
## 40                                            PLATINUM
## 41                                             ALUMINA
## 42                                GARNET (INDUSTRIAL)
## 43                                MAGNESIUM COMPOUNDS
## 44                    ABRASIVES, crude silicon carbide
## 45                                          GERMANIUM
## 46                                             IODINE
## 47                                            TUNGSTEN
## 48                                             CADMIUM
## 49                                     MAGNESIUM METAL
## 50                                              NICKEL
## 51                                     COPPER, refined
## 52                                            ALUMINUM
## 53 DIAMOND (INDUSTRIAL), bort, grit, dust, and powder
## 54                                       LEAD, refined
## 55                                           PALLADIUM
## 56                                            FELDSPAR
## 57                     SILICON, metal and ferrosilicon
## 58                                                SALT
## 59                     MICA (NATURAL), scrap and flake
## 60                                            LITHIUM
## 61                                            BROMINE
## 62                    ZIRCONIUM, ores and concentrates
## 63                                            PERLITE
## 64                                         VERMICULITE
##    Net.import.reliance.as.a.percentage.of.apparent.consumption....
## 1                                                              100
## 2                                                              100
## 3                                                              100
## 4                                                              100
## 5                                                              100
## 6                                                              100
## 7                                                              100
## 8                                                              100
## 9                                                              100
## 10                                                             100
## 11                                                             100
## 12                                                             100
## 13                                                             100
## 14                                                             100
## 15                                                             100
## 16                                                             100
## 17                                                             100
## 18                                                              99
## 19                                                             >95
## 20                                                              93
## 21                                                              91
```

22		>90
23		>90
24		90
25		90
26		84
27		84
28		80
29		80
30		79
31		78
32		76
33		76
34		76
35		>75
36		>75
37		>75
38		>75
39		72
40		70
41		58
42		56
43		55
44		>50
45		>50
46		>50
47		>50
48		<50
49		<50
50		48
51		45
52		44
53		41
54		38
55		37
56		32
57		32
58		29
59		28
60		>25
61		<25
62		<25
63		23
64		20

	Major.Import.Sources
1	China, Morocco, Belgium
2	Brazil, Russia
3	Germany, China
4	Mexico, Vietnam, South Africa, Canada
5	China, United Kingdom, Germany, Ukraine
6	China, Mexico, Canada, India
7	China, Canada, Republic of Korea, France
8	Gabon, South Africa, Australia, Georgia
9	China, Brazil, Belgium, India
10	Canada

```
## 11                                 Brazil, Canada
## 12                                        Germany
## 13                   Europe, China, Japan, Russia
## 14                         Mexico, Germany, China
## 15            China, Germany, Australia, Indonesia
## 16             Canada, China, Brazil, South Africa
## 17                 China, Republic of Korea, Japan
## 18            India, Israel, Belgium, South Africa
## 19             Canada, Germany, China, Philippines
## 20                         Canada, Russia, Belarus
## 21                          China, Germany, Brazil
## 22                China, Estonia, Malaysia, Japan
## 23                     Japan, Kazakhstan, Ukraine
## 24       China, Republic of Korea, Mexico, Belgium
## 25 South Africa, Australia, Madagascar, Mozambique
## 26                           China, Belgium, India
## 27                     China, Brazil, Italy, India
## 28        South Africa, Kazakhstan, Russia, Mexico
## 29                                        Canada
## 30                  Mexico, Canada, Chile, Poland
## 31              Indonesia, Peru, Malaysia, Bolivia
## 32                  Norway, Canada, Japan, Finland
## 33 South Africa, India, Congo (Kinshasa), Botswana
## 34                     Canada, Mexico, Peru, Spain
## 35                  China, France, Bahrain, Russia
## 36                   China, India, Morocco, Mexico
## 37              Jamaica, Brazil, Guyana, Australia
## 38             Philippines, China, Mexico, Germany
## 39                Chile, Canada, Kazakhstan, Japan
## 40       South Africa, Germany, Switzerland, Italy
## 41              Brazil, Australia, Jamaica, Canada
## 42           South Africa, China, India, Australia
## 43                   China, Brazil, Israel, Canada
## 44                China, Netherlands, South Africa
## 45                 China, Belgium, Germany, Russia
## 46                                   Chile, Japan
## 47                 China, Bolivia, Germany, Canada
## 48                 Australia, China, Germany, Peru
## 49                           Canada, Israel, Mexico
## 50              Canada, Norway, Finland, Australia
## 51                           Chile, Canada, Mexico
## 52     Canada, United Arab Emirates, Russia, China
## 53       China, Ireland, Republic of Korea, Russia
## 54        Canada, Mexico, Republic of Korea, India
## 55                    Russia, South Africa, Germany
## 56                                          Turkey
## 57                  Russia, Brazil, Canada, Norway
## 58                    Chile, Canada, Mexico, Egypt
## 59                             Canada, China, India
## 60                 Argentina, Chile, China, Russia
## 61                           Israel, Jordan, China
## 62        South Africa, Senegal, Australia, Russia
## 63                    Greece, China, Mexico, Turkey
## 64                             South Africa, Brazil
```

```r
colnames(minerals) <- c("Commodity", "Net import reliance as a percentage of apparent consumption", "Ma
minerals_col<-minerals
minerals_col
```

```
##                                       Commodity
## 1                                ARSENIC, all forms
## 2                                          ASBESTOS
## 3                                            CESIUM
## 4                                          FLUORSPAR
## 5                                            GALLIUM
## 6                                 GRAPHITE (NATURAL)
## 7                                            INDIUM
## 8                                         MANGANESE
## 9                               MICA (NATURAL), sheet
## 10                                 NEPHELINE SYENITE
## 11                               NIOBIUM (COLUMBIUM)
## 12                                         RUBIDIUM
## 13                                         SCANDIUM
## 14                                        STRONTIUM
## 15                                         TANTALUM
## 16                                         VANADIUM
## 17                                          YTTRIUM
## 18                                        GEMSTONES
## 19                                        TELLURIUM
## 20                                           POTASH
## 21        IRON OXIDE PIGMENTS, natural and synthetic
## 22                RARE EARTHS,3 compounds and metals
## 23                                TITANIUM, sponge
## 24                                         BISMUTH
## 25                    TITANIUM MINERAL CONCENTRATES
## 26                        ANTIMONY, metal and oxide
## 27                                STONE (DIMENSION)
## 28                                         CHROMIUM
## 29                                             PEAT
## 30                                           SILVER
## 31                                    TIN, refined
## 32                                           COBALT
## 33                     DIAMOND (INDUSTRIAL), stones
## 34                                    ZINC, refined
## 35             ABRASIVES, crude fused aluminum oxide
## 36                                           BARITE
## 37                                          BAUXITE
## 38                                         SELENIUM
## 39                                           RHENIUM
## 40                                         PLATINUM
## 41                                           ALUMINA
## 42                              GARNET (INDUSTRIAL)
## 43                              MAGNESIUM COMPOUNDS
## 44                  ABRASIVES, crude silicon carbide
## 45                                         GERMANIUM
## 46                                            IODINE
## 47                                          TUNGSTEN
## 48                                           CADMIUM
```

```
## 49                                    MAGNESIUM METAL
## 50                                             NICKEL
## 51                                   COPPER, refined
## 52                                          ALUMINUM
## 53 DIAMOND (INDUSTRIAL), bort, grit, dust, and powder
## 54                                     LEAD, refined
## 55                                         PALLADIUM
## 56                                          FELDSPAR
## 57                        SILICON, metal and ferrosilicon
## 58                                              SALT
## 59                        MICA (NATURAL), scrap and flake
## 60                                          LITHIUM
## 61                                          BROMINE
## 62                       ZIRCONIUM, ores and concentrates
## 63                                          PERLITE
## 64                                       VERMICULITE
##    Net import reliance as a percentage of apparent consumption
## 1                                                           100
## 2                                                           100
## 3                                                           100
## 4                                                           100
## 5                                                           100
## 6                                                           100
## 7                                                           100
## 8                                                           100
## 9                                                           100
## 10                                                          100
## 11                                                          100
## 12                                                          100
## 13                                                          100
## 14                                                          100
## 15                                                          100
## 16                                                          100
## 17                                                          100
## 18                                                           99
## 19                                                          >95
## 20                                                           93
## 21                                                           91
## 22                                                          >90
## 23                                                          >90
## 24                                                           90
## 25                                                           90
## 26                                                           84
## 27                                                           84
## 28                                                           80
## 29                                                           80
## 30                                                           79
## 31                                                           78
## 32                                                           76
## 33                                                           76
## 34                                                           76
## 35                                                          >75
## 36                                                          >75
## 37                                                          >75
```

```
## 38                                                          >75
## 39                                                           72
## 40                                                           70
## 41                                                           58
## 42                                                           56
## 43                                                           55
## 44                                                          >50
## 45                                                          >50
## 46                                                          >50
## 47                                                          >50
## 48                                                          <50
## 49                                                          <50
## 50                                                           48
## 51                                                           45
## 52                                                           44
## 53                                                           41
## 54                                                           38
## 55                                                           37
## 56                                                           32
## 57                                                           32
## 58                                                           29
## 59                                                           28
## 60                                                          >25
## 61                                                          <25
## 62                                                          <25
## 63                                                           23
## 64                                                           20
##                                Major Import Sources
## 1                             China, Morocco, Belgium
## 2                                      Brazil, Russia
## 3                                      Germany, China
## 4                Mexico, Vietnam, South Africa, Canada
## 5             China, United Kingdom, Germany, Ukraine
## 6                       China, Mexico, Canada, India
## 7            China, Canada, Republic of Korea, France
## 8             Gabon, South Africa, Australia, Georgia
## 9                       China, Brazil, Belgium, India
## 10                                             Canada
## 11                                     Brazil, Canada
## 12                                            Germany
## 13                       Europe, China, Japan, Russia
## 14                             Mexico, Germany, China
## 15                China, Germany, Australia, Indonesia
## 16                 Canada, China, Brazil, South Africa
## 17                     China, Republic of Korea, Japan
## 18                India, Israel, Belgium, South Africa
## 19                 Canada, Germany, China, Philippines
## 20                           Canada, Russia, Belarus
## 21                            China, Germany, Brazil
## 22                    China, Estonia, Malaysia, Japan
## 23                         Japan, Kazakhstan, Ukraine
## 24          China, Republic of Korea, Mexico, Belgium
## 25 South Africa, Australia, Madagascar, Mozambique
## 26                             China, Belgium, India
```

```
## 27                     China, Brazil, Italy, India
## 28        South Africa, Kazakhstan, Russia, Mexico
## 29                                          Canada
## 30                   Mexico, Canada, Chile, Poland
## 31              Indonesia, Peru, Malaysia, Bolivia
## 32                  Norway, Canada, Japan, Finland
## 33 South Africa, India, Congo (Kinshasa), Botswana
## 34                     Canada, Mexico, Peru, Spain
## 35                  China, France, Bahrain, Russia
## 36                   China, India, Morocco, Mexico
## 37              Jamaica, Brazil, Guyana, Australia
## 38             Philippines, China, Mexico, Germany
## 39                Chile, Canada, Kazakhstan, Japan
## 40       South Africa, Germany, Switzerland, Italy
## 41              Brazil, Australia, Jamaica, Canada
## 42          South Africa, China, India, Australia
## 43                   China, Brazil, Israel, Canada
## 44                China, Netherlands, South Africa
## 45                 China, Belgium, Germany, Russia
## 46                                   Chile, Japan
## 47                 China, Bolivia, Germany, Canada
## 48                 Australia, China, Germany, Peru
## 49                           Canada, Israel, Mexico
## 50              Canada, Norway, Finland, Australia
## 51                           Chile, Canada, Mexico
## 52     Canada, United Arab Emirates, Russia, China
## 53       China, Ireland, Republic of Korea, Russia
## 54        Canada, Mexico, Republic of Korea, India
## 55                   Russia, South Africa, Germany
## 56                                         Turkey
## 57                  Russia, Brazil, Canada, Norway
## 58                    Chile, Canada, Mexico, Egypt
## 59                             Canada, China, India
## 60                  Argentina, Chile, China, Russia
## 61                           Israel, Jordan, China
## 62        South Africa, Senegal, Australia, Russia
## 63                    Greece, China, Mexico, Turkey
## 64                             South Africa, Brazil
```

```
str(minerals)
```

```
## 'data.frame':    64 obs. of  3 variables:
##  $ Commodity                                                  : chr  "ARSENIC, all forms" "ASBESTOS"
##  $ Net import reliance as a percentage of apparent consumption: chr  "100" "100" "100" "100" ...
##  $ Major Import Sources                                       : chr  "China, Morocco, Belgium" "Brazi
```

```
# Extract the specific column
percentage_column <- minerals_col$`Net import reliance as a percentage of apparent consumption`

# Add a percent sign to the numbers and keep as character
minerals_col$percentage_with_percent <- ifelse(grepl(">", percentage_column),
                                               percentage_column,
                                               paste0(percentage_column, "%"))
```

```
minerals_col
```

```
##                                          Commodity
## 1                                ARSENIC, all forms
## 2                                          ASBESTOS
## 3                                            CESIUM
## 4                                          FLUORSPAR
## 5                                            GALLIUM
## 6                                GRAPHITE (NATURAL)
## 7                                            INDIUM
## 8                                         MANGANESE
## 9                             MICA (NATURAL), sheet
## 10                                NEPHELINE SYENITE
## 11                             NIOBIUM (COLUMBIUM)
## 12                                         RUBIDIUM
## 13                                         SCANDIUM
## 14                                        STRONTIUM
## 15                                         TANTALUM
## 16                                         VANADIUM
## 17                                          YTTRIUM
## 18                                        GEMSTONES
## 19                                        TELLURIUM
## 20                                           POTASH
## 21        IRON OXIDE PIGMENTS, natural and synthetic
## 22               RARE EARTHS,3 compounds and metals
## 23                             TITANIUM, sponge
## 24                                         BISMUTH
## 25                  TITANIUM MINERAL CONCENTRATES
## 26                      ANTIMONY, metal and oxide
## 27                             STONE (DIMENSION)
## 28                                        CHROMIUM
## 29                                            PEAT
## 30                                          SILVER
## 31                                TIN, refined
## 32                                          COBALT
## 33                  DIAMOND (INDUSTRIAL), stones
## 34                                ZINC, refined
## 35            ABRASIVES, crude fused aluminum oxide
## 36                                          BARITE
## 37                                         BAUXITE
## 38                                        SELENIUM
## 39                                         RHENIUM
## 40                                        PLATINUM
## 41                                         ALUMINA
## 42                             GARNET (INDUSTRIAL)
## 43                             MAGNESIUM COMPOUNDS
## 44                ABRASIVES, crude silicon carbide
## 45                                        GERMANIUM
## 46                                           IODINE
## 47                                         TUNGSTEN
## 48                                          CADMIUM
## 49                             MAGNESIUM METAL
## 50                                           NICKEL
```

```
## 51                                    COPPER, refined
## 52                                          ALUMINUM
## 53 DIAMOND (INDUSTRIAL), bort, grit, dust, and powder
## 54                                       LEAD, refined
## 55                                           PALLADIUM
## 56                                           FELDSPAR
## 57                     SILICON, metal and ferrosilicon
## 58                                                SALT
## 59                     MICA (NATURAL), scrap and flake
## 60                                           LITHIUM
## 61                                           BROMINE
## 62                    ZIRCONIUM, ores and concentrates
## 63                                           PERLITE
## 64                                        VERMICULITE
##    Net import reliance as a percentage of apparent consumption
## 1                                                           100
## 2                                                           100
## 3                                                           100
## 4                                                           100
## 5                                                           100
## 6                                                           100
## 7                                                           100
## 8                                                           100
## 9                                                           100
## 10                                                          100
## 11                                                          100
## 12                                                          100
## 13                                                          100
## 14                                                          100
## 15                                                          100
## 16                                                          100
## 17                                                          100
## 18                                                           99
## 19                                                          >95
## 20                                                           93
## 21                                                           91
## 22                                                          >90
## 23                                                          >90
## 24                                                           90
## 25                                                           90
## 26                                                           84
## 27                                                           84
## 28                                                           80
## 29                                                           80
## 30                                                           79
## 31                                                           78
## 32                                                           76
## 33                                                           76
## 34                                                           76
## 35                                                          >75
## 36                                                          >75
## 37                                                          >75
## 38                                                          >75
## 39                                                           72
```

```
## 40                                                  70
## 41                                                  58
## 42                                                  56
## 43                                                  55
## 44                                                 >50
## 45                                                 >50
## 46                                                 >50
## 47                                                 >50
## 48                                                 <50
## 49                                                 <50
## 50                                                  48
## 51                                                  45
## 52                                                  44
## 53                                                  41
## 54                                                  38
## 55                                                  37
## 56                                                  32
## 57                                                  32
## 58                                                  29
## 59                                                  28
## 60                                                 >25
## 61                                                 <25
## 62                                                 <25
## 63                                                  23
## 64                                                  20
##                            Major Import Sources percentage_with_percent
## 1                          China, Morocco, Belgium                  100%
## 2                                  Brazil, Russia                  100%
## 3                                  Germany, China                  100%
## 4            Mexico, Vietnam, South Africa, Canada                 100%
## 5          China, United Kingdom, Germany, Ukraine                 100%
## 6                    China, Mexico, Canada, India                  100%
## 7         China, Canada, Republic of Korea, France                 100%
## 8          Gabon, South Africa, Australia, Georgia                 100%
## 9                    China, Brazil, Belgium, India                 100%
## 10                                        Canada                   100%
## 11                                 Brazil, Canada                  100%
## 12                                        Germany                  100%
## 13                   Europe, China, Japan, Russia                  100%
## 14                         Mexico, Germany, China                  100%
## 15            China, Germany, Australia, Indonesia                 100%
## 16             Canada, China, Brazil, South Africa                 100%
## 17                 China, Republic of Korea, Japan                 100%
## 18            India, Israel, Belgium, South Africa                  99%
## 19             Canada, Germany, China, Philippines                  >95
## 20                         Canada, Russia, Belarus                  93%
## 21                          China, Germany, Brazil                  91%
## 22                 China, Estonia, Malaysia, Japan                  >90
## 23                      Japan, Kazakhstan, Ukraine                  >90
## 24       China, Republic of Korea, Mexico, Belgium                  90%
## 25 South Africa, Australia, Madagascar, Mozambique                  90%
## 26                           China, Belgium, India                  84%
## 27                     China, Brazil, Italy, India                  84%
## 28        South Africa, Kazakhstan, Russia, Mexico                  80%
```

```
## 29                                        Canada                    80%
## 30                    Mexico, Canada, Chile, Poland                 79%
## 31                Indonesia, Peru, Malaysia, Bolivia                78%
## 32                    Norway, Canada, Japan, Finland                76%
## 33 South Africa, India, Congo (Kinshasa), Botswana                  76%
## 34                       Canada, Mexico, Peru, Spain                76%
## 35                    China, France, Bahrain, Russia                >75
## 36                     China, India, Morocco, Mexico                >75
## 37                Jamaica, Brazil, Guyana, Australia                >75
## 38               Philippines, China, Mexico, Germany                >75
## 39                  Chile, Canada, Kazakhstan, Japan                72%
## 40         South Africa, Germany, Switzerland, Italy                70%
## 41                Brazil, Australia, Jamaica, Canada                58%
## 42             South Africa, China, India, Australia                56%
## 43                     China, Brazil, Israel, Canada                55%
## 44                  China, Netherlands, South Africa                >50
## 45                   China, Belgium, Germany, Russia                >50
## 46                                     Chile, Japan                 >50
## 47                   China, Bolivia, Germany, Canada                >50
## 48                   Australia, China, Germany, Peru               <50%
## 49                             Canada, Israel, Mexico              <50%
## 50                Canada, Norway, Finland, Australia                48%
## 51                               Chile, Canada, Mexico              45%
## 52     Canada, United Arab Emirates, Russia, China                  44%
## 53       China, Ireland, Republic of Korea, Russia                  41%
## 54        Canada, Mexico, Republic of Korea, India                  38%
## 55                     Russia, South Africa, Germany                37%
## 56                                          Turkey                  32%
## 57                    Russia, Brazil, Canada, Norway                32%
## 58                     Chile, Canada, Mexico, Egypt                 29%
## 59                               Canada, China, India               28%
## 60                  Argentina, Chile, China, Russia                 >25
## 61                               Israel, Jordan, China              <25%
## 62         South Africa, Senegal, Australia, Russia                 <25%
## 63                     Greece, China, Mexico, Turkey                23%
## 64                               South Africa, Brazil               20%
```

```
str(minerals_col)
```

```
## 'data.frame':    64 obs. of  4 variables:
##  $ Commodity                                                  : chr  "ARSENIC, all forms" "ASBESTOS"
##  $ Net import reliance as a percentage of apparent consumption: chr  "100" "100" "100" "100" ...
##  $ Major Import Sources                                       : chr  "China, Morocco, Belgium" "Brazi
##  $ percentage_with_percent                                    : chr  "100%" "100%" "100%" "100%" ...
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

```
# Remove percent sign and convert to numeric (handling non-numeric characters)
minerals_col$percentage_with_percent <- as.numeric(gsub("[^0-9.]", "", minerals_col$percentage_with_per
```

```r
# Reorder Commodity based on percentage_with_percent
minerals_col$Commodity <- reorder(minerals_col$Commodity, -minerals_col$percentage_with_percent)

# Create a bar graph with percentages inside the bars (vertical text)
p <- ggplot(minerals_col, aes(x = Commodity, y = percentage_with_percent)) +
  geom_bar(stat = "identity", fill = "skyblue", color = "black") +
  geom_text(aes(label = paste0(percentage_with_percent, "%")), angle = 90, hjust = 1, size = 2) +  # Pl
  labs(title = "Net Import Reliance by Commodity",
       x = "Commodity",
       y = "Net Import Reliance (%)") +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))

# Print the plot
print(p)
```