

# Nickel - A Metal for the Future

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Elementum Metals: 09/07/2021

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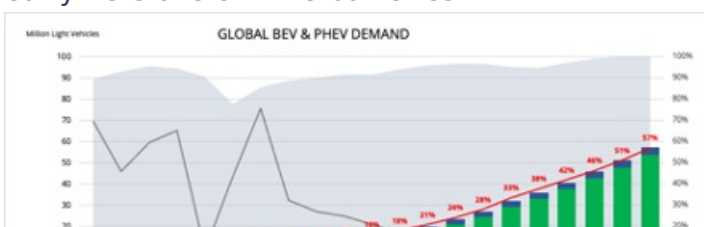


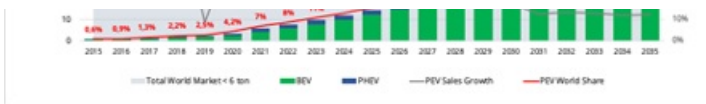
**N**ickel is a metal that is much in demand today. Many will be familiar with its use in stainless steel and in applications such as pipes for clean water, however it is its use in new technologies which is going to create incremental demand over the next decade and beyond.

The principal area of focus for investors is battery technology, with applications ranging from areas such as electric vehicles and drones for power storage. Nickel has been identified as one of the critical metals that will enable the transition to a clean energy economy. We will look at this in more detail in this article as well as touching on areas of potential future demand growth: the drone industry and space travel.

## Powering the Charge

Nickel's unique natural properties has seen it favoured in high-grade battery technology, where efficiency, longevity and sustainability are favoured. It can provide higher energy density, resistance to high voltages and greater power without sacrificing chemical stability. Electric vehicle production has grown over the last few years, rising from 2 million units in 2018 to a forecasted 21 million by 2030 - of which 70% will be BEVs.<sup>1</sup> Li-Ion batteries, which include Nickel-Manganese-Cobalt (NMC) and Nickel-Cobalt-Aluminium (NCA) have become the dominant battery technologies. They are both nickel-based but use different weightings of the metal. Traditionally, nickel makes up 33% of a NMC battery, however; continuous development over the last few years has resulted in this weighting increasing to 80%.<sup>2</sup> Despite the changes in battery chemistry, nickel has seen itself settle as the main cathode for EV batteries at the expense of cobalt which was more prevalent in early versions of NMC batteries.





Increased governmental pressures around carbon emissions is forcing a shift from internal combustion powered vehicles to EVs. Notably, the US 2022 Budget proposed an injection of \$600 million towards EV and charging infrastructure in the individual budgets of 18 Federal agencies.<sup>3</sup> In conjunction, the UK has banned the sale of new internal combustion engine (ICE) cars by 2030, followed by hybrids in 2035. The phasing out of conventional ICE and hybrid cars will result in EVs dominating the automobile market. With a weighting of 30 – 110kg of nickel per EV compared to 5 – 22kg in ICE and Hybrid vehicles, nickel demand will see a substantial increase driven by international environmental legislation.<sup>4</sup>

## Nickel Takes Flight

Lithium-ion batteries are also used in the drone industry. Replacing lead-acid and Ni-Cd batteries, Li-ion provides higher energy density at a lower weight as well as temperature resistance at high altitudes. Importantly, the components of a drone are sparse due to compromises on strength-to-weight ratio. The light-weight nature of Li-Ion batteries has enabled improved storage and camera capabilities which have consequently led to its industrial and commercial adoption. Through demand from commercial uses such as: construction, agriculture, mining, insurance and law enforcement, the drone services market is expected to grow to \$63.6 billion by 2025.<sup>5</sup> In the bigger picture, Goldman Sachs forecast the future drone market to be worth more than \$100 billion.<sup>6</sup> During the COVID pandemic, drone technology has been used for monitoring temperatures, disinfecting large areas, and providing contactless delivery through Amazon’s drone fleet.

## To the Moon

More broadly, nickel’s abundance, malleability, magnetism, and temperature resistance has contributed to its inclusion in other innovations aside from batteries. Its durability in extreme conditions has led to its use in satellites and more recently in NASA’s ‘Perseverance’ Rover. In the super-alloy field nickel has emerged as the favoured component. When combined with other metals, it offers greater resistance to corrosion, fractures, and deformation under extreme temperatures. In space tech, Ni-alloys are used in rocket motors, propulsion units, power generation and gas turbines due to its propensity for withstanding high temperatures and oxidation.

## In Orbit

In satellites, nickel plating is vital to limiting degradation under extreme conditions and propulsion into orbit in external devices. Additionally, Nickel-Hydrogen batteries have historically been used in satellites and space stations; the International Space Station (ISS) only recently being updated to Li-Ion batteries due to improvements in power density, size, and weight. Satellites and space stations batteries are required to be able to withstand thousands of charges and discharges over their useful lives. as well as storing solar energy generated by the satellites and the ISS for use during periods where the vehicle is out of direct sunlight.<sup>7</sup>

NASA’s Perseverance Rover which landed on Mars in February was constructed partly using 3D printed nickel, one of these pieces was the Mars Oxygen In-Situ Resource Utilisation Experiment, or MOXIE. The MOXIE component’s purpose is to produce oxygen from the Carbon Dioxide which makes up 96% of the Martian atmosphere – in anticipation for human exploration. It does this through a process called solid oxide fuel cell (SOFC) technology.

exploration. It does this through separating oxygen atoms from carbon dioxide molecules by heating gas up to 800°C. The use of nickel allows Moxie to generate oxygen at these incredible temperatures without losing structural stability or heating neighbouring components.<sup>8</sup>

These scientific achievements and realisation of nickel's properties have prompted an increase in its use in alloys. Aerospace, transportation, and defence are the largest consumers of nickel alloys due to its superior physical and chemical properties compared to iron and steel.<sup>9</sup> High-performance nickel is expected to contribute \$4.87 billion to the alloy market by 2026 as accelerated developments and intensive requirements prove to be lucrative for demand.<sup>10</sup>

## And Back

The EV, drone and aerospace industries are expecting a compound annual growth rate of 29%, 57.5% and 15.7% respectively by 2030.<sup>11,12,13</sup> Through its favourable physical and chemical properties, nickel has become indispensable to these sectors which is reflected the 500% production growth forecast for 2050.<sup>14</sup> Cleaner methods of energy production, storage and usage have become a priority for companies and lawmakers worldwide as we transition to a net-zero carbon world. Nickel's usage appears to be the great enabler for these innovative technologies, showing no signs of slowing. Technological progress such as battery storage technology and electric vehicles will enable economies to make greater strides towards meeting ever tightening environmental goals and nickel is one of the key metals that will make this transition feasible.<sup>15</sup>

## Footnotes

1. <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/manufacturing/deloitte-uk-battery-electric-vehicles.pdf>
2. <https://nickelinstitute.org/about-nickel/nickel-in-batteries/>
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