# Lithium Mining in Australia for Electric Cars and Renewable Energy Report

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## *Project Summary*

With the rapid development of science and technology, Lithium gradually entered scientists’ vision, occupied an increasingly important position and is used in many fields. In the medical science, lithium can be used to treat mania; in the military, lithium is one of the most important elements in the manufacture of nuclear bombs. The most important aspect which is also our research direction is the application of lithium in renewable energy. Such as lithium battery, it has high energy density and can store more electricity in the same volume (Junqing, 2019). Therefore, it is often used in laptops, electric cars and phone.

Australia is rich in lithium resources and is also one of the countries with the most lithium mines in the world. According to the data collected by Robert (2019), Australia has the largest lithium production in the world, accounting for 52.9%, and lithium reserves accounts for 18.1% of the world, second only to Chile.

Our project is aimed to make an engineering findings and discussion on renewable energy for lithium mining project in Australia. The context of the project will be discussed in these following parts: stakeholders, social challenge, environment challenge and ethical challenge.

The Lithium mining is a really huge project. In this process, many different systems will be involved, such as: employment, economy, transportation and so on and they are also the stakeholders of lithium mining. However, lithium mining will also bring many challenges. From an environmental perspective, water consumption and the production of toxic chemicals are main impacts and the low recycling rate of lithium batteries is difficult to solve in production. In terms of social challenge, land ownership, labor demand and the economic impact of lithium mining are all worthy of attention. From the perspective of engineering ethics, safety industry standards, dust suppression, etc., are all possible problem.

Following, we will show our specific findings and detailed discussion from these different aspects and propose some suitable solutions for these problems which may occur in the lithium mining project.

## *Findings*

### *Stakeholder Analyze*

With Lithium mining as the center, this part is divided into four parts. The first place is a financial institution. The financial institution can be divided into banks and mining companies. The primary role of banks is to provide funds or invest in projects. Some mining companies which are Wesfarmers, Galaxy Resources Limited and Altura Mining Limited operate in Australia. Altura is the leading supplier of mines. In addition, the environmental protection organization is one of the key stakeholders. Even though Lithium mine can bring us new energy, the environment will also be affected. The article of The Environmental Impact of Lithium Batteries indicates that most electronics such as unwanted MP3 players and laptops are thrown away (IER, 2020). The metal in the electrodes and the ionic liquid in the electrolyte can leak into the environment. It causes that the environment has been polluted. Last but not least, the client can be separated into local and import. Some countries such as China and Japan rely on Australian spodumene, one of the elements used to make the battery. Therefore, Lithium mining has taken over the market. All in all, employment is one of them. Worker and technical personnel have gained employment opportunities in this project. It is an excellent solution to solve the employment problem, but also technical personnel can develop the latest technology to enhance production efficiency and reduce environmental pollution.

### *Environmental Challenges*

Although lithium itself is one of the most important elements in current renewable energy technology, mining it will cause side effects on the environment.

Current technology asks the engineers to extract lithium from rare earth and heavy metals, which may emit large amounts of toxic chemical by-products. Even if Australia follows the traditional way to extract lithium from rocks, it still requires the use of chemicals to extract it in a useful form. Plus, mining lithium needs lots of water. More than 50% of lithium reserves in the world are within Argentina, Bolivia and Chile (MINING.COM Staff Writer, 2021), which is water intensive. During extraction, two million liters of water can only create one ton of lithium. According to the data in Statista.com, only Australia has produced 208 tons of lithium in 2020. The rising demand for lithium extraction leads to concern on water shortage in agricultural use. Following issue from the extraction process is how to deal with the water used in it. The disposal of industrial water will make a threat on local water supplies, which may even worse result in social unrest. According to research (IER, 2020), large evaporation ponds are usually used for more than a year and may leak toxic chemicals and pollute water bodies.

Besides mining, the products from lithium like lithium batteries also affect the environment. The main issue for batteries is its low recycling rate. In Australia “only two percent of the country’s 3,300 metric tons of lithium-ion waste is recycled” (MINING.COM Staff Writer, 2021). It is common to see unwanted laptops end up in landfills, which may leak “metals from the electrodes and ionic fluids from the electrolyte” (IER, 2020). One of the reasons for low recycling is that manufacturers of batteries are secretive about their products. The current technology to recycle is to shred the batteries and burn the mixture of mental for decompose. However, this will waste lots of lithium, leading to energy and financial costs. Moreover, the market for recycling lithium is quite unimpressive in Australia. Although the total recycling market rises quickly, the proportion for lithium is much lower than nickel and cobalt.

### *Social Challenges*

Lithium mining will undoubtedly bring many benefits to the society, such as providing jobs and promoting local economic development, and the produced lithium can also promote the development of clean energy. However, lithium mining will also bring some social challenges.

The first is the problems about the land ownership. As mentioned by Doris (2016), lithium mining requires the construction of facilities, which requires land. If private lands are occupied, the owners of these lands may need to relocate. However, there may be people who are reluctant to leave the place where they live for a long time. And If the land was originally used for subsistence, they may need to find some other ways to make living. These people need to be compensated appropriately, and the compensations need to meet their long-term needs.

Environmental problems caused by lithium mining may also bring social challenges. The mining industry is likely to cause pollution to the environment, which may affect the health of surrounding residents. Moreover, it will also use a lot of water, which may cause water shortage especially in the western region (Scarlett, 2021). The surrounding residents might be forced to relocate due to these environmental impacts.

Moreover, while benefits to the society, the jobs provided by lithium mining may bring social challenges at the mean time. The development of the mining industry needs lots of labors, which is benefit, but this demand varies with the life cycle of the mine. According to Doris et al. (2018) Lithium mines require the most labor during the construction period, but less labor during subsequent operations. Mining companies need to solve the problem of subsequent labor surplus. And if unskilled workers are employed, the company should also ensure they are trained to understand and comply with safety regulations, otherwise there may be safety hazards and even accidents. In addition, the public usually has high expectations for the jobs created by mining. If this expectation is not met, the company needs to address the disappointment of the public.

In addition, there might be economic impacts. The rapid development of mining may make the local economy overly dependent on it. If the mine is closed for some reason, the local economy may hard to continue developing steadily. Also, how to distribute mining income will also face challenges. The proportion of these incomes used for business investment and regional development and construction needs to be balanced (Doris et al., 2018).

### *Ethical Challenges*

The ethical challenges include dust, soil and water pollution. Lithium mining produces inhalable and inhalable dust particles. Transportation, storage, grinding and ore processing involving crushing and screening will generate dust. An effective dust control management plan focuses on removing dust from the source. The dust generated during the crushing and sieving process exposes lithium mine workers to silica. Inhaled silica can be deposited in the alveolar area of the lungs. In the long run, this will cause diseases such as silicosis and lung cancer.

Mining companies have a responsibility to expand their prudential duties. It is important to consider uncompromising dust suppression measures for air quality. The storage dust control in the port can ensure that nearby water bodies will not encounter lithium dust, which may eventually interfere with the marine ecosystem. Hauling mine roads are the backbone of daily mining operations, and the dust suppression of hauling roads is critical to providing services to achieve business goals related to the operational goals of lithium mines in Australia. Because the manufacturer keeps the components in the battery secret, it is difficult to recycle them correctly (Troy, 2021).

According to James (2019), it also proposes ways to use responsible mining companies to promote safer industry standards, thereby reducing harmful environmental impacts and ensuring compliance with labor laws. Although this is not a perfect solution, there are many ways to mitigate and reduce the impact of electric vehicle batteries.

According to a report by Friends of the Earth (2020), the extraction of lithium will inevitably damage the soil and cause air pollution. In the Salar de Hombre Muerto region of Argentina, locals claim that lithium mining activities have polluted humans and livestock, as well as water used for crop irrigation. In Chile, there were conflicts between mining companies and local communities. They said that lithium mining had destroyed the landscape by discarded salt on the mountains and canals filled with polluted water and unnatural blue hues. According to Amit (2018), Guillermo Gonzalez, an expert on lithium batteries at the University of Chile, said in an interview in 2009: “Like any mining process, it is invasive, destroys the landscape, destroys the groundwater level, and pollutes the earth and local wells." "This is not a green solution — it's not a solution at all."

Like Tibet, there are also potentially toxic chemicals leaking from the evaporation pond into the water supply system. These include chemicals (including hydrochloric acid) used to process lithium into a saleable form, as well as those waste products that are filtered out of the brine at each stage. In Australia and North America, more traditional methods are used to extract lithium from rocks, but chemicals are still needed to extract lithium in a useful form. A study in Nevada found that fish in 150 miles downstream were affected after lithium processing (Amit, 2018).

## *Discussion*

For those who may be affected, it must be considered that financial institution and government benefits the most. The Financial institution can receive substantial funding from projects. It can connect to different systems. The mine needs to be transported to the processing plant, or some industries were needs battery. The Financial Institution can benefit more by partnering with companies in the transportation industry. As the market demand increases, the economy of the Australian government will rise. The country's comprehensive strength will be enhanced. The government can also connect different systems because the technology for extracting lithium is constantly evolving. The government may allow universities to set up specialized majors or courses to study. Meanwhile, the government also solve the employment problem. It is like a cycle. Environmental protection organization is marginalized in the project. The first reason is that as the technology improves, the original problems will be solved. The second reason is that Although mining lithium ore will bring pollution to the environment, we only need to collect the pollutants to ensure that they are not discharged into the environment.

As for the environmental issues, the issues we discussed above ask engineers to find a way that leaves a small footprint and low energy consumption. Direct Lithium Extraction (DLE) technology is a good choice for sustainable lithium extraction. According to IER (2020), this will extract lithium in geothermal water and selectively removing compounds from the water, so that it can reduce the carbon footprint and water waste. Plus, engineers should find the way to reuse the wasted batteries. For example, China planned to put repurposed batteries as backup power systems for China’s 5G stations or reused in shared e-bikes, which save 63 million tons of carbon emissions.

And to solve the social challenges, the government plays a very important role. They can formulate policies and improve laws about mining and strengthen supervision on these companies. They should also balance the interests of the companies and residents when making decisions. To avoid a single type of economy, the local government should develop other types of economy when relying on lithium mines to improve the economy. For the mining companies, the interests of surplus labors should be considered in advance. At the same time, relevant information should be published to the public so that they can know what is happening.

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