

Thesis Project Portfolio

Old Ivy Road Mixed-Use Development

(Technical Report)

There Are No Ethical Lithium Ion Batteries:

The Decarbonization Divide & Ethical Practices of the Lithium Battery Supply Chain

Analyzed Through a Deontological Framework

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Grey Anteros Webbert

Spring, 2024

Department of Civil and Environmental Engineering

Table of Contents

Sociotechnical Synthesis

Old Ivy Road Mixed-Use Development

There Are No Ethical Lithium Ion Batteries: The Decarbonization Divide & Ethical Practices of the Lithium Battery Supply Chain Analyzed Through a Deontological Framework

Prospectus

Sociotechnical Synthesis

My technical capstone project is quite different from my STS thesis in both topic and scope. My capstone project has to do with the practices and regulations of land development engineering in Albemarle as I had to utilize various design practices to design a site plan that could accommodate 300 housing units for a future mixed-use community. My STS thesis however, has less to do with housing and real estate development and more to do with the unethically of lithium ion batteries and the cobalt supply chain as a whole when looked at through a deontological framework.

The technical portion of my thesis produced a fully designed site plan (including stormwater, traffic, construction, and grading plans) for a future mixed-use residential and commercial development on a 35.7 acre parcel off of Old Ivy Road in Albemarle County. I was primarily responsible for two areas of the project, mainly the site plan and stormwater plan. We were able to design the site to accommodate 300 housing units (the maximum), multiple recreational amenities, and we prioritized the walkability of the site above all else. In order to do this we followed many urban design principles by building as densely as possible on the site, providing ample communal urban amenities (large community greenspace in the form of a large park, playgrounds, utilizing scenic views of the large pond on site, resting areas off of sidewalks with benches/gazebos/picnic tables, basketball courts, and a tennis court), and utilizing green infrastructure to design our site (ample tree plantings to protect from the urban heat island effect in parking lots but also to act as a visual shield from the roads, utilizing bioretention areas to capture and treat stormwater on site, using filterstrips to treat stormwater from our highly impervious areas, and making the large community park integral to the design itself).

In my STS research, I explored why the idea of ethical lithium ion batteries through a deontological framework is not possible. I specifically looked at the exploitation of the Democratic Republic of the Congo (DRC) for its ample cobalt resources and its subsequent labor issues and human rights violations that plague the industry. Since there is no way to know where most cobalt truly comes from as it is all processed the same and illegal or artisanally mined cobalt is mixed in with legally mined cobalt during the exportation process - many companies that claim to have followed due diligence in their supply chains have been called out for not being able to verify where and how they source *all* of their cobalt. I also touch on some of the historical contexts of the DRC which informs what its people are owed under a deontological framework by explaining that the people of the DRC, as one of the richest places in the world in terms of resources, has been exploited for those resources since its previous brutal reality under Belgian colonial rule before its legal independence in 1960. By explaining both the previous and current exploitative practices and power structures that have affected and shaped an entire group of people, I found that it is not right to say there is such a thing or ever will be such a thing as an ethical lithium ion battery. Our collective future dependence on the DRC's resources as the globe continues to decarbonize is significant. We will only continue to ramp up cobalt mining in the country to meet global demands for batteries. Following the fact that the majority of cobalt is sourced from this country and produced through a capitalist economic structure that disempowers its workers while funneling profits to multinational corporations instead of the DRC or its people - I have found that without deep interventions that come from within the country itself there will never be any robust supply chain that produces ethical lithium ion batteries due to the previous and current amounts of human suffering that go into its production and infrastructure.

There is much to be gained when discussing the ethicality of the technologies we create and depend on as societies in the new technological age. Only through an STS framework, which considers both current, future, and historical context of technological problems that concern engineers - can engineers more effectively understand and fight back against the various power structures that are baked into the production of our technologies that can lead to the systemic oppression and exploitation of other people in other countries.