

PhD and Master's Opportunities in Electromobility for Underground Mining at Universidad de Chile



Universidad de Chile ¹(UCHILE) offers exciting 4 PhD and 5 Master's research positions in Electrical Engineering, Mining Engineering, and Mechanical Engineering. These positions provide a unique opportunity to engage in cutting-edge research focused on **electromobility within underground mining operations**. The candidates will have the opportunity to work in an applied research program funded by Codelco², the world's largest copper producer and world leader in massive underground operations.

Successful candidates will join a dynamic research team and work under the guidance of UCHILE faculty members, including [Prof. Angela Flores](#) (Electrical Engineering), [Prof. Luis Felipe Orellana](#) (Mining Engineering), [Prof. Marcos Orchard](#) (Electrical Engineering), and [Prof. Javier Ruiz del Solar](#) (Electrical Engineering). The primary objective is to contribute to advancing sustainable and efficient technologies for underground mining.

¹ <https://uchile.cl/>

² <https://www.codelco.com/>

Position 1: PhD Mining Engineering

- Identify and address the technical, logistical, and economic challenges of adopting electromobility in underground mining.
- Develop a framework to analyze and optimize the impact of electromobility on production efficiency, mining costs, and greenhouse gas emissions.
- Develop, simulate, and analyze multiple scenarios for integrating electric mobile equipment in underground mines.
- Contribute to developing and improving the ELMO-UG (ElectroMobility management for zero carbon MINing) simulation and optimization tool for underground mining.

Direct supervision: Prof. Luis Felipe Orellana & Prof. Angela Flores

Position 2: PhD Electrical Engineering

- Develop a framework to optimize the operation of electric mobile equipment in underground mining and propose efficient solution methodologies.
- Adapt and integrate advanced into the operational optimization framework models of electric mobile equipment consumption, battery operation, and state of health.
- Develop and analyze multiple scenarios for integrating electric mobile equipment in underground mines.
- Contribute to developing and improving the ELMO-UG (ElectroMobility management for zero carbon MINing) simulation and optimization tool for underground mining.

Direct supervision: Prof. Angela Flores & Prof. Luis Felipe Orellana

Position 3: PhD Electrical Engineering

- To establish technical and operational baselines, review and assess various charging solutions for electric mobile equipment in underground mining, including direct charging, battery swapping, and catenary systems.
- Develop a methodology for sizing charging infrastructure based on simulation results and real-world data, considering multiple operational scenarios.
- Determine the optimal locations and necessary upgrades for charging infrastructure, ensuring efficient and effective integration of electric mobile technologies in underground mining operations.
- Contribute to developing and improving the ELMO-UG (ElectroMobility management for zero carbon MINing) simulation and optimization tool for underground mining.

Direct supervision: Prof. Angela Flores & Prof. Marcos Orchard

Position 4: PhD Electrical/Mechanical Engineering

- Establish technical and operational baselines and conduct a detailed analysis of technological gaps in monitoring E-mobile LHD and CAEX, focusing on range autonomy, task performance, and battery health.
- Develop and verify probabilistic power consumption models for E-mobile LHD and CAEX using machine learning and multimodal operational data.
- Develop real-time monitoring systems to characterize the state of charge (SoC), maximum state of power available (SoMPA), and range autonomy of E-mobile LHDs and mining trucks.
- Design the architecture for monitoring models that assess batteries' state of health (SoH) in E-mobile LHD and mining trucks.

Direct supervision: Prof. Marcos Orchard & Prof. Javier Ruiz del Solar

Position 5: MSc. in Mining Engineering/Electrical Engineering

- Conduct an in-depth review of operational models for electric mobile equipment, focusing on their applicability to underground mining.
- Propose and implement operational models for electric mobile equipment consumption and battery operation, tailored to different technologies, within an optimization framework.
- Develop and analyze multiple scenarios to evaluate the integration (economic and technical framework) of electric mobile equipment in underground mines.
- Contribute to developing and improving the ELMO-UG (ElectroMobility management for zero carbon MINing) simulation and optimization tool for underground mining.

Direct supervision: Prof. Luis Felipe Orellana & Prof. Angela Flores

Position 6: MSc. in Electrical engineering

- Contribute to modeling and characterizing energy consumption and power profiles in low-profile LHD and CAEX equipment (electric vehicles).
- Contribute to modeling of the impact (electrical) on low-profile LHD and CAEX batteries (electric vehicles) associated with energy consumption and power profiles, particularly considering:
 - Energy autonomy of equipment
 - State of Maximum Available Power (SoMPA)

Direct supervision: Javier Ruiz del Solar

Position 7: MSc. in Mechanical engineering

- Contribute to modeling of the thermal impact on low-profile LHD and CAEX batteries (electric vehicles) associated with energy consumption and power profiles as a function of the State-of-Health.

Direct supervision: Prof. Marcos Orchard

Position 8: MSc. in Electrical engineering/Mining Engineering

- Simulate different integration scenarios of electric mobile technologies in underground mining operations.
- Evaluate energy consumption of various equipment and analyze charging infrastructure needs.
- Contribute to the development and enhancement of the ELMO-UG (ElectroMobility management for zero carbon MINing) simulation and optimization tool for underground mining.

Direct supervision: Prof. Angela Flores & Prof. Luis Felipe Orellana

Position 9: MSc. in Electrical engineering

- Contribute to developing a range autonomy prediction system, SoMPA, and SoH, for low-profile LHD and CAEX batteries based on the probabilistic characterization of operational profiles and the definition of utilization strategies.

Direct supervision: Prof. Marcos Orchard

Requirements

1. A master's or bachelor's degree in a discipline related to mining engineering, electrical engineering, computer engineering, mechanical engineering, or other related disciplines. A master's degree will be considered a plus (only for PhD candidates).
2. Excellent academic record. A minimum grade point average (GPA) of 5.0 on a scale of 1.0 to 7.0 is required (Chilean grade system), or equivalent.
3. English language proficiency: good verbal and written communication skills for effective collaboration and for writing peer-reviewed journal publications and technical reports.
4. Excellent teamwork and communication skills.

5. Ability to work independently, with flexibility, and critical thinking.
6. A strong interest in the role of mining in climate change and mitigation strategies.
7. A strong interest in optimization and its application to mining, energy, or industrial sectors.
8. Good programming skills in Python, C++ or Java and knowledge of algebraic or optimization modeling languages such as Pyomo or GAMS will be considered a plus.

Starting date: Upon agreement, the starting date will be between December 2024 and March 2025.

Important: Non-Chilean residents must have a work permit to work in Chile legally.

What You Will Do

- Collaborate with industry partners and other researchers.
- Complete the coursework requirements of the PhD program or Masters
- Assisting in the instruction of both undergraduate and postgraduate courses in Mining and/or Electrical Engineering as a Teaching Assistant (~20%).
- Collaborating on research grant proposal writing
- Write reports and publications, and presentations.
- Attending conference(s).
- Other activities of your interest.

Successful candidates for the **PhD and Master positions** will have a strong academic and research background, excellent communication skills, and an evident passion for their research area. Candidates should also be prepared to work independently and as part of a team, and to engage in both academic and industry collaborations.

PhD Program duration: 3.5 – 4 years. This is a full-time appointment.

Master Program duration: 1.5 – 2 years. This is a full-time appointment.

How to apply

Please send an email with the subject “Research – Electromobility” to luorella@uchile.cl, with the following documents (**English or Spanish**) and information:

- **Position of interest:** PhD or master, and the position number.
- **An updated version of your C.V.**
- **Transcripts of your academic degrees.**
- **A statement of research interests (max 500 words)**
- **The contact information of two potential referees.**
- **Preferred starting date.**

Any inquiries should be addressed to the same mail.

We invite you to apply until September 30, 2024.

The review of applications will begin immediately and will continue until the positions are filled.

We promote equality of opportunity, value diversity, and nurture a working and learning environment in which the rights and dignity of all our staff and students are respected.

Santiago, Chile, August 2024