



Annual Highlights 2020



International
Minerals Innovation
Institute

Growing Saskatchewan's Natural Resource Economy

Message from the Executive Director

Even though COVID-19 put many challenges before our members and partners in 2020, IMII undertook and delivered on several innovation initiatives and projects in the past year. The organization:

- Issued its third set of Diversity & Inclusion Challenges, committed an additional \$500,000 to the program, and approved four new projects to build capacity for increasing the numbers of Indigenous peoples with the digital skills to work in the minerals industry.
- Increased the number of RD&D projects in its portfolio and increased the total value of supported projects to more than \$20 million and the total number of projects to more than 50 in 2020.
- Released the first “requests for researchers” under the \$1.2 million partnership with Mitacs to fund student internships to advance research and development into innovations in the minerals industry and approved two projects in response.
- Announced the first winner of The Mining Futures Award scholarship, valued at \$12,000 and designed to help undergraduate students currently enrolled in one of three IMII-sponsored Mining Engineering Options at the University of Saskatchewan cover most of the costs for tuition, books, instruments, and fees.
- Launched and advanced the organization's first innovation challenge - the Alternative Energy Systems Innovation Challenge – a \$500,000 prize competition to find and advance a new technology to help member companies meet their energy and greenhouse gas emissions reductions targets.

IMII recognizes it could not have achieved any of these outcomes without the ongoing support and participation of its funding members – BHP, Cameco, K+S Potash, Mosaic, Nutrien and Innovation Saskatchewan, and other members as project partners. Management and staff extend their heartfelt thanks to all the individuals giving of their time to serve on the Board of Directors, RD&D and E&T panels, steering committees, and as subject matter experts.



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Our vision is to make Saskatchewan home to the world's most innovative and sustainable mining and minerals industry.

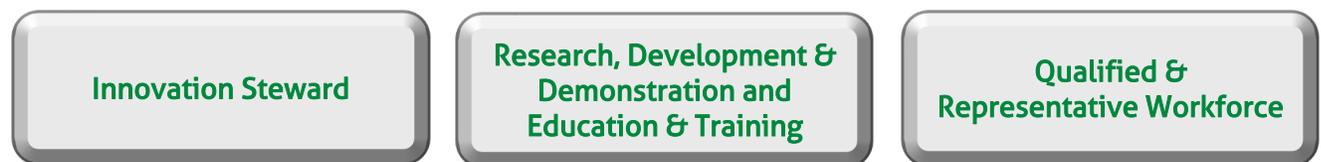
Letter from the Board Chair

2020 marks my first year as independent Board Chair and I am incredibly pleased to report on IMII's renewed strategic plan and its role in growing Saskatchewan's natural resource economy.

IMII has always taken governance matters seriously and strives to operate and govern consistently with robust and transparent practices. Governance is important to an organization such as IMII to:

- preserve and strengthen member confidence;
- provide the foundation for the achievement of goals and the best performance and results; and
- ensure the organization is well placed to respond to a changing external environment.

Good governance appears as one of four pillars in IMII's renewed strategic plan to ensure the organization's management and staff have the framework for planning, implementation and monitoring of good performance. The other three pillars



are reflected in IMII's new purpose:

IMII serves as an **Innovation Steward** to strengthen the Saskatchewan minerals industry's competitiveness and growth through **Research, Development & Demonstration and Education & Training** to drive the future's **Qualified & Representative Workforce**.

IMII's renewed strategic plan sets the organization up for making contributions to help grow Saskatchewan's resource economy through innovation – be it technology development and deployment, diversity and inclusion, or internships. By strengthening the innovation capacity for Saskatchewan's minerals industry, which is foundational to the province's COVID recovery and long-term growth, IMII will continue to add value to its members and the province.

STRATEGIC PILLARS & HIGH-LEVEL GOALS

To learn more about IMII's strategic pillars and high-levels goals see [IMII Strategic Plan 2020-2024 Summary](#)

Arnfinn Prugger

Sustainable Innovations that Matter to Mining

Productivity, safety, and environmental gains from technological innovation are vital to the future of Saskatchewan's minerals industry. Technologies can allow companies to remove staff from potentially dangerous working conditions while also offering efficiency and productivity gains that could be substantial. Technologies can also allow companies to become more energy efficient, lowering both their costs and their environmental emissions. Innovations that lead to productivity, safety, and environmental solutions will make the minerals industry more sustainable – benefiting Saskatchewan and all its citizens.

Developing a Real-Time Location System

BHP and Nutrien are collaborating in an applied R&D project with Saskatchewan Polytechnic to build a positioning system that will provide location information for assets in an underground environment to within 30 cm of actual. The accrued benefits of this type of technology will touch on safety, process optimization, and automation. This project will build a prototype mesh network of beacons that can automatically position themselves within the mesh. These beacons will be able to transmit both data and positioning information throughout areas of an underground mine. Mobile mining equipment and various kinds of vehicles will be trackable by positioning beacons within the mesh. In the case of mining equipment such as a boring machine, this positioning data in combination with other data being collected while mining can be used to better forecast developing hazards at the mining faces. Significant safety data is collected at the mining face, but real-time data driven decisions are not possible because the position of this data is not known until surveyors provide location information. With such technology it may be possible to implement a real-time geotechnical hazard warning for supporting safer production in underground mining.

Dust Collection System & Modelling

This Operationalizing Innovations project is a collaboration between Mosaic, Nutrien and Continental Mine and Industrial Supply Ltd., and came out of DEMOday 2019. The objectives of this project will be to identify a transfer point underground in a potash mine and install a new and innovative dust collection skid to provide the proof of concept for this design to both collect and treat the potash dust. Working with industry, a testing methodology will be developed to apply to a transfer point before and after the installation of the dust collection system. This will allow the benefits to be quantified for future justification for commercializing the new technology.

This project could help to increase efficiency in the Saskatchewan potash industry by reducing the clean-up requirements associated with dust in the underground belt drifts. This increased efficiency will help support decreased emissions associated with diesel powered mobile equipment. It will also allow workers to be re-prioritized onto higher productivity work associated with production requirements.

Mining for the Environment

The IMII and its funding members are together addressing the need to accelerate development, demonstration and deployment of low carbon energy technologies. These leading minerals companies and the provincial government have established goals to reduce greenhouse gas emissions over the course of this decade (e.g., reducing GHG emissions intensity by 30% by 2030) and beyond. However, achieving “net zero carbon emission” goals by 2050 will require technologies that either do not exist today at commercial scale or are not affordable.

Investigations by IMII in 2020 found there to be several technology areas of interest: including: waste heat recovery, cogeneration, zero or lower emissions sources for electricity, zero or lower emissions fuels or fossil fuel replacements, energy efficiency improvements, expanded electrification, and energy storage systems. There are, however, current technological limitations imposed by original plant designs and some by facility life spans often more than 40 years in the minerals industry.

A report issued during Climate Week in 2020 by the Canadian Institute for Climate Choices, titled *11 Ways to Measure Clean Growth*, recognized that developing technology is a key catalyst for clean growth and that one of the barriers to technology development has been slow adoption. By working collaboratively IMII’s members are looking to address both.

Building the low carbon minerals industry of the future requires that two key questions be addressed:

- What is needed to provide reliable, resilient, safe, affordable low carbon energy technologies that can be effectively integrated by industry?
- What are the pathways to low carbon energy use that are environmentally responsible?

Reducing Carbon Emissions

It has been recognized that in heavy industrial sectors – including the minerals industry, that most deep emissions reduction technologies are not available on the market today and that innovation is required to develop and deploy new technologies. This is the driver behind the following energy-related initiatives launched by IMII in 2020.

Two projects launched by IMII 2020 are meant to contribute initial answers to these questions.

Application of Clean Power Generation Technologies

IMII is collaborating with March Consulting Associates Inc. in a study on the application of clean power generation technologies to the Saskatchewan minerals industry. This project will evaluate various cleaner, renewable, and innovative options for power generation for a mining operation with a target of reducing the environmental impact of mine operations while considering the economics of new technologies. The study will produce information that will help drive the future of electricity production for the mining

industry in Saskatchewan. Technology is changing rapidly, and this study will provide a detailed analysis of the current state of art and the trend for the next 5 years for electricity generation and how the mining industry in Saskatchewan may leverage new power production technologies to improve operating expenditures. Technologies which will be reviewed and assessed will include new options for low carbon sources of electricity, such as renewables and small modular reactors, as the state-of-the-art over the next five years will be profiled. These technologies represent alternatives to the power grid which may offer a method to address the increasing need for more economically and environmentally sustainable means of power generation for use by mines across Saskatchewan.

AES Innovation Challenge

The International Minerals Innovation Institute (IMII), with support from their members and the Challenge Dialogue System Network, as well as Western Economic Diversification, launched the Alternate Energy Systems Innovation Challenge in the fall of 2020. This Innovation Challenge is seeking solutions to provide new technologies that can be piloted at a mine site in Saskatchewan. Mining has large energy consumption requirements, and the Challenge presents a perfect opportunity for innovative energy solutions to be showcased in Saskatchewan for a global industry.

The IMII Alternative Energy Systems Challenge Prize is a new initiative of the IMII and presented innovators with a unique opportunity to advance their technology solution for the minerals sector by working with Saskatchewan’s leading minerals companies. Ten applications were received, four were shortlisted for interviews and two selected to proceed to the Innovation Spring phase of the Challenge in early 2021. IMII will be providing up to \$250,000 to each of the finalists to advance both the business and technology use case for the deployment of the technologies in mining. It is expected that one of the two finalists will be selected by the end of 2021 for a field trial in 2022.



Digital Transformation of Mining

IMII members – industry, government and academic, all recognize that people are the key to mining’s digital transformation. Digital is impacting mining with all of IMII’s minerals company members making advancements with digital technologies by digitizing geological data, incorporating sensors for real time data capture, using drones for inspection, stock and safety monitoring, connecting their workforce, and digitizing engineering and asset information. They are developing autonomous equipment, and integrated/remote operations centres and will use digital technology to manage their operations better, integrate information and ultimately to optimize systems.

This means that the way people will work will change – almost every job will be re-invented, creating an augmented workforce working next to and with smart machines in many instances. Minerals companies will be leading a more diverse, distributed, and connected workforce – one that embraces data-led decision-making and new ways of operating. They will be competing for digital talent – some would say scarce digital talent as skills and experience in data science and analytics are in demand. To succeed, they will need to bring in new skills whilst also supporting their current workforce to successfully make the digital transformation.

This vision of the digital transformation of mining influenced IMII’s project selection in 2020.

The Future of Work: Defining the Skills, Competencies and Roles for a 21st Century Mining and Metals Workforce

In response to recommendations arising from IMII’s Digital Mining Transformation Initiative, which concluded in 2019, it undertook a project to examine the future of work in the minerals industry with the global consulting firm EY. The project resulted in the release of a report - the [*Workforce of the Future: Critical Skills in Saskatchewan’s Minerals Industry.*](#)

The Digital Mining Transformation Initiative found that as digital technologies transform how mine and mills operate, the composition and level of specialization within the workforce will change. As a result, defining 21st century competencies and skills for Saskatchewan’s minerals increasingly digital workforce has become a priority for IMII and its members. This report is IMII’s first effort at identifying such competencies and the ways by which new skills can be acquired.



Key report findings include:

- The successful adoption and deployment of digital technologies to increase safety and productivity will depend on an educated workforce.
- As the future of work changes, so must the future of education.
- The response will require new approaches and new partnerships among and between the minerals industry, post-secondary institutions, and government.

The report made two recommendations, and in response the Board approved a special project with respect to micro-credentialing. This project, in collaboration with IMII's minerals company members and Saskatchewan Polytechnic, is underway in 2020.

Diversity & Inclusion Challenge Program 2020

IMII released four new diversity & inclusion challenges in 2020, all with a focus on the technological change that is occurring with mining's digital transformation and ways and means for the minerals industry to develop and access new sources of digitally savvy workers. With a further commitment of \$500,000 by IMII's Board of Directors four new projects were selected in December 2020 in response to two challenges:

- *Challenge 8* - Design and Develop in Collaboration with Indigenous Communities Adjacent to Mines/Mills Training and Support Opportunities in Basic ICT Skills and Digital Literacy
- *Challenge 9* – Equip On and Off-Reserve Teachers with the Resources, Materials and Professional Development Opportunities to Allow Them to Incorporate ICT and STEM into Lesson Plans for Indigenous Youth in Culturally Relevant and Appropriate Ways

The four new projects approved in 2020 were:

- Innovative Digital Training: Tailored for Indigenous, focused on Potash, Morris Industries
- Diggin' Digital: Roving Discovery Centre and 2-day Bootcamp, Saskatchewan Polytechnic
- Building Mineral Literacy with STEM: Teacher Training Project, Mining Matters
- Diggin' Digital Professional Development (PD): An Educator's Online ICT & STEM Resource Hub, Saskatchewan Polytechnic



Developing a Qualified and Representative Workforce

Saskatchewan’s minerals industry has long been a cornerstone of the province’s economy, and its workforce. IMII’s minerals company members recognize the value of developing and supporting a qualified workforce that is representative of the communities in which they operate. Three of seven projects funded by IMII under the original \$1 million Diversity & Inclusion Challenge Program, aimed at incentivizing innovative approaches to increase the number of women and Indigenous peoples enjoying successful careers in the minerals industry in our province, carried into 2020.

MentorSTEP

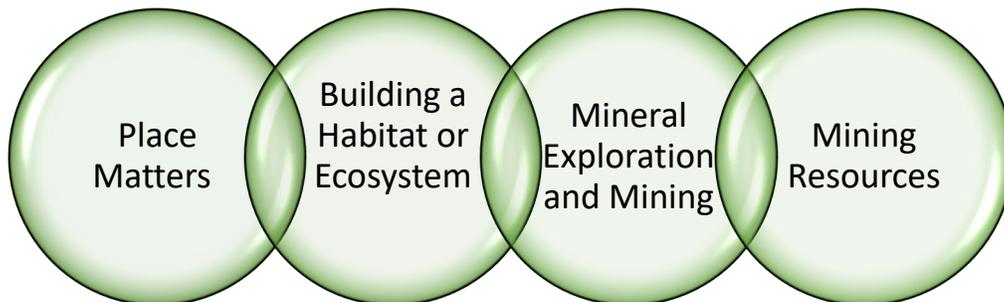
MentorSTEP, a collaboration between the University of Saskatchewan and the Saskatoon Tribal Council, was launched in the fall of 2019 and supported its set of summer research internships in 2020.

MentorSTEP was designed to provide a suite of mentorship, hands-on learning, industry-networked events, and paid summer research internships to Indigenous girls and women learners over 2-years. The activities were to pave the way to Indigenous women in the province of Saskatchewan choosing careers in Science Technology, Engineering and Math (STEM) and stepping into welcoming careers in the Mining Industry. Regrettably, COVID-restrictions put constraints on the ability of the project and IMII’s minerals company members to provide hands-on learning and networking events.

Indigenization of Mineral Resource K-12 SMA Lesson Plans

The Saskatchewan Mining Association successfully wrapped up a project, funded by IMII, in which several curriculum-correlated lesson plans related to Saskatchewan’s minerals industry and resources were infused with Indigenous content and perspectives to create rich, land-based, and culturally appropriate educational materials.

Indigenous knowledge keepers were engaged in the project, which addressed topics such as



and professional development sessions were held with teachers. In all, 31 lesson plans and activities were Indigenized, contributing to curriculums from grades 4 to 9.

The project also created and distributed 44 sets of role model posters and career cards featuring Indigenous peoples working in the minerals industry.

Gender Equity in Mining (GEM) Works – Saskatchewan

IMII welcomed the release of the Gender Equity in Mining Works (GEM Works) [case studies report](#) on Saskatchewan by the Mining Industry Human Resources Council (MiHR). IMII partnered with MiHR to bring its GEM Works program to the Saskatchewan minerals sector.

MiHR's inclusion and diversity subject matter experts and practitioners supported a 10-member Gender Champion Taskforce of leaders working in Saskatchewan's mining industry including two of IMII's member companies, Mosaic and Nutrien, and representatives of mining supply chain companies. This GEM Works cohort received training and support in applying proven tools to identify and mitigate systemic barriers in current organizational policies, processes, and procedures.

The case studies report showcases six specific examples of how GEM Works was adopted to review current practices and ultimately eliminate gender biases discovered in policies, processes and procedures in several Saskatchewan minerals producers and suppliers.

Saskatchewan was the first jurisdiction in Canada to approach the challenge of increasing women's participation in the mining industry in a collaborative manner, dedicating time, and resources to help eliminate systemic barriers, as validated in the case studies report.

Diversity & Inclusion Scholarships

In 2019, IMII created two innovation scholarships to further support diversity & inclusion in Saskatchewan's minerals industry – the iMpowered Scholarship and the Mining Futures Award.

The iMpowered Scholarship, valued at \$25,000, was awarded to three recipients in 2020, Vonda Roberts, Michelle Low and Xiaoying (Sharon) Wang. 2019 winner, Corine Strube, also received the scholarship for a second year. The Scholarship is designed to help women and Indigenous people with the financial responsibility for their family enrolled in STEM related programs and interested in a career in mining.

In 2020, the \$12,000 Mining Futures Award was awarded to Jodi Boser, a young woman majoring in geological engineering. IMII's **Mining Futures Award** recognizes undergraduate students enrolled in the one of three mining options – chemical, geological, and mechanical, in the College of Engineering at the University of Saskatchewan who have developed a plan to succeed in the workplace following graduation.

IMII's support was instrumental in the establishment of the mining options in the College of Engineering, having providing funding of \$1.2 million for the development of new courses and the hiring of new faculty to teach in these three disciplines. The **Mining Futures Award** recognizes IMII's minerals company members continued commitment to the options as a path into careers in mining.

Innovation Steward

IMII is a unique innovation supporting network of mining companies, government departments and agencies, and post-secondary and research institutions, jointly funded by industry and government. It exists to deliver innovations that matter to mining in Saskatchewan. IMII is unique as it is driven by the innovation needs of its minerals industry members as they may be expressed in the context of education and training and research, development, and demonstration.

With these understandings, IMII works as an innovation steward to engage the array of participants and resources that contribute to and are necessary for ongoing innovation in the minerals industry, including: post-secondary institutions and other research organizations that contribute to the education and research capacity available to the minerals industry; the mining companies and service & technology suppliers that make up the business enterprises in the minerals industry; and the funding agencies and other entities which provide capital and services in support of innovation. The following highlight IMII's efforts to bring the minerals industry together with innovators in the supply chain.

DEMOfay

IMII invited applications for its 2020 DEMOfay and Innovation Award which, due to COVID, were held virtually in December in association with the 12th Annual *Saskatchewan Mining Supply Chain Forum*.



Supporting the transformation of Saskatchewan's economy through innovation and technology and the growth of Saskatchewan's technology sector.

Applications for innovations in the following categories were accepted:

- Safety innovation - applying technology or improving processes in innovative ways, above and beyond mandatory requirements, to improve mine worker safety and health
- Technical innovation – improving productivity through advances in automation, digitalization, electrification, drones and smart sensors
- Green innovation – technologies for increasing efficiency of assets, strengthening recovery rates, reducing releases of wastes, lessening consumption of energy and water

Five finalists were selected to pitch their technologies to DEMOfay 2020:

- EECOL Electric & SafeBox - SafeBox Systems (safety innovation)
- Noble Construction Corp. - NobleVR Safety Experience (safety innovation)
- OXO Valve Inc. / Westlund (safety innovation)
- RESPEC & Automodality, Inc. - Autonomous UAV (technical innovation)
- EECOL Electric & Phoenix Contact – PLCnext Open Controller (technical innovation)

DEMOfay 2020 was hosted by IMII on the eve of the 12th Annual Saskatchewan Mining Supply Chain Forum on December 1st.

Innovation Award

The technology selected for the Innovation Award in 2020 was chosen from among DEMOday applications for not only demonstrating innovation in design or engineering but also for the impact its adoption has could have on the way the minerals industry operates (e.g., safer, more efficient, increased productivity, less energy or water consumed).

EECOL Electric and SafeBox System by Ionic Mechatronics was named the 2020 Innovation Award winner by the industry members of the IMII. The Safebox System represents a technical and safety innovation - applying technology or improving processes in innovative ways, above and beyond mandatory requirements, to improve mine worker safety and health.

SafeBox offers a distributed energy isolation and single point lock -and-tag system which allows users to execute complex, system-wide lockouts in a matter of seconds. It automates what has historically been a manual process and presents an opportunity to improve productivity and safety.

2020 marks the third time IMII has given out an Innovation Award on behalf of its minerals company members – BHP, Cameco, KSPC, Mosaic and Nutrien, and was again pleased to do so in association with the *Saskatchewan Mining Supply Chain Forum*.



Collaborate to Innovate – Innovate for Impact

An innovative solution is often a combination of ideas, from conception to delivery. Collaborating with industry, supply chain, academia, and government brings together unique perspectives to drive innovation bring value add to your innovation resources. IMII supports our members and the innovation process with:

- ❖ Clear objectives and manageable and credible goals for collaboration
- ❖ Clear processes for sharing investments and results
- ❖ Processes for connecting with potential partners and managing risks of collaboration
- ❖ Engagement and interaction between the funding and other members
- ❖ The ability for its members to identify other potential collaborators
- ❖ Funding for projects – increasing return on innovation investment
- ❖ Dedicated management representing the members

- ❖ Leveraging the innovation ecosystem and increasing the likelihood of finding a match between your problem and a solution
- ❖ Creating and responding to “demand pull” from industry need
- ❖ Participating in a facilitated process of idea generation, experimentation, information gathering, evaluation
- ❖ Becoming embedded in the Saskatchewan minerals industry’s innovation ecosystem
- ❖ Sharing understanding, resources and experience to reduce innovation risks and costs
- ❖ Participating in the opportunity to solve common issues

IMII Members

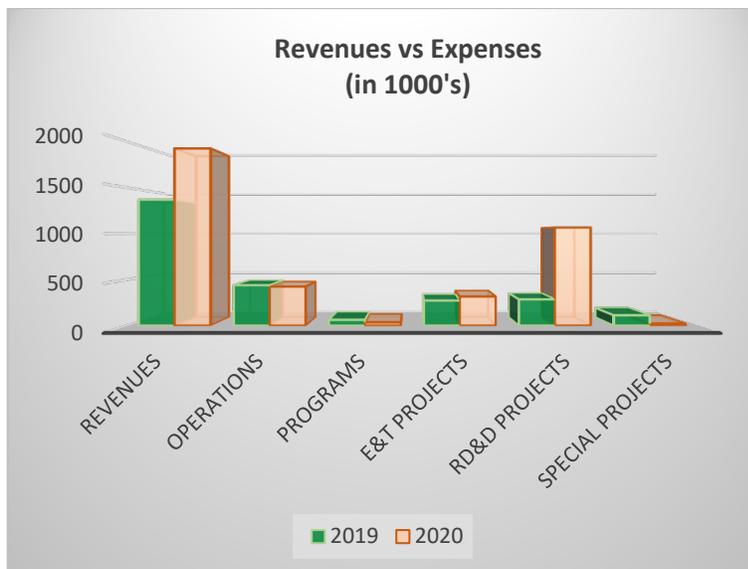
- BHP
- Cameco Corporation
- K+S Potash Canada GP
- Mosaic Company
- Nutrien Ltd.
- Innovation Saskatchewan
- Ministry of Advanced Education
- Hatley Engineering and Applied Technologies
- Saskatchewan Mining Association
- Saskatchewan Industrial & Mining Suppliers Association Inc.
- Canadian Light Source
- Prairie Agricultural Machinery Institute
- Saskatchewan Research Council
- Carlton Trail College
- Cumberland College
- First Nations University of Canada
- Genome Prairie
- North West Regional College
- Northlands College
- Parkland College
- Saskatchewan Indian Institute of Technologies
- Saskatchewan Polytechnic
- University of Regina
- University of Saskatchewan
- Saskatchewan Literacy Network
- Saskatoon Regional Economic Development Authority
- Women in Mining and Women in Nuclear Saskatchewan

Financial Highlights

Since inception, IMII continues to support innovation in the minerals industry, investing \$11.5 million in 51 projects valued at just over \$20 million. IMII has been taking active steps to harness and extend locational advantages for innovation with the long-term goal of building a competitive advantage for Saskatchewan minerals producers.

Audited statements can be found on our website at www.imii.ca/communications/publications.

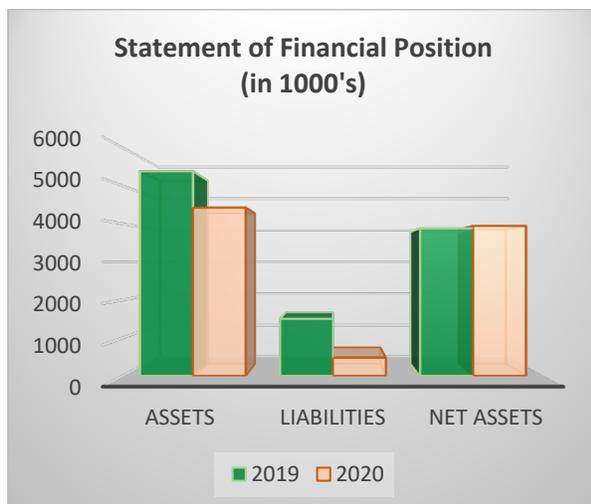
Revenues and Expenses



Both Revenues and RD&D Projects show an increase in spending due to the full recognition of funding received and equipment purchased for the Corrosion Mining Materials Research Cluster project upon completion.

IMII also recognized the cost of running the E&T and R&D programs separate from Operations costs in 2020 and provided a comparison of costs for 2019.

Financial Position



With the completion of the Corrosion Mining Materials Research Cluster project, the equipment purchased for the project was transferred to the universities involved in the project, thus decreasing liabilities.

\$3.9 million of IMII's net assets at the end of 2020 was committed to fund approved projects and initiatives for 2021 to 2024.

- ◆ \$1,107,340 for education and training/diversity and inclusion commitments
- ◆ \$1,610,628 for research, development and demonstration commitments
- ◆ \$50,000 for special project commitments
- ◆ \$938,400 for future initiatives
- ◆ \$210,000 held as a windup reserve