SMR Forum | CASMR Canadian Association of Small Modular Reactors | TORYS LLP

Powering the Future: SMRs, Nuclear Fuel, and Decarbonizing the Mining Sector

Key takeaways

Side Event | PDAC 2025 – Toronto, Canada

March 3, 2025

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Table of Contents

SMR Forum | CASMR Canadian Association of Small Modular Reactors

About CASMR

The Canadian Association of Small Modular Reactors (CASMR) is a newly established non-profit organization dedicated to advancing SMRs as a transformative nuclear energy solution that supports Canada's environmental, economic, and social objectives. CASMR is led by the founding team that established the SMR Forum, a policy platform and event series that fosters high-level dialogue and collaboration on SMR development by convening leaders from government, industry, Indigenous communities, academia, and civil society.

www.canada-smr.ca

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TORYS LLP

About Torys LLP

Torys is a business law firm known for sophisticated counsel and building the trust of our clients through dedicated service, superior results and novel solutions. Torys' nuclear experience is second to none in Canada. We are highly regarded for our experience in the nuclear sector, having acted on many significant matters in the last 25 years. From the early stages of project development through to permitting and licensing, financing, investments, acquisitions and divestitures, decommissioning and waste management, our team advises across the full lifecycle of nuclear projects.

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Acknowledgments and Disclaimer

Powering the Future: SMRs, Nuclear Fuel, and Decarbonizing the Mining Sector was co-hosted in partnership with the Nuclear Energy Agency (NEA/OECD) and supported through sponsorship by Centrus Energy, NexGen Energy, and Sandstone Group. We are also grateful for the partnership of the Mining Association of Canada and for our media collaboration with The Hill Times.

We extend our sincere appreciation to these partners for their support in convening this important dialogue. The findings and discussions presented in this publication reflect the synthesis of perspectives shared during the event and do not necessarily represent the views of the NEA, sponsors, partners, or media collaborators. No endorsement of this publication by these organizations should be implied.

List of Acronyms

SMR	Small Modular Reactor
MMR	Micro-Modular Reactor
NEA	Nuclear Energy Agency

OECD Organisation for Economic Co-operation and Development

PDAC Prospectors & Developers Association of Canada

IAEA International Atomic Energy Agency

IPCC Intergovernmental Panel on Climate Change

HALEU High-Assay Low-Enriched Uranium

Foreword

The decarbonisation of industrial sectors is crucial to achieving global net-zero targets and ensuring a sustainable future. As industries transition from fossil fuels to clean energy alternatives, the mining sector stands at a critical juncture. Mining is essential for producing the materials and critical minerals required for the clean energy transition, but it is also one of the most difficult sectors to decarbonise. Consequently, mining faces the dual challenge of expanding production to meet growing demand while reducing its own carbon footprint.

— **Erveina Gosalci,** Founder of Canadian Association of Small Modular Reactors and the CEO of the SMR Forum —

Small Modular Reactors (SMRs) and Micro-Modular Reactors (MMRs) have emerged as promising technologies to help meet this challenge. By providing reliable, low-carbon electricity and high-temperature heat, SMRs and MMRs can replace diesel and heavy fuel oil in mining operations, while supporting a range of industrial processes. Analyses show these technologies can reduce emissions, improve reliability, and lower costs in remote or off-grid mining operations, many of which are critical to securing the global supply of essential minerals.

To address these pressing challenges, we organized “Powering the Future: SMRs, Nuclear Fuel, and Decarbonizing the Mining Sector” on the sidelines of PDAC 2025, in partnership with the Nuclear Energy Agency of the OECD (NEA). The event brought together government leaders, industry executives, Indigenous representatives, international experts, and policymakers to develop a shared understanding of the opportunities and pathways forward. The dialogue focused on how nuclear innovation can decarbonize mining, secure energy supply chains, and position Canada as a global leader in clean energy solutions.

Executive Summary

This report captures the key takeaways from the sideline event “Powering the Future: SMRs, Nuclear Fuel, and Decarbonizing the Mining Sector” held during the PDAC 2025 Convention in Toronto. The event convened government leaders, policy makers, industry executives, Indigenous representatives, and international experts to explore the role of Small Modular Reactors (SMRs), nuclear fuel, and the mining sector in shaping a sustainable energy future.

Key findings highlight Canada’s first-mover advantage in new nuclear deployment, the importance of a resilient nuclear fuel supply chain, the opportunity to decarbonize mining operations, and the economic benefits of interprovincial and cross-border collaboration. With SMRs poised to complement Canada’s abundant uranium resources, this report underscores the urgent need to accelerate deployment, secure investment, and strengthen partnerships to meet national and global net-zero goals.

"The event highlighted the growing recognition of nuclear energy's role in Canada's clean energy future. SMRs are moving from concept to deployment, with profound implications for energy security, industrial decarbonization, and critical mineral development. At the same time, the nuclear fuel cycle is assuming renewed importance as Canada and its partners prepare for the next generation of reactors. Canada, already a first mover with Ontario's Darlington New Nuclear Project, must build on this momentum to extend leadership into mining, heavy industry, and beyond."

— **The Hon. Tony Clement**, Chair of the Advisory Board, The SMR Forum —

Key Findings

- Canada is a first mover in nuclear deployment, with the Darlington project positioning the country at the forefront of global nuclear innovation.
- Interprovincial collaboration is driving momentum: Ontario is advancing deployment, New Brunswick is building on reactor expertise, Alberta is explring industrial applications, and Saskatchewan is assessing next-generation nuclear while anchoring the uranium supply chain.
- SMRs and MMRs offer transformative opportunities for industrial decarbonization, particularly in mining, petrochemicals, oil sands, and data centers.
- The nuclear fuel cycle is central to energy security, requiring reliable uranium supply, enrichment capacity, and market confidence.
- Canada's mining sector is uniquely positioned to benefit from SMRs and MMRs, as both a supplier of critical minerals and a user of clean energy.
- In Canada, Indigenous partnership on nuclear projects is essential to ensure equity, trust, and expediated deployment.
- Cross-border collaboration with the United States presents a strategic opportunity to strengthen the North American supply chain.
- Public confidence and Canada's regulatory excellence remain vital, offering a global competitive advantage.

Interprovincial Collaboration on Nuclear Innovation

"The question is no longer if SMRs will play a role in powering mining, but how quickly we can bring these projects online and scale up their deployment. Ontario is answering that question. We aren't just talking about SMRs, we are building them."

The Hon. Stephen Lecce
Minister of Energy and Mines, Ontario

Finding: Canada's provinces are advancing nuclear innovation through complementary strengths.

Discussion: Ontario is pioneering deployment with the Darlington New Nuclear Project, the first grid-scale SMR in a G7 nation. New Brunswick contributes decades of nuclear expertise through Point Lepreau and advanced reactor initiatives. Alberta is exploring SMRs to meet surging electricity demand and decarbonize industrial sectors such as oil sands and petrochemicals. Saskatchewan is assessing the role of next-generation nuclear in its long-term energy mix and, through the Saskatchewan Research Council, is advancing deployment of Canada's first-of-a-kind MMR for the development and testing of industrial, research, and energy use applications. Together, these provinces are building a national framework for nuclear innovation, reinforcing Canada's leadership in energy security, industrial competitiveness, and critical mineral development.


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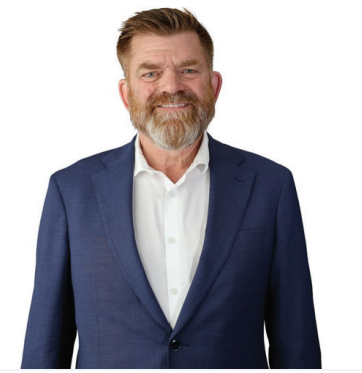
Decarbonizing the Mining Sector



"Growing Indigenous interest in SMRs is a promising development. Many Indigenous communities are approaching the government with ideas for nuclear facilities, highlighting the potential for Indigenous partnerships and economic opportunities."

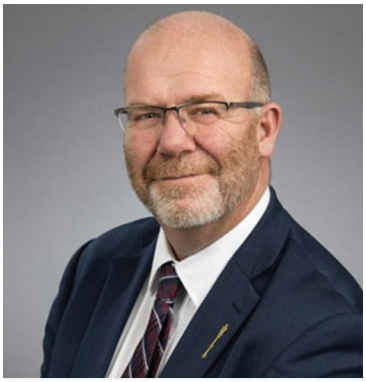
The Hon. Brian Jean
Minister of Energy and Minerals, Alberta

Finding: SMRs and MMRs can transform energy use in mining.

Discussion: Mining, central to the clean energy transition, is highly energy-intensive and emissions-heavy. SMRs and MMRs can provide reliable, low-carbon baseload electricity and high-temperature heat, replacing diesel and natural gas in remote or industrial operations. Beyond reducing emissions, they improve energy security and operational stability, enhancing competitiveness. Indigenous partnerships are vital to ensure deployment is equitable, extending beyond employment toward procurement and equity ownership. Canada's respected nuclear regulator provides certainty for investment, reinforcing Canada's advantage in safe and competitive deployment.


SMB Forum

Unlocking Critical Minerals with Nuclear Energy



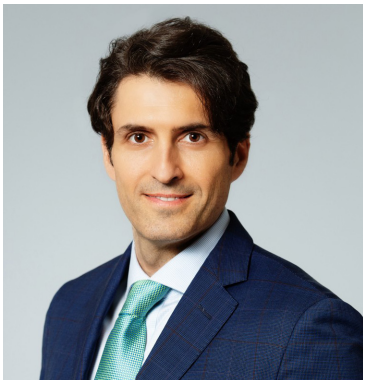
"New Brunswick holds 21 of Canada's 34 identified critical minerals, including world-class base metal deposits in the Bathurst region. These resources are essential for technologies such as electronics, electric vehicles, and renewable energy systems. New Brunswick's mining strength and nuclear energy expertise position the province as a cornerstone of Canada's economic prosperity and a key contributor to the global energy transition."

The Hon. René Legacy
Deputy Premier of New Brunswick, Minister responsible for Energy

Finding: Clean nuclear energy is essential to unlock Canada's critical minerals sustainably.

Discussion: Meeting net-zero goals requires scaling the production of minerals such as uranium, nickel, cobalt, and rare earth elements. SMRs and MMRs can provide clean power and heat for mineral extraction and processing, enabling sustainable growth in critical mineral supply. This synergy positions Canada to strengthen domestic value chains while reinforcing its role as a global supplier of responsibly sourced critical minerals.

Energy Security and the Nuclear Fuel Cycle



"Canada's vast uranium resources, coupled with Centrus' expertise in enrichment, make for a powerful combination. Together, we can establish a North American supply chain to fuel the next generation of reactors."

Amir Vexler
President & CEO, Centrus Energy Corp.

A North American Supply Chain for Next-Generation Reactors

Finding: Cross-border collaboration is essential for a secure nuclear fuel supply chain.

Discussion: A U.S.–Canada partnership can combine Canada's uranium resources with North American enrichment capacity to power next-generation reactors, strengthening regional energy security and global market leadership.

Resilient Fuel Cycle for a Net-Zero Future

Finding: A robust and adaptive fuel cycle is required to meet net-zero goals.

Discussion: Modeling from IPCC scenarios and NEA analyses (NEA, 2022) shows that nuclear must expand through a combination of life extensions of existing reactors, deployment of new large-scale units, and innovative technologies such as SMRs and MMRs. While global progress is moving in the right direction, the pace of deployment must accelerate to achieve net-zero objectives. About 90% of the world's reactor fleet relies on enriched uranium, and some SMR designs require enrichment up to 19.75%, raising licensing, safeguards, and infrastructure challenges. Ensuring sufficient enrichment capacity and regulatory readiness is therefore essential. The NEA's 2024 report on High-Assay Low-Enriched Uranium (HALEU) explores its role in meeting energy goals while ensuring safety, security, and resource utilization (NEA, 2024a).

Market Confidence and Investment Needs

Finding: Long-term investment and policy certainty are required to scale the fuel cycle.

Discussion: Uncertainty in fuel markets risks supply security. Expanding uranium conversion and enrichment infrastructure, ensuring steady demand signals, and building investor confidence are critical to enabling rapid reactor deployment.

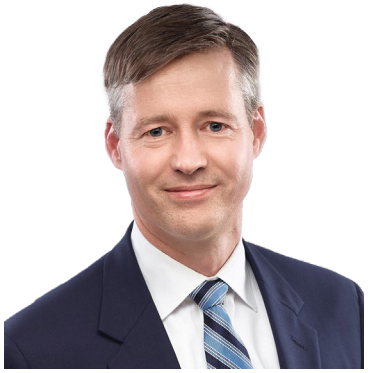
Findings and Discussion

Economics and Competitiveness of SMRs and MMRs in Mining

Finding: SMRs and MMRs present competitive alternatives to fossil fuels in mining operations.

Discussion: MMRs offer an opportunity to replace diesel and heavy fuel oil in small, remote mines, reducing emissions and potentially lowering costs. Beyond mining, they can support industrial heat applications, hydrogen production, and reliable power for data centers. Analyses indicate potential operating cost reductions of up to 30% for off-grid mining operations adopting micro-SMRs (NEA, 2024b). Market assessments suggest that up to 5% of current remote mines could benefit immediately, while SMRs could play a significant role in powering the 16% of critical mineral deposits globally located in off-grid areas (NEA, 2024b). These advantages increase, as carbon reduction pressures intensify, and energy price volatility increases. For larger operations, SMRs provide scalability, stability, and long-term predictability in costs. Integrating SMRs and MMRs into mining can unlock efficiencies and strengthen Canada's global leadership in both energy and resource sectors.

Regulatory Keys for SMR Deployment at Mines in Canada



"Developing principle-based Indigenous partnerships and appropriately tailoring regulatory processes would expedite SMR deployment in Canada."

Michael Fortier
Partner, Torys

Finding: Expedited SMR deployment at mines in Canada will require Indigenous partnerships, "right sizing" regulatory processes and reasonable regulatory timelines.

Discussion: In Canada's current regulatory landscape, effective Indigenous partnerships will generally be a pre-condition for expediated deployment of SMRs at mines. Practically, this typically requires developing trust and understanding with potentially affected Indigenous groups. In addition, regulatory processes for SMRs at mines must be appropriately tailored and implemented to address the actual circumstances and risks within reasonable timelines. While there has been much discussion and some effort to provide regulatory tailoring and approving projects within reasonable timelines in Canada, the results have generally not met such aspirations. A notable exception has been Canada's nuclear regulator, especially with respect to its licensing of the first SMR in the G7. However, a SMR at a mine is likely to require approvals from other regulators.

Conclusion **and** Call to Action

The discussions at PDAC 2025 underscored Canada's opportunity to lead globally in SMR and MMR deployment for mining and other industrial applications. Provinces, industry leaders, and Indigenous communities must work together to seize the first-mover advantage and solidify Canada's role as a pioneer in nuclear innovation.

Achieving this requires decisive action in six areas:

1. Accelerate deployment of SMRs and MMRs in mining and other industrial applications.
2. Align SMR and MMR development with mining and critical minerals to strengthen both energy and resource security.
3. Deepen interprovincial and cross-border collaboration to leverage Canada's leadership and partnerships.
4. Ensure Indigenous partnerships and public engagement remain central to deployment.
5. Strengthen the nuclear fuel cycle, secure long-term supply, and build market confidence.
6. Unlock critical minerals with the next generation of reactors, supported by policies and investments that build confidence in nuclear innovation.

Canada is uniquely positioned to pioneer a new era of clean, reliable, and secure energy solutions. Seizing this opportunity will not only decarbonize mining and other heavy industry but also strengthen Canada's economic and geopolitical standing in the global energy transition.

"The road ahead involves early adopters taking the lead. The mining sector can serve as a first mover in SMR deployment, demonstrating its viability for heavy industries. Successful early projects will provide a blueprint for broader industrial adoption across Canada, positioning Canada as a global testbed for SMR deployment in industrial applications."

Pierre Gratton
President & CEO, Mining Association of Canada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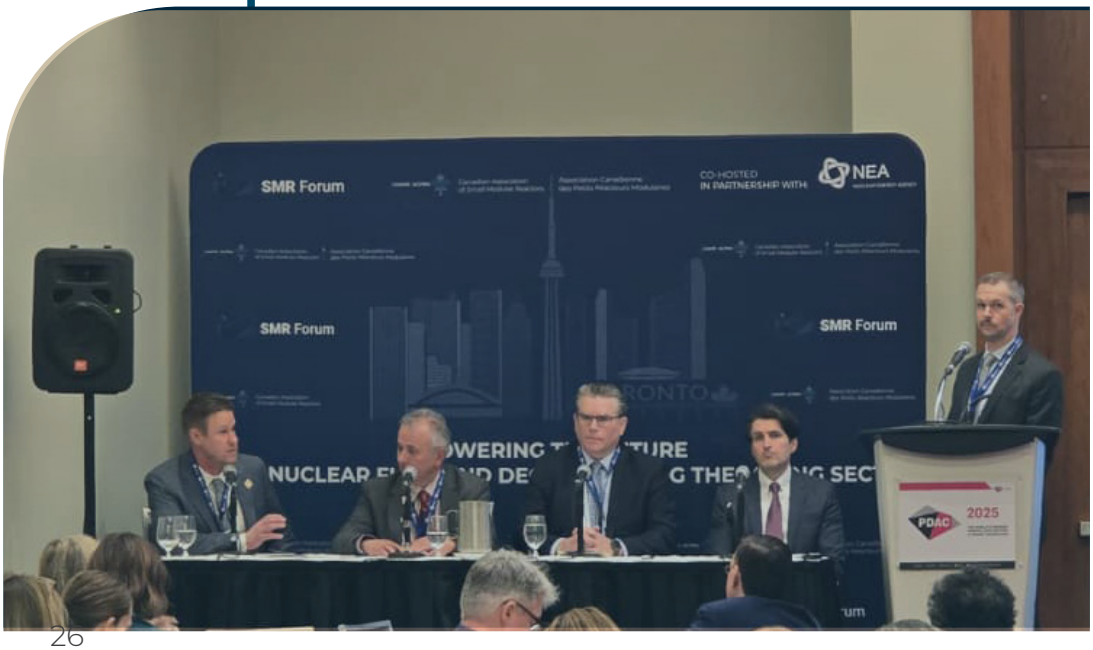
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