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Maximising Uranium Mining's Social and Economic Benefits: A Guide for Stakeholders


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The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for the safe, environmentally sound and economical use of nuclear energy for peaceful purposes.
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of NEA competence include the safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

Cover photos: Cameco's Cigar Lake (Cameco, Canada); Signing of the Ya'Thi Néné Collaboration Agreement with the 7 communities of the Athabasca Basin in 22 June 2016, Hatchet Denesuline Lake, northern Saskatchewan, Canada (Orano); Husab Uranium Mine (Swakop Uranium).

Foreword

Reducing carbon emissions in response to the threat of climate change is one of society's greatest challenges, a global issue that requires urgent action. There is no doubt that the nuclear sector has an important role to play as it provides large-scale, low-carbon baseload electricity. Uranium is the raw material used to produce fuel for nuclear power plants, and with an expected rise in the number of nuclear reactors and the commercialisation of new designs, demand for uranium is forecast to rise, boosting uranium mining activities.

Mining has numerous economic, social and environmental impacts that can be positive or adverse for communities, ecosystems and economies. As the uranium industry addresses negative perceptions and legacies associated with past activities, the environmental, socio-economic and governance aspects of the uranium mining life cycle are gaining increased attention from investors, communities, regulators and other stakeholders.

While environmental and human health and safety concerns often dominate stakeholder engagement programmes and public conversations about uranium operations, less public discussion and analytical research are typically devoted to the socio-economic aspects. This was the starting point of this report.

Examining case studies from several countries helps clarify how the numerous activities related to uranium mining affect various aspects of socio-economic development – including employment, supply chain investments, exports, taxes and royalties, innovation, infrastructure, education and medical care. This report's inventory of leading practices is intended to inform public debate on uranium mine development and provide policymakers with a framework of approaches to maximise the social and economic benefits of uranium mining projects.

While this report's case studies confirm that uranium mining is a powerful vehicle to bring technologies and skills to developed and developing countries, including remote regions, governments need to enact proactive policies to ensure that uranium mining projects contribute to sustainable social and economic development and avoid the negative impacts.

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CBO	Bilateral Guidance Council
CNSC	Canadian Nuclear Safety Commission
EA	Environmental assessment
EIA	Environmental impact assessment
EIS	Environmental impact statement
EITI	Extractive Industries Transparency Initiative
ERA	Energy Resources of Australia
ESA	Euratom Supply Agency
FXB	Association François-Xavier Bagnoud (Swiss international development organisation)
GDP	Gross domestic product
GSP	Gross state product
HRDA	Human Resource Development Agreement
IAEA	International Atomic Energy Agency
ICMM	International Council on Mining and Metals
ICP	Institutional Control Program
ISR	In situ recovery
LEU	Low-enriched uranium
MoU	Memorandum of understanding
NEA	Nuclear Energy Agency
NERA	National Energy Resources Australia
NGO	Non-governmental organisations
NSCA	Nuclear Safety Control Act
PWMTF	Permanent Wyoming Mineral Trust Fund
R&D	Research and development
RSA	Russian Suspension Agreement
SME	Small and medium-sized enterprises
SRC	Saskatchewan Resource Credit

Executive summary

Uranium is the primary source of fuel for nuclear power plants, which provide large-scale low-carbon baseload electricity for more than 30 countries around the world – the world's second largest source of low-carbon electricity after hydropower, accounting for approximately 10% of global electricity supply. Being a low-emissions energy source, nuclear energy can play an important role in carbon emissions reduction programmes. With further potential growth in the number of nuclear power reactors worldwide and the commercialisation of new designs (including small modular reactors), demand for uranium is expected to rise, providing the opportunity to boost uranium mining activities and maximise the societal benefits they may offer.

Like other extractive industries, uranium mining has numerous economic, social and environmental impacts – both positive and negative. As the uranium industry addresses negative perceptions and legacies associated with past activities, the environmental, socio-economic and governance aspects of the uranium mining life cycle are gaining attention from investors, communities, regulators and other stakeholders.

Environmental and human health and safety concerns often dominate stakeholder engagement programmes and public conversations about uranium operations. Discussions and analytical research into the socio-economic aspects are typically given less public attention, even though the uranium industry can be a driver of economic growth and social development in many countries and regions.

This report's case studies focus on uranium-producing regions in both developed and emerging economies to provide a contemporary understanding of leading practices as well as sustainability opportunities and challenges in the uranium mining industry. It is hoped that these studies will inform public discussions on uranium mine development and provide decision makers with approaches that may maximise the socio-economic benefits of uranium exploration and extraction and avoid environmental and health impacts. The case studies target several specific social, economic and environment policy areas:

- in-country value creation, including employment, supply chains and innovation;
- governance, especially related to uranium industry policy and regulation;
- delivery of socio-economic benefits for local communities within a framework of engagement and participation from communities;
- uranium royalties and taxation;
- uranium exports and imports, including security of supply.

While certain practices have been proven to support sustainability opportunities (e.g. education and training for mine employment; provision of goods and services; and redistribution of more tax revenues to local governments), there is no single, universal prescription to ensure that any uranium development will be considered "sustainable". Every jurisdiction and operation has its own unique resource endowment, human resource capacities, infrastructure and historical, sociocultural and political characteristics.

Sustainable social and economic benefits can be realised when the needs of rights holders and stakeholders are met

Engagement is one of the most important ways to obtain support for – and acceptance of – a uranium project. To gain what has been called "social licence to operate", the importance of engagement cannot be overestimated: the inclusion or exclusion of rights holders and

stakeholders can determine whether a uranium mining project obtains social licence, and therefore whether it is a success.

The case studies that appear in subsequent chapters demonstrate that engagement needs to be conducted during the entirety of a mine's life cycle – from early exploration through planning, development, operation and closure. The scale of the approach may depend on the operation's size and duration, location and regional impact. It is also important to manage expectations at each stage. Open and transparent communications should address the benefits of uranium mining and processing – both locally and nationally – as well as the risks, commitments and obligations associated with an operation.

Sustainable social and economic benefits can be realised when the needs of rights holders and stakeholders are met and their standing is advanced. These benefits transcend mere regulatory compliance to create a positive legacy for the communities and regions affected by uranium developments. Maximising uranium mining's socio-economic benefits will require the collaborative action from many individual departments and tiers of government. Furthermore, mining industry decision makers will need to develop relationships and partnerships with communities and leaders in education, planning, finance, environmental protection and health to promote a broader general shift towards sustainable development.

In-country value creation, including employment, supply chains and innovation

The three case studies in Chapter 1 focus on uranium industry activities in Australia, Canada (Saskatchewan) and Kazakhstan. They present information and good practices related to employment, local supply chains and national expertise and innovation, and demonstrate how well-targeted policies can improve outcomes in these areas. Employment is a significant potential benefit of mining projects, with jobs being created directly or indirectly, or induced. Direct employment generally includes mine and on-site employees; indirect employees are primarily off-site contractors and suppliers of goods and services; and induced employment refers to the derivative results of direct and indirect employees' expenditures. In-country value creation also includes developing downstream industries, from uranium ore conversion to manufacturing nuclear fuel assemblies (e.g. Canada and Kazakhstan).

Leading practices generally involve collaboration between operators and local stakeholders, with an explicit capacity-building element that partners companies with government agencies to enhance the skills base and employability of local populations. Specific "local content" policies can be part of a government's overall approach to ensure that mining projects catalyse sustained socio-economic development within the jurisdiction/region and beyond the immediate vicinity of the mine site. These policies can incorporate a variety of mechanisms, from mandatory targets to soft guidance, to regulatory support for capacity-building and education, but as each country has different conditions, local content policies will have to be tailored to each context. The aim is to help governments, companies and citizens collaborate (or partner) with each other to ensure that uranium mining projects provide jurisdictions and/or regions with significant inclusive and sustainable development opportunities.

Ensuring that adverse impacts on environment and people can be mitigated: Governance specific to uranium industry policy and regulation

The importance of effective regulatory frameworks, policies and practices that deliver economic and social benefits and avoid environmental and health impacts throughout a uranium mine's entire life cycle has been widely recognised. Uranium governance (both policy development and regulation) is managed independently by each respective jurisdiction under international nuclear oversight and may be implemented at the national, provincial, state or municipal level. The primary regulatory goal for stakeholders and rights holders at all phases of uranium activity (from exploration to post-closure) is to ensure that adverse impacts on land, people and natural resources can be mitigated or avoided. As Australia and Canada have a long history of strong industry regulation and an inherent uranium resource advantage that has provided economic

prosperity, the case studies in Chapter 2 outline the leading regulation practices they have implemented.

Unsurprisingly, transparent and robust regulation and standards for uranium developments benefit all rights holders and stakeholders – the public, communities, Indigenous peoples, governments and industry participants. Adopting an independent scientific approach is therefore critical to guide regulation and oversight. Aside from the regulatory regime, it is a government policy decision whether uranium mining may be allowed, and policy decisions may differ between successive governments and even across government tiers. From a developmental perspective, complex, overlapping and dual regulatory systems and a lack of policy consistency have prevented or banned access to some uranium resources, and investments in future uranium mine developments continue to decline globally.

From a sociocultural perspective, a robust and competent regulatory system builds trust and acceptance and grants social licence, while from the developmental point of view, regulatory burden and uranium policy uncertainty significantly affect investment decisions. Jurisdictions that plan to develop a uranium regulatory system are encouraged to compare various systems' methodologies and results to choose one that strikes a balance among regulator, industry and public concerns and interests. Policymakers should also recognise that streamlining policies and regulations for uranium activities will attract the investments needed to deliver sustainable development outcomes and economic prosperity while maintaining mechanisms to protect human and environmental health into the future.

Delivering socio-economic benefits for local communities with engagement and participation from communities

As Chapter 3 explains, much of the world's known uranium deposits and operations are in geographically remote locations, and some are on the traditional lands of Indigenous peoples. Some of these locations and peoples may lack access to basic services and infrastructure, so that local economies and human development indicators often lag compared with urban populations. A uranium operation may be the first (or most significant) industrial activity these populations encounter, and it is imperative that the experiences be positive, respectful and empowering.

Aware of this challenge, the uranium industry has instituted, contributed and/or supported numerous programmes to strengthen the delivery of socio-economic benefits for local communities within a framework of engagement and participation from communities. Moreover, as government agencies are essential partners and facilitators of socio-economic development, they are increasingly taking steps to support the sustainable development of communities and host regions by partnering with uranium mining companies and civil society organisations. At a high level, companies, government agencies and civil society organisations have numerous tools, frameworks and principles available to guide their contributions to (and monitoring and reporting on) the delivery of socio-economic benefits for local communities, including Indigenous peoples, through uranium mining projects.

While reality is often more complex than suggested in international declarations, building relationship and trust with local communities and Indigenous peoples is clearly essential to the success of uranium mining projects. Moreover, without such relationships it can be more difficult for companies to receive a social licence to operate and they may be denied access to lands, fail to receive necessary regulatory and government approvals, and suffer reputational and financial damage.

The Chapter 3 case studies, which describe the experiences of Australia, Canada, Mongolia, Namibia and Niger, summarise the leading practices of uranium companies, government sectors and civil society organisations to deliver socio-economic benefits for local communities within a framework of engagement and participation from communities.

A key insight is that uranium mining companies can deliver value for host communities and regions more effectively when they partner with others than if they act alone. Moreover, when companies leverage or support existing government, community, Indigenous and civil society programmes and projects to deliver socio-economic benefits for communities hosting or affected by uranium operations, the benefits are far more likely to be long-lasting because of "buy-in"

(e.g. the Namibian uranium industry's tailoring of projects to advance the government's Harambee Prosperity Plan, and the Canadian industry's support for Indigenous advancement through partnerships with northern businesses).

Uranium royalties and taxation

Like other extractive industries, uranium mining can generate significant social and economic benefits, affecting areas such as gross domestic product (GDP), foreign direct investment, export earnings and mineral rents paid to host governments. Direct benefits include higher levels of employment, training, salaries and wages, and government revenues (royalties and taxes). Uranium mining can also provide economic stimulus to the local and broader economy by elevating secondary industries, such as those in the retail and service sectors that supply the mine and its employees.

Mineral royalty and tax systems and methodologies vary from one jurisdiction to another, and are designed to meet government objectives, whether they be revenue generation or socio-economic development. These systems are nonetheless subject to external factors such as market fluctuations, which can impair their ability to achieve the desired objective(s) and may require their revision, as explained in Chapter 4. In Canada's province of Saskatchewan and Australia's Northern Territory, it has been demonstrated that revenue-based, profit-based and hybrid methodologies can successfully achieve economic objectives. When designing a tax system, however, policymakers must remember that tax rates considerably affect a mine's economics and future investment levels. The overall tax system should be equitable for both the host jurisdiction/region and local communities as well as for the investor, noting that the investor assumes the largest amount of project risk. Although there is no one ideal scheme for royalty taxation, policymakers should carefully assess the long-term development, employment, infrastructure and economic diversification benefits that a sustainable uranium mining industry can offer.

Uranium exports and imports, including security of supply

Uranium extraction obviously provides important economic benefits for exporting countries, and key resources for importers that generate nuclear power. As nuclear power plant operators must ensure the continuous availability of nuclear fuel to prevent supply disruptions, supply security and diversity are of significant concern. Countries seeking to ensure availability of supply for current demand or for the demands of new plants must therefore establish reliable and diverse flows from either domestic or international sources. As explained in Chapter 5, investment is currently insufficient to guarantee long-term nuclear fuel supply chain security, and without new investments the results of less uranium production and exploration in recent years will become more visible in the medium to longer term. Countries seeking to secure domestic (thus protected) supplies could provide opportunities for local or vertically integrated mining companies. Creating an open and supportive trading environment for the uranium industry and its suppliers could help increase productivity, foster technology transfer and innovative business practices and enhance the security of supply of a low-carbon electricity source.

Conclusions

This report's case studies confirm that uranium mining is a powerful vehicle to bring technologies and skills to both developed and developing countries and remote regions, but proactive policies are required to ensure that it contributes to sustainable social and economic development.

For uranium projects to be successful in the broadest sense, they must deliver real benefits to the communities and regions in which they operate. Partnering across various sectors not only creates shared value from uranium projects, but raises trust in industry and government participants and increases their transparency.

Key recommendations

Policy- and decision makers from countries with uranium operations or plans to develop their uranium resources should:

1. Adopt a policy framework that co-ordinates uranium mine development with a broader long-term vision for national, regional and/or local socio-economic development. Co-operation among industry, federal and local governments, Indigenous peoples, local communities, and education and research institutes is essential.
2. Prepare a strategy to enlarge local economic diversification, either through the mining value chain or in other sectors in which the country or region has competitive advantages. Measures to support diversification can range from increasing the capacity of local companies/workers to implementing proactive support for training, employment pathways and entrepreneurship, providing information on market trends, and offering community support grants and credits for small and medium-sized enterprises.
3. Upskill the workforce and adapt the curricula of educational and research institutions to meet current and future industry and economic needs. Uranium and energy resource sector jobs in general are increasingly recognised as being highly technology dependent, requiring high level science and numeracy skills. As skills demand continues to evolve, the uranium sector must maintain its engagement with the training, education and research and development sectors.
4. Raise awareness of the potential benefits of innovation and encourage automation and digitalisation of the sector. This transformation can lead to higher productivity in the uranium mining and milling stages, reduce the environmental footprint of operations, and help overcome some mining regions' demographic challenges.
5. Build community knowledge about uranium mining and its processes, and work with Indigenous peoples and local communities in general to integrate traditional knowledge into operational management plans and activities. Companies should also create development plans, particularly pertaining to education, economic diversification and post-closure land use to ensure that communities do not become dependent solely on uranium mining operations for their existence, revenues and access to services and infrastructure. Greater collaboration among companies, community-based organisations, civil society and governments should result in better and more sustainable development outcomes, higher degrees of trust and confidence in the uranium industry, and better regulatory oversight of operations.
6. For countries or regions developing a uranium regulatory system, review the methodologies and results of comparable jurisdictions to find a methodology that balances regulator, industry and public interests. Policymakers need to recognise that streamlining uranium industry policies and regulations will attract the investment needed for sustainable development and local and national prosperity, while also safeguarding human and environmental protection into the future.
7. For policymakers, remember how importantly taxes and royalties can affect mining project economics and future investments. The overall tax system should be equitable and meet policy objectives for the country, the region, local communities and the investor while ensuring that future generations also benefit. Furthermore, all uranium-producing countries must proactively address the transparency, governance and management of revenue streams from uranium resources.
8. Create an open and supportive trading environment for uranium industry participants and their suppliers to increase productivity, foster technology transfer, generate innovative business practices and enhance security of supply for a low-carbon electricity source.

Introduction

Why uranium?

Uranium is the raw material used to produce fuel for nuclear power plants. These plants generate approximately 10% of the world's electricity at a life cycle CO_2 emissions level that is low. A small amount of uranium contains considerably more energy than other energy sources, with one 20-gramme uranium fuel pellet having as much energy as 400 kilogrammes of coal, 410 litres of oil or 350 cubic metres of natural gas.

Climate change, one of society's greatest challenges, is a global issue that requires urgent mitigation. To achieve their emission abatement goals, countries will need to meet significantly higher electricity demand while decarbonising a wide range of other energy uses, such as industrial processes, heating and transport. All available low-carbon technologies will likely have to be deployed to achieve full decarbonisation, so planning a net-zero energy system without nuclear energy contributions would be a high-risk strategy (IEA, 2019).

The International Energy Agency asserts that mitigating climate change will be much costlier and more difficult if the global nuclear fleet is not maintained, replaced and expanded. Already in the past 50 years, the use of nuclear power has reduced CO_2 emissions by more than 60 gigatonnes (IEA, 2019). Current and emerging nuclear technologies (e.g. small modular reactors and advanced reactor concepts) can be used for power generation, process heat, desalination, or other industrial uses and can be therefore key to large-scale decarbonisation.

The impacts of the COVID-19 pandemic have been global, and countries around the world are currently developing economic recovery plans that will shape infrastructure, energy systems and industrial development for decades to come. There is a strong argument for giving the nuclear sector a central role in these plans, as the relatively uninterrupted operations of nuclear power plants and the nuclear fuel cycle throughout the crisis have demonstrated the sector's resilience. Nuclear energy could aid economic recovery considerably by boosting immediate economic growth while supporting the long-term development of low-carbon, resilient electricity infrastructure (NEA, 2020).

As there are over 440 reactors operational in the world, nuclear fuel will be required for many decades to meet the requirements of the existing reactors – and of new reactors, given projected growth in nuclear generating capacity (NEA/IAEA, 2020). New uranium mines will consequently be necessary to supply the requisite resources.

The transformative activity of mining has numerous economic, social and environmental impacts that can be both positive and adverse for communities, ecosystems and economies. As the sector responds to some negative perceptions and legacies of the early years of uranium mining, the environmental, socio-economic and governance elements of the mining production cycle are becoming increasingly important.

The OECD Nuclear Energy Agency (NEA) provides extensive information on the environmental and health implications of the uranium production cycle in its 2014 report *Managing Environmental and Health Impacts of Uranium Mining*, which summarises leading practices in radiation protection, environmental stewardship, health and safety, and the regulatory environment – as well as the outcomes of implementing these practices.

While environmental issues and radiation protection are often the primary concerns when companies are trying to obtain stakeholder engagement, public discussions and analytical research on economic and social development associated with uranium mining activities have been limited. Because the uranium sector can be a key driver of economic growth and social

development in many countries, regions and communities, this report presents examples from both developed and developing countries to convey a contemporary understanding of sustainability in relation to uranium mining industry opportunities and challenges.

Examining case studies from several countries helps understand how the numerous activities related to uranium mining affect various aspects of socio-economic development, including employment, supply chain investments, exports, taxes and royalties, innovation, infrastructure, education and medical care. This report's inventory of leading practices is intended to inform public debate on uranium mine development and provide policymakers with a framework of approaches to maximise the social and economic benefits of uranium mining projects.

Who are the main stakeholders and what are the potential benefits of hosting a uranium mine?

A stakeholder in the context of uranium mining is generally an individual or group that has a specific interest in the industry and the decisions made – whether they be social, economic or environmental, or related to public safety. During a mine's life cycle (development, operation and closure), stakeholders can be categorised as either internal or external. Internal stakeholders are directly involved in the decision-making process, while external stakeholders are those who may be affected by the project's outcome.

Stakeholders may also be defined as statutory or non-statutory to identify organisations and bodies that are required by national law or policy to be involved in the planning, development or operational activities of a uranium mine, including those that will be affected directly or indirectly by the mine. From the perspective of a uranium mine proponent or operator, statutory stakeholders include national and provincial or state regulatory bodies, local and national planning authorities, various service-related bodies (water, electricity and emergency-planning agencies) that service or are affected by the uranium mine, and national and local government entities involved in policymaking and implementation. Non-statutory stakeholders (in the context of uranium mines) include organisations and individuals that are (or feel they are) affected by the presence, operations or impact of a uranium mine. Local communities and non-governmental organisations (NGOs) may fall into this group, and it is well recognised that Indigenous peoples hold a unique position as rights holders and can be considered both statutory and/or non-statutory depending on the jurisdiction. The unique issues associated with Indigenous rights and engagement are addressed separately in Chapter 3. In many countries, the right of Indigenous peoples to determine what activities can take place on their traditional lands, including uranium exploration and mining projects, are recognised in international declarations such as *The United Nations Declaration on the Rights of Indigenous Peoples* and/or by industry organisations such as the International Council of Mining and Metals (see Chapter 3). Regarding obtaining a social licence to operate (see also Chapter 3), the importance of recognising non-statutory stakeholders cannot be overestimated: mining companies' inclusion or exclusion of non-statutory stakeholders may contribute significantly to the success or failure of a uranium mining project.

Obtaining stakeholder engagement is the process by which an organisation involves people who may be affected by its decisions, or who can influence the implementation of those decisions. Stakeholder involvement and the corresponding social licence to operate should be addressed early in a uranium mining project and be included in the mine's feasibility study. In fact, one of the International Institute for Environment and Development's key messages is that receiving a social licence to operate is essential to any successful mining project (IIED, 2002). Lacking a comprehensive social licence has been consistently ranked as one of the top five business risks to mining companies (Ernst & Young, 2016).

Acquiring a good understanding of who the stakeholders are and what concerns they might have may be accomplished through surveys, public hearings, interviews and facilitated focus-group meetings. As local regulations may differ from international leading practice, it is important for communities to be involved in commenting on regulatory applications when appropriate so that their voices may be heard. Support may be won through early engagement and partnership with the community, and clear messaging on what can realistically be achieved.

A successful stakeholder strategy addresses the different requirements of stakeholders over a mine's life cycle, from early exploration through planning, development, operation, closure, remediation and subsequent land use. The scale of the approach may depend on the size and duration of the operation, its location (remote or urban) and its regional impact (significant or minor). It is also important to manage expectations based on the stage of development the mine is at: in the exploration or pre-feasibility phase, commitments should reflect the developer's level of certainty that the mine will be established. To gain the trust and sustained support of key stakeholders for the project's full duration, project proponents should be as open and transparent as possible. Communications with all stakeholders, including local, regional and national government officials, members of the public, heads of business and industry, the media and leaders of NGOs should address not only the benefits but the risks of uranium mining and processing, and the developer's commitments and obligations.

Economically, uranium mining can significantly benefit stakeholders. Mining activities can raise local and national government revenues considerably through royalties, taxes, exports and net foreign exchange earnings. Uranium mining can also foster better social conditions, including through the direct creation of employment opportunities, with the attendant benefits of rising incomes and wealth accumulation.

Uranium mining projects also benefit stakeholders through increased investments in social services such as health and education, especially in remote regions, and pre-employment training in transferable skills can lead to opportunities beyond the mine. In addition to mine operations, the construction of infrastructure including roads, port facilities and railways can provide direct and indirect benefits as well as regional economic stimulus; this could increase or sustain regional employment and facilitate indirect employment throughout the mine's lifetime. Uranium mining may also positively affect environmental management by rehabilitating and remediating land that was previously disturbed (not necessarily by extractive operations); monitoring and improving environmental conditions; protecting biodiversity; and developing new, sustainable economic activities on old mine sites.

The table below details the direct and indirect economic benefits of uranium industry activities that may accrue to stakeholders and rights holders at the local, regional and national levels. Benefits need to be communicated clearly during the early stages of mine development, and regular updates must follow (for example in the form of public hearings, site operating licence renewal applications, company-generated sustainability reports, website communications and community relations programmes) to win and sustain support and beneficial outcomes throughout the mine's lifetime.

Sustainable socio-economic benefits are realised when projects not only satisfy regulatory compliance requirements, but also leave a positive legacy for regions that host uranium mining. As different stakeholders have varying interests, values, and priorities, the process for determining how best to maximise socio-economic benefits requires communication to first understand the priorities of stakeholders in a particular context, then collaboration across multiple groups and stakeholders, as well as various departments and different tiers of government, to achieve optimum socio-economic benefits. There is no "one size fits all" approach to achieving these benefits, nor is there a "one size fits all" approach to the process of engagement itself. While this reality presents complexities to project proponents, effective two-way communications and collaborations can reduce uncertainties. These types of open and constructive relationships with communities and officials – in the education, planning, finance, environment, and health sectors – can promote a positive relationship between industry and stakeholders, contributing to the economic, social and environmental sustainability of the uranium mining sector overall.

Stakeholders and rights holders and potential socio-economic benefits

Stakeholder	Stakeholder type	Potential socio-economic benefits from uranium mining
Employees	Internal	Direct employment Income Education and training opportunities
Indigenous peoples	External	Compensation for land use, preservation of culture and traditions (as required) Business development opportunities Local infrastructure (e.g. roads, electrical, water, internet infrastructure, schools, medical facilities) Employment Training and development (direct and indirect) Funding and support for cultural or sporting activities Attraction of skills to local community (e.g. medical, educational)
Local communities	External	Business development opportunities Local infrastructure (e.g. electrical, water and internet infrastructure, roads, schools, medical facilities) Employment Training and development (direct and indirect) Funding and support for cultural and sporting activities Attraction of skills to local community (e.g. medical, educational)
Landowners	External	Compensation for land use (if required) Relocation funding (if required)
Local and national business owners; service providers	External	Revenue from business sales and services that support mine activities Business development and potential growth Sustained employment for indirect and induced employees
Shareholders (if publicly traded) **Banks and investors**	External	Potential returns on investments Interest for environmental, social and governance criteria; responsible and sustainable mining is needed to access financing opportunities
Local/provincial/state government **National government**	Internal	Government revenues (royalties and taxes) National income (GDP, gross national income) Foreign direct investment Exports International trade agreements Mining activities create government-based positions
Provincial/state and federal regulatory bodies	Internal	No direct economic benefits, but mining activities do create government-based regulatory positions and may provide licensing revenue
NGOs	External	Typically no direct economic benefits, but some mining companies do provide funding for NGOs to attend public hearings as part of their social licence to operate
Academia and research institutes	External	Downstream activities related to mining Research and development funding
Customers (utilities and utility customers)	External	Security of nuclear fuel supply from responsible uranium suppliers Low-carbon electricity for homes and businesses

In recognition of the importance of participatory approaches to indigenous issues to promote full respect, a special submission from English River First Nation, Saskatchewan, Canada, is included in this report in the box on pages 19-26. This submission has been drafted by English River First Nation. These are their words. They have not been edited by the NEA.

The United Nations Declaration on the Rights of Indigenous Peoples recognises the rights of Indigenous peoples to strengthen their own institutions while retaining their rights to participate through institutions of the state. They have their own backgrounds and priorities, which may differ from those of the state. Different Indigenous peoples may also have different perspectives. They do not speak with one voice. It is important to listen to their voices.

Community perspective:
Members of the English River First Nation share their experiences with the uranium industry

BOLD, COLLABORATIVE SPIRIT DRIVES NATION FORWARD

About English River First Nation

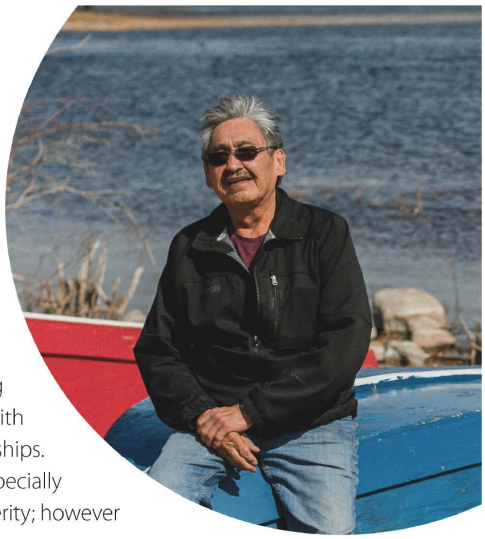
The name of the northern Saskatchewan Nation originates from the English River where the 'Poplar House People,'Kés-ye-hot'ıné, inhabited the area for periods during the year. In the summer of 1906, the Dene people of English River and Clear Lake, and the Cree people of Canoe Lake, entered a Treaty with the Canadian government. In return for granting settlers access to nearly 220,000 square kilometers of Land in northern Saskatchewan, they were promised access to education, medicine, assistance in times of need, support for the elderly and yearly annuity payments. Most importantly, the Nation entered Treaty Ten to secure a promise that non-Indigenous settlers coming north would not disrupt their traditional subsistence activities.

For ERFN, the idea of Land use goes well beyond conventional Western conceptions that see it as an economic asset. The spiritual beliefs and worldviews of Dene people are deeply rooted in their connection with Land. Traditional knowledge, languages, cultural practices and oral traditions built up over the millennia are all connected to the Land and centered on living in harmony.

With environmental stewardship as a priority, ERFN has forged partnerships with the mining industry, and in particular with the uranium industry. Their experience stretches back to the 1980s and continues today. The uranium industry has sparked significant economic and employment opportunities for the community, their businesses and the region. Known for their entrepreneurial spirit and drive for self-sufficiency, ERFN has used the benefits and opportunities to expand and diversify into other industries, such as insurance, retail, professional consulting, property management and more.

Navigating this path with industry has come with challenges. It has meant balancing varying degrees of support and opposition for the nuclear industry, advocating for the Lands and striving to be much more than recipients of benefits – but instead leaders at the table. This supplement to Maximising Uranium Mining's Social and Economic Benefits: A Guide for Stakeholders hears fr om four ERFN members and their intersection with the industry. It offers insight into community priorities and challenges, and in turn some direction for proponents.

Patuanak serves as the largest community of the English River First Nation. It is located about 480 kilometers north of Saskatoon, Saskatchewan. The region provides a home and livelihood for Dene and Cree people who have come to the region for over a century to fish, hunt, and gather, building an economy on the plentiful natural resources. The Nation has approximately 1,600 members, with about half living on reserve and the rest living in urban settings such as Saskatoon or Prince Albert or on other First Nations.



Elder, Norman Wolverine

As an Elder, respected Knowledge Keeper and long-time member of the Northern Saskatchewan Environmental Quality Committee (EQC), Norman Wolverine is often asked to start things in a good way, offering prayers and wisdom as his community embarks on new endeavours with the uranium industry and continues to build on decades long relationships. He sees the value in these relationships and in uranium itself. This is especially true as English River strives for economic self-determination and prosperity; however future implications are never far from his mind.

A lot of people will be against uranium, but I am not. I know what it is used for, there is uranium all over the world and Cameco and Orano do not produce uranium for anything other than power, hospitals and industrial processes – not weapons. So, I agree with the industry producing uranium.

I worked in Key Lake in the 1980s for a few years. There wasn't that much talk about uranium back then, they were setting up shop to mine. As time went on, I was working for the Nation, and they put me on the EQC. That's where I learned a lot – what uranium was, what the uranium industry was about and that got me interested to read more. I've been with the EQC since day one, I am a useful member because of that 25+ years experience.

> "I want to ensure our Land is well taken care of. I always want to know what happens after mining is done. Jobs and money are important, but for us in English River, we use that land to teach our kids. We need to always hear what's happening after the life of mines.

I am 72 years old now and still taking that information to Chief and Council, so we have a good line of sight on activities happening in our traditional territory. I get the information required so our band and our business can understand opportunities – it's useful.

The Dene people, we have our own ways – we are a proud people. Often, we don't feel comfortable asking questions. I try to encourage our members that there are not any stupid questions. Site tours have been helpful. Cameco for instance would give information and do site tours with different focuses, such as tailings, which is an area many of us had a lot of questions about, especially for anything above ground.

They talk about reclaiming, but I think protection upfront is most important. Our ancestors protected the Land and water, they always had respect for nature. I learnt that from my father and grandfather.

When industry asks for an extension of a licence – I often disagree with that. There's been flooding at McArthur and Cigar Lake – with a ten-year licence there are more chances of things being unforeseeable. I am more comfortable with five years. What is happening to the environment needs to be top of mind. Industry destroys Land – we do see it that way.

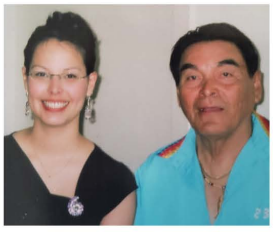
We were once owners of this country, and it was taken from us. We are doing the best we can now. I did a lot of work in the past for the Band – as Lands and Resources Manager – and I've spent lots of time protecting our Land through Treaty Rights. That is why I am still here, as an Elder to guide them. As long as I am around, I will be there to give my advice to our leadership and the industry. They need to come to us and ask. I am there for those proponents who want to learn and ask questions.

Cheyenna Campbell

Cheyenna Campbell is the Lands and Resources Manager for English River First Nation and a lawyer with a speciality in Indigenous Law. She was mentored by Norman Wolverine who held the role of Lands and Resources Manager for many years. They continue to collaborate and work to represent land users' concerns with the uranium industry. Cheyenna grew up on English River's La Plonge reserve.

I remember sitting under the kitchen table listening to the Elders talk and the conversation would often turn there – to industry and uranium. I'd listen to them go between Cree, Dene and English and hear those words: uranium, Cameco – the big names, and they'd talk about their traplines. The industry was also the employer of our family members, so I had that background – it was just there – a low hum in the background.

My grandpa, Alec Campbell, always had a voice in our community and was very involved. He was tuned into the industry right from the early days of exploration hearing the helicopters overhead while he was moose hunting, and then being consulted as a trapper. He was always finding ways to gain more information. He was never a Chief or on council, but he was there as an advisor. It was interesting to hear about how he got information as a day-to-day land user. He participated on boards, but a lot of it was sitting around the kitchen table, having tea or coffee or meeting people at the Forks. It was about talking to people he trusted and hearing from them.



As a trustee on the boards for our agreements with uranium companies, I learn more about environmental impact. When I stand in front of the CNSC I think of my grandpa and how it affected his trapline – and hold that view as I continue my work.

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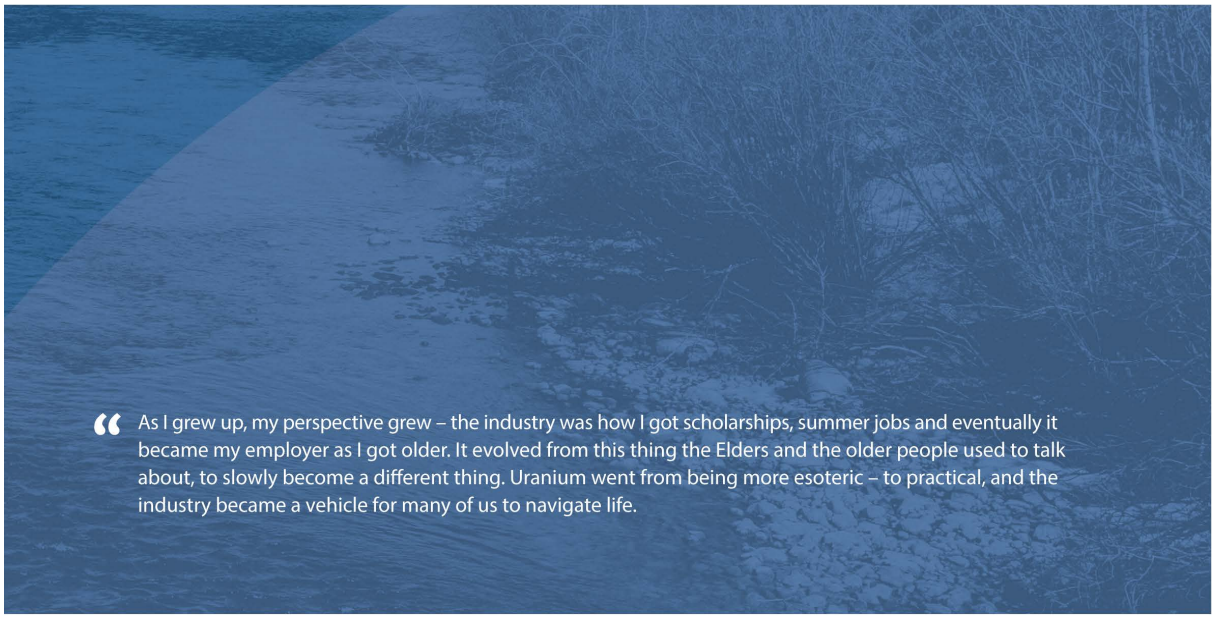

> As I grew up, my perspective grew – the industry was how I got scholarships, summer jobs and eventually it became my employer as I got older. It evolved from this thing the Elders and the older people used to talk about, to slowly become a different thing. Uranium went from being more esoteric – to practical, and the industry became a vehicle for many of us to navigate life.

While that kind of sharing of information is still important, access has evolved with demand. The younger generations are more tuned in with globalization. We go to social media, radio and television – more than just sitting around now. You still have the people who continue the old ways despite colonization and others who are perfectly assimilated. The people have changed so our expectations have changed.

Change has a negative connotation. Evolve is more accurate. It means we are moving with the times, adapting – and that is one of our strengths as people of English River. It's built into out DNA because of our relationship with the Land. We are seeking and expecting more – based on our needs of the day.

The Nation is looking for education, training and workforce development because not everyone holds on to being a traditional Land harvester. But we are also very cognizant of the old ways – so we want to make sure they can continue. We have our cultural camp every year, and it means community members can see the benefits from industry partners and government that invest in it. That's really reconciliation at work. Those who didn't receive those skills can have access and industry is supporting that, it's the purest form of reconciliation.

The growth and evolution have been positive. We have learned through trial and error what works for us and what doesn't. That's the difference between just capacity funding and the more important investment of capacity building. The more direct contact between Nations and the industry or government, the better. That's how those long-term relationships grow. It also means that the knowledge and capacity stay with the community, instead of leaving with a consulting company. We want to be able to build those solutions with our partners.

We now have people and our leadership sitting at the table and negotiating rather than having someone do that for us. That is because of our leadership and the people in our community and the willingness to keep pace with industry. Its not going anywhere and we are adapting and learning from each interaction – positive or otherwise. That is making us better as a community, better prepared as a community to ensure the future generations of the Nation get the best benefits and are provided the same opportunity to hand down their culture and retain those traditional practices. Protecting the Land, continuing our stewardship, that is enduring.

Tom Lariviere

Tom Lariviere is proud of his long career in the uranium industry. He was one of the initial people to participate in a pre-employment mill operator program in Beauval in 1980, and then move into a trainee role at Cluff Lake. It was the first time a progressive system was put in place that allowed people to work several months within six different areas of the mill, writing a test between each, until finally becoming fully qualified. Tom says special consideration is needed to create programs in the north as the industry modernizes so community members can continue in the workforce.

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> Communication is important – be visible. The industry needs to have regular, open communication. Tell the whole story. Seeing companies in the community makes a difference. I am for the industry – it gave me a good life – and I like to see that for others. Those that don't understand it, are often against the industry.

The communities weren't prepared when the mines opened in the 80's. As the industry progresses more effort needs to be made to be sure we have a strong local workforce. I am thinking new uranium projects and new nuclear technology, like SMR's – we want to be a part of that.

There isn't a lot of work that you can make a decent living at. A lot of it is seasonal, so the industry has really allowed for more opportunity. I enjoyed meeting different people and working in a challenging environment. I made a good living at it; it gave me a good life and I want that for our young people.

The technology is shifting. When I started at Cluff Lake it was all hands on. We were initially on the imperial system and moved to metric. The industry is now highly computerized. You can run the whole mill from a computer – that is how much it's changed in the last 40 years. I was a part of that change. Education is definitely required, and Grade 12 won't be enough.

Many of the technical schools are too far away. We need some programs closer to home. A college on the westside would be helpful. Better communication and coordination with the schools to get young people excited about opportunities and informed about what's needed for training should also be a priority for the industry. There needs to be a better understanding that there is no end to education. I used to speak at career symposiums, and I am excited to see those start up again.

The opportunity is there. Lots of community people have progressed to foreman or landed management positions, have gone on to train in trades and are operating heavy equipment. There are new opportunities all the time.

Instead of contracts going south – the north is prioritized. It's moving, the doors are opening. I feel like we have an established workforce now – it's here now. The companies that have representatives in the community providing information offer a good support. I'd like to see more training and bigger contracts. I want people to realize there is more out there and that we can continue to get better positions. The economic spin-offs are real too. The contracts for our companies also create employment for the communities.

Some people say the industry is going to ruin our Land and that's often reinforced in the media. There are pros and cons to all projects. I sat on the environment quality committee onsite, and I always raised concerns if I had them. How we treat water, the safety of the workers – we spent a lot of time on all those things, and it built my understanding over time. I feel confident, there is a lot being done. That larger context and exposure to community liaisons, site tours and what's happening in other regions is important to building trust and understanding.

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JB Campbell

JB Campbell worked as a commercial fisher and trapper before spending two decades as a mill operator at the Cluff Lake uranium and mine and the Key Lake mill in northern Saskatchewan. JB also served a term on council between 2007-2009. He's been retired for the last nine years, enjoying a quiet life in Patuanak on the English River First Nation. Like many families in the community, the experience with industry has been generational, with his brother and son working in the industry too. He wants to see the partnerships with the industry continue to grow. To him this means more ERFN members in leadership roles, running operations and involved in the future-looking safety of the Lands.

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> My priority was providing for my family, and I was able to do that well because of the industry. Now that I am older, I find myself reflecting on the environment and thinking long term. Those aspects of what happens during decommission and reclamation is now what I am most interested in and what I want to know more about.

The safety culture really grew over the years I was working. I spoke my mind if something wasn't right, or I didn't like it. That long-term safety is critical for us. Once it's done, when all the minerals are gone, we are still going to be here living off the Land. The way agreements are approached now need to go beyond jobs. They need to be focused on the future – impacts economically and environmentally.

I like the idea of our company operating a mine, like what is being discussed with Denison's Wheeler River project. It's in our backyard and the more involvement we can have the better. The more support we have for our northern infrastructure, the better. I really value the investments that have made in things like our cultural camp at kilometre 160.

Things are starting back up this month at the sites. Its good to see people being hired again. I'm glad for people to have those opportunities.

References

IEA (2019), *Nuclear Power in a Clean Energy System*, IEA, Paris, www.iea.org/reports/nuclear-power-in-a-clean-energy-system.

IIED (2002), *Breaking New Ground: Mining, Minerals, and Sustainable Development,* Report of the MMSD Project, Earthscan Publications Ltd., London, www.iied.org/mmsd-final-report.

Ernst & Young (2016), *Top Ten Business Risks Facing Mining and Metals 2016-17*, EY, London.

NEA (2020), "Building Low-carbon Resilient Electricity Infrastructures with Nuclear Energy in the Post-COVID-19 era", NEA policy brief, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_34301/webinar-building-low-carbon-resilient-electricity-infrastructures-with-nuclear-energy-in-the-post-covid-19-era.

NEA/IAEA (2020), *Uranium 2020: Resources, Production, Demand,* OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_52718/uranium-2020-resources-production-and-demand.

Chapter 1

In-country value creation: Employment, supply chains and innovation

Introduction

Although many countries seek to exploit mining's powerful potential for national and/or local socio-economic development, there is no one-size-fits-all solution because each country has its own particular geological context, mineral resources, human capital, infrastructure and investment environment.

Job creation is a major potential benefit of natural resource investments. Employment linked to mining projects can be created directly or indirectly, or through induced effects (Cordes, Östensson and Toledano, 2016). Direct employment generally includes the mine's employees and on-site contractors, while indirect employment comprises off-site contractors, suppliers of goods and services, and other jobs that can arise from related social investment activities. Induced employment results from the expenditure effect of direct and indirect employment. Some mining projects may also lead to additional employment through infrastructure investments.

Although there is no universal standard for measuring job creation from mining investments, global data suggest that mining typically contributes 1-2% of a country's total employment (direct employment) (ICMM, 2016). However, taking indirect and induced employment into account can increase this portion to as much as 15%. Many factors influence employment potential in the mining sector (Cordes, Östensson and Toledano, 2016; ICMM, 2016):

- *The type of commodity being mined*. Different commodities generate varying levels of employment. Uranium mines tend to create the most jobs (ICMM, 2016).
- *The phase of the mine's life cycle*. Employment levels are much higher during the construction period. Job types also change as a mining project shifts from the exploration phase to site design and construction, to operation, to final closure and decommissioning, and finally to post-closure.
- *The type of ownership*. State-owned mines often employ more workers than private companies; however, market-driven companies tend to generate more indirect employment opportunities.
- *The mine's size and lifespan*. Larger mines generate higher employment. A mine's lifespan is typically assumed to be 20 to 30 years, but in many uranium operations it is much longer (40 to 50 years). Consequently, the period of profitability and employment is also longer. Additionally, exploration often continues and has led to new discoveries in many uranium-operations host provinces (e.g. in Australia, Canada and Namibia), creating potential for new mines in established mining regions.
- *The type of mining operation*. Underground mining methods tend to generate higher employment than open-pit mines or in situ leaching operations.
- *The mineral grade*. Generally, the lower the mineral grade, the higher the employment due to the need for higher tonnage through the mine and processing facility. Also, lower-grade mines may have larger infrastructure that requires additional maintenance support.
- *The need for new infrastructure*. More employment can be generated through infrastructure construction, and new infrastructure in turn offers additional productive economic opportunities for the local population, particularly in remote regions.

- *Technical assistance programmes*. Implementing supplier development programmes or other proactive support (entrepreneurship schemes, clusters and hubs) can hasten capacity-building among local suppliers and generate more indirect employment opportunities.
- *An enabling business environment, effective collaboration and innovation*. These three factors have been shown to have a strong, positive long-term impact on employment.

This chapter assesses the potential of uranium companies and local stakeholders to cultivate skills, knowledge and innovation – applicable not only to the uranium industry, but to other sectors of the economy as well. Three case studies from Australia, Canada and Kazakhstan – the world's top three uranium-producing countries – examine various aspects and good practices concerning employment, local supply chains and national expertise/innovation, and suggest how better policies can improve outcomes in these areas.

Leading practices generally involve collaborative partnerships between mining companies and in-country stakeholders, with an explicit capacity-building element. For example, partnerships with government authorities can be created for collaborative planning of development to enhance the national skills base and employability of local populations around mine sites.

In terms of policy instruments, "local content" policies can be part of a government's overall approach to ensure that mining projects catalyse sustained socio-economic development within the country/region and beyond the immediate vicinity of the mine sites (IGF, 2018). These policies can focus on increasing:

- local employment;
- local procurement;
- domestic processing of mined products;
- the capacity of local participants such as mining sector operators, including state-owned enterprises;
- national expertise and innovation in the sector;
- links with non-mining sectors.

Local content policies cover a variety of approaches, from mandatory targets to soft requirements, to supportive policies in areas such as capacity-building and education. However, as each country has different conditions, local content policies are highly context-specific. The aim, though, is to help governments, companies, and citizens collaborate to ensure that uranium mining projects deliver significant, inclusive and sustainable development to countries and/or regions.

Canada's province of Saskatchewan: Socio-economic benefit agreements

Overview of the Saskatchewan uranium industry

Canada is the world's second-largest uranium producer, Saskatchewan being its only producing jurisdiction since 1996. Saskatchewan's uranium production history began in 1953 in the Beaverlodge area, with current production based in the Athabasca Basin of the northern part of the province. Northern Saskatchewan, a large region covering over 32 million hectares, is home to 48 Indigenous, Métis and municipal communities. Of the approximately 38 000 residents, 80% self-identify as Indigenous.

The case study presented here is inclusive of all current operations in northern Saskatchewan and is not specific to one project.[1] Current operations are:

- Cigar Lake mine – majority owned and operated by Cameco Corporation (50.025%), with minority partners Orano Canada Inc. (37.10%), Idemitsu Canada Resources Ltd. (7.875%)

1. Data provided for this case study do not include statistics from exploration companies or from decommissioning activities not associated with operating companies (Cameco and Orano).

and Tokyo Electric Power Company (TEPCO) Resources Inc. (5.0%). McClean Lake is the mill facility for Cigar Lake ore.

- McArthur River mine/Key Lake mill – McArthur is majority owned and operated by Cameco Corporation (69.805%), with minority partner Orano Canada Inc. (30.195%). Key Lake is majority owned and operated by Cameco Corporation (83.33%), with minority partner Orano Canada Inc. (16.33%). McArthur River is an underground mine, and Key Lake is the mill facility for McArthur ore. Production was suspended in January 2018 due to low uranium demand, but the mine is expected to restart when the market improves.
- McClean Lake mine and mill – majority owned and operated by Orano Canada Inc. (77.5%), with minority partner Denison Mines Inc. (22.5%). Mining has been suspended and the mill currently processes only Cigar Lake ore.
- Rabbit Lake mine and mill – wholly owned and operated by Cameco Corporation. Mining and milling were suspended in 2016 and it remains in care and maintenance.

Table 1.1. **Saskatchewan's main uranium operations**

Mine	Mining method	Nominal capacity (tU)	Grade (% U)	Recoverable resources (tU)
Cigar Lake	Underground	6 900	11.0	115 100
McArthur River	Underground	9 600	5.5	153 700
McClean Lake	Open-pit	9 200 (mill capacity)	1.1	12 100
Rabbit Lake	Underground	6 500	0.6	27 000

Note: tU = tonnes of uranium.

Source: NEA/IAEA, 2020.

In addition to current mine operations, advanced development projects include the proposed Midwest and Millennium operations. Exploration activity also has led to new uranium discoveries in the Athabasca Basin. Notable recent discoveries of large high-grade uranium deposits include Phoenix/Gryphon, Triple R, Arrow and Fox Lake (NEA/IAEA, 2020).

It is noteworthy that in addition to producing uranium, Canada expanded its activities to other segments of the nuclear cycle such as uranium refining (Blind River facility, Ontario) and uranium conversion (Port Hope facility, Ontario). Plants that process natural uranium powder and assemble nuclear fuel bundles are also located in the Ontario province at Port Hope, Toronto and Peterborough.

Socio-economic benefit agreements

Socio-economic benefits and requirements were not recognised prior to the 1970s, when they were first addressed as part of the Cluff Lake Inquiry and in the Saskatchewan government's response to questions of revenue sharing and socio-economic impacts from mine/mill operations. The provincial government decided not to provide revenue sharing but to require, by regulation, socio-economic benefits from the operations. This requirement continued through the federal/provincial panel processes of the 1990s to the present.

Saskatchewan's uranium mines and mills are regulated primarily by several schemes/bodies:

- federally as "nuclear facilities" by the Canadian Nuclear Safety Commission;
- federally through various environmental statutes and the Canada Labour Code;
- environmental and worker protection by Saskatchewan Ministry of Environment and Saskatchewan Ministry of Labour Relations and Workplace Safety;
- surface lease agreements through the Saskatchewan Ministry of Government Relations;
- mineral leases, Crown royalties and post-closure management through the Saskatchewan Ministry of Energy and Resources.

Saskatchewan requires that uranium operations provide socio-economic benefits through regulation, specifically under the Mine Surface Lease Agreement and the accompanying Human Resource Development Agreement (HRDA). These agreements focus on maximising northern employment, training and business opportunities, and increasing stakeholder communications.

Northern Saskatchewan's uranium industry socio-economic benefits include:

- employment and training targeted to northerners under a "best practices" policy;
- large capital investments to support economic activities;
- northern business support and development under a "best practices" policy;
- revenues to the government in the form of royalties and taxes, surface lease payments and mineral lease rents (see Chapter 4);
- community-based agreements, including investments in communities through donations and partnerships (see Chapter 3).

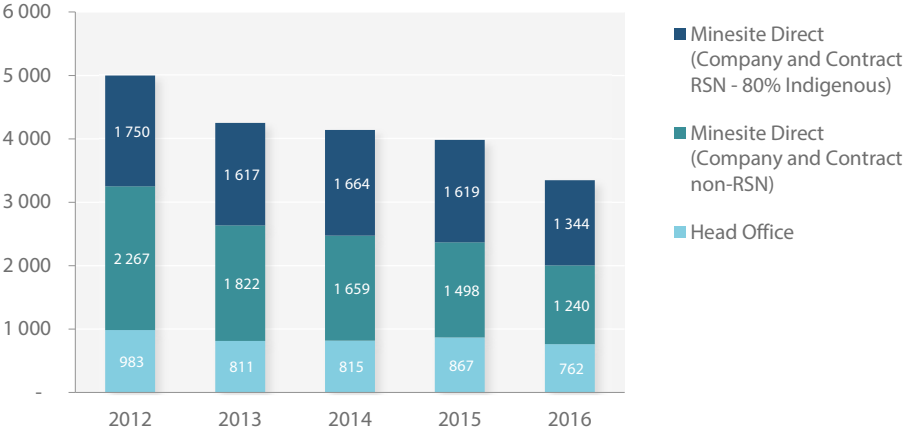
The companies also have impact benefit agreements (now called collaboration agreements) with Indigenous and Métis communities living in proximity to their operations. These collaboration agreements focus on employment, economic opportunities, engagement and environmental stewardship, and direct community investment (e.g. www.cameconorth.com/about/collaboration-agreements).

Employment commitment

In the area of employment, the two agreements with the provincial government encapsulate commitments from the uranium mining companies to ensure that best efforts are made to hire local employees. A surface lease agreement provides access to provincially owned land, and the related HRDA defines the criteria to qualify as a Resident of Saskatchewan's North (RSN). As 80% of northern Saskatchewan's residents are Indigenous, as uranium companies make efforts to hire locally, they may incidentally hire Indigenous workers. Under the surface lease agreements, uranium operations must make their best attempts to maximise employment participation by residents of northern Saskatchewan, striving towards a goal of 67% northern employment.

Uranium companies employ people directly at their head offices (in Saskatoon, Saskatchewan) and at each of the mine sites (Figure 1.1). Also important are the contractors hired to work at the mine sites.

Figure 1.1. **Saskatchewan total direct mine site and head office employment**



Note: Data provided do not include statistics from exploration companies.

The economic impact of employment in Saskatchewan in general and northern Saskatchewan in particular is significant, and the uranium industry is widely recognised as one of Canada's best performers when it comes to the meaningful employment of Indigenous people. Employment numbers peaked in 2012 during construction of capital projects for expanded and new mine facilities. Mine expenditures are now decreasing with completion of these projects, and employment numbers have also declined recently due to the temporary cessation of production at the McArthur/Key Lake and Rabbit Lake operations because of unfavourable uranium market conditions.

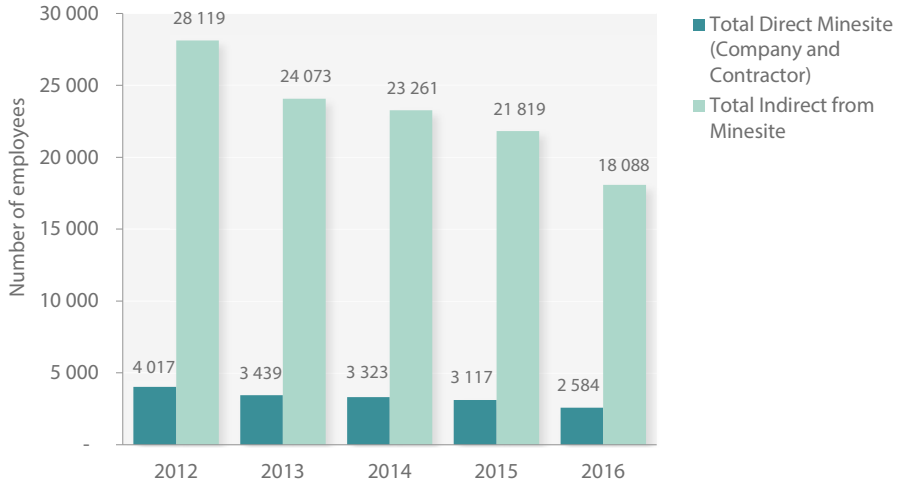
In 2015, the average income (before taxes) of a full-time, year-round uranium industry employee was CAD 105 000, which falls within Saskatchewan's top 15% of wage earners. Of the almost CAD 2 billion the uranium industry paid out in salaries to direct employees in the past five years, more than CAD 500 million went to northern Saskatchewan workers. Additionally, almost CAD 900 million was paid to contractors, roughly 80% of whom are northern Saskatchewan residents. In 2018, northern mining operations paid CAD 72 million in wages to their employees, which despite a decline in recent years is double the wages paid in 2003. Since 1991, the uranium sector has paid CAD 7.7 billion to northern employees and northern suppliers of goods and services (Government of Saskatchewan, 2018).

In 2015, the uranium industry employed about 4 000 people (head office, company employees and on-site contractors), 3 117 of whom were based at northern mine or mill sites. That year, northern Saskatchewan's total employable population numbered approximately 18 000, meaning that the uranium mining industry employed about 22% of all those available. When the high salaries are taken into consideration as well, this equates to a significant impact on the region's economy.

Furthermore, indirect employment has been estimated by the Ministry of Energy and Resources using a factor of seven times mine site employment (head office jobs are excluded) for the uranium industry. Employees therefore include personnel for uranium transport, crew transportation (e.g. flight crews), external goods and services, non-mine/mill exploration, and exploration services.

In 2016, for example, direct employees numbered 3 346 (including head office), while indirect employment was estimated at 18 088 (Figure 1.2). In the last five years, direct and indirect employment from the uranium mining industry in Saskatchewan was just over 27 000 employees each year on average – taking into account head office staff, site personnel and indirect employment.

Figure 1.2. **Saskatchewan total direct and indirect mine site employment**



Notes: Data provided do not include statistics from exploration companies. Head office value is not included in this figure.

On 1 January 2019, the Saskatchewan uranium industry employed 1 583 people at mine sites in direct and contract jobs and had a female participation rate of 16%, with half working in higher skill categories such as supervisory, technical, trades and professional jobs. Despite the temporary cessation of production at several mine sites in response to uranium market conditions, it was reported that 68% of northern workers continue to reside in the northern region. The sector maintained a high rate of northern employment (47%) and achieved an Indigenous participation rate of 39%, one of the highest rates of Indigenous employment in Canada's industry sector (Government of Saskatchewan, 2018).

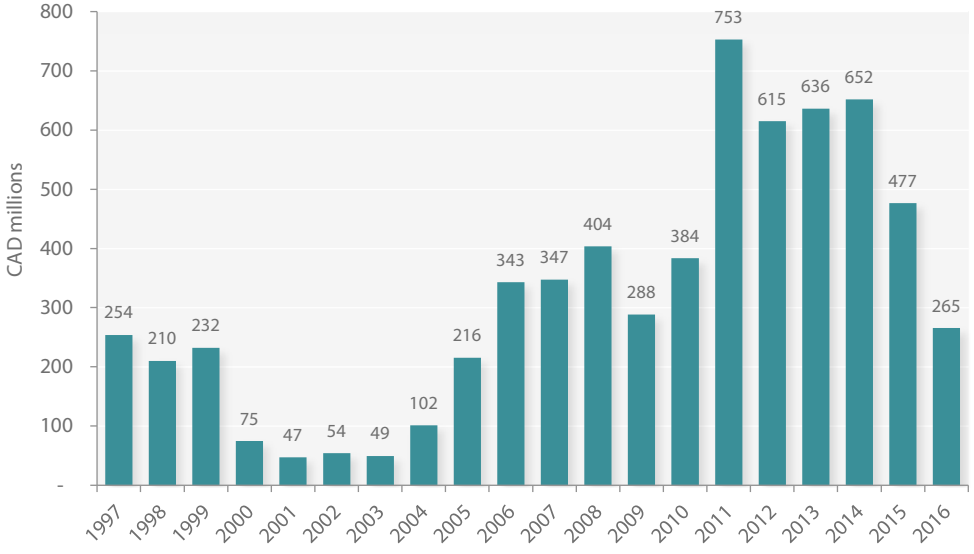
Capital and business expenditures

Under surface lease agreements signed with affected communities, uranium companies are required to do their best to obtain at least 35% of the annual total goods and services required to support their operations in northern Saskatchewan from local businesses.

Mine purchases of goods and services from northern businesses and joint ventures peaked in 2012 during the construction of capital projects for expanded and new mine facilities. Mine expenditures in this area are now decreasing as projects are limited to sustaining capital expenditures.

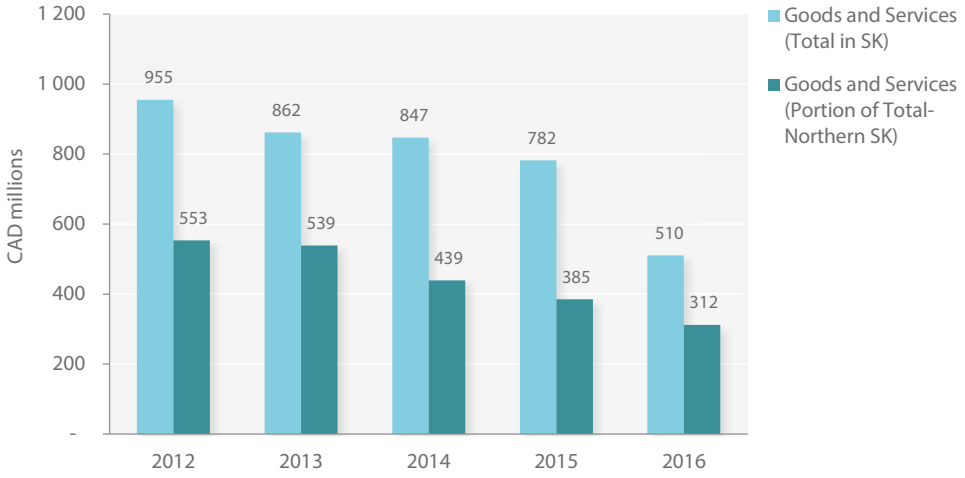
In the past 20 years, the uranium industry has spent more than CAD 6.4 billion on mining projects in Saskatchewan, in addition to their operating expenditures (Figure 1.3).

Figure 1.3. **Saskatchewan uranium industry capital expenditures (1997-2016)**



In 2016, 70% (CAD 510 million) of the value of goods and services was allocated to businesses based in Saskatchewan and 43% (CAD 312 million) went specifically to businesses based in northern Saskatchewan (Figure 1.4). On average, almost 80% of the businesses based in northern Saskatchewan are Indigenous-owned and employ Indigenous people. On 1 January 2019, the uranium sector reported a total of CAD 392 million spent on goods and services and purchased 45% of this total from northern businesses and joint ventures. Over the years, the number of suppliers and the variety of their goods and services has expanded, with many of the main suppliers now being businesses owned by Indigenous persons or northern communities (Government of Saskatchewan, 2018).

Figure 1.4. **Saskatchewan and Northern Saskatchewan goods and services for the uranium industry**



Note: SK = Saskatchewan.

Education and training commitments

All mining companies are concerned with training their employees and report on their activities to the provincial government annually. Surface lease agreements require that operations upgrade and train their employees and ensure a positive work environment, with a particular focus on northern Saskatchewan residents. Training is undertaken through external partnerships, in-house training and education promotion (e.g. the "Stay-in-School Program").

External partnerships have benefitted Saskatchewan's northern residents by providing work placements and summer student employment from post-secondary and technical training institutes for experience and training. They have also supplied in-kind training contributions, trainers and site facilities (e.g. in conjunction with Northern Career Quest).

In-house employee development training programmes support apprenticeships, skills advancement and certification training in mining and equipment operations. They also provide workplace safety and emergency response training and support higher training in management/supervision, professional, technical and trades categories.

Meanwhile, under the Stay-in-School Program, uranium mining operations commit to work with the government, other companies and local schools to design and implement programmes that encourage northern students to complete high school, pursue higher education and consider professional careers in the mining industry. Through this programme, the uranium sector has provided more than 1 190 awards and scholarships since 2010, worth CAD 1.7 million (Government of Saskatchewan, 2018).

Final remarks

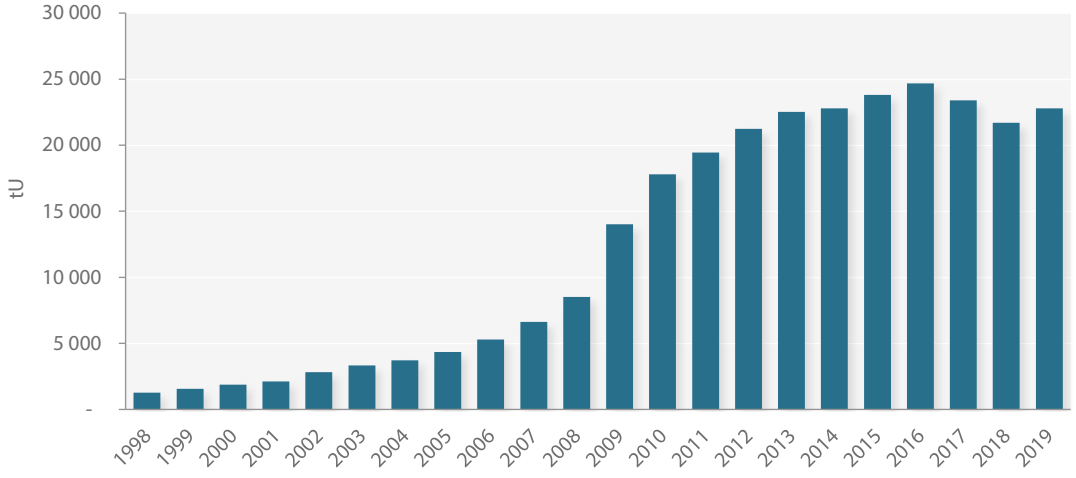
It is noteworthy that the province of Saskatchewan has received national and international attention for its policies and programmes to involve and provide socio-economic benefits to regional Indigenous and northern populations. The importance of obtaining social licence and commitments from all corporate levels of government and industry to develop and maintain a strong and positive image with members of the public cannot be overstated.

Kazakhstan: Building local capacity

Kazakhstan's uranium mining "turbo" plan

Kazakhstan's uranium resource development in recent years has undergone major expansion wholly supported by government policy. With local experience in in situ *recovery* (ISR) mining and significant foreign investment, annual uranium production grew from about 3 300 tU in 2003 to over 24 500 tU in 2016 (NEA/IAEA, 2018), and was 22 808 tU in 2019 (NEA/IAEA, 2020) (Figure 1.5). In 2009, Kazakhstan became the world's largest uranium producer. With its significant resource base and demonstrated ability to expand production, the country maintains a leading position and supplies about 40% of the global uranium market.

Figure 1.5. **Kazakhstan historical uranium production (tU)**



Source: NEA/IAEA data.

Since becoming an independent sovereign state in 1991, Kazakhstan has experienced remarkable economic transformation owing to modernisation and deep socio-economic change. Between 2000 and 2015, its per-capita gross national income doubled, generating considerable revenues that were used to finance large national projects such as development of the new capital city, Nur-Sultan (Astana) (OECD, 2017a). Per-capita income has doubled and the unemployment rate has halved (OECD, 2011). Developing, extracting and exporting Kazakhstan's significant oil, gas, mineral and metal resources, including uranium, drives the economy.

Like many other countries that produced uranium during the Cold War for military purposes (and in the 1970s when rapid expansion of civilian nuclear power was envisioned), the industry went into decline when demand for uranium waned in the 1980s. As the industry deteriorated, so did the communities that had developed around the uranium production centres, as they had been economically dependent on uranium mining.

Following independence, all nuclear facilities in Kazakhstan became the property of the national government. In 1997, the government-owned National Atomic Company Kazatomprom JSC was formed to focus on mining uranium, along with other civilian nuclear activities and rare metals (tantalum, niobium) production. Under Kazatomprom, the uranium industry began to flourish again, contributing to national and local economic development in outlying regions of the country.

At the end of 2018, Kazatomprom placed 15% of its shares on international markets. The company's main shareholder, Samruk-Kazyna Sovereign Wealth Fund, received and transferred USD 450 million to the state's National Fund from the sale of its shares. Kazatomprom's initial public offering was one of the first major milestones of the privatisation programme adopted

by the government at the end of 2015 as part of a larger plan to reduce the state's share in the economy. In 2018, the state share of uranium production in Kazakhstan was 55% (11 842 tU) (NEA/IAEA, 2020).

Most of Kazakhstan's uranium mines (12 from 17 mining projects) are joint ventures between Kazatomprom and foreign mining enterprises such as Canada's Cameco, France's Orano (formerly Areva), Russia's Uranium One, Chinese interests (China National Nuclear Corporation and China General Nuclear Power Group) and Japanese consortia (e.g. Sumitomo and Kansai). These joint ventures gave Kazakhstan access to its partners' technologies and innovations. The combination of cost-effective, low-environmental-impact ISR technology and generous uranium resource endowment has allowed Kazakhstan to remain among the lowest-cost uranium producers globally.

Table 1.2. **Kazakhstan uranium industry joint ventures**

Company, project and mine	Foreign investor and share	Value of share or project (if known)
Inkai JV (Inkai mines)	Cameco 40%	
Betpak Dala JV, now JV Southern Mining and Chemical Company LLP (Inkai section 4, Akdala mines)	Uranium One 70%	USD 350 million for 70% in 2005
Appak JV (West Mynkuduk deposit)	Sumitomo 25%, Kansai 10%	USD 100 million total in 2006
JV Karatau (Budenovskoye 2 deposit)	Uranium One 50% (bought from ARMZ in 2009)	USD 117 million for Uranium One shares (giving 19.9% ownership) + USD 90 million
Akbastau JSC (Budenovskoye 1, 3, 4 deposits)	Uranium One 50% (bought from ARMZ in 2010)	
Zhalpak	CNNC 49%	
Katco JV (Moinkum, Tortkuduk mines)	Areva (now Orano) 51%	USD 110 million in 2004
Kyzylkum JV, now Khorasan-U LLP (Kharasan 1 mine)	Uranium One 30%, Energy Asia (Japanese + 40.05% Kazatomprom) 20%	USD 75 million in 2005 for 30%, USD 430 million total in 2007 (both mines)
Baiken-U JV (Kharasan 2 mine)	Energy Asia (Japanese + 40.05% Kazatomprom) 47.5%	USD 430 million total in 2007 (both mines)
Semizbai-U JV (Irkol, Semizbai mines)	China National Nuclear Power Group 49%	
Zarechnoye JSC (Zarechnoye deposit)	Uranium One 49.98% (bought from ARMZ in 2010), Kyrgyzstan 0.04%	ARMZ paid USD 60 million total

Source: WNA and Kazatomprom data.

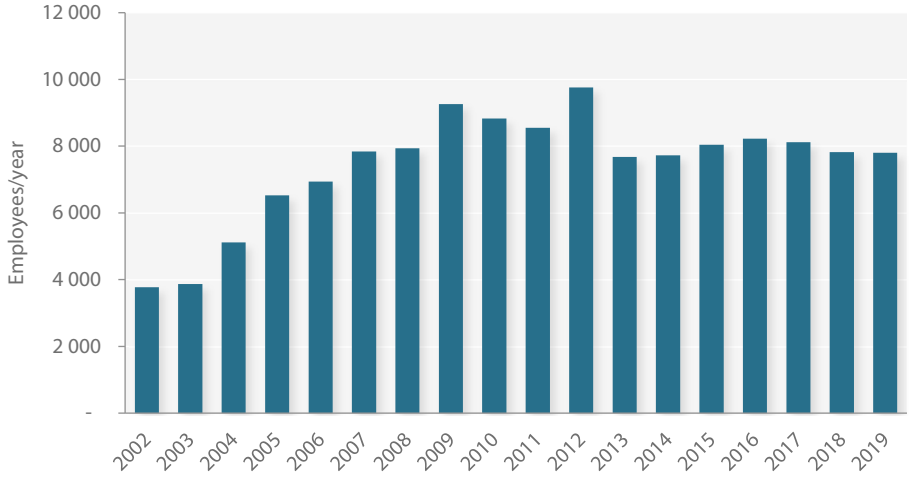
As part of its obligations under subsoil use contracts (e.g. mineral licences), Kazatomprom and its partners provided KZT 1.4 billion in 2019 to local budgets for socio-economic and infrastructure development in the various regions in which it operates, such as Turkestan, Kyzylorda, East and North Kazakhstan and Akmola (Kazatomprom, 2020).

Enhancing skills and business capabilities to support the uranium mining boom

Capacity-building

Kazakhstan's government is making efforts to ensure that the uranium industry contributes to the socio-economic development of communities located near mine sites and associated facilities. About 3 770 people were employed at operational uranium production centres in 2002, rising to almost 10 000 by 2012 (Figure 1.6).

Figure 1.6. **Kazakhstan employment at uranium mine sites (2002-2019)**



Source: NEA/IAEA data.

According to the state's subsoil use contracts, in addition to paying various taxes, subsoil users are required to spend an amount equal to 1% of annual income on capacity-building for Kazakh specialists.

Kazakhstan has different minimum targets for employing Kazakh nationals in various roles depending on their level of expertise. For example, in management positions the minimum requirement is 70%, whereas in technical and specialist roles the goal rises to 90%. There also is an overall minimum target of 90% national workers by headcount (Decree 45/2012 on Expatriate Workforce Quota and Work Permit Use).

With rapid expansion of uranium production, shortages of qualified staff became an issue in the 2000s. To build capacity and address this issue, training was conducted in two educational centres, drawing residents from near the existing production facilities in the Kyzylorda (Shieli) and Taukent regions. The Kazakhstan Nuclear University, founded by Kazatomprom, and the Regional Geotechnology Training Center were involved in training to raise the skill levels of new personnel. The newer uranium production centres also create opportunities for students in Kazakhstan's higher and secondary technical institutes.

When it gained its independence, Kazakhstan inherited a well-developed but dual science and education system in which research was performed almost exclusively in public research institutes, while universities were responsible for higher education. As funding decreased dramatically during the 1990s, the country's research capacity and performance declined, as did schools' and universities' educational standards. However, a gradual increase in national research and development (R&D) efforts and major reforms in the early 2000s resulted in profound structural and qualitative changes in the higher education and research system (OECD, 2017a).

The uranium mining industry co-operates with 25 universities and 11 colleges from Kazakhstan and neighbouring countries, and an International Scientific and Educational Centre for Nuclear Industry was established in 2017 in collaboration with Kazatomprom and the Kazakh National Research Technical University. The centre trains highly skilled personnel for the nuclear sector and offers disciplines such as "geology and exploration of mineral deposits", "chemical technology for non-organic substances" and "automation and management".

As a result of co-operation between Kazatomprom and the Ministry of Education and Science, some universities have opened departments in new research areas (including nuclear fuel assemblies and refineries), or they have implemented international master's degree programmes in specialisations such as "nuclear energy materials" and "innovative technologies for producing uranium products" (NEA/IAEA, 2020). In addition, Kazakhstan's strategy for innovation and technological development in the uranium sector is led by Kazatomprom's main

scientific and technical division, the Institute of Advanced Technologies LLP, as well as by research divisions of subsidiaries and affiliates (e.g. Scientific Centre of Ulba Metallurgical Plant JSC and Volkovgeologia JSC, with about 490 employees in total) (Kazatomprom, 2020).

Future jobs in the uranium and other energy resource sectors are increasingly being recognised as highly technology-dependent, requiring new and existing personnel to have high levels of science and numeracy skills. These emerging technologies are crucial for the sector to preserve its global edge. As the skills demand within the industry continues to evolve, the sector must maintain its engagement with training and education providers to ensure the courses offered meet current and future needs.

Local procurement

Kazakhstan's initiatives also include helping local businesses develop, recognising that uranium mines alone cannot provide employment for all local inhabitants. Trained specialists assist local entrepreneurs, with priority given to projects that can create additional employment opportunities for locals and support economic diversification.

On the policy side, Kazakhstan requires mining investors to enter into bidding agreements with the government to establish a certain percentage of local content (IGF, 2018). The 2010 Law on Subsoil and Subsoil Use requires companies issuing tenders to favour local suppliers by giving them a 20% margin of preference in the bidding price.

In addition to ensuring the preferential treatment of Kazakh producers of goods and services, the government is urging the use of an e-procurement system to monitor items that companies purchase locally. Companies must provide all procurement opportunities through this electronic portal, including advertising, agreement documentation and results of tenders (IGF, 2018). Local goods require a certificate attesting that they were made in Kazakhstan. The development of small and medium-sized enterprises (SMEs) is also an integral part of Kazakhstan's 2020 Business Road Map programme. While the SME share in Kazakhstan's GDP increased from 24.9% in 2015 to 28.4% in 2018, the government is aiming for 50% by 2050.

In compliance with state policy, Kazatomprom also helps issue contracts for the procurement of products, work and services among its subsidiaries and local suppliers to support domestic supply in the regions. The group and its partners also ensure the procurement of goods produced by domestic electricity, furniture, food and construction material enterprises. For example, when Kazatomprom was selecting pump suppliers for the first time, it used a total cost of ownership tool, with a total economic benefit of KZT 3.07 billion – well above the planned figure of KZT 2.3 billion (Kazatomprom, 2020). In addition, a 2018 project aimed at managing procurement by category developed four new category-based procurement strategies (for sulphuric acid, shipping and packaging containers, ion-exchange resins and hydrogen peroxide).

In 2019, Kazatomprom tendered a total of 11 305 contracts with 96% of them issued to 3 209 local Kazakh suppliers and the remaining 4% awarded to foreign enterprises. The contracts covered the supply of both goods and services, worth KZT 229.1 billion. The complete transition of all stages of the procurement process to the e-procurement portal in 2019 was an important step in managing and ultimately optimising and automating the procurement process. Testing of the system deployed at eight subsidiaries and affiliates also began, with a view to automating procurement planning (Kazatomprom, 2020).

To further support domestic producers, Kazatomprom has created a Central Project Office (including its subsidiaries and affiliates) that issues offtake contracts with producers. It has also formalised a pre-qualification procedure based on potential suppliers posting questionnaires and supporting documentation through a special information system. The main qualification criteria concern the legal and contractual aspects of working with the potential supplier; the potential supplier's resources; quality assurance of products, work, and services; and environmental protection and occupational health and safety.

The percentage of uranium mine goods and services purchased locally was 77% in 2017; 80% in 2018; and 77% in 2019 (Kazatomprom, 2020).

Developing value chain components to expand Kazakhstan's activities to new segments of the nuclear fuel cycle

In addition to producing uranium, Kazakhstan has strategic goals for other components of the nuclear fuel cycle, from uranium conversion and enrichment to manufacturing nuclear fuel assemblies.

The Ulba Metallurgical Plant at Oskomen in eastern Kazakhstan was commissioned in 1949. It has a variety of functions relevant to uranium and it also produces beryllium, niobium and tantalum. Since 1973, the Ulba plant has used enriched Russian uranium to produce nuclear fuel pellets that are used in Russian and Ukrainian reactors and are also exported to the United States and Asia. It also briefly produced fuel for submarines and satellite reactors, and since 1985 has been able to handle reprocessed uranium to make fuel pellets for western world reactors, supplied through Russia's TVEL. It is also a major supplier of nuclear fuel pellets to China.

As part of efforts to expand its presence in all areas of the nuclear fuel cycle, Kazatomprom has signed an agreement with the Canadian company Cameco Corporation to investigate the development of a uranium conversion plant. If market conditions are favourable, this will enable the two companies to explore the economic feasibility of using nuclear fuel conversion technologies in Kazakhstan. Through equity participation in the Ural Electrochemical Integrated Plant JSC and International Uranium Enrichment Centre (IUEC), Kazatomprom has gained access to uranium enrichment plants. Meanwhile, in December 2019 Kazatomprom agreed to sell its 50% interest (minus one share) in the Uranium Enrichment Centre JSC to its partner, TVEL Fuel Company. With France's Areva (now Framatome), it is working towards establishing a fuel fabrication line at the Ulba plant.

In 2015, the Kazakh government approved a draft agreement with the International Atomic Energy Agency (IAEA) to establish a low-enriched uranium (LEU) fuel bank at the Ulba Metallurgical Plant. According to international norms, such a fuel bank must be located in a country with no nuclear weapons and be fully open to IAEA inspectors. The fuel bank would potentially supply 90 tonnes of LEU (as uranium hexafluoride [UF_6]) to produce fuel assemblies for nuclear power plants, and any state wishing to develop nuclear energy or experiencing a fuel supply shortage can apply for the uranium fuel it needs. The IAEA's LEU bank was completed in 2019 and received its second shipment of low-enriched uranium in that year.

In conclusion, not only is Kazakhstan's uranium industry contributing to national economic development but also to local development and prosperity in the nation's outlying regions. While the mining companies alone cannot solve all the country's inequality issues, the Kazakh government and the industry are working together to ensure development opportunities for local inhabitants and are helping improve regional standards of living, service provision and infrastructure. Given the size of Kazakhstan's uranium resource base and the potential for new discoveries, uranium mining can be expected to contribute to national and local economic development for decades to come.

Australia: Enabling effective collaboration and innovation

A success story in mineral-based economic development

Australia's major success in mineral-based economic development refutes what is known as the "resource curse" thesis (IGF, 2018). In 2014, the mining sector contributed 8.7% of Australia's GDP (OECD, 2017b). Plus, the resources sector represents almost 20% of the Australian Securities Exchange market by capitalisation and Australia is home to some of the world's largest mining companies (e.g. BHP, Rio Tinto and some of the most significant uranium producers).

Australia is not just a producer and exporter of minerals. It has one of the strongest upstream supplier bases, particularly in mining equipment, and highly sophisticated technology and services. Furthermore, the mining equipment, technology and services (METS) sector now accounts for nearly 7% of GDP and employs 7% of Australia's labour force – more than the mining sector itself (OECD, 2017b).

In recent decades, the Australian Government's general approach has been to support mining and related industries, adopting interventions focused on industry participation partnerships and innovation and skills support, rather than strict local content policies (OECD, 2017b). Public-private partnerships and strong links among the industry, education and research sectors have helped forge an "enabling environment" that generates significant socio-economic benefits for the country (IGF, 2018). Many education initiatives have been designed to promote awareness of the mining industry as a pathway to career progress, for instance Mining Education Australia and the Mining Leaders Program under the umbrella of the Sustainable Minerals Institute. The Minerals Council of Australia and National Energy Resources Australia (NERA) also support education initiatives.

As the knowledge required for the mining industry becomes increasingly specialised, R&D has also become more important to adapt to changing industry conditions. The advance of digital and automation technologies in the mining industry is transforming skills requirements for all levels of roles. One example of an initiative to support the industry's successful digital transition is the CORE Innovation Hub (www.corehub.com.au), the first co-working collaboration and innovation hub focused on the mining industry. CORE opened in 2016 and has brought together operators, suppliers, researchers and entrepreneurs to connect and collaborate on digital technologies and data skills in the resources sector.

Overview of Australia's uranium industry

Australia holds 111 known uranium deposits and 30% of the world's uranium resources – the most of any nation. Around 80% of the country's known uranium resources are in South Australia, with 9% in the Northern Territory, 7% in Western Australia, 4% in Queensland and 1% in New South Wales. Three operations currently produce uranium: Olympic Dam (copper, gold, silver and uranium) in South Australia; Ranger in the Northern Territory; and Four Mile in South Australia. The Four Mile mine processes at the idled Beverley facility. Olympic Dam is the single largest uranium deposit in the world, containing more than one million tonnes of uranium (NEA/IAEA, 2020).

Australia produced 7 618 tonnes of uranium oxide in 2018-19. It is the world's third-ranking producer, behind Kazakhstan and Canada, but its production is expected to decline in upcoming years due to decreased output from the Ranger mine, which was closed in January 2021. A comprehensive rehabilitation programme is already under way to return the Ranger mine area to a viable ecosystem and ensure protection of the region's social, economic and cultural heritage.

Low commodity prices have sharply reduced uranium exploration in Australia. However, several projects are in an advanced stage of development and are positioned to begin production when uranium market conditions improve. For example, Honeymoon, an ISR mine in South Australia, is currently in care and maintenance, and in Western Australia four potential mines (Kintyre, Yellerie, Wiluna, and Mulga Rock) have obtained primary approvals but are awaiting higher uranium market prices before advancing to the secondary approval phase and starting production.

At the national level, the uranium industry contributes roughly AUD 600 million to Australia's economy annually and employs over 4 500 direct employees (NEA/IAEA, 2018). At the state level, in 2016 South Australia's Nuclear Fuel Cycle Royal Commission found that the state's uranium industry had "produced substantial benefits to the South Australian economy, and will continue to do so". In fact, in the decade leading up to 2016, uranium contributed more than AUD 3.5 billion to South Australia's export revenues and delivered AUD 141 million in royalties (Government of South Australia, n.d.).

Opportunities to improve Australian uranium industry competitiveness

While the country's uranium industry has significant potential, mine development has been slower than anticipated. In 2017, NERA, in association with Accenture, undertook an Australian Uranium Industry Competitiveness Assessment that included an Industry Competitiveness Score (NERA, 2017). The assessment examined the global uranium industry from exploration through production, providing a data-based analysis of how countries could enhance industry

potential. The study gave the Australian uranium industry an overall competitiveness score of 6.5 out of 10, placing the country above the world average of 5.5 but behind Canada's 8.1 and Kazakhstan's 6.7. Although Australia performed well in the "exploration and development", "industry support services" and "country stability" competitiveness areas, lower scores for other pillars such as "government policy" reduced the country's overall competitiveness (NERA, 2017).

To identify the factors that influence industry competitiveness, four key questions were asked (NERA, 2017):

1. Does the uranium industry have the required skills, infrastructure and equipment to produce uranium to meet market demand?
2. Does the uranium sector have the capability (labour, capital and technology) to deliver uranium to the market at competitive prices?
3. Is the regulatory environment contributing to, and enabling the success of, the uranium industry?
4. Are the political and social environments supportive of the uranium sector?

To raise Australia's overall industry competitiveness, the report identified several ways to improve the country's performance (NERA, 2017):

- streamline regulation (also see Chapter 2);
- improve exploration capabilities by leveraging research to find innovative ways to identify new economic uranium resources (see examples below);
- enhance mining and ore processing capabilities by investing in research to reduce operating costs as well as technical and environmental risks for future mines;
- reinforce companies' social licence to operate through campaigns to educate the public on uranium industry benefits;
- expand export networks.

The report modelled three potential scenarios for the Australian uranium industry to quantify the impact of opportunities and associated improvements on competitiveness. The study suggests that Australia could attract significant investment to its uranium industry through a combination of regulatory reforms and collaborative initiatives, which would boost production and unlock up to AUD 650 million in additional value for the economy by 2025 (NERA, 2017). In an even more optimistic scenario that assumes Australia's uranium export market share increases from 10% to 30%, the uranium sector could employ up to 20 000 people and deliver an additional economic value of AUD 6 billion to AUD 9 billion per year (MCA, 2019).

Innovative ways to identify new uranium resources

While Australia possesses the world's largest uranium resources, it is vital that industry participants continue to discover additional deposits that can be exploited economically. Continued government participation is critical to support exploration and build geosciences datasets; for example, the South Australian Royal Commission recommended that the South Australia state government consider committing to increased long-term investment in programmes such as the Plan for Accelerating Exploration (PACE) to enhance industry investment in greenfield exploration (Nuclear Fuel Cycle Royal Commission, 2016). Industry also continues to emphasise research to improve current exploration techniques through partnerships with research organisations including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Australian Nuclear Science and Technology Organisation (ANSTO), the Deep Exploration Technologies Cooperative Research Centre, and universities.

Furthermore, two recent initiatives in South Australia are trying to understand and unlock that state's vast mineral resources base, including uranium: the Accelerated Discovery Initiative and the ExploreSA Gawler challenge, an open, crowd-sourced innovation platform.

The Accelerated Discovery Initiative (ADI)

Through the Accelerated Discovery Initiative (ADI), the South Australian Government will provide AUD 10 million by way of an Accelerated Discovery Fund to explore untapped mineral resources that could expand the state's economy. The government-funded mineral exploration initiative is concerned not only with drill targets, but with economic, social and environmental benefits as well (Government of South Australia, n.d.). Potential benefits include data to support the development of regional and rural communities; Aboriginal training and employment opportunities; and the development and application of innovative exploration technologies.

A budget of AUD 10 million over three years is available for approved co-funded exploration activities (Government of South Australia, n.d.):

- single and multiple drilling programmes in frontier terrains;
- collaborative innovation and technologies to generate new exploration ideas;
- logistical support in remote greenfield areas;
- encouragement of Aboriginal employment during exploration;
- identification and testing of new groundwater resources;
- geophysical programmes to test new concepts.

The first round of funding started in early 2020 and several rounds will be available depending on the performance of the programme.

ExploreSA: An open, crowd-sourced data competition to discover mineral deposits

South Australia's Department for Energy and Mining is partnering with the open innovation platform Unearthed to host an AUD 250 000 crowd-sourced online competition (Unearthed, 2020). The ExploreSA Gawler Challenge aims to identify or predict areas of potential mineralisation in the highly prospective Gawler Craton, which already hosts the Olympic Dam polymetallic mine. Using the state government's geoscience datasets, the competition combines geological expertise with new mathematical models, machine learning and artificial intelligence to generate new exploration models and ideas.

The ExploreSA Gawler initiative was launched in March 2020. All prospects identified during the competition will be shared with the public, facilitating access to science data, novel approaches and modern geoscience thinking to boost innovation and understanding in the resources sector. Crowd-sourced competitions have recently become a leading method to test new ideas and find solutions, and they can also lead to the creation of start-up companies, new jobs and economic opportunities.

Developing and implementing innovative solutions and partnerships across the sector will allow Australia to address challenges, boost competitiveness and enhance the uranium industry's significant value for the wider economy.

Lessons learnt and recommendations

As uranium resource endowments vary among countries/regions, local population skill sets, infrastructure assets, investment environments and policies supporting employment, procurement, education and innovation will be highly context-specific. However, although local content policies may prescribe a variety of approaches, from mandatory targets to soft requirements, they all have the common aim of ensuring that uranium mining projects provide countries and/or regions with significant and sustainable socio-economic benefits. To take advantage of opportunities and address challenges (e.g. depletion of uranium resources, uranium market volatility), countries and regions can:

- Implement a policy framework that links the development of uranium mining projects with a broad plan for national and local socio-economic development. Co-operation among all stakeholders – industry, federal and local governments, local communities and education and research institutes – is essential.

- Upskill the workforce and adapt the curricula of educational and research institutions to meet current and future industry and economic needs. Uranium/energy resources sector jobs are increasingly recognised as being highly technology-dependent, requiring high level science and numeracy skills. As skills demands continue to evolve, the uranium industry must maintain its engagement with training, education and R&D activities.
- Prepare a strategy to increase local economic diversification, either through the mining value chain or in other sectors in which the country/region has competitive advantages. Measures to support diversification can involve increasing the capacity of local companies/workers, developing variety among local suppliers, and implementing proactive support (for training, employment pathways and entrepreneurship, providing information on market trends, offering grants and supplying credits for SMEs, among other initiatives). This would help reduce volatility and provide alternatives and resilience for local communities in the case of a mine closure.
- Raise awareness of potential innovation benefits and encourage uranium industry automation and digitalisation to raise productivity in the mining and milling phases, reduce the industry's environmental footprint and combat some mining regions' demographic challenges, such as depopulation and ageing. The COVID-19 pandemic has also revealed the importance of automation and digitalisation for economic resilience. However, job displacement may be an unintended outcome of mining companies' local-value propositions, so well-planned transition arrangements are needed to ensure new socio-economic development opportunities for local communities.

References

Cordes, K.Y., O. Östensson and P. Toledano (2016), *Employment from Mining and Agricultural Investments: How Much Myth, How Much Reality?*, Columbia Center on Sustainable Investment, New York.

ICMM (2016), *Role of Mining in National Economies*, third edition, International Council on Mining and Metals, London.

Government of Saskatchewan (2018), Benefits from Northern Mining: 2018 Summary, www.saskatchewan.ca/business/first-nations-metis-and-northern-community-businesses/economic-development/northern-socio-economic-benefits-summary.

Government of South Australia (n.d.), Accelerated Discovery Initiative, https://energymining.sa.gov.au/minerals/about_us/initiatives/accelerated_discovery_initiative#adi_initiative (accessed September 2020).

IGF (2018), *IGF Guidance for Governments: Local Content Policies*, International Institute for Sustainable Development, Winnipeg, Canada, www.iisd.org/library/igf-guidance-governments-local-content-policies.

Kazatomprom (2020), *Integrated Annual Report of Kazatomprom for 2019*, Kazatomprom, Nur-Sultan, Kazakhstan.

MCA (2019), *Untapped Potential and the Case for Nuclear Energy*, Minerals Council of Australia, Melbourne.

NEA/IAEA (2020), *Uranium 2020: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_52718/uranium-2020-resources-production-and-demand.

NEA/IAEA (2018), *Uranium 2018: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_15080/uranium-2018-resources-production-and-demand.

NERA (2017), *Uranium Industry Competitiveness Assessment: Report on the Framework, Baseline Score, Insights and Opportunities*, Australian Resources Research Centre, Kensington.

Nuclear Fuel Cycle Royal Commission (2016), *Nuclear Fuel Cycle Royal Commission Report*, Government of South Australia, Adelaide.

OECD (2017a), *OECD Reviews of Innovation Policy: Kazakhstan 2017*, OECD Publishing, Paris, www.oecd.org/publications/oecd-reviews-of-innovation-policy-kazakhstan-2017-9789264270008-en.htm.

OECD (2017b), "Local Content Policies in Minerals-Exporting Countries", OECD Trade Policy Paper No. 209, OECD Publishing, Paris, http://dx.doi.org/10.1787/4b9b2617-en.

OECD (2011), *Competitiveness and Private Sector Development: Kazakhstan 2010*, OECD Publishing, Paris, www.oecd-ilibrary.org/finance-and-investment/competitiveness-and-private-sector-development-kazakhstan-2010_9789264089792-en.

Unearthed Solutions (2020), ExploreSA: The Gawler Challenge, https://unearthed.solutions/u/challenge/gawler-challenge (accessed September 2020).

Chapter 2

Ensuring the protection of the environment and people: Governance specific to uranium industry policy and regulation

The importance of strong and effective regulatory frameworks, policies and practices that deliver economic and social benefits and avoid environmental and health impacts throughout a uranium mine's life cycle has been widely recognised. The primary regulatory goal for stakeholders and rights holders at all phases of uranium activity (from exploration to post-closure) is to ensure that adverse impacts on land, water, climate, flora, fauna and people can be mitigated or avoided. Transparency, robust regulation and standards, and access to data on uranium mining activities and environmental performance are required for all stakeholders – the public, host communities, governments and industry. An independent scientific approach is also critical to support regulation and oversight. Around the world, uranium governance (in terms of both policy and regulation) is managed by each jurisdiction and may be implemented at the national, provincial or municipal level.

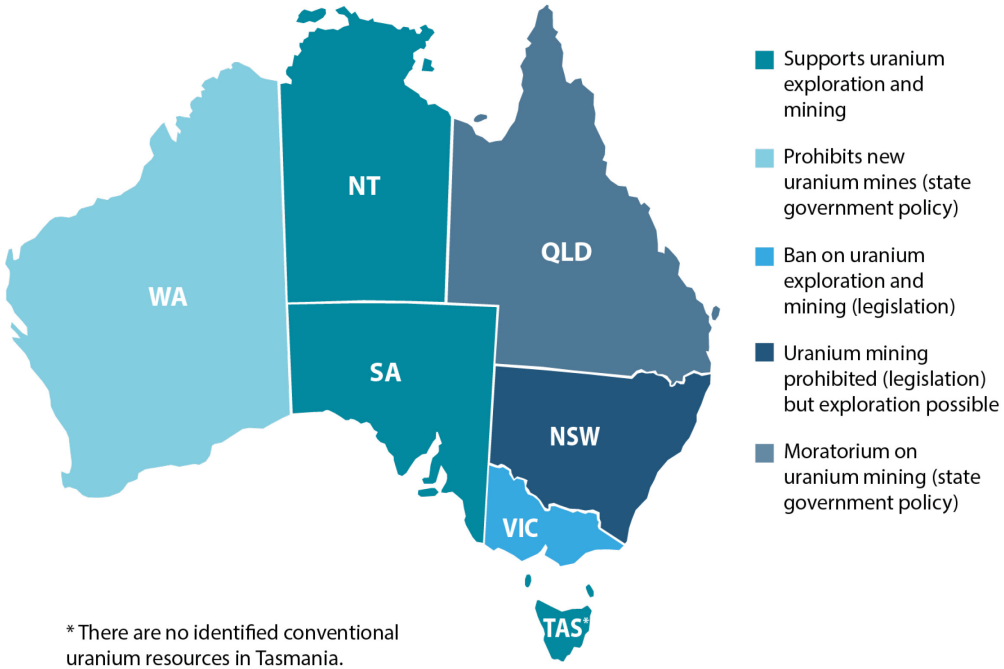
Australia and Canada have a long history of (and good reputation for) strong industry regulation, and an inherent uranium resource advantage that has provided economic prosperity. This chapter's case studies summarise the leading regulation practices stakeholders have implemented in these jurisdictions.

Uranium development policy

People's perceptions of the uranium industry are determined by the same issues that influence views on nuclear power and all stages of the nuclear fuel cycle. Nuclear power generation incidents, nuclear armament and environmental and health issues associated with uranium mining's legacy shape public impressions of the industry, which consequently influence political attitudes and governance decisions. Aside from the regulatory regimes governing uranium developments, it is a government policy decision whether uranium mining may be even allowed in a region, and this decision hinges on social licence. Government support for the uranium industry may differ among successive governments (as has been the case in the Australian states of Western Australia and Queensland) as well as between state, provincial, regional and national governments, depending on the policy positions of the respective governing parties. Because uranium mine development is a long-term, highly capital-intensive commitment, government policy stability is an important consideration for investors.

There are many examples in Australia's history of both supportive and unsupportive uranium development climates, and of state and national policy being at odds. In 1983, Australia's social democratic government implemented what became known as the Three Mines Policy, which restricted uranium production to the country's three existing or planned mines, halting all further development during the height of global nuclear market growth. While the policy was abolished at the national level in 1996, it led to fracturing at the state level that endures to this day. Although the current South Australian (SA) and Northern Territory (NT) governments support the industry and encourage exploration, development and production activities, other states across the country still enforce limits on uranium activity (Figure 2.1). Western Australia (WA) lifted its ban on uranium in 2008, but in March 2017, the incoming government reinstated the policy prohibiting new mines. Victoria (VIC) currently has a ban on all uranium exploration and mining activities, though a parliamentary inquiry was addressing this subject at the time of writing. New South Wales (NSW) currently permits exploration but prohibits mining, while Queensland (QLD), which once allowed uranium mining, reinstated a ban on all mining activity in early 2015 following a change of government in that state.

Figure 2.1. **Australian state positions on uranium mining**



Similar variances also exist in Canada, which has the world's third-largest uranium reserves. It is the second-largest global producer, with all production occurring currently in the province of Saskatchewan. The Canadian government supports and regulates both the nuclear and uranium industries, and while uranium policy has been reviewed several times under different governments, Saskatchewan has remained supportive of uranium production through multiple administrations since the 1950s. However, three other provinces (none of which have ever produced uranium) have banned uranium mining and exploration: Nova Scotia has imposed a moratorium since 1981 and implemented a legislative ban in 2009; British Columbia had a moratorium during 1980-1987 and implemented a legislative ban in 2008; and Quebec has had a moratorium in place since 2013.

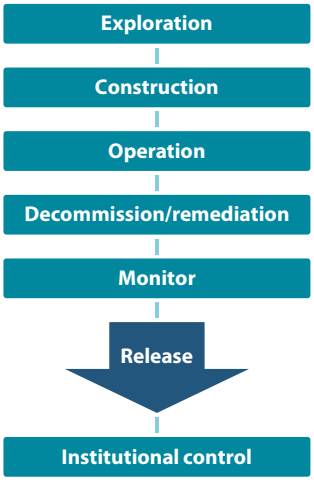
Uranium regulation

The importance of a robust and competent regulatory regime for uranium industry activities cannot be overstated. An effective regulatory regime generates trust among a public that is often concerned about historic nuclear fuel cycle activities such as weapons programmes, as well as with environmental and safety issues resulting from reactor incidents or from the legacy impacts of uranium mining. The uranium industry therefore recognises the importance of a robust regulatory system and advocates for predictable and timely environmental approval processes in making financial decisions to proceed with developments.

Regulations may be implemented using a variety of legislative instruments and at multiple jurisdictional levels. Uranium is particularly prone to governance by multiple regulatory regimes (municipal, local, provincial, state, regional and federal) in addition to international oversight of nuclear fuel cycle activities. Uranium may thus be subject to more onerous regulation than other commodities, even though the risks and impacts of uranium mining and milling are similar to those of other extractive operations (discounting the radiological nature of uranium).

A regulatory system should cover all the stages of a mine's life cycle, from discovery to closure (Figure 2.2). Post-closure management (e.g. institutional control) has become of increasing concern during the environmental approval process, and a later section of this report discusses this topic in more detail.

Figure 2.2. **Uranium mine life cycle, including post-closure management**



Exploration

A jurisdiction does not have to implement specifically targeted regulatory conditions for uranium at the exploration stage, as regulations addressing environmental and safety standards for operating and rehabilitating an exploration site should be similar for all mining commodities. One area that may require specific regulatory control is the storage and disposal of uranium exploration cores, as their radiation levels may exceed standard regulatory requirements for management.

Development

A uranium mine or mill operation is a significant undertaking, and its development may have consequential environmental and safety impacts that require assessment and regulation. If regulations do not exist to manage these risks, they should be developed and implemented.

All governing jurisdictions (municipal, local, provincial, state, regional and national) for the geographic region in which a uranium development is proposed are responsible for ensuring the establishment of the necessary regulatory controls. A jurisdiction may or may not have regulatory controls in place, and those that do exist may overlap or duplicate those of other jurisdictional levels, so each jurisdiction's authority needs to be determined. Furthermore, a region may also have multiple legislative authorities in addition to its multiple jurisdictional authorities, and these excessive layers may complicate the regulatory process. The greater the complexity, the longer and more expensive the process will be for both regulators and the company proposing a development. Industry participants are more supportive of a predictable timeline and single-window review process (for either a single or joint jurisdictions).

The standard broad categories used to assess a project are:

- environmental impact;
- human health and safety;
- socio-economic impacts.

A company that has decided to proceed with a uranium development will be required to complete an environmental impact assessment (EIA) and submit an environmental impact statement (EIS) to obtain approval from the required authorities. In some jurisdictions, however, this process takes more than a decade, during which time the financial assumptions under which the development decision was made can change substantially. Some development decisions have even been withdrawn, as happened with Western Australia's proposed Kintyre and Wiluna projects.

Assessment and review

A company is expected to initiate discussions with a jurisdiction early in the decision-making process. Through these discussions, a jurisdiction gains a basic understanding of the scope of the proposed project and the assessment level needed. The jurisdiction may be required to develop regulations for assessment and compliance if there are issues not yet covered by regulatory controls. Governments may also implement regulatory schemes to address socio-economic issues (e.g. the Northern Territory imposes royalties and taxes to provide monies to an Indigenous beneficiary agency and Saskatchewan stipulates surface lease agreements that require a human resource development commitment).

The environmental assessment (EA) process determines which jurisdictional levels have the authority to regulate and approve a uranium mine or mill development and to designate a lead authority to implement and manage it. The EA process should also define administrative roles when multiple jurisdictions are involved, as well as how to carry out co-operative EAs and to designate the various parties' responsibilities. The process may engage academic resources, national, regional and local departments, and other agencies/ stakeholders to provide advice on the adequacy, accuracy and completeness of the EIS.

The type of review and assessment used depends on the project's developmental level/extent, and can include (in ascending order):

- screening;
- comprehensive study;
- panel process;
- public inquiry.

The EA process should ensure public and stakeholder participation, and Indigenous consultation activities should be integrated as much as possible. An EIA is based primarily on information the applicant or licensee submits through the established approval process, such as the licence/permit application and its supporting documentation, and information on environmental protection measures.

When approval has been granted, the developer may proceed with obtaining the required regulatory permits and licences. The regulatory licences/permits dictate the compliance conditions for the development, from construction through operation. A separate approval process may be required for project changes during operation, based on screening of those changes.

Project decommissioning and reclamation are substantive activities that, like proposed operational changes, require review and approval. For example, a new project may require a public inquiry for initial approval; subsequent changes may require only a screening-level review; and final decommissioning and reclamation may necessitate a comprehensive study.

Compliance

Once a company has received the jurisdictional authority's approval, it may obtain all the other requisite regulatory permits and licences that identify the operation's regulatory compliance conditions. Companies must comply with the terms and conditions of an approval as defined in the legislation, as well as with corresponding regulations and policies.

Environmental, health and safety compliance is typically covered under separate legislation, regulation and policy from the EA process. Compliance requirements (e.g. technical standards for environmental release) are defined specifically by numeric value in regulations and policies, and the jurisdiction decides which methodology will be used. Values set in regulations are more onerous to revise than those stipulated in policies due to the administrative and approval processes.

A guideline may be a standard issued by a regulatory authority but not stated in specific regulations (e.g. water quality standards). In assigning environmental standards to uranium mine/mill operations, a jurisdiction may use the national standards already in place for all

industrial operations. When appropriate, a jurisdiction should co-operate and enter into formal agreements with other jurisdictional levels and agencies to determine environmental and human health and safety protection standards to increase their effectiveness.

Jurisdictions should regularly inspect environmental and human safety compliance to ensure an operator meets operating approval requirements and guidelines. However, both regulators and industry operators have identified the problem of regulatory overlap and duplication in oversight (e.g. dual inspections and reports) when multiple jurisdictions are involved, and the resultant heavier regulatory burden and associated costs. As with the determination of regulatory requirements, a jurisdiction could co-operate and enter into formal agreements with other levels and departments to minimise the overlap and duplication of regulatory activities.

Study example 1: Australia

In Australia, extractive commodities are primarily the responsibility of the states, with the national government having only a secondary role in regulatory activities. In the Northern Territory, however, the federal government may be more involved in regulation through its Supervising Scientist Branch.

South Australia

The Mineral Resources Division of the Department for Energy and Mining is the state agency responsible for administering and managing mineral resources, and for regulating South Australia's mineral exploration and mining sectors. The Mineral Resources Division is committed to the principles of effective and efficient regulation. Best-practice management of South Australia's mineral assets, including streamlined regulation processes for exploration and mining activities, attracts investments that deliver sustainable development and prosperity.

Exploration and mining companies generally need communities to grant them a social licence to operate so that they can establish effective long-term working relationships with all stakeholders. In the case of South Australia, community confidence in the industry's overall performance and its demonstrated commitment to best-practice environmental management is paramount. The Government of South Australia recognises that community confidence will be gained only when the uranium industry and communities work together openly and co-operatively to develop and achieve mutually acceptable outcomes.

South Australia's lead mining approvals and regulation agency has adopted a performance and outcome-based regulatory approach in preference to a prescriptive method. Furthermore, South Australian mining legislation seeks to satisfy:

- Stakeholder needs, by building confidence in the government's regulatory processes and environmental controls, and in the uranium industry's environmental performance and commitment to identify environmental outcome goals.
- Industry needs, by establishing predictable procedures for access to land, mining tenure security and stable regulatory processes.

The Government of South Australia clearly recognises that the exploration and mining sectors require land access, exploration and/or mining tenure and regulatory process certainty in order to commit to higher-risk investments in resource exploration, new mine developments and life-of-mine operations (see www.energymining.sa.gov.au).

Northern Territory (Ranger Uranium Mine)

In 1978, the Government of Australia established a Supervising Scientist position to recognise the outstanding conservation significance of the region in which Ranger mine was to be established. The Supervising Scientist acts autonomously from the regulatory authorities to oversee mining activities and their regulation, in addition to conducting independent monitoring and research on the environmental effects of uranium mining.

Regulation

Ranger Uranium Mine has been operated by Energy Resources of Australia (ERA) since 1980. Although mining at Ranger ceased in 2012, stockpiled material continued to be processed by the Ranger Authority until that authority expired in January 2021. Aboriginal people have occupied the region surrounding the mine for over 50 000 years, and they continue to use the area for cultural purposes and to collect bush foods. Ranger's location on Aboriginal land, surrounded by the World Heritage-listed Kakadu National Park, presents significant cultural and environmental challenges. The mine is subject to strict regulatory requirements, including that its operations have no detrimental effects on Kakadu's biodiversity.

The regulatory regime for Ranger is unique and was based largely on the recommendations of the second *Ranger Uranium Environmental Inquiry* report published in 1977. The report recommended a strict and transparent regulatory regime with responsibility shared between the Northern Territory Government and the Government of Australia (the regulatory authorities), including the establishment of a Supervising Scientist (Commonwealth of Australia, 1977). A Ranger Minesite Technical Committee consisting of the regulatory agencies, Aboriginal community representatives and the Supervising Scientist was established to advise on regulatory matters. Although the committee meets regularly and conducts joint mine site inspections and environmental audits, it has no regulatory powers, but it does provide the opportunity to gain consensus prior to regulatory decisions being taken.

Stringent environmental objectives were established for Ranger mine's operation and rehabilitation to ensure the protection of the local population and the environment. Given the high conservation significance of the surrounding region, the site-specific water quality limits developed by the Supervising Scientist are designed to protect 99% of all species and apply to all rivers downstream of the mine. Key rehabilitation requirements include the disposal of mine tailings in the mine pits and the isolation of tailings from the environment for 10 000 years, as well as revegetation of the site to a state similar to the surrounding ecosystem so that it may one day be incorporated into the national park.

Environmental protection

ERA is required to monitor water quality in rivers surrounding the mine site to demonstrate compliance with the limits set by the Supervising Scientist. The Supervising Scientist also monitors water quality to detect and assess both short- and long-term impacts. Water quality is monitored continuously so that any change can be detected immediately and management interventions implemented. Additionally, the aquatic ecosystem is monitored through annual assessments of fish and macroinvertebrate communities.

After nearly 40 years of monitoring by the Supervising Scientist, no impacts on the environment downstream of Ranger Uranium Mine have been detected. Moreover, the Supervising Scientist's recently completed review of more than 16 years of radiological data conclusively demonstrates that Ranger does not present a radiological risk to the health of those living in the region (Supervising Scientist, 2019).

The results of the Supervising Scientist's monitoring programme are published annually in the *Supervising Scientist Annual Technical Report* series (www.environment.gov.au/science/supervising-scientist).

Wetlands in Kakadu National Park (Ian Oswald-Jacobs/Creative Commons).

Closure and rehabilitation

Progressive rehabilitation work is under way at Ranger. Since 2012, ERA has spent more than AUD 435 million on rehabilitation and water management activities.

ERA's closure plan for the Ranger mine, released in June 2018 (www.energyres.com.au), includes a detailed work programme of activities required to meet the rehabilitation objectives. The plan also covers proposed closure criteria for key areas: final landform; radiation; water and sediment; ecosystem restoration; soils; and cultural heritage. These criteria continue to be refined in consultation with the Gundjeihmi Aboriginal Corporation, the Northern Land Council, the Supervising Scientist Branch and regulatory authorities. The Supervising Scientist published a first detailed assessment of the closure plan in September 2018 (Supervising Scientist, 2018) and updated versions in 2019 and 2020.

In addition to the closure plan, ERA is required to submit an annual cost estimate to the Australian Government for Ranger mine rehabilitation. The estimate is assessed independently and the company deposits the final agreed sum into the Ranger Rehabilitation Trust Fund, which has both cash and financial guarantees. Rio Tinto, ERA's majority shareholder, has committed an additional AUD 100 million loan to cover any funding shortfalls ERA may have.

As shown in Chapter 3, Ranger mine has contributed significantly to the Northern Territory economy for four decades, in addition to providing employment, facilities and services in a remote region of Australia. Thanks to the government's strict regulatory regime, these economic benefits have been achieved without detrimental impacts on the environment or direct harm to the physical health of the land's Traditional Owners. Equally, rigorous demands are being applied to rehabilitation of the mine to ensure that the region's environment remains protected into the future.

Study example 2: Canada

In Canada, minerals are primarily the responsibility of the province, and the national government has only a secondary role in regulatory activities. The Government of Canada may regulate on behalf of the country's territories, however, and there may also be separate provincial and federal regulatory regimes for both EAs and operational oversight.

Uranium is a special case. Under the 1946 *Atomic Energy Control Act*, the Canadian government declared atomic energy to be "a work or undertaking for the general advantage of Canada". However, the responsibility for uranium mining remained with the provinces and territories until 1976 when the federal government began extending its regulatory power to uranium mining activities. Federal regulation of uranium mining and milling was expended further in 2000 under the Nuclear Safety Control Act (NSCA). With that declaration, the national government claims jurisdictional authority over uranium mines and mills, and the Canadian Nuclear Safety Commission (CNSC) is the responsible regulator. For autonomy, however, the provinces also maintain a level of regulatory authority, which has resulted in regulatory overlap and duplication. Both the uranium industry and regulators have voiced their concern about this increased regulatory burden and the costs associated with it.

Saskatchewan

In Saskatchewan, the issue of federal vs provincial jurisdictional authority was identified as early as the Bayda (Cluff Lake) Inquiry in the 1970s. The province stated that jurisdictional uncertainty did not remove its responsibility to safeguard Saskatchewan's lands and workers, and therefore continued to provincially legislate standards pertaining to environmental and occupational health and safety.

Provincial ministries that may be involved in the uranium industry in addition to the Ministry of Environment are:

- the Ministry of Energy and Resources (minerals, mine plans);
- the Ministry of Labour Relations and Workplace Safety (occupational health and safety, radiation);

- the Ministry of Government Relations (surface leases, and northerner and Aboriginal issues).

Exploration

The CNSC regulates exploration conducted underground via a shaft or a ramp but does not regulate exploration activities conducted from the surface; this is the sole responsibility of the province. Companies therefore require an exploration permit from Saskatchewan's Ministry of Environment to conduct mineral exploration activities in the province. Permits vary depending on the programme and may pertain to forest products; aquatic habitat protection; work authorisation; and temporary work camps.

Environmental assessment

Saskatchewan's EA programme is legislated by the Environmental Assessment Act, which requires the proponent of a development to conduct an EIA and submit an EIS for review and approval by the Minister of Environment. When the minister grants approval, the proponent may proceed to obtain all other requisite regulatory permits and licences. Proponents are required to comply with the terms and conditions of an approval as outlined in the EA Act.

The EA programme is designed to evaluate the ecological, socio-economic and cultural aspects of a development, and it ensures public access to information. The EA Act defines development to mean any project, operation or activity, or any alteration or expansion of any project, operation or activity that is likely to:

- Affect any unique, rare or endangered feature of the environment.
- Substantially utilise any provincial resource and, in doing so, pre-empt the use or potential use of that resource for any other purpose.
- Cause the emission of any pollutants, or create by-products, residual or waste products that require handling and disposal in a manner not regulated by any other act or regulation.
- Cause widespread public concern because of potential environmental changes.
- Involve a new technology that is concerned with resource utilisation and that may induce significant environmental change.
- Have a significant impact on the environment or necessitate a further development that is likely to have a significant environmental impact.

The EA branch works closely with the Impact Assessment Agency of Canada and the CNSC when proposed uranium projects required federal approvals. The national and provincial EA processes, guided respectively by the Canadian Impact Assessment Act and the Environmental Assessment Act, are co-ordinated when possible using protocols and milestones established for projects with joint national and provincial jurisdiction.

The CNSC ensures that the public has an opportunity to participate in the EA and the CNSC licensing process. Indigenous consultation activities are also integrated into the EA and licensing process as much as possible.

Environmental compliance

Once a proponent's EA has received Saskatchewan ministerial approval, the operator applies for operating approval under the Mineral Industry Environmental Protection Regulations 1996, issued pursuant to the Environmental Management and Protection Act 2010 (EMPA). The operation is then issued an Approval to Operate a Pollutant Control Facility (a detailed decommissioning and reclamation plan as well as financial assurance are also approved at this time). Saskatchewan's environmental compliance and monitoring are managed under EMPA by the Ministry of Environment's Environmental Protection Division – Uranium and Northern Operations Branch, while the Mines Unit of Saskatchewan's Ministry of Labour Relations and Workplace Safety supervises employee safety under the Saskatchewan Employment Act. Multiple legislative instruments and various regulations are applicable, including the Clean Air Act (and associated regulations), the Mines Regulations 2018, the Radiation Health and Safety Regulations 2005, and the Occupational Health and Safety Regulations 1996.

Saskatchewan government employees regularly inspect environmental and human safety compliance to ensure that operators meet operating approval requirements and guidelines. A guideline may be a standard issued by a regulatory authority but not specifically stated in the regulations, such as water quality (e.g. the Saskatchewan Surface Water Quality Objectives).

The CNSC also performs compliance inspections under its regulatory framework for licensees, which includes:

- General Nuclear Safety and Control Regulations;
- Radiation Protection Regulations;
- Uranium Mines and Mills Regulations.

The CNSC uses multiple Canadian Standards Association guidelines in applying and implementing environmental standards, and it co-operates with other jurisdictions and federal departments to determine environmental protection standards. The CNSC may also enter into formal agreements to increase the effectiveness of environmental protection, when appropriate. For example, the CNSC has memorandums of understanding with other national departments (such as Natural Resources Canada; Fisheries and Oceans Canada; the Coast Guard; and Environment and Climate Change Canada) that may be consulted on EAs.

The problem of regulatory overlap and duplication (dual inspections and reports) in provincial and national oversight has been raised by uranium industry participants for many decades, and regulators have also recognised the weightier regulatory burden and associated costs. In 2003, Saskatchewan's Ministry of Environment and its Ministry of Labour Relations and Workplace Safety signed an administrative agreement with the CNSC to harmonise regulation of the province's uranium mines and mills. This initiative was prompted by a recommendation of the Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan.

Closure

For decommissioning and reclamation, both provincial and national authorities must review the operator's proposed plan. While the province can approve plans under existing operational approvals and authorities, the plan's activities typically require a specific CNSC licence (a Licence to Decommission, or a Waste Facility Operating Licence). The need for a licence decision from the CNSC in turn may trigger a federal requirement for an EA, which is then performed jointly by the provincial and national regulators. However, the CNSC has exempted Saskatchewan's numerous small, abandoned Cold War-era uranium mines which did not process ore on-site from licensing, which means the province is able to approve remediation.

Post-closure

Saskatchewan is a world leader in developing and implementing post-closure site management, with its Institutional Control Program (ICP) overseeing the actions, mechanisms and arrangements necessary to maintain control and knowledge of a remediated site after project closure and custodial transfer to a responsible authority. The ICP's primary objectives are to:

- Protect human health and safety.
- Protect the environment.
- Ensure future generations are not burdened with the costs of long-term monitoring and maintenance for current mining developments.
- Be sustainable.
- Recognise federal jurisdiction regulatory roles and responsibilities for national and international obligations.

The ICP is concerned with all aspects of conventional closed mines as well as uranium-specific issues of radioactive waste management, including all applicable articles of the International Atomic Energy Agency (IAEA) and, party to their safeguards and protocols, the requirements of the NSCA, the expectations of the CNSC, and all applicable provincial acts and regulations.

The ICP has two primary components, the Institutional Control Registry and the Institutional Control Funds (the Monitoring and Maintenance Fund, and the Unforeseen Events Fund). The Reclaimed Industrial Sites Regulations prescribe the conditions under which the Saskatchewan Ministry of Energy and Resources will transfer a closed site to the ICP, the requirements of the ICP to monitor and maintain a closed site, the funding method, and the enforcement of records and information preservation. For a closed project to be placed in ICP care, the province must accept the final state of the project and the CNSC must approve its release to the ICP. This requires a full public hearing and formal decision from the CNSC.

Lessons learnt and recommendations

The importance of strong and effective regulatory frameworks, policies and practices to deliver economic and social benefits and avoid environmental and health impacts throughout a uranium mine's entire mine life cycle, including post-closure, is widely recognised. Industry practices and regulations have advanced significantly since development of the first uranium mines in the early 1900s, and these practices and regulations now govern all mineral sectors.

Nevertheless, ten years is currently the amount of time deemed necessary for a new mine project to advance from the application stage to production, during which period market conditions may change significantly and a proponent's development decision be re-evaluated. The uranium industry has consistently stated that regulatory burden and uranium policy uncertainty significantly affect investment decisions. Furthermore, concerns about regulatory complexity, overlapping and duplication in both the assessment and the compliance and monitoring processes have been raised not only by the uranium industry but also increasingly by regulators.

From a sociocultural perspective, a robust and competent regulatory system builds trust and acceptance, which can win social licence from the population, and multi-jurisdiction oversight is viewed as offering greater protection because the multiple stages of review and evaluation reduce chances for error or revision without consultation.

Countries or regions developing a regulatory system to govern uranium industry activity should first conduct a comparative review of other jurisdictions' methodologies and results to design a structure that addresses regulator, industry and public concerns in a fair and balanced manner. Policymakers need to recognise that simplifying policies and streamlining the regulation of uranium activities will attract the investments needed to deliver sustainable development outcomes while preserving mechanisms to protect human and environmental health into the future.

References

Commonwealth of Australia (1977), *Ranger Uranium Environmental Inquiry,* Australian Government Publishing Services, Canberra.

Supervising Scientist (2019), *Supervising Scientist Annual Technical Report 2017-18*, Commonwealth of Australia, www.environment.gov.au/science/supervising-scientist/publications.

Supervising Scientist (2018), *Assessment Report: Ranger Mine Closure Plan Rev 0*, Internal Report 658, Supervising Scientist, Commonwealth of Australia.

Chapter 3

Delivering socio-economic benefits for local communities while fostering engagement and participation

Introduction

Uranium exploration and mining companies have proven potential to generate substantial intergenerational benefits for the communities in which they operate, including:

- direct, indirect and induced employment opportunities;
- royalty/resource rents paid at the provincial and/or national levels and, potentially, at the individual, family, community or regional level;
- community support programmes, usually aimed at capacity-building, socio-economic development, community resilience and economic diversification (or a combination of these);
- infrastructure provision and upgrades, e.g. roads, bridges, potable water supplies, electricity generation/transmission, communication networks, petroleum stations, airfields and community/wellbeing facilities;
- better access to services, e.g. housing, healthcare, education and family/employment support;
- increased consumer goods and services availability, e.g. groceries, retail goods and cafes/restaurants.

Delivery of these benefits, and contributions to the broader sustainable development of the communities and regions in which they operate, has been a priority for uranium companies seeking to establish operations and build and maintain social and political support for their presence.

But the role of local and/or regional, provincial and national governments in supporting and contributing to the socio-economic development of mining communities cannot be overlooked. Indeed, the primary responsibility of all tiers of government is to ensure citizen wellbeing, safety and security, essential to which are basic services and infrastructure. Too often, however, mining companies have been asked to take on (or by necessity have assumed) the exclusive role of services and infrastructure provider. In these cases, governments have regrettably neglected or abrogated their responsibility to provide basic goods and services to their citizens, outsourcing this responsibility to the private sector and/or civil society instead (Social Medicine, 2007).

An adverse consequence for communities and regions hosting uranium mining projects is that they can become dependent on mining operations for their development and sustainment. Other potential undesirable impacts include:

- disruption of established ways of life and unwanted socio-economic changes;
- exposure to new ideas and knowledge processes that may challenge or erode traditional value systems, beliefs and social hierarchies;
- unwanted in-migration, e.g. of non-local mine workers and associated service/supply chain personnel;
- potential exposure to communicable diseases due to in-migration;

- environmental degradation;
- anxiety about exposure to ionising radiation.

Preventing and/or mitigating these impacts, *even if they are only perceived*, should be a priority for uranium companies, host communities, civil society organisations and governments – all of which are partners in ensuring the delivery of socio-economic benefits for local communities within a framework of engagement and participation from communities.

Uranium mining and Indigenous peoples

It is often overlooked that much of the world's known uranium deposits and operations are situated on the traditional lands of Indigenous peoples, usually in locations that are far from larger urban areas (Graetz, 2014 and 2015). These locations and peoples tend to lack access to basic services and infrastructure; local economies may be stagnant or in decline, and human development indicators often show a lag compared with urban populations.

In many cases, mining operations may be the first, or certainly the most significant, industrial activity these peoples and regions may encounter, and it is imperative that their experiences with uranium mining projects be positive, respectful and empowering. Unfortunately, this has not always been the attested experience of many Indigenous peoples, who have reportedly suffered from unwanted social impacts, including disempowerment and marginalisation, the denial of access to their traditional lands as well as the right to refuse developments on those lands, and weakening of their traditional culture. Accordingly, many Indigenous communities have come to hold unfavourable perceptions of the uranium industry (and the mining sector in general).

The Australian example is instructive. As a witness to this view and experience, Yvonne Margarula, the Senior Traditional Owner of the lands on which the Ranger Uranium Mine is located and chair of the Gundjehmi Aboriginal Corporation, says that uranium mining has:

> upturned our lives – bringing a town, many non-Aboriginal people, greater access to alcohol and many arguments between Aboriginal people, mostly about money. Uranium mining has also taken our country away from us and destroyed it – billabongs and creeks are gone forever, there are hills of poisonous rock and great holes in the ground with poisonous mud where there used to be nothing but bush. (Margarula, 2005)

While practices and compliance vary, Indigenous peoples' right to determine what activities can take place on their traditional lands – including uranium exploration and mining projects – is recognised in international declarations,[1] by peak industry organisations (e.g. ICMM, 2015), and by some national and provincial governments in specific protective legislation[2]. Certain mining companies may also internalise the principles of these declarations or legislated protection in their corporate guidance and practices.

Clearly, reality is often more complex than suggested in international declarations or even national legislations. Nevertheless, building relationship and trust with Indigenous peoples is essential to both the economic and commercial success of a uranium mining project *and* the delivery of socio-economic benefits for local communities. Without such engagement with Indigenous peoples, it can be considerably more difficult for companies to receive what is known as the social licence to operate (Thomson and Boutilier, 2011; Owen and Kemp, 2013). Indeed, without gaining social licence to operate, developers may be denied access to lands, fail to receive regulatory and government support for their operations, and risk reputational and financial repercussions on their broader business.

1. E.g. the UN Declaration on the Rights of Indigenous Peoples, adopted by the UN General Assembly on 13 December 2007.
2. E.g. the Indigenous People's Rights Act of 1997 (IPRA) (RA 8371) (the Philippines), Section 35 of the Constitution Act 1982 (Canada), and the Aboriginal Land Rights (Northern Territory) Act 1976 (Australia – Northern Territory).

Leading practices and community support initiatives

Aware of this challenge, and recognising the need to support host communities' and regions' economic and social development and minimise negative impacts, the uranium industry has instituted, contributed to and/or supported numerous programmes to strengthen socio-economic benefits for local communities while fostering engagement and participation. Moreover, as government agencies are essential partners and facilitators of socio-economic development, they are increasingly taking steps to support the sustainable development of uranium communities and host regions by partnering with mining companies and civil society organisations. This section discusses the leading practices, activities and approaches of the various stakeholder groups.

At a high level, companies, government agencies, and civil society organisations have numerous tools, frameworks and principles available to guide how they contribute to (and monitor and report on) socio-economic benefits for local communities, including Indigenous communities. The table below lists the prominent tools, frameworks and principles used by each sector.

Common tools, frameworks and principles used by companies, governments and civil society organisations to enhance the socio-economic benefits for local communities, including Indigenous communities

Corporate sector	Government sector	Civil society
Common to all sectors		
Bi- or tri-sector partnerships	Bi- or tri-sector partnerships	Bi- or tri-sector partnerships
Free, prior, and informed consent	Free, prior, and informed consent	Free, prior, and informed consent
Local community grants and programmes	Local community grants and programmes	Local community grants and programmes
Universal Declaration of Human Rights (and Covenants)	Universal Declaration of Human Rights (and Covenants)	Universal Declaration of Human Rights (and Covenants)
United Nations Declaration on the Rights of Indigenous Peoples	United Nations Declaration on the Rights of Indigenous Peoples	United Nations Declaration on the Rights of Indigenous Peoples
Extractive Industries Transparency Initiative	Extractive Industries Transparency Initiative	Extractive Industries Transparency Initiative
Sustainable Development Goals	Sustainable Development Goals	Sustainable Development Goals
Overlapping between sectors		
Royalty payments	Resource rents and royalties for regional programmes	N/A
Indigenous land use agreements (Australia); other agreement processes (e.g. for Saskatchewan, see below)	Native title legislation and Indigenous land use agreements (Australia); other agreement processes (e.g. for Saskatchewan, see below)	N/A
Environmental impact assessment	Environmental impact assessment	N/A
Protect, Respect and Remedy ("Ruggie") Framework and the subsequent Guiding Principles on Business and Human Rights: Implementing the United Nations Protect, Respect and Remedy Framework	Protect, Respect and Remedy ("Ruggie") Framework and subsequent Guiding Principles	N/A
Human rights impact assessment	Human rights impact assessment	Human rights impact assessment
Social impact assessment	Social impact assessment	Social impact assessment

Common tools, frameworks and principles used by companies, governments and civil society organisations to enhance the socio-economic benefits for communities including Indigenous communities*(cont'd)*

Corporate sector	Government sector	Civil society
Sector-specific		
Corporate social responsibility	Environmental protection legislation	Advocacy and awareness-raising
Social licence to operate	Mining legislation and regulations	Monitoring and reporting – e.g. of transparency and accountability in corporate and government sector actions and practices
Risk assessment	Health policy	Provision of training
Impact and benefit agreements	Social policy	
United Nations Global Compact	Industry policy	
Global Reporting Initiative		
Voluntary Principles on Security and Human Rights		
Global Business Initiative on Human Rights		
International Council on Mining and Metals' (ICMM) 'Indigenous peoples and mining position statement' and its Good Practice Guide: Indigenous Peoples and Mining		

Notes:

This is not an exhaustive list, but aims to capture the most prominent tools, frameworks and principles.

As indicated in the table, some of the tools, frameworks and principles are used or given effect by more than one sector, and lines may blur.

Use of the tools, frameworks and principles may arise through corporate and/or legislative impetus, and/or as a result of pressure exerted by, or advocacy from, civil society organisations.

Civil society refers to "the space for collective action around shared interests, purposes and values, generally distinct from government and commercial for-profit actors. Civil society includes charities, development NGOs, community groups, women's organisations, faith-based organisations, professional associations, trade unions, social movements, coalitions and advocacy groups" (WHO, 2020).

Although the table above does not show individual company policies, procedures, processes, tools, frameworks and principles, some will be cited in the following case studies. The case studies are intended to provide a high-level summary of leading practices adopted or used by companies, government agencies and civil society organisations to deliver socio-economic benefits for local communities within a framework of engagement and participation from those communities. The case studies do not cover all the activities initiated or supported by these sectors, and while the samplings may explicitly draw attention to some of the common tools, frameworks and principles they use, more frequently the actions and activities emerge as implicit examples.

Australia

As noted in Chapter 1, Australia's various uranium deposits account for 30% of the world's uranium resources, currently estimated at 1.7 million tonnes of uranium (tU) in the cost category of less than USD 130 per kilogramme of uranium (kgU) (NEA/IAEA, 2020). Of these resources, 80% are in the State of South Australia, which is home to the Olympic Dam, Honeymoon, Four Mile

and Beverley/Beverley North mines. The fifth operation was the Ranger Uranium Mine in the Northern Territory. Ranger ceased production in January 2021 and a comprehensive rehabilitation programme is under work. Part of the country's resources are also in Western Australia, which hosts several advanced uranium projects, including Kintyre, Mulga Rock, Yeelirrie and Wiluna.

The industry is a major employer of Aboriginal and Torres Strait Islander peoples, with these two cultural groups making up about 13% of the Ranger mine's workforce (ERA, 2019).

Ranger Uranium Mine, Northern Territory

Australia's Northern Territory has a land area of approximately 1.35 million square kilometres (km^2) but a population of less than 250 000. Its economy is highly dependent on mining, which accounted for nearly 12% of the AUD 25-billion gross state product (GSP) in 2016-17 (Northern Territory Government, 2018) (https://budget.nt.gov.au). Ranger mine's contribution to the Northern Territory economy has varied over the years, fluctuating with uranium prices and production. While it generated AUD 768 million in 2009 (4.7% of GSP), its input fell to AUD 240 million in 2017 (1% of GSP) (ERA, 2017). While highly significant for the Northern Territory overall, the Ranger mine is even more important to its immediate region.

Ranger mine is operated by Energy Resources of Australia (ERA), the majority shareholder of which is Rio Tinto, one of the world's largest diversified mining companies. The mine is located in the Alligator Rivers Region of the Northern Territory, 260 km southeast of the territory's capital city of Darwin and 8 km east of Jabiru township, which was established as a mining services town.

Australia's Ranger Uranium Mine, Pit 3 (Kakadu National Park uranium mining, Creative Commons).

The mine was established in 1980 and reached full operating capacity in 1981. It is one of only three mines in the world to have produced in excess of 125 000 tonnes of uranium oxide (NEA/IAEA, 2018). Mining at Ranger mine ceased in 2012, and stockpiled material continued to be processed until expiry of the Ranger Authority in January 2021. During peak production, the Ranger mine produced approximately 5 500 tonnes of uranium oxide annually.

The Ranger mine is surrounded by (but is not part of) the World Heritage-listed Kakadu National Park, which covers approximately 20 000 km^2. The Alligator Rivers Region has been continuously inhabited for more than 50 000 years (Roberts, Jones and Smith, 1990), including by the Mirarr people, the Traditional Owners of the lands on which the Ranger mine and the Jabiluka Mineral Lease are situated. Since 1995, the Mirarr have been represented by the Gundjeihmi Aboriginal Corporation.

Alongside the views of Senior Traditional Owner Yvonne Margarula on the mine's impacts on Indigenous culture and heritage, over many years ERA has established or contributed to a suite of community and Indigenous initiatives and programmes that have arguably provided a range of socio-economic and other benefits for the community and surrounding region:

- Establishment of the Community Partnership Fund to contribute to development of the Alligator Rivers Region through investments in education, health and community wellbeing, environmental sustainability, and sport and culture (ERA, 2016).
- Contributions to the Kakadu West Arnhem Social Trust, established to address disadvantages among the region's Aboriginal peoples. More than AUD 10 million has been paid to organisations across the region (Gundjeihmi Aboriginal Corporation, 2020).
- Creation of numerous jobs in Jabiru and the Alligator Rivers Region, particularly for Indigenous people. At its peak, Ranger mine employed 400 to 500 people, accounting for more than 70% of jobs and nearly 90% of the total economy of the Jabiru region (ERA, 2014). ERA employees made up a large proportion of Jabiru's population, keeping the town's population at a level that enables government services, including a school and health clinic, as well as private sector services such as a small shopping centre and supermarket.
- Ranger mine's provision of electricity to Jabiru and operation of the region's only airport (which is heavily utilised by locals and tourism operators).
- More than AUD 100 million spent on salaries and local expenditures in the Jabiru township annually (ERA, 2019).
- Collaboration with the Native Title representative body (the Gundjeihmi Aboriginal Corporation) on matters such as water management, cultural heritage and environmental protection, employment and training, housing and town planning, and the beneficial use of royalties (ERA, n.d.).
- Establishment of a protocol to ensure protection of the region's cultural heritage.

Over the Ranger mine's lifetime, operations resulted in the payment of more than AUD 500 million in royalties to individual and community beneficiaries (ERA, 2019). Since 2013, royalty payments have been calculated on 5.5% of net sales revenues from mine production, with the equivalent of 4.25% of sales revenues paid to Northern Territory-based Aboriginal organisations, including the Gundjeihmi Aboriginal Corporation. The remaining 1.25% of royalties were paid to the Australian Government and subsequently distributed to the Northern Territory Government for the benefit of all Northern Territory residents (see also Chapter 4). This money was allocated to projects to improve educational outcomes for Aboriginal people, healthcare, property acquisition and economic diversification, particularly in support of the tourism sector.

Despite the mine's success and the many benefits it reportedly brought to the community and surrounding region, Ranger ceased operations in January 2021 in conformation with section 41 of Australia's 1953 Atomic Energy Act, which requires the Ranger Project Area to be fully rehabilitated by 2026 so that it can be incorporated into the Kakadu National Park. Rio Tinto/ERA had held discussions with the Traditional Owners regarding the possibility of extending the section 41 authority (which allows it to operate), with a view to mining the Ranger 3 Deeps deposit (estimated at about 44 000 tonnes of uranium oxide). However, negotiations were unsuccessful because the Traditional Owners continue to be opposed to mining in the region, and several incidents at the Ranger mine in 2013 further eroded trust in Ranger's operations (Graetz, 2015); accordingly, the Atomic Energy Act was not amended.

With closure of the mine, ERA/Rio Tinto, the host community, several government bodies and civil society organisations are confronting a future for the region that does not involve uranium mining. ERA, Mirarr Traditional Owners and the Gundjeihmi Aboriginal Corporation, the Northern Territory Government and the Australian Government have therefore developed a plan for the region's future socio-economic development and have signed a resultant memorandum of understanding (MoU). Under the terms of the MoU, the Northern Territory

Government has committed AUD 135.5 million for numerous projects (Commonwealth of Australia et al., 2019):

- a new power station;
- the Bininj Resource Centre;
- maintenance of local roads as well as sewage, electricity and water networks;
- upgrades to the Jabiru airstrip and associated facilities;
- upgrades to existing landfill capacity;
- establishment of a government services hub;
- a multi-use health clinic;
- an education precinct;
- infrastructure to enable mobile connectivity in Kakadu (co-investment with the Australian Government);
- establishment of Jabiru Kabolkmakmen Ltd, a company that will guide the township's transition to a post-mining economy (the Hon. Selena Uibo, 2019).

For its part, the Government of Australia has committed AUD 216.2 million over ten years for:

- development of a roads strategy;
- upgrades to road infrastructure;
- development of a tourism sector masterplan;
- a World Heritage Interpretive Centre;
- remediation of the Jabiru township;
- infrastructure to enable mobile connectivity in Kakadu (co-investment with the Northern Territory Government).

Under the MoU, "ERA will commit to meeting its rehabilitation obligations and will work with the other parties to support a smooth transition for the town with regard to such matters as ERA's residential workforce, services provided by ERA and ERA's town assets" (Commonwealth of Australia et al., 2019). A masterplan that presents a vision for the future of the Jabiru township has also been published (Gundjeihmi Aboriginal Corporation, 2018). Achievement of this vision will result in Jabiru developing as a national park town, tourism hub and regional service centre.

Collectively, these plans and arrangements are intended to ensure a sustainable post-mining future for the town and its residents – both Indigenous and non-Indigenous.

Olympic Dam, South Australia

Olympic Dam is a large polymetallic underground mine in South Australia, about 550 km north of Adelaide, the state capital. The site contains the world's largest known uranium deposit and the fourth-largest copper deposit; gold and silver also are extracted. Operations commenced in 1988 under the ownership of Western Mining Corporation, and BHP assumed control of the mine in 2005.

The mine's remoteness presents challenges for the social and economic advancement of the local population (approximately 4 500 residents), including of the mine's staff and their families, who reside in the mining services town, Roxby Downs, about 10 km south of Olympic Dam.

Aware of these challenges, the producer has developed a programme to support, monitor, measure and improve educational outcomes in the region. The Mining Minds programme seeks to keep children and families in the area, as families often send their children to boarding schools in Adelaide instead. This is important because Olympic Dam's workforce consists predominantly of residents of Roxby Downs, with a smaller proportion being fly-in-fly-out workers.

Addressing the early years of children's development to their adult education, Mining Minds has provided opportunities for more than 1 000 students from 120 families and involves the town's four schools, three childcare centres, two kindergartens and various vocational education providers, with the objective for higher-year participants to receive diploma or degree qualifications. The programme comprises four initiatives:

- educator development – a professional development and leadership training programme for local teachers and educators to improve local capacity and educational outcomes;
- student learning and wellbeing – an integrated wellbeing and learning programme designed to increase educational outcomes;
- parent partnership – a project that helps parents develop their own learning pathways and their ability to partner with teachers to improve their children's learning outcomes;
- community hub – a shopfront information and training facility that supports all Mining Minds programmes in a central location, facilitating greater participation and collaboration (BHP, 2017).

A social monitoring programme has also been established to measure the "social effects arising from the current operations of Olympic Dam and to assess the performance of control measures used to limit negative impacts and maximise benefits" (BHP, 2018). The programme "considers both positive and negative social effects, focusing on those social effects that are within ODC's (Olympic Dam Corporation Pty Ltd) control and authority to manage, and/or the contribution that ODC will make to collaboratively achieve desired social outcomes as they relate to: i) Community relations; and ii) Social character, amenity and well-being" (BHP, 2018).

The programme requires that the company work with the South Australian Government and key stakeholders in civil society and the community to identify indicators "for the delivery and monitoring of social infrastructure provision" and community health and social wellbeing indicators "to manage social wellbeing within Roxby Downs and other affected communities" in the region (BHP, 2018).

While the Government of South Australia and the Roxby Downs Council have primary responsibility for providing social services and infrastructure in the township, the producer works with these tiers of government to improve amenities and facilities as well as maintain community cohesion, harmony and health.

Canada

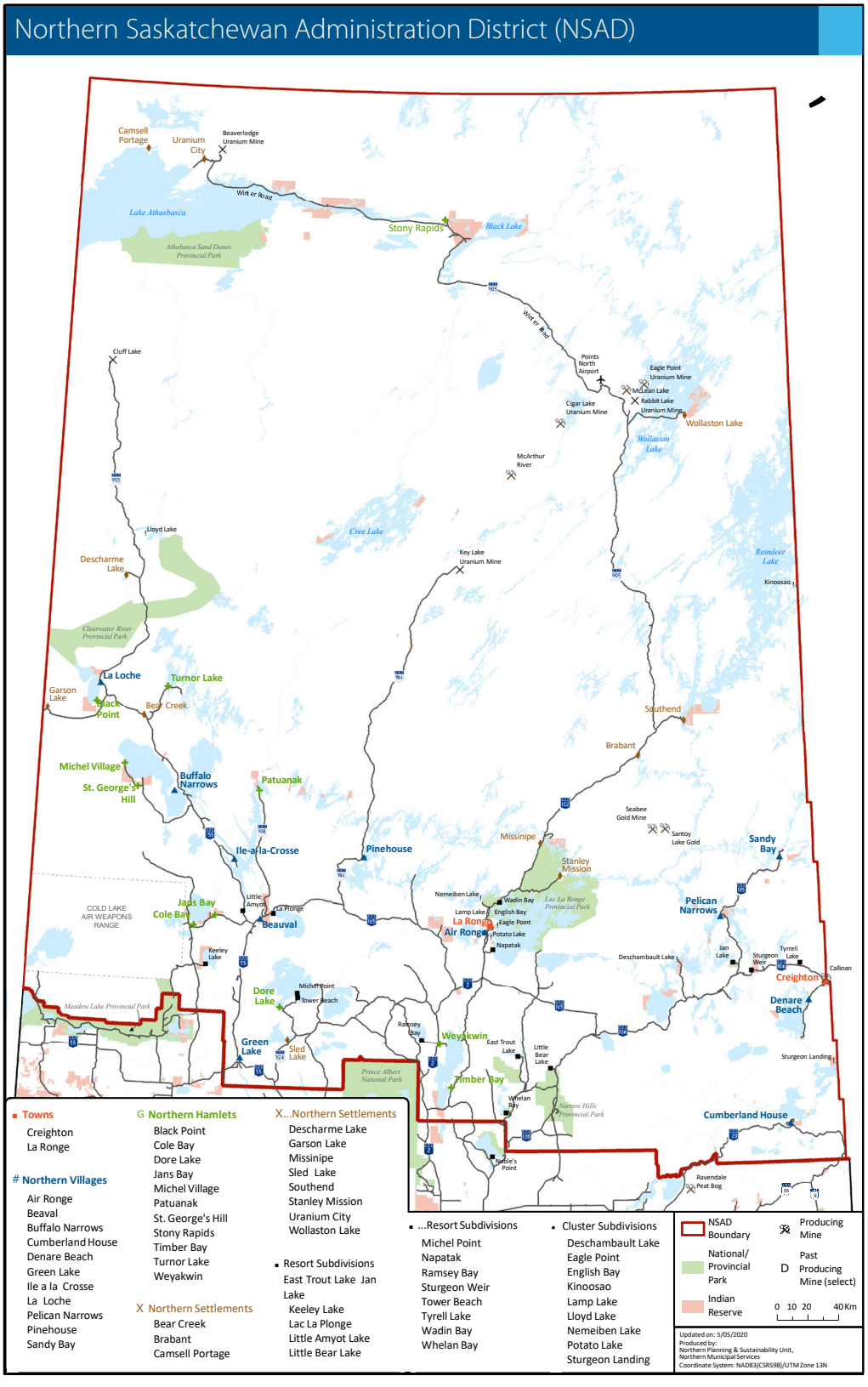
Overview of Saskatchewan's uranium industry

As reported in Chapter 1, Canada is the world's second-largest uranium-producing country and holds approximately 10% of global uranium resources. Production began in the Northwest Territories in 1942 and increased significantly when uranium mining operations began in Saskatchewan and Ontario in the 1950s. However, since 1996, all Canadian uranium mining production has been concentrated in the northern Saskatchewan (NEA/IAEA, 2020).

Cameco and Orano are Saskatchewan's main uranium producers, with Cameco operating the Cigar Lake, McArthur River and Rabbit Lake mines, as well as the Key Lake mill, and Orano operating the McLean Lake mine and mill (not currently mining); Orano also has a minor ownership stake in the Cigar Lake mine, Key Lake mill and McArthur River mine. In 2019, Canada's production totalled 6 944 tU, a significant reduction from the 2017 output of 13 130 tU (NEA/IAEA, 2020). The majority (85%) of the country's uranium is exported.

Northern Saskatchewan, a large region typified by its remoteness and cold climate, covers 32 million hectares and its sparse population is spread among 48 distantly located First Nations, Métis and municipal communities (Figure 3.1). Of the area's 38 000 residents, 80% identify as Indigenous.

Figure 3.1. **Northern Saskatchewan**



Source: Government of Saskatchewan.

Canada's uranium industry and Indigenous peoples

Like Australia, most of Canada's uranium developments are located on or adjacent to traditional Indigenous lands and treaty territories. Canadian legislation recognising Indigenous peoples' rights has evolved over a number of years, with the Supreme Court ruling in 1973 that "Canada's Indigenous people have an ownership interest in the lands that they and their ancestors have traditionally occupied, and the resources that they have traditionally used" (Anderson, Dana and Dana, 2006). Under the Canadian Constitution, the Crown has an obligation to consult Indigenous peoples (i.e. First Nations, Metis, or Inuit) on any decisions (including activities such mining) that have the potential to adversely affect the rights of Indigenous peoples. Although not required in Saskatchewan (where treaties have been executed), mining companies enter into agreements with Indigenous peoples to access lands and must provide benefits in return.

First Nations and Métis people in Northern Saskatchewan have sought to partner with the uranium industry to derive greater benefits from resource extraction. These benefits may stem from direct engagement in uranium operations (e.g. through employment at the mine site), participation in various community support initiatives established by companies (solely or in partnership with the communities and government), or involvement in the mining value chain. Indeed, many Indigenous-owned enterprises provide a range of services to uranium mining companies operating in the region, through community business development associations such as Athabasca Basin Development (https://athabascabasin.ca) and Kitsaki Management Limited Partnership (https://kitsaki.com).

Local uranium companies believe that "partnerships with Indigenous communities anchor support for [their] existing operations and facilitate the prospects of expansion and new mine development" (Sloan and Hill, 1995). Partnerships often take the form of procurement contracts: for instance, Cameco procured products and services totalling CAD 3.85 billion from northern Saskatchewan businesses between 2004 and 2019, with procurement from northern businesses accounting for 85% of services contracted in 2019. The uranium industry's stated goal is "to help northern businesses become fully supported and self-sustaining contractors, to build capacity for the future" (Cameco, 2020a). Orano also prioritises hiring northern employees and service providers, with the company spending CAD 49 million of its CAD 74 million procurement budget on northern businesses in 2017.

Partnerships between the uranium industry and local communities are not restricted to financial interactions, however. The Athabasca Working Group (AWG), made up of Cameco, Orano and Athabascan communities, was founded in 1993 to develop an impact management agreement for environmental management (AWG, 2015).

> Community members were industry funded and trained to monitor water, sediment, fish, plants, wildlife, and air quality near their communities either alongside [the companies'] staff or independently. The sampling locations and components were designed with significant input from community members. Each year, the results were communicated through local community brochures and other means. (CanNorth, 2014)

In 2016, the uranium industry and Indigenous communities established a collaboration agreement to replace the previous impact benefit agreement, and in 2018 the Athabasca Working Group programme became the Community-Based Environmental Monitoring Program. Sampling continues to be conducted by CanNorth, an independent First Nations environmental services company, and samples are analysed by the Saskatchewan Research Council, a provincial Treasury Board Crown corporation. Results are reported to the communities directly through the Ya'Thi Néné Land and Resource Office and the environmental committee established pursuant to the collaboration agreement.

Delivering socio-economic benefits for local communities, including Indigenous communities

The need for the uranium industry to provide socio-economic benefits to communities affected by mining operations was first recognised by the Saskatchewan government in the 1970s. Uranium companies operating in the province have signed formal agreements with communities

and First Nations groups to deliver and define the distribution of benefits, and to frame the nature of partnerships. Agreements focus on:

- workforce development;
- business development;
- community engagement and environmental stewardship;
- community investments.

Agreement formats include collaboration agreements (with individual or multiple signatories), participation agreements and compensation agreements (for example, for trappers whose livelihoods are affected by mining operations). Collaboration agreements, which are in place for the companies' entire operational lifetimes, will likely amount to CAD 800 million for 2012-2022 alone.

To further enhance these agreements, uranium companies have committed to in-house employee development training and education by establishing funding for a Stay-in-School programme. The companies also support northern students pursuing post-secondary education through the provision of funds (in the form of scholarships) not tied to disciplines associated with uranium mining. In other words, scholarship recipients are not required to work in the uranium industry upon graduation. From 2013 to 2018, students from the Northern Saskatchewan Administrative District (see Figure 3.1) were granted more than CAD 1.3 million in scholarships by the uranium mining industry.

The uranium sector also invests heavily in community organisations and activities. These investments focus on health and wellness, early childhood education, cultural programmes and community initiatives. During 2013-2018, the uranium industry invested more than CAD 200 million in community initiatives in addition to the collaboration agreement funding discussed above.

The industry has also established a legacy trust fund for northern Saskatchewan, with the goal of amassing CAD 50 million to provide funding for future community projects. Called the Six Rivers Fund, the independent non-profit organisation provides financial support for projects and initiatives that focus on youth, education, sport, recreation and health and wellness in northern Saskatchewan (Six Rivers Fund, 2020).

In addition, the collaboration agreements establish independent funds to govern administration of the community investment funding received directly from uranium companies. The trusts, administered by community-appointed members and an independent trustee review application for funding, offer support in four general areas:

- youth – projects from preschool to high school and throughout the community;
- education and literacy – projects that create opportunities for young people in the local communities;
- health and wellness – projects that improve access to health services for the company's employees and their neighbours;
- community – programmes and projects that contribute to prosperity and quality of life in the community, building infrastructure for the future and strengthening local economies.

In response to the COVID-19 economic crisis, in April 2020 the uranium industry announced the creation of a relief fund for not-for-profit organisations, charities and town offices or First Nation band offices that had been affected by the pandemic, from the city of Saskatoon upwards throughout Saskatchewan's far-north region. Grant guidelines require that funds be used to help manage the economic challenges of the COVID-19 pandemic, and can be directed to ongoing programme support, targeted COVID-19 community responses or specialised programmes (Cameco, 2020b). In addition, uranium companies have directly provided personal protective equipment and supplies to support Athabasca Basin communities during the pandemic.

As a result of these initiatives, Saskatchewan's uranium industry has one of the highest rates of public support internationally. Indeed, support was 82% provincially and 85% in northern Saskatchewan in 2018 (Saskatchewan Mining Association, 2019). This high level of acceptance results from continual socio-economic improvements for local communities and regulatory policy evolution, as well as industry supportiveness and proactiveness based on the shared government and industry commitment to develop and maintain a strong, positive reputation.

Mongolia

Overview of Mongolia's uranium industry

According to *Uranium 2020: Resources, Production and Demand* (commonly referred to as the "Red Book"), a joint report of the Nuclear Energy Agency and the International Atomic Energy Agency, Mongolia's identified recoverable conventional resources as of 1 January 2019 were 143 455 tU.

While Mongolia currently has no active uranium mines, uranium was extracted in the country between 1989 and 1995 from the Dornod open-pit mine. All mined ore was transported to the former Union of Soviet Socialist Republics, and later the Russian Federation, for beneficiation and processing (NEA/IAEA, 2018). As the Mongolian government considers the mining of uranium deposits an important national interest as it would positively influence and improve the national economy, it encourages new investments in the country's uranium industry through financing for exploration and to bring projects to market, and indirect funding to raise the country's human resource and technical capabilities.

Since 1996, Orano (formerly Areva) has been undertaking exploration activities in the Dornogovi and Sukhbaatar provinces of south-eastern Mongolia's Gobi Desert. The company first discovered the Dulaan Uul and Zuuvch Ovoo uranium deposits in 2011, with their resources estimated at 54 640 tU. Badrakh Energy, a joint venture between Orano and the Mongolian state-owned company Mon-Atom LLC, is investigating the use of in situ recovery methods for the Zuuvch Ovoo deposit.

Partnering to deliver socio-economic benefits for local communities

Almost half of Mongolia's population lives in the capital city of Ulaanbaatar, and the ongoing rural exodus presents significant social and economic challenges. Rural-to-urban migrant populations currently have few employment opportunities and live in rather precarious conditions.

The François-Xavier Bagnoud (FXB) association is a Swiss international development organisation with over 30 years of experience in breaking the cycle of poverty. Its mission is to provide people living in extreme poverty with the tools and support they need to become self-sufficient. In 2016, with support from the Mongolian staff of the Areva Foundation and Orano (formerly Areva), the FXB association launched a programme in Dornogovi province to reduce migration towards Ulaanbaatar (Badrakh Energy, 2020). The main objective of the FXB Village programme is to improve the living conditions of families in the province by creating opportunities in the region. The programme has benefitted approximately 600 people who had previously been living in extreme poverty, leading them towards social and economic independence (FXB, 2020).

The programme takes an integrated approach to providing nutritional, health, education and housing support and information to meet the immediate needs of affected families while helping them increase their incomes to become economically self-sufficient. For three years, programme participants received family planning, hygiene, health and education support, as well as tailored training, seed funding and practical advice to initiate income-generating activities.

Furthermore, the FXB team facilitated training in the fields of felt art, horticulture and baking, supplemented by awareness-raising activities related to hygiene, which is being advanced progressively as sanitation facilities improve. Clean water has also been made available, and every month a social worker provides lessons on the Mongolian alphabet to address illiteracy. In addition, school kits have been provided to more than 150 children, and more than 90 000 trees have been planted.

Significant improvements in psychological wellbeing have been realised thanks to the programme, with participants being given support and counselling to help them become more dynamic and proactive in their personal and business affairs. At the end of the three years, all participating families were able to sustain themselves financially on incomes that were 162% higher on average than at the beginning of the programme, allowing them to put 17% into savings. Furthermore, 80% of training programme graduates were able to find employment (FXB, 2020).

Following on the success of FXB Village's first programme, FXB, Orano/Badrakh Energy and local Mongolian authorities launched a second round in early 2019.

Namibia

Overview of Namibia's uranium industry

Namibia's economic development, particularly in the central-western Erongo Region that is home to the Topnaar people, an Indigenous Nama ethnic group, has been heavily dependent on the country's four uranium mines:

- Rössing Mine commenced operation in 1976 (under Rio Tinto) and has been operated by China National Uranium Corporation Limited since 2019.
- Langer Heinrich Mine started production in 2007 and is operated by Paladin Energy. It was placed in care and maintenance in August 2018 due to low global uranium prices.
- Husab Mine began production in 2016 and is owned by Swakop Uranium, a partnership between Namibia and China, of which 10% is held by the Namibian state-owned Epangelo Mining Company and 90% by Taurus Minerals Limited, jointly owned by China General Nuclear Power Group and China Africa Development Fund.
- Trekkopje Mine is owned by Orano and was placed in care and maintenance in October 2012.

A number of other deposits have not yet been brought into production (e.g. Etango and Norasa). The country's reasonably assured resources of uranium amount to 335 319 tU, recoverable at a cost of less than USD 130/kgU (NEA/IAEA, 2018).

A key focus of Namibia's uranium industry has been the development of human capacity and capabilities through education and training, as well as the provision of support for small businesses to participate in the mining services supply chain (NUA, 2020). In addition to providing direct mine site employment, a principal way the industry (particularly the Rössing Mine) has contributed to delivering socio-economic benefits for local communities is through the Rössing Foundation.

Rössing Mine and the Rössing Foundation

Rössing Uranium Mine has been operating for more than 40 years, during which time it has strongly emphasised the development of regional capabilities, particularly in education, health care and small and medium-sized enterprises. As a major employer and purchaser of goods and services, Rössing contributes significantly to the economic development of the Erongo Region in particular, and to Namibia at large. The company invested NAD 26 million in Namibian communities during 2019, either directly or through the company's foundation (Rössing Uranium, 2020).

The Rössing Foundation was established in 1978 to provide support for education, training, innovation and enterprise development to empower communities to be self-reliant. Since Namibia gained its independence in 1990, the Foundation has worked directly with the Ministry of Education, Arts and Culture to support education and other community initiatives. The Foundation also partners with other companies, civil society organisations (e.g. the Erongo Development Foundation), government agencies (including the Erongo Regional Council and the Arandis Town Council) and international organisations (including the UN Children's Fund) through its various programmes and initiatives (Rössing Foundation, 2018).

To further its pedagogical goals, in 2008 the Foundation established English, mathematics and science centres in Swakopmund and Arandis in the Erongo Region, and in Ondangwa in the Oshana Region. In addition to providing support for students at all levels of the school and tertiary education system through dedicated learning programmes and initiatives, the centres serve as teacher training hubs, with teachers receiving help in lesson planning, the development of worksheets with step-by-step solutions, classroom diagnostics, exam preparation and various other aspects of pedagogy. In 2018, 234 teachers participated in the Teachers' Support Programme offered by the centres.

In 2012, the Rössing Foundation expanded its education programme with the launch of its first Mobile Education Laboratory to take support to rural schools in various areas of the country. The main purpose of the Laboratory was to cater to isolated schools that cannot easily access the education centres due to the schools' remoteness and the high cost of transport. The Laboratory was initiated to expand the Foundation's reach to outlying schools to support training programmes in English, mathematics and the sciences. A team of senior education officers from Namibia's Directorate of Education worked with the Rössing Foundation and local teams in various regions.

In the area of enterprise development, the Foundation in partnership with the Erongo Regional Council has provided aid to the Ûïba Ôas Crystal Market Cooperative, which was established to support the economic advancement of the region's small-scale miners. Crystal Market offers training in jewellery design and provides facilities for cutting and polishing stones, in addition to serving as a marketplace. The Rössing Foundation also assists local entrepreneurs by offering business plan assistance, loan programmes and micro-finance schemes.

All Rössing Foundation support, including the initiatives described above, is strategically planned and agreed upon in consultation with government partners, with projects being established through MoUs. This means that projects obtain the buy-in of multiple stakeholder groups and are more likely to succeed.

The Harambee Prosperity Plan

All programmes and initiatives supported by the Namibian uranium industry more broadly are also designed to help realise the objectives of the Harambee Prosperity Plan, a "targeted action plan of the Namibian government that aims to accelerate development in clearly defined priority areas in order to eradicate poverty and social inequality" (NUA, 2020). According to the Namibian Uranium Association,

> [t]he Harambee Prosperity Plan has five pillars, namely Effective Governance, Economic Advancement, Social Progression, Infrastructure Development, and International Relations and Cooperation. The Namibian Uranium Association and its members fully support the Harambee Prosperity Plan initiative, and work with Government in this important venture. (NUA, 2020)

As this case study has shown, the scope of benefits arising from uranium extraction in Namibia extends well beyond the immediate mining region of Erongo to the entire country, with the industry serving as a catalyst for much of the country's economic success and social progress.

Niger

Overview of Niger's uranium industry

Niger is responsible for about 5% of global uranium output. Uranium mining, which began in the early 1970s, continues to contribute significantly to the national economy, with uranium accounting for an important share of the country's exports. Natural resource output (mainly uranium and oil) made up 12.3% of total GDP in 2013 (IMF, 2015). Niger's uranium-producing area is located west of the granitic Aïr Massif, near the towns of Arlit and Akokan in the Agadez Region (Figure 3.2). This region is home to the Tuareg people, an ethnic Berber confederation whose traditional territory spans many North African countries.

Figure 3.2. **Niger's uranium industry geographical concentration**

Source: Orano.

Three major mines, Somaïr, Cominak and Imouraren, have been important to Niger's uranium industry as vectors of investment and technology transfer. The main shareholders in Niger's uranium industry are:

- Société des Mines de l'Aïr (Somaïr) – 63.4% owned by Orano Mining; 36.6% by Société du Patrimoine des Mines du Niger SA (Sopamin SA – Government of Niger). Operations encompass an open-pit mine and an ore treatment plant.
- Compagnie Minière d'Akouta (Cominak) – 34% owned by Orano Mining; 31% by Sopamin SA; 25% by Ourd (Japan); 10% by Enusa Industrias Avanzadas SA (Spain). Operations encompass an underground mine and an ore treatment plant. On 31 March 2021, the mine ceased production after over 40 years of service and 75 000 tU extracted.
- Imouraren SA – 66.65% owned by Orano Expansion (a joint venture between Orano and the Korea Electric Power Company); 33.35% by the State of Niger. The project has been in stand-by mode since 2015 pending an increase in the uranium market price.
- In 2006, the China National Nuclear Corporation (CNNC) signed an agreement with Niger's government to develop the Azelik uranium deposit. It had produced about 670 tU by 2014, when it was put in care and maintenance (NEA/IAEA, 2018).

In addition to these mines, advanced uranium projects include deposits at Madaouela (Goviex) and Dasa (Global Atomic Fuels Corp).

Niger's main uranium operations[1]

Company	Mining method	Nominal capacity	tU produced/year (2018)	Content (%)	Resources (tU at end 2017)
Somaïr[2]	Open-pit	2 000 to 3 000 tU	1 783	1.9	53 397
Cominak[3]	Underground	1 000 to 1 500 tU	1 128	0.36	9 260
Imouraren	Open-pit	5 000 tU	Start-up pending uranium price rise	0.07	279 185
Azelik	Open-pit and underground	700 tU	Care and maintenance	0.14	13 770 (recoverable)

Notes:

1. More than 140 000 tU have been extracted in Niger since uranium mining started in the 1970s; (Orano, n.d.[b]), www.orano.group/en/orano-across-the-world/niger.

2. Somaïr produced 70 021 tU from 1971 to 2017.

3. Cominak produced about 75 000 tU from 1978 to 2021. The mine closed in March 2021 due to depletion of the deposit, Orano (2018) and Orano (n.d.[c]), www.orano.group/reamenagement-cominak/en.

Uranium mine operations around Arlit and Akokan have improved local populations' living conditions. With Orano entities registering about 1 500 direct employees (as of 2018) and 99% of the workforce being local, the uranium industry is a major employer in Niger. In addition, the mines supply employment for roughly 1 700 Nigerien subcontractors (mechanical, electrical, construction, security, etc.) and spend about EUR 53 million per year in purchases from local companies. In 2017, Nigerien uranium mines' personnel costs, including salaries paid to employees, social security costs, and taxes on payments and salaries, totalled more than XOF (CFA Franc) 20 billion.

Since Niger's commitment in 2005 to implement the Extractive Industries Transparency Initiative (EITI), Orano entities have been participating in this multi-party (government, company and civil society) process and annually declare amounts paid as taxes, mining fees, taxes on profits, royalties, etc. These financial data are first audited by a certified firm, then sent to Niger's EITI Permanent Secretariat, which consolidates them with the earnings recorded by government bodies. In 2012-2016, the uranium industry paid more than XOF 245 billion to tax, customs and other Nigerien state services.

Uranium industry contributions to deliver socio-economic benefits for local communities within a framework of engagement and participation from communities

Uranium companies in Niger have established a comprehensive programme to support projects focused on improving education, health, access to water, economic development, cultural life and sport, as well as the provision of emergency food aid. The programme endorses development activities in partnership with non-governmental organisations and direct support for local communities.

Bilateral Guidance Council (CBO)

The main vehicle for the uranium industry to create socio-economic benefits for local communities is the Bilateral Guidance Council (or CBO). Created in May 2006, the CBO is a multi-party partnership and co-ordination committee that identifies and implements development actions. It is chaired by the head of the Arlit department (the administrative tier above the level of the Arlit township). Through this Council, uranium companies partner with local elected officials, technical agencies of the Arlit and Iférouane departments, and civil society organisations to support local development policy, participate in projects in priority areas (education, health, water access and economic development), issue opinions on projects, and define conditions and criteria to ensure that local, departmental and regional community facilities are allocated fairly.

Each year, member companies contribute financially to the CBO to implement the projects selected for each community. A total of around XOF 5 billion was allocated between 2006 and 2018, and there had been 136 projects focused on education, 97 on clean-water initiatives and 129 on health by the end of 2017.

The CBO has had a social impact through the provision of XOF 182.5 million since 2006 to communities in Arlit and Iférouane to support artisan, market gardener and herder co-operatives, and to help women's organisations and vulnerable groups develop revenue-generating activities. The CBO has supported projects to: supply agricultural equipment to farming co-operatives; provide tools and raw materials to artisan co-operatives; provide agricultural inputs and equipment to Arlit market gardeners; allocate 124 motor-driven pumps to Iférouane market gardeners; and open credit lines with micro-financing institutions to fund revenue-generating activities for women.

It has also been instrumental in the construction of 82 classrooms: 58 in Arlit, 6 in the rural community of Dannat, 5 in the rural community of Gougaram, 6 in the rural community of Timia and 7 in Iférouane.

Another project established a new library in Arlit, with a donation of more than 30 000 books for young readers and training for librarians. These investments, which were made over a ten-year period, totalled more than XOF 2.6 billion and have resulted in an Agadez Region literacy level of more than 52%, which is higher than the Nigerien national rate of 35% among the population aged 15 years and older (UNESCO [n.d.], http://uis.unesco.org/en/country/ne).

To make these education investments sustainable, the CBO has allocated a dedicated budget to teacher training. Around 30 teachers have been trained to service the communities of Timia and Iférouane. The uranium sector also supports Nigerien higher education by awarding scholarships to high-school graduates from disadvantaged areas who have been admitted to one of the country's higher education institutions (such as the Higher Institute of Mining, Industry and Geology), and it has additionally created a training school for mining technicians and supervisors in the Agadez Region (Orano, 2020).

The Irhazer agropastoral project

Initiated by Orano in partnership with the Government of Niger, the Irhazer agropastoral project aims to improve sustainable food security by developing irrigation systems in the desert areas of the Agadez Region. Total project investments of over XOF 11.4 billion (EUR 17 million) have allowed for the testing of possible plant and animal production systems and the validation of investment models. The plan is to increase the size of plots granted to private producers and to diversify the crops being grown. Techniques that use less water (such as micro-irrigation) will be deployed to improve yields and reduce production costs.

Community health

Niger's uranium industry also contributes significantly to public health and community wellbeing. Built to support the medical care of mine site personnel and their families, the hospitals in Arlit (established by Somaïr) and Akokan (established by Cominak) also are open to the general public and provide free treatment for all patients. The hospitals operate with a budget of XOF 3 billion per year and provide healthcare services to local communities from Arlit and Akokan as well as other regions of Niger.

Initiated by Orano with the support and participation of the Nigerien government and local community organisations, the Agadez Regional Health Observatory (OSRA) was established separately in 2011 to provide independent, post-professional monitoring of former Somaïr and Cominak employees who might have been exposed to ionising radiation at work (Orano, 2020). Consultations are provided to former employees every two years and include an interview with a physician, a clinical examination, a chest X-ray and blood work. The physicians are independent employees of OSRA – not of Orano or its subsidiaries.

CBO investments in community health and wellbeing include the construction of 17 medical centres (4 in Arlit, 4 in Dannat, 6 in Timia, 1 in Iférouane and 2 in the rural community of Gougaram) at a cost of more than XOF 500 million. The medical centres are also provided with equipment and consumables, and the CBO has invested in quality of care by providing training for medical personnel. These investments have significantly improved the health of the communities in which the centres operate. For example, the level of medical coverage is 83% in Arlit, compared with 48% nationally.

Lessons learnt and recommendations

A recent report of the International Council of Mining and Metals (ICMM, 2018) states that mining-dependent countries (including uranium producers such as Australia, Kazakhstan, Mongolia, Namibia, Niger and Uzbekistan) have made substantial social progress in the past two decades. Although people in these countries are now generally better educated, wealthier and healthier than before, the rate of socio-economic improvement among these countries is inconsistent. The report highlights that government policies and capacity, the quality of governance, and economic activity in non-mining sectors clearly affect socio-economic performance. Additionally, in the case of Niger, maintaining political stability and improving regional co-operation to reduce security risks could help ensure that public resources from the mining sector get invested in high-return infrastructure projects that guarantee long-term socio-economic benefits and poverty reduction (IMF, 2015).

This chapter's five case studies showcase the significant investments the uranium industry makes to deliver socio-economic benefits for local communities within a framework of engagement and participation from the communities.. A key message that emerges is that uranium companies can deliver more value and increase sustainability for host communities and regions when they work in partnership with other stakeholders than if they act alone.

Moreover, companies' development contributions that leverage or support existing government, community and civil society programmes and projects (such as the Namibian uranium industry tailoring projects to advance the government's Harambee Prosperity Plan objectives, or Canada's industry promoting Indigenous advancement by partnering with northern businesses to procure products and services) are much more likely to deliver lasting benefits for communities hosting (or affected by) uranium operations because the projects already have the buy-in of the other stakeholders.

While the uranium industry's global record of contributing to socio-economic benefits for local communities is strong, it has numerous tools, frameworks and principles at its disposal to further ensure the extension of benefits beyond a uranium operation's lifetime. In addition to current actions, policy and decision makers can:

- Increase transparency and accountability, particularly regarding how much and to which agencies royalties and resource rents are paid, and how they are subsequently used – i.e. what they are spent on, and how the projects receiving funding contribute strategically to create socio-economic benefits for local communities, including Indigenous communities.
- Build community knowledge about uranium mining and its processes, including environmental management, and work with local communities and Indigenous peoples to integrate traditional knowledge into operational management plans and activities.
- Create sustainable development plans, particularly for education, economic diversification and post-closure land use to ensure that host communities and regions do not become dependent on uranium mining operations for their existence, revenue and access to services and infrastructure.
- Continue to improve environmental management practices, including reducing water use to make more water available for community use and the environment.
- Manage legacy issues better, including rectifying historical environmental mis-management of uranium operations; this is particularly important for Indigenous peoples.

Government participation is crucial to the success of a uranium mining operation, but too often governments cede responsibility for community and Indigenous development to the corporate sector and/or civil society organisations. While governments are increasingly cognisant of their responsibilities, the various relevant tiers need to be more involved in uranium projects and in providing industry oversight.

An area that particularly needs improvement is transparency regarding the amount and subsequent use of royalties and other revenues received by governments from uranium operations, as it is difficult to obtain government revenue receipts from uranium projects (and from other resource projects, for that matter). In many jurisdictions, royalty receipts from all extractive industries are aggregated in government reports and retained in consolidated revenue funds. Consequently, it is difficult to track the broader and specific benefits of uranium mining at the provincial and national levels, or to see how monies are returned to host communities. In this respect, companies may be performing better than governments (for example, BHP, Orano and Rio Tinto support the EITI initiative [EITI, n.d.]).

Civil society organisations and community leaders can also help maximise the benefits of uranium operations by ensuring that companies and governments act in accordance with community expectations, rights and interests. As community-based organisations are direct agents for development, greater collaboration among civil society, community organisations, companies and governments will lead to better and more sustainable development outcomes, higher degrees of trust and confidence in the uranium industry and regulatory oversight of operations, and increased opportunities for participation in tri-sector projects and initiatives.

References

Anderson, R.B., L.P. Dana and T.E. Dana (2006), "Indigenous land rights, entrepreneurship, and economic development in Canada: 'Opting-in' to the global economy", *Journal of World Business*, Vol. 41, No. 1, pp. 49-50. https://doi.org/10.1016/j.jwb.2005.10.005.

Athabasca Basin Development (2020), About Athabasca Basin Development, https://athabascabasin.ca.

AWG (2015), *2015 Industry Report to Communities*, Athabasca Working Group, www.cameconorth.com/uploads/downloads/environment/2015-AWG-Report-Web.pdf.

Badrakh Energy (2020), FXB Mongolia Dornogobi, 2 February, Badrakh Energy LLC, www.youtube.com/watch?v=Zw5KQXFxMzk&feature=emb_logo.

Badrakh Energy (n.d.), Communities, Badrakh Energy LLC, www.badrakhenergy.com/EN/communities.html.

BHP (2018), "Monitoring Program – Social Effects", Document No. 110687 V., Olympic Dam Shared Services, 27 July, p. 2.

BHP (2017), *Sustainability Report 2017*, BHP, Melbourne, www.bhp.com/-/media/documents/investors/annual-reports/2017/bhpsustainabilityreport2017.pdf, p. 27.

Cameco (2020a), Partnerships, Cameco Corp., www.cameconorth.com/partnerships.

Cameco (2020b), $1 million COVID-19 relief fund, Cameco Corp., www.cameco.com/community/stories/relief-fund.

CanNorth (2014), CanNorth Community Programs, Canada North Environmental Services Limited Partnership, https://cannorth.com/community-programs.

Commonwealth of Australia, et al. (2019), "Memorandum of Understanding on the Future of Jabiru Township", https://dcm.nt.gov.au/__data/assets/pdf_file/0007/736936/future-jabiru-mou-signed.pdf.

EITI (n.d.), Companies, Extractive Industries Transparency Initiative, Oslo, https://eiti.org/supporters/companies.

ERA (2019), *Sustainability Report 2018*, Energy Resources of Australia, Darwin.

ERA (2017), *Annual Report 2017*, Energy Resources of Australia, Darwin.

ERA (2016), "Community Partnership Fund – Guidelines", Energy Resources of Australia, Darwin, www.energyres.com.au/uploads/general/20160519_CPF_Guidelines.pdf.

ERA (2015), "ASX Announcement: Ranger 3 Deeps Project – Further Update", 12 June, Energy Resources of Australia, Darwin, www.energyres.com.au/documents/ASX_Announcement_-_Ranger_3_Deeps_further_update.pdf.

ERA (2014), *Ranger 3 Deeps Environmental Impact Assessment*, Energy Resources of Australia, Darwin.

ERA (n.d.), "Community and Social Performance at ERA," Factsheet, Energy Resources of Australia, Darwin, www.energyres.com.au/uploads/docs/CommunitySocialPerformance_factsheet_FA2.pdf.

FXB (2020), Mongolia, Association François-Xavier Bagnoud International, https://fxb.org/countries/mongolia.

Government of South Australia (2021), Uranium, http://energymining.sa.gov.au/minerals/mineral_commodities/uranium.

Graetz, G. (2015), "Ranger uranium mine and the Mirarr (Part 2), 2000–2014: A risk to them is a risk to us", *The Extractive Industries and Society*, Vol. 2, No. 1 (January), pp. 145-147. https://doi.org/10.1016/j.exis.2014.10.005

Graetz, G. (2014), "Uranium mining and First Peoples: The nuclear renaissance confronts historical legacies", *Journal of Cleaner Production*, Vol. 84 (December), p. 341. https://doi.org/10.1016/j.jclepro.2014.03.055

Gundjeihmi Aboriginal Corporation (2020), Kakadu West Arnhem Social Trust, Gundjeihmi Aboriginal Corporation, Jabiru, www.mirarr.net/kakadu-west-arnhem-social-trust.

Hon. Selena Uibo, Gundjeihmi Aboriginal Corporation and Jabiru Kabolkmakmen (2019), Investing in the bush: Jabiru Kabolkmakmen to guide the future of Jabiru, media release, 31 July, http://newsroom.nt.gov.au/api/attachment/byId/11535.

ICMM (2018), *Social Progress in Mining-Dependent Countries: Analysis Through the Lens of the SDGs*, International Council on Mining and Metals, London.

ICMM (2015), *Good Practice Guide: Indigenous Peoples and Mining*, second edition, ICMM, London.

ICMM (2013), "Indigenous Peoples and Mining", position statement, ICMM, London.

IMF (2015), *Niger: Selected Issues*, International Monetary Fund, Washington, DC.

Margarula, Y. (2005), Foreword, in *Submission to House of Representatives Standing Committee on Industry and Resources Inquiry into Developing Australia's Non-Fossil Fuel Energy Industry*, Gundjeihmi Aboriginal Corporation, Jabiru, p. 1.

NEA/IAEA (2020), *Uranium 2020: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_52718/uranium-2020-resources-production-and-demand.

NEA/IAEA (2018), *Uranium 2018: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_15080/uranium-2018-resources-production-and-demand.

Northern Territory Government (2019), *A Bright Future for Jabiru*, Northern Territory Government of Australia, 14 August 2019, https://nt.gov.au/news/2019/a-bright-future-for-jabiru.

Northern Territory Government (2018), "Northern Territory Budget 2017-2018: Northern Territory Economic Overview", https://treasury.nt.gov.au/dtf/financial-management-group/previous-budget-papers.

NUA (2020), Uranium Mining in Namibia, Namibian Uranium Association, Swakopmund, Namibia, www.namibianuranium.org/uranium-mining-in-namibia/.

NUA (n.d.), Corporate Social Responsibility – Making a Difference, NUA, Swakopmund, Namibia, www.namibianuranium.org/corporate-social-responsibility.

Orano (2020), Niger: Responsible Mining, Orano, https://orano.group/en/expertise/orano's-sites-around-the-world/uranium-mines/niger/responsible-mining.

Orano (2018), *Corporate Social Responsibility Report*, Edition 2018, Orano, Courbevoie, France, p. 4.

Orano (n.d.[a]), Northern Saskatchewan Presence, Orano, http://canada.orano.group/EN/canada-207/orano-canada-incsustainabilitynorthern-saskatchewan-presence.html.

Orano (n.d.[b]), Orano in Niger, Orano, www.orano.group/en/orano-across-the-world/niger.

Orano (n.d.[c]), Cominak: Remediation Project, Orano, www.orano.group/reamenagement-cominak/en.

Owen, J.R. and D. Kemp (2013), "Social licence and mining: A critical perspective", *Resources Policy*, Vol. 38, No. 1, pp. 29-35.

Reuters (2019), French nuclear group Orano's uranium mine in Niger to close in 2021, *Reuters*, 23 October, www.reuters.com/article/us-niger-uranium/french-nuclear-group-oranos-uranium-mine-in-niger-to-close-in-2021-idUSKBN1X22B7.

Roberts, R.G., R. Jones and M.A. Smith (1990), "Thermoluminescence dating of a 50,000-year-old human occupation site in Northern Australia", *Nature*, Vol. 345 (10 May), pp. 153-156. https://ui.adsabs.harvard.edu/link_gateway/1990Natur.345..153R/doi:10.1038/345153a0

Rössing Foundation (2018), *Annual Report 2018*, Rössing Foundation, Windhoek, www.rossingfoundation.com/files/rf_annual_report2018.pdf.

Rössing Uranium (2020), *Our Value Addition and Summary Annual Financial Statements*, Rössing Uranium, Windhoek, www.rossing.com/value_addition.htm.

Saskatchewan Mining Association (2019), Uranium in Saskatchewan, http://saskmining.ca/ckfinder/userfiles/files/2019%20UinSK%20factsheet%20final%20web.pdf.

Social Medicine (2007), "Civil society's report to the Commission on Social Determinants of Health", *Social Medicine*, Vol. 2, No. 4 (October 2007).

Six Rivers Fund (2020), A Legacy for Northern Saskatchewan, https://sixriversfund.ca.

Sloan, P. and R. Hill (1995), *Corporate Aboriginal Relations: Best Practice Case Studies*, Hill Sloan Associates, Toronto, p. 35.

Thomson, I. and R.G. Boutilier (2011), "Social license to operate", in *SME Mining Engineering Handbook*, 3rd edition, ed. P. Darling, Society for Mining, Metallurgy and Exploration Inc., Englewood, CO, pp. 1779-1796.

UNDP (2019), "Table 1: Human development index and its components", in *Human Development Report*, http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components-1.

WHO (2020), Social Determinants of Health: Civil Society, World Health Organization, Geneva, www.who.int/social_determinants/themes/civilsociety/en.

Chapter 4

Uranium royalties and taxation

Mining is a major contributor to the world economy, occupying a prime position at the beginning of the global supply chain and providing resources that can enable the shift to a low-carbon future. Mining's benefits for many countries are evident in multiple areas, including gross domestic product (GDP), foreign direct investment, export earnings, and mineral rents paid to host governments. Like other extractive industries, the uranium mining industry can generate significant social and economic advantages directly through increased employment, training, salaries and wages (as discussed in previous chapters) as well as government revenues (i.e. royalties and taxes). The industry can also provide economic stimulus to the local and broader economy through secondary industries, such as those in the retail and service sectors that supply the mine and its employees.

Host governments must decide on taxation levels and methodologies, and on disposition of the resulting revenues, based on desired economic and social policy outcomes. Policy decisions must balance the promotion of mine development with the potential benefits for (and impacts on) host communities. Stakeholder consultation is essential, as the impacts of mining are greatest at the local level (NEA, 2014).

Background

Two of the main forms of government income from mineral exploitation are royalties and taxes, usually characterised as a payment due to the sovereign owner of the resource in exchange for the right to extract and derive a profit from that resource. What are known as "resource rents" are unique to the natural resources sector.

It is important to factor taxation into the economic forecasting and evaluation part of the decision-making process for uranium project development. As taxation can be applied to a mine's entire life cycle, companies will begin comparing the rates of different jurisdictions as soon as exploration funding has been assigned. Any country or region trying to attract and foster uranium industry development must therefore be aware of national and international royalty and tax rates, as they are an important consideration for companies that operate globally. Royalty/tax systems can be profit-based or revenue-based, or a hybrid combination of the two, and each jurisdiction and commodity can have its own system.

In discussing mineral royalties and taxation, it is important to know how these revenues will be distributed and what the social and economic consequences will be. It is the host government receiving these revenues that must take both economic and social licence considerations into account to decide on a disposition method and beneficiaries. Unsurprisingly, these decisions are often subject to considerable public and political debated regarding the potential positive and negative impacts of a uranium development and resource rents that may be received and distributed. Depending on the jurisdiction, revenue distribution may be direct (e.g. revenue sharing with affected stakeholders) or indirect (e.g. public spending from general revenues).

The total marginal tax rate for a uranium development will include multiple taxes, such as corporate income taxes, capital taxes, sales taxes and payroll taxes that may be administered by federal, provincial or municipal authorities, and some jurisdictions may also apply mineral royalties or taxes. This chapter focuses specifically on uranium industry royalty/taxation policies, which directly affect uranium development decisions.

The Extractive Industries Transparency Initiative (EITI) was founded in 2003 in response to growing international concern about transparency in the management of government revenue streams. The EITI initiated a process by which governments and companies voluntarily disclose the revenues they receive from extractive-industry companies (Box 4.1).

Box 4.1. The Extractive Industries Transparency Initiative

In 2003, a diverse group of countries, companies and civil society organisations attended the Lancaster House Conference in London, hosted by the UK government. Participants agreed to a Statement of Principles to increase transparency regarding payments and revenues received from the extractive industries sector; these principles became the cornerstone of the EITI. According to the principles, wealth gained from a country's natural resources should benefit all its citizens, necessitating high standards of transparency and accountability in all aspects of natural resource management, including taxation, commodity trading and licensing.

Mineral royalty and tax regimes that aim to provide a jurisdiction with a specific economic result must acknowledge that uranium prices (and thus revenues) are based on uranium supply and demand, and may therefore be affected by decisions and events in the global nuclear market. One example is Japan's Fukushima Daiichi Nuclear Power Plant accident of March 2011, which continues to affect uranium prices today (NEA/IAEA, 2020).

This chapter presents a comparative case study of two leading uranium jurisdictions (Saskatchewan, Canada, and Australia's Northern Territory) to provide specific information on different royalty systems, as well as on methodologies and results.

Saskatchewan, Canada – Royalty system

As discussed in Chapter 1, Canada is the world's second-largest uranium producer, with Saskatchewan being its only currently producing jurisdiction. In 1930, under the Natural Resources Transfer Agreement, the Government of Canada transferred jurisdiction of mineral ownership to the country's western provinces, including Saskatchewan. This transfer granted Saskatchewan the right to lease, manage and impose royalties and taxes on Crown minerals within the province. While uranium (as pitchblende) was first discovered in Saskatchewan in 1935, it was not produced in the province until 1953.

Prior to 1976, uranium royalties were regulated as a metallic mineral royalty under the Mineral Disposition Regulations 1961. The royalty was levied at a maximum of 12.5% of "income derived from mining operations" (Government of Canada, 1961).

Saskatchewan's first uranium-specific royalty system was implemented in 1976 amid rising uranium prices and a government policy of allowing resource companies to earn a fair rate of return but taxing any excess returns. The system's policy objectives were to:

- Ensure that a fair and equitable share of the economic rent from hard-rock minerals was captured by the province as owner of the resource.
- Provide producers with an adequate rate of return on investment, bearing in mind that mineral exploration is a relatively risky proposition and that market fluctuations had been substantial.
- Leave marginal production decisions as unaffected as possible.
- Provide an incentive for exploration in Saskatchewan that was as great for potential producers as it was for existing producers.
- Guarantee a minimum payment to the province in return for its resources so that resources were not simply given away to maintain production.

The royalty system had a two-component structure in which the total was a combination of a basic revenue-based royalty (3%) and a graduated profit-based royalty (with rates rising from 0% to 50% as profits increased).

In 1980, amendments were made to clarify fair market value reporting requirements and royalty/taxation revisions that recognised certain expenditures. In 1988, the basic royalty rate was amended (from 3% to 5% of gross sales) and both a corporate capital tax and a resource credit were implemented. A capital tax surcharge of 2% coupled with a 1% Saskatchewan Resource Credit (SRC) were also added.

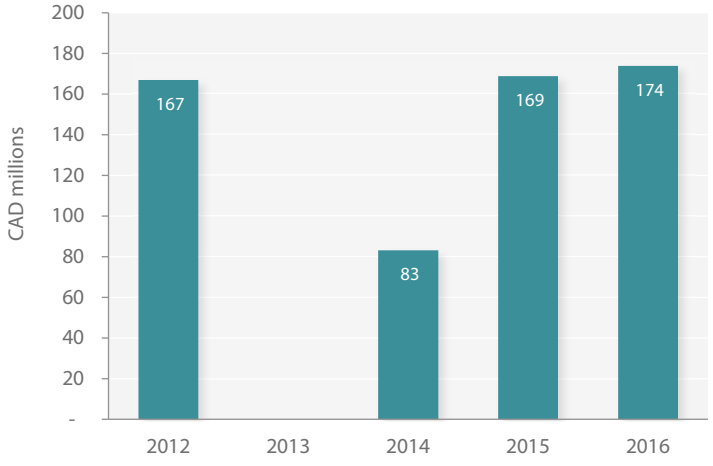
In 1990, the system was replaced to allocate the royalty burden more fairly among producers. It continued to ensure a fair financial return for the province and security for the industry by extracting higher royalties during years of high profitability and lower royalties in less-profitable periods. It maintained long-term revenue neutrality for the industry as a whole (relative to the 1976 system) but generated more revenues in the short term.

In 2001, another new system was implemented, this time entirely revenue-based. With new operating regimes no longer following the one-mine/one-mill design, companies could also report royalties on a consolidated corporate basis. The royalty system had three components: a base royalty (5% of gross sales), a tiered royalty (rates rose from 6% to 15% as the sales price increased), and the retained SRC (1% of gross sales).

In 2013, a new profit-based system was introduced to recognise costs incurred by the industry. The province returned to a profit-based system that acknowledges actual capital costs because this type of regime is more sensitive to industry profitability and is expected to promote new investment. The three components of this royalty system are a basic royalty (5% of gross sales), a profit royalty (rises from 10% to 15% as profit increases) and a revised SRC (0.75% of gross sales).

Between 2012 and 2016, the Canadian uranium mining industry paid more than CAD 600 million in taxes and royalties (not including income taxes) (Figure 4.1).

Figure 4.1. **Saskatchewan uranium mining industry production taxes and royalties**



Note: Data for 2013 are not currently available.

Saskatchewan royalty revenue disposition

As noted above, Saskatchewan gained the right to lease, manage and impose royalties and taxes on Crown minerals within the province thanks to the 1930 Natural Resources Transfer Agreement. While certain commodities in southern Saskatchewan have freehold ownership, all uranium operations are situated in northern Saskatchewan and sole ownership lies with the Crown, with no Indigenous rights formally existing on uranium mining lands.

Having sole ownership, the province of Saskatchewan receives all uranium royalties, and disposition of these revenues is the prerogative of its government. Since the beginning of uranium production in the province, all royalty monies have been deposited in Saskatchewan's General Revenue Fund (GRF), along with royalty payments from all other activities. The serving government therefore decides on the disposition of GRF funds in general, rather than determining specifically how uranium royalty revenues will be used.

As noted in Chapter 3, all of Saskatchewan's uranium production takes place in the northern part of the province. This region's sparse population is distributed among 48 First Nation, Métis and municipal communities situated distantly from one another. Of the approximately 38 000 residents, 80% self-identify as Indigenous.

Northern residents have consistently been raising the issue of revenue sharing since the first public inquiries of the 1970s, and they continued to do so at the federal-provincial panels of the 1990s. In fact, the 1977 Bayda (Cluff Lake) Inquiry recognised the issue and recommended that the provincial government "institute a royalty sharing scheme under which the government would pay a share to certain northern governing bodies and in return those northern governing bodies would undertake to perform certain governmental functions" (Bates, 1978).

When revenue sharing was raised during hearings of the Joint Federal-Provincial Panel on Uranium Mining Developments in Saskatchewan held from 1991 to 1997, the Government of Saskatchewan stated that it supports the responsible development of its uranium resources, provided that individual projects:

- adequately protect the environment;
- provide for worker health and safety;
- provide an equitable distribution of socio-economic benefits.

The province also affirmed that for every CAD 1 it receives in revenue (primarily through uranium royalties, as all other revenues are of very low value), it would spend CAD 1.60 in the north to support healthcare, education and training, social services, justice, community and economic development, and environmental protection.

To address socio-economic development and revenue sharing, Saskatchewan requires uranium operations to provide social and economic benefits through regulation, specifically through mine surface lease agreements and human resource development agreements (HRDAs), discussed in previous chapters. These agreements focus on maximising northern employment, training and business opportunities, and improving communications among stakeholders. Programmes and regulatory instruments developed in co-operation with the uranium industry, Indigenous communities and representative agencies to offer direction and economic benefits from royalty revenues include the Northern Labour Market Committee and Northern Career Quest (the Multi-Party Training Plan [MPTP] or Northern Saskatchewan Environmental Quality Committee [NSEQC]).

Cigar Lake mine, Saskatchewan, Canada (Cameco).

While revenue sharing, royalty revenue disposition and low-income population issues continue to co-exist in northern Saskatchewan, support for the uranium industry remains strong, with 82% of northerners in favour of it according to a public opinion survey undertaken in the autumn of 2018. The Government of Saskatchewan and uranium mining companies have maintained this high level of public acceptance through the continual evolution of development policies and industry supportiveness and proactiveness.

Northern Territory, Australia – Royalty system

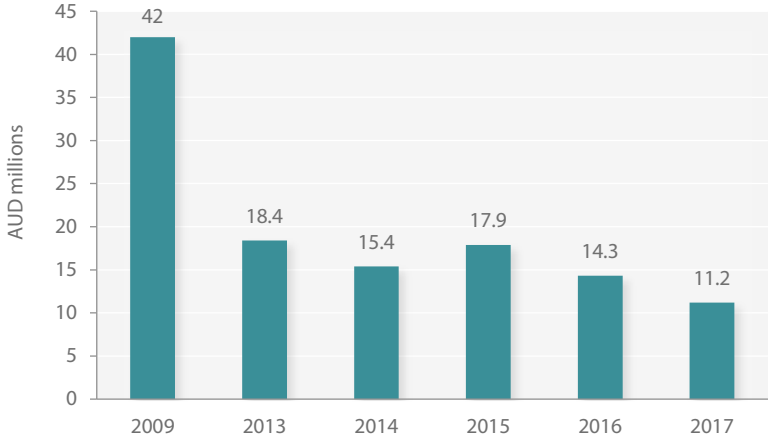
Although uranium (as tobernite) was first discovered in 1869 in what is now Australia's Northern Territory, uranium production did not begin until 1954 at Rum Jungle. The Government of Australia, through the Australian Atomic Energy Commission – the predecessor of today's Australian Nuclear Science and Technology Organisation (ANSTO) – was responsible for the mine located at this site.

When the Australian Government granted the Northern Territory self-government in 1978, it retained ownership of uranium and the power to approve the development of uranium mines. While at its political inception the Northern Territory was originally a self-governing jurisdiction under control of the Australian parliament, it did not have ownership of mineral rights, which were under the authority of the Australian Government. The Aboriginal Land Rights (Northern Territory) Act 1976, enacted by the Commonwealth, pre-dates self-government in the Northern Territory. While the Act endowed the Crown with mineral property rights, it vested title to the land in Land Trusts on behalf of traditional Aboriginal owners.

In 1977, the Northern Territory Mining Ordinance determined the amount of royalties on uranium production as 1.25% of the gross proceeds of uranium sales, minus transport costs. The rate for production taking place on Aboriginal reserve land was 2%.

In 1980, however, royalties for uranium mining operations in the Territory were determined case by case, based on a range of considerations such as world uranium market conditions, payments negotiated with Traditional Owners, losses or damages likely to be suffered by Indigenous communities due to mining operations, and royalty rates for other mines. *Ad valorem* royalty rates were accordingly set at 5.5% for the Ranger mine, 3.75% for Nabarlek and 5.25% for Jabiluka (which was never mined). Under the latest Ranger arrangements, the *ad valorem* royalty of 5.5% was collected by the Australian Government and then shared between the Aboriginal Benefits Account (4.25%) and the Northern Territory Government (1.25% as a grant in lieu of uranium royalties). As of 2012, ERA had paid a cumulative AUD 345 million to Aboriginal interests and AUD 100 million to the government in royalties (ERA, 2014). In 2009, for example, its royalty payments amounted to AUD 42 million (Figure 4.2).

Figure 4.2. **ERA annual royalty payments, 2009-2017**



Note: Based on data from ERA reports.

In 2013, the Gundjeihmi Aboriginal Corporation, the Northern Land Council, ERA and the Government of Australia finalised a suite of agreements governing operations at the Ranger Project Area, including a new mining agreement. These agreements entitle the Traditional Owners (the Mirarr people) to a greater share of the benefits from mining on their land, including a larger portion of royalties. They also established a regional socio-economic trust and a Relationship Committee with ERA to promote information sharing and collaboration. Total royalty rates have remained unchanged at 5.5%.

From the time Ranger mine began operating to the present, ERA has paid more than AUD 1 billion in taxes to the Australian Government. Ranger mine's operations have also resulted in the payment of more than AUD 500 million in royalties to individual and community beneficiaries (ERA, 2019).

Ranger Uranium Mine adjacent to Kakadu National Park, Northern Territory, Australia (Rhonda.W, Creative Commons).

Northern Territory royalty revenue disposition

As explained above, while the original Aboriginal Land Rights (Northern Territory) Act 1976 allowed the Commonwealth to retain mineral property rights, title to the land was nevertheless vested in Land Trusts on behalf of traditional Aboriginal owners. Under current Ranger mine arrangements, ERA pays an *ad valorem* royalty of 5.5% collected by the Commonwealth government and subsequently shared between the Aboriginal Benefits Account (4.25%) and the Northern Territory (1.25%).

Although the 1997 report *Impact of Uranium Mining on Aboriginal Communities in the Northern Territory* indicates that paying royalties directly to Traditional Owners has negative social impacts (Wilson, 1997), not all outcomes from royalty payments have been negative, and in some cases uranium royalties have provided significant benefits. In the 1980s and 1990s, the Gagudju Association received royalties from the Ranger mine and used this revenue to develop successful tourism ventures, build trust funds for children, assist its members, and supplement personal incomes and expand health and education services at Gagudju out-stations.

Box 4.2. **Wyoming, United States: Permanent Mineral Trust Fund**

Wyoming has the largest known uranium ore reserves in the United States (Wyoming Mining Association, 2017). Commercial uranium production started around 1953, but prospection had begun as early as 1918. From the 1950s through the early 1980s, production typically exceeded 2 000 tonnes of uranium (tU) per year, peaking at approximately 4 600 tU in the late 1970s. However, it declined precipitously thereafter, with output (based on in situ leaching) estimated at 758 tU in 2016, accounting for 78% of the US production. In June 2017 the Wyoming uranium industry employed about 300 people, compared with roughly 5 300 in the late 1970s (Wyoming Mining Association, 2017).

Various local, state and federal taxes and fees are assessed on all minerals, including uranium, in the State of Wyoming. The main direct taxes are a severance tax, an ad valorem tax, income tax, payroll tax and sales tax. Severance for extracted minerals is assessed at 4% of gross production, and ad valorem taxes are also charged at a rate of 4%. Revenues from specific taxes are paid to each responsible government agency (e.g. state or county), as are the required licensing and permitting fees. Direct taxes on uranium mining peaked recently, at over USD 80 million in 2015.

Wyoming relies heavily on revenues from mineral production and in 1974 established the Permanent Wyoming Mineral Trust Fund (PWMTF), which acts as an endowment with interest and investment income going to the state's general fund (Kenton, 2019). The PWMTF applies to both minerals (including uranium) and petroleum production, and its primary goal is to ensure the sustainability of benefits from mineral resources for future generations. The state constitution designates a 1.5% severance tax to be deposited in the PWMTF, and over the years additional amounts of up to 1% have been levied as supplementary severance taxes. In 2019, the PWMTF had over USD 8.2 billion in protected assets (Wyoming State Treasurer, 2020), and as of 2015 had generated USD 4.5 billion in interest income, which is deposited into Wyoming's general fund to be distributed and spent through the state budget. The PWMTF is a very valuable tool, as it enables the State of Wyoming to not only benefit from its mineral wealth, but to preserve some of that wealth for future generations and to weather the volatility of the extractive industry sector.

Lessons learnt and recommendations

Royalty systems and methodologies vary widely among jurisdictions because they are designed to meet government objectives, whether they be revenue generation or the promotion of social and economic development. Such systems are nonetheless subject to external factors such as market fluctuations, which can impair their ability to achieve the desired objectives and may therefore require their revision. It has been demonstrated in both Saskatchewan and the Northern Territory that using revenue-based, profit-based or hybrid methodologies can successfully achieve economic objectives.

Methodologies for distributing uranium royalty revenues are similarly designed to meet a government's legislative or policy objectives, which are primarily to ensure that affected local populations benefit from uranium developments. In the case of Saskatchewan, while direct revenue sharing continues to be a concern for local stakeholders, the methodology for delivering socio-economic benefits through government programming has provided sums that may actually exceed royalty revenues, to significant positive effect. In Australia's Northern Territory, direct revenue sharing has produced both positive and negative outcomes, but a lack of education and support to manage the revenues has arguably resulted in significant adverse social impacts.

When designing a tax system, policymakers must keep in mind the important effect of taxes on project economics and on future investment. The overall tax system should be equitable for both the country and the region, as well as for local communities and the investor bearing the financial risk. Although there is no one ideal royalty/taxation policy approach, policymakers should carefully consider the long-term benefits to be gained from a sustainable uranium mining industry that will contribute to increasing the standard of living for local communities, infrastructure projects and economic diversification.

For developing countries (e.g. Niger), it is particularly important to ensure the efficient, transparent and sustainable use of uranium resource revenues to finance poverty reduction programmes, while striking the right balance between immediate spending and conservation of assets for the future. Unlike developed economies, Niger does not have access to a variety of domestic financing options for its public investment and infrastructure projects (IMF, 2015). Moreover, the country has not yet established a well-functioning sovereign wealth fund to save against revenue volatility and ensure intergenerational equity.

Finally, there is a need for all uranium-producing countries to proactively address transparency, governance and management of revenue streams from uranium resources – an increasingly important topic for the international community. Greater company and government engagement with the EITI is therefore advisable.

References

Australian Institute of Aboriginal Studies, Uranium Impact Project Steering Committee (1985), *Aborigines and Uranium: Consolidated Report on the Social Impact of Uranium Mining on the Aborigines of the Northern Territory,* Australian Government Publishing Services, Canberra.

Bates, D.V. (1978), "The final report of the Cluff Lake Board of Inquiry: Review of health and environmental considerations", *Musk-Ox*, No. 24, pp. 7-9.

ERA (2019), *Sustainability Report 2018*, Energy Resources of Australia, Darwin.

ERA (2014), *Ranger 3 Deeps Draft Environmental Impact Statement*, Energy Resources of Australia, Darwin.

Government of Canada (2013), "Crown Minerals Royalty Regulations", Chapter C-50.2 Reg. 29 (effective 1 January 2013), R.R.S. Saskatchewan, http://canlii.ca/t/52zsz.

Government of Canada (1961), "Mineral Disposition Regulations 1961", Saskatchewan, and subsequent amendments.

Government of Canada (1930), "The Saskatchewan Natural Resources Act S.C. 1930", c. 41, https://laws-lois.justice.gc.ca/eng/acts/T-10.49/page-1.html#docCont.

IMF (2015), *Niger: Selected Issues*, International Monetary Fund, Washington, DC.

Kenton, W. (2019), Permanent Wyoming Mineral Trust Fund (PWMTF), www.investopedia.com/terms/p/permanent-wyoming-mineral-trust-fund.asp.

NEA (2014), *Managing Environmental and Health Impacts of Uranium Mining,* OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_14766/managing-environmental-and-health-impacts-of-uranium-mining.

NEA/IAEA (2020), *Uranium 2020: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_52718/uranium-2020-resources-production-and-demand.

NEA/IAEA (2018), *Uranium 2018: Resources, Production and Demand,* OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_15080/uranium-2018-resources-production-and-demand.

RUEI (1997), *Second Report,* Australian Government Publishing Service, Canberra, www.environment.gov.au/science/supervising-scientist/publications/ranger-uranium-environmental-inquiry-report-final.

Wilson, I. (1997), *Impact of Uranium Mining on Aboriginal Communities in the Northern Territory,* Committee Office, Department of the Senate, Australia, www.aph.gov.au/Parliamentary_Business/Committees/Senate/Former_Committees/uranium/report/c11.

Wyoming Mining Association (2017), *2017 Wyoming Uranium: An Overview*. *Wyoming*. Legislature Joint Minerals Committee, Casper, Wyoming.

Wyoming State Treasurer (2020), Wyoming State Investment Portfolio, https://statetreasurer.wyo.gov/wp-content/uploads/2020/09/Packet-08312020.pdf.

Chapter 5

Uranium exports, imports and security of supply

Introduction

Uranium is unique among extractive commodities, both for historical reasons related to its military use and because of its importance as a key material for energy security of supply, given that the metal is used primarily as nuclear power plant fuel. As a result of uranium's strategic value, governments have been involved extensively in its production, trade and use.

Uranium resources and the nuclear industry have been generating significant export earnings and government revenues for several decades. In Canada, in addition to the value of the uranium used to fuel domestic nuclear reactors, which meet about 15% of the country's electricity needs (NEA, 2020), uranium exports inject roughly CAD 1.2 billion per year into the economy (CNA, 2020). Canada also exports fuel-grade natural uranium dioxide (UO_2) and reactor systems, putting the nation's overall nuclear industry revenues at over CAD 6 billion annually (CNA, 2020).

Uranium mining is also an important economic enabler in Namibia: along with other mineral resources such as diamonds, it provides one-quarter of Namibia's revenues and accounts for over half of its annual export earnings. For instance, Namibia's uranium exports from 2007 to 2012 were worth about NAD 28.4 billion (NSA, 2013), and recently Namibia's uranium sector attracted the country's largest foreign direct investment through a joint venture with a Chinese state-owned corporation.

Globally, approximately 443 nuclear reactors are operational in more than 30 countries, with an installed net generation capacity of about 400 gigawatts electrical (GWe) supplying 10% of the world's electricity. Five new nuclear reactors were connected to the grid in 2020, construction began on another four, and six were shut down (IAEA, 2021). Expansion, as well as near- and long-term growth prospects, remains centred in Asia, which is home to 29 of the 52 reactors under construction in May 2021. Uranium demand will remain robust as long as the global economy and electricity usage continue to grow, and as countries begin to use nuclear energy more extensively to meet their CO_2 emissions reduction targets.

Export trade markets acknowledge the strategic significance of uranium that differentiates it from other energy commodities and recognise that special arrangements need to be made for uranium-trading countries to distinguish between civil and military applications of nuclear energy. For this reason, uranium may be exported for peaceful purposes only, with national and international provisions to guarantee that safety, security and safeguarding (non-proliferation) objectives are being met throughout the fuel cycle. These regulations are administered by governments, regional and international organisations such as the International Atomic Energy Agency (IAEA) and the European Atomic Energy Community (Euratom).

Uranium is not traded on an open market like other commodities; instead, buyers and sellers negotiate contracts directly. Prices are published by independent market consultants (e.g. UxC and Trade Tech), and some price-related data are published by public authorities such as the Euratom Supply Agency (ESA) and the US Energy Information Administration.

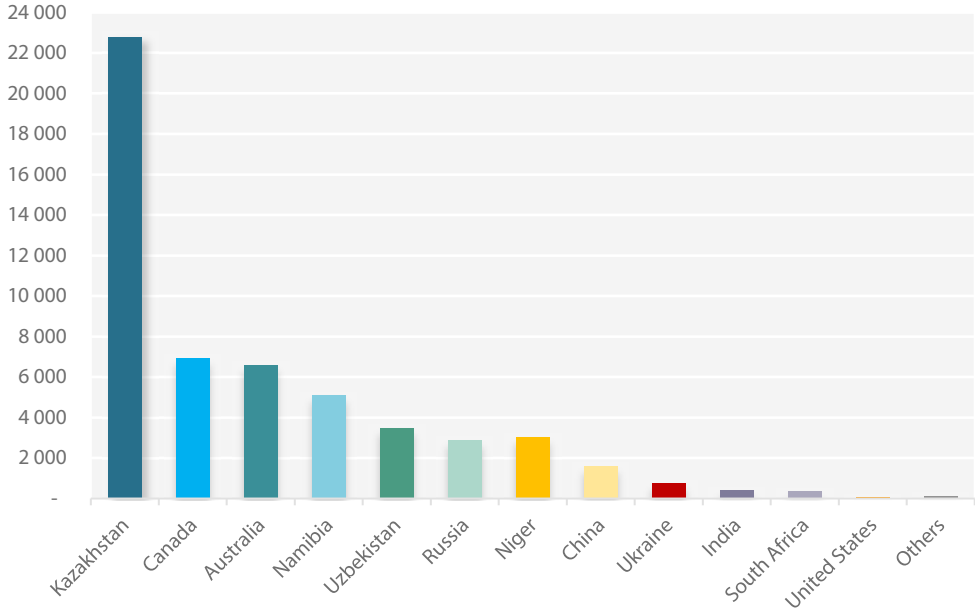
Global uranium production and consumption and exports and imports

Annual world uranium demand amounts to about 62 500 tonnes of uranium (tU), supplied from mines, stockpiles and secondary sources (NEA/IAEA, 2018). When initial cores for new reactors coming into service are considered, consumption increases to about 67 500 tU (WNA, 2019). While nuclear capacity is expanding slowly, at the same time reactors are being run more efficiently, with higher capacity factors and reactor power levels. Rising fuel demand is thus being offset by greater efficiency, causing overall demand to fall: indeed, from 1970 to 1990 uranium demand per kilowatt hour (kWh) of output in Europe dropped 25% owing to such improvements, which continue to be implemented today.

Nevertheless, global demand for uranium is expected to continue rising into the foreseeable future as nuclear power use expands with increasing electricity usage and the need for more low-carbon electricity generation to support decarbonisation in other industries and economic sectors. Under these circumstances, annual global reactor requirements are projected to rise to 100 225 tU by 2040 (NEA/IAEA, 2020).

As Chapter 1 describes, Kazakhstan is the world's leading uranium exporter. Its 2019 uranium production of 22 808 tU made up 43% of total worldwide uranium output (Figure 5.1). Canada produced 6 938 tU in 2019, or 13% of world production, and Australia's 6 944 tU accounted for 12%. These three countries along with Namibia, Niger and Uzbekistan provided approximately 85% of the world's uranium supply.

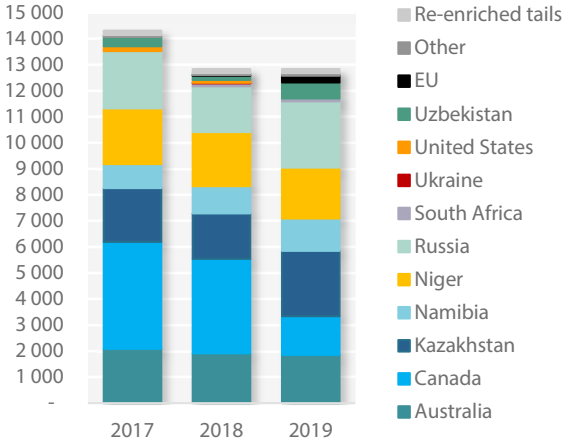
Figure 5.1. **Global uranium production, 2019 (tU)**



Source: NEA/IAEA, 2020.

The 2019 global trade in natural uranium was worth approximately USD 5.5 billion at the average 2019 spot price. The world's foremost importers of uranium are the European Union and the United States, but demand from China, South Korea and Russia is also high. The European Union imports almost 100% of the natural uranium it needs, accounting for about 20% of the world's annual uranium imports.

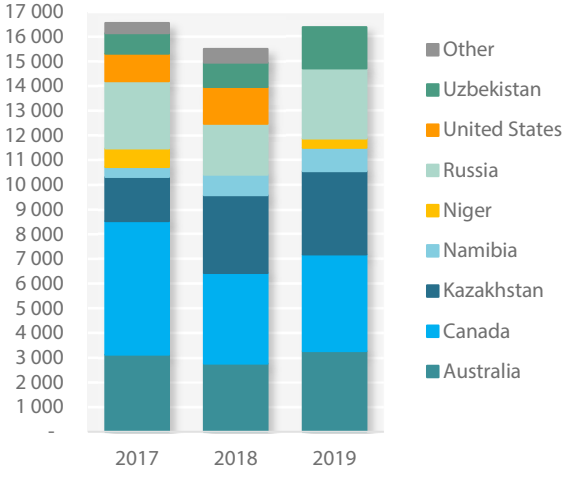
Figure 5.2. **Origins of uranium delivered to EU utilities in 2017, 2018 and 2019 (tU)**



Source: ESA (2019), *Annual Report 2018*.

The United States imports more than 90% of the natural uranium it uses, and its annual purchases represent about 25% of global uranium imports.

Figure 5.3. **Origins of uranium delivered to US utilities in 2017, 2018 and 2019 (tU)**

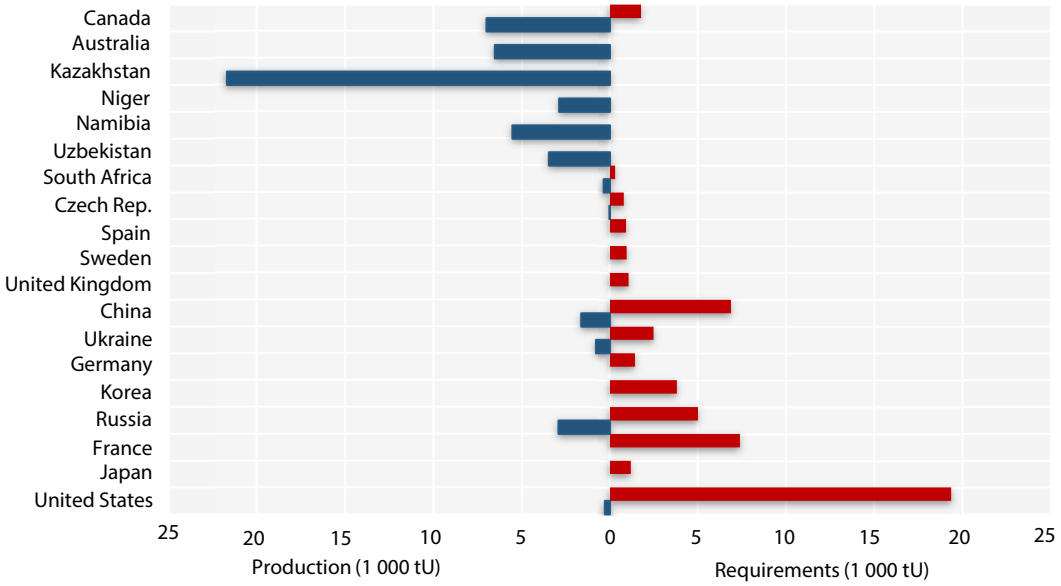


Note: The 2019 data for the United States and Other are withheld to avoid disclosure of individual company data.

Source: EIA (2020), *Uranium Marketing Annual Report 2019*.

As the major uranium-producing countries either do not use uranium or they produce much more than they consume, the largest portions of produced uranium are exported from countries that do not operate nuclear power reactors to those that do. Countries such as Australia (see Box 5.1), Kazakhstan, Namibia and Niger export all the uranium oxide concentrates produced in their territories, whereas Canada, China, Russia, South Africa and Ukraine are examples of producing countries that consume either part or all of the uranium they mine (Figure 5.4). Approximately 85% of Canada's uranium production is exported, while the rest is used to power domestic reactors.

Figure 5.4. **Uranium production and reactor-related requirements for major producing and consuming countries, 2019**

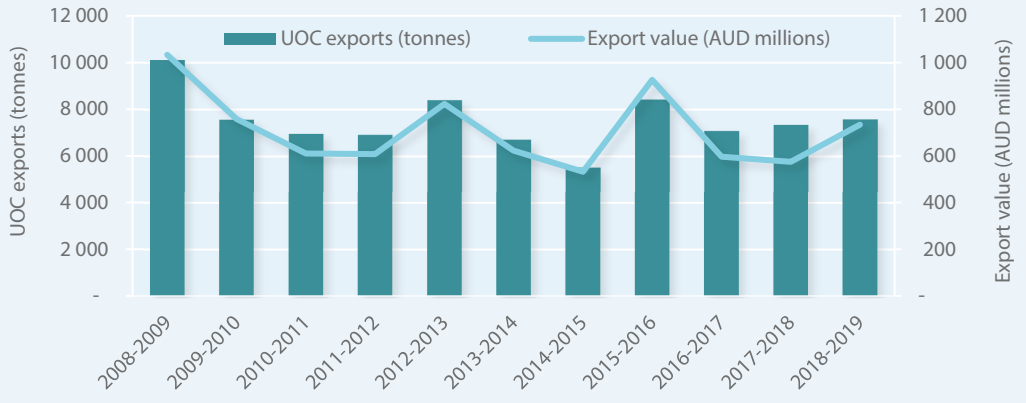


Source: NEA/IAEA, 2020.

Box 5.1. **Australia's uranium export value**

Uranium is an important revenue-earning export for Australia. In 2008-2009, for example, Australia exported AUD 1.03 billion worth of uranium from 10 114 tonnes of uranium oxide concentrate (UOC) (Figure 5.5). In 2015-2016, it exported 9 417 tonnes of UOC at a value of AUD 926 million, equivalent to 103% of Australia's electricity production (257 terawatt hours [TWh]); these exports could power about 40 (GWe) reactors. Australia's uranium export earnings were AUD 748 million in 2018-2019 in real terms, up from AUD 657 million in 2017-2018. Export volumes are forecast to decline from 2019-2020 as production decreases due to closure of the Ranger mine in January 2021. Earnings are also expected to fall to AUD 585 million in 2020-2021, though the forecast price increase will offset the drop in production somewhat.

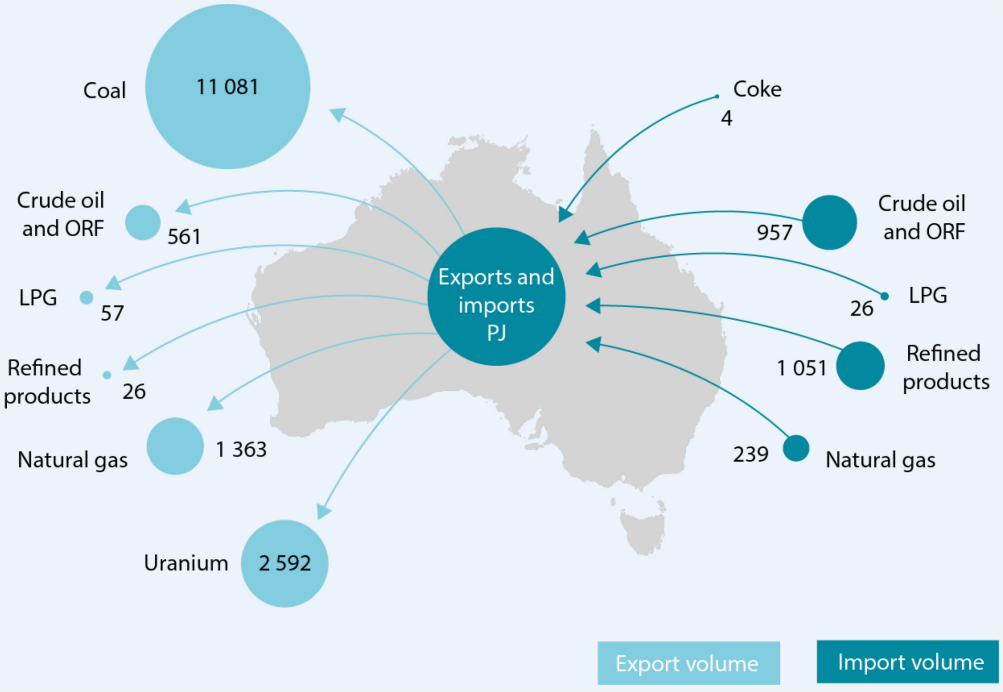
Figure 5.5. **Australian uranium export quantities and value**



Sources: ASNO (2016), Annual Report 2015-2016; ASNO (2019), Annual Report 2018-2019.

While uranium is not as significant in terms of value and volume as coal exports, in petajoules (PJ) of energy it makes up a substantial part of Australia's energy portfolio: for example, it represented about 17% of the country's energy exports in 2014-2015 (Figure 5.6). This explains its strategic importance to Australia's major trading partners, especially China.

Figure 5.6. **Australian energy resource exports, 2016**



Notes: ORF = other refinery feedstock. LPG = liquefied petroleum gas.

Source: Department of Industry, Innovation and Science (2016), *Australian Energy Update 2016*. Licensed from the Commonwealth of Australia under a Creative Commons Attribution 3.0 Australia Licence.

Australian uranium export markets include Belgium, Canada, China, Finland, France, Germany, Japan, Korea, Spain, Sweden, the United Kingdom and the United States. In addition, the Australian Government finalised a bilateral agreement with India in December 2015 to make that country a future market for Australian uranium (though no uranium had been exported to India at the time of writing). Also in December 2015, the Australian Government finalised an agreement with the United Arab Emirates (UAE) to allow Australia to sell uranium to this growing market. Four nuclear units (5.6 GWe) are now under construction, and the first units of the Barakah nuclear energy plant began operating in August 2020. Furthermore, the Australian Government signed a bilateral agreement with Ukraine in 2016, enabling Australia to sell uranium to this important market as well. Ukraine already has 15 reactors, and the country's government foresees a 45% nuclear share in electricity production by 2035 (NEA/IAEA, 2018).

However, Australia is not just a producer and exporter of mineral resources: it also provides specialised equipment for extraction and processing; sophisticated technologies; and expert services such as engineering, mapping and geological analysis. The mining equipment, technology and services (METS) sector represents about 7% of GDP and employs more than 7% of Australia's labour force – more than the mining sector itself (Korinek and Ramdoo, 2017).

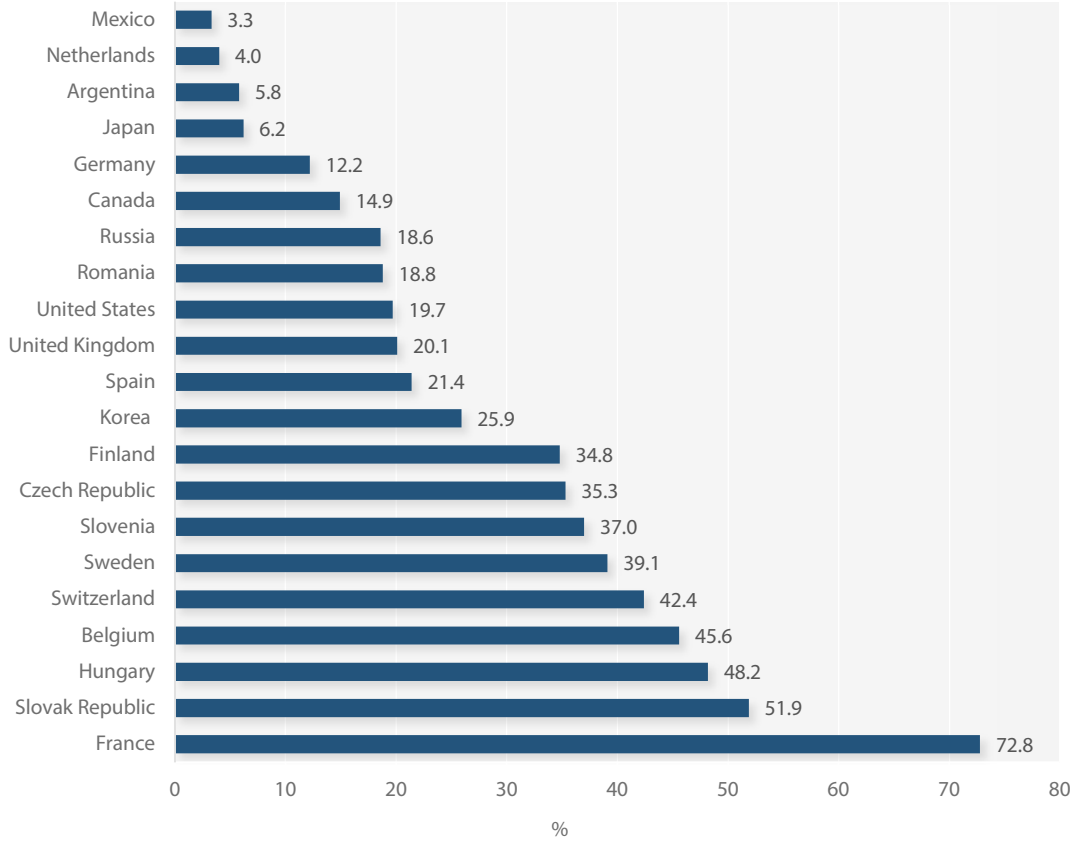
Security of supply

A major concern of nuclear power reactor operators is to ensure continuous fuel availability and the prevention of supply disruptions. As electricity produced by nuclear power plants is a reliable source of low-carbon baseload electricity, it plays an important role in energy security.

The world began confronting the COVID-19 pandemic in early 2020, and by March of that year most countries were imposing national lockdowns affecting social and economic life. Although the impact of these lockdowns on nuclear power plants has been limited, as no reactor units were forced to shut down, the consequent drop in electricity demand reduced the output of many plants or extended routine outages. It is noteworthy that nuclear energy and renewables have been the energy sources least affected by the pandemic situation; in contrast, fossil fuel demand and production have fallen drastically (IEA, 2020). Nuclear energy has been one of the most resilient electricity sources during the crisis, and the nuclear fuel cycle industry has also proved robust. While the COVID-19 pandemic triggered a drop in uranium supplies as the main producers suspended operations and temporarily closed their mines in 2020, the suspension of uranium activity did not disrupt the performance of nuclear power reactors owing to significant stocks held by utilities and fuel cycle producers.

Nuclear energy provides more than 50% of the electricity in France, Hungary, the Slovak Republic and Ukraine, and it is an important part of the energy mix in several other countries (Figure 5.7). As several more nations are also seeking to include nuclear power in their energy mix, securing nuclear fuel supplies (including natural uranium at the first stage of the fuel cycle) will be important in the decades ahead. One key goal to ensure long-term security of supply is to maintain nuclear industry viability at every stage of the fuel cycle.

Figure 5.7. **Nuclear power share of total electricity production in OECD/NEA countries (1 January 2020)**



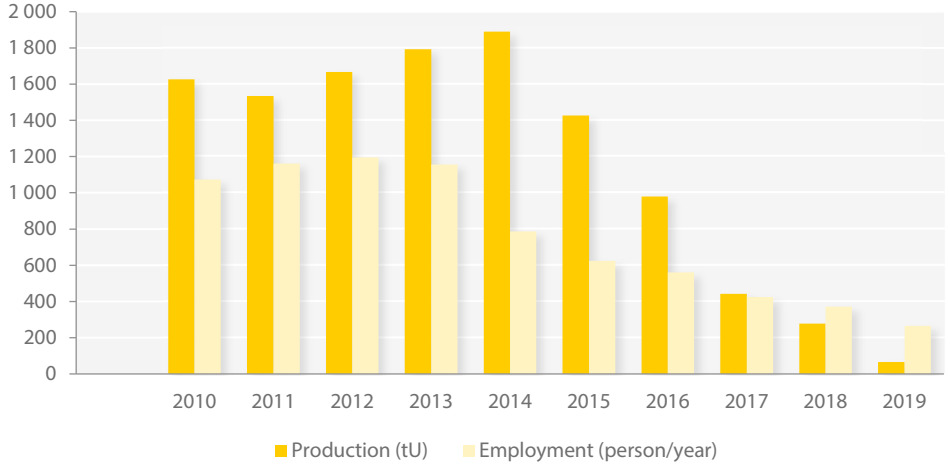
Source: NEA (2020), *Nuclear Energy Data 2020*.

To ensure nuclear fuel security of supply for EU users, the Euratom Treaty[4] (Euratom, 1957) was signed in 1957 to create a common nuclear market. The ESA was also established by treaty, and it applies a supply policy based on the principle of equal access to source materials and nuclear fuel for all users. It focuses on improving security of supply for users in the European Union, contributing to the viability of the European nuclear industry. It recommends in particular that Euratom utilities operating nuclear power plants maintain stocks of nuclear materials, and that they ensure their requirements by entering into multi-year contracts to diversify their supply sources and prevent excessive dependence on any single supply source from a non-EU member state. Diversification is advised for all stages of the fuel cycle.

Policy impacts on market activity

In the United States, uranium production fell to an historical low of 67 tU in 2019, 29 times lower than in 2014 (Figure 5.8).

Figure 5.8. **United States uranium production and employment, 2010-2019**



Sources: Based on data from EIA (2020) and NEA/IAEA (2020).

In 2018, two US uranium producers submitted a petition to the US Department of Commerce for Relief Under Section 232 of the Trade Expansion Act of 1962 for uranium products imports that threaten national security. At the heart of the complaint was whether the domestic uranium industry is threatened by unfair competition from Kazakhstan, Russia and Uzbekistan, and whether reliance on these countries for uranium supplies also threatens national security, including uranium-dependent defence assets (such as the Navy's nuclear-powered vessels) and civilian nuclear power reactors.

The US president established a working group to undertake deeper analysis of national security considerations with respect to the entire nuclear fuel supply chain, and this working group has confirmed that it is in the country's national security interest to preserve the assets and investments of the entire US nuclear enterprise and to revitalise the sector to regain global nuclear energy leadership. According to the report *Restoring America's Competitive Nuclear Energy Advantage: A strategy to assure US national security*, immediate action should be taken to support the domestic uranium and conversion industries by establishing a uranium reserve (DOE, 2020). In December 2020, the US Congress provided the Department of Energy with USD 75 million to establish a

4. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12012A/TXT.

domestic uranium reserve. The proposed uranium reserve would also serve as a limited backup supply source in the event of a market disruption. Additional longer-term actions include reducing permitting and regulatory burdens, placing greater value on the benefits of nuclear power, expanding research and development for the next generation of reactors and advanced fuels, and enhancing international competitiveness. The working group's strategy recommends policy options to create new commercial demand while recognising that the US national security interest is truly integrated with the health of the entire front end of the nuclear fuel cycle.

Additionally, the United States included uranium in its 2018 list of critical minerals (US DOI, 2018) generated pursuant to Executive Order 13817 (Executive Office of the President, 2017). In 2019, the US Department of Commerce published a critical-minerals strategy pursuant to the same executive order (US Department of Commerce, 2019). Among other topics, this multi-faceted strategy focuses on advancing research, development and deployment across the supply chain, strengthening US critical-mineral supply chains, enhancing international trade and co-operation related to critical minerals, reducing permitting times, and increasing the critical-minerals-related workforce. In 2020, the US president signed an executive order declaring a national emergency in the mining industry, aimed primarily at boosting domestic production of rare earth minerals and reducing the country's dependence on China. Uranium, as a critical mineral, is covered by the order.

In the past several years, US uranium producers and enrichment service suppliers have been expressing concern to the US Department of Commerce about the end-2020 expiry of the Agreement Suspending the Antidumping Investigation on Uranium from Russia (the Russian Suspension Agreement, or RSA). However, an October 2020 amendment, agreed upon by both the United States and Russia, extends the RSA through 2040 and reduces US reliance on Russian uranium to the end of this period (US Department of Commerce, 2020). Extension of this agreement beyond 2020, with an average import limit of 17% of US reactors' fuel requirements for the term of the amendment (lower than the current 20% quota), garnered both industry and political support. Despite the higher export limits of 24% of US enrichment demand in 2021 and 2023, the import limit remains at 20% until 2027, then will drop to 15% through 2040.

The amended agreement allows only a portion of the export quota to be used for the sale of natural uranium and conversion from Russia (on average, this portion will be equivalent to 7% of US enrichment demand, and no higher than 5% starting in 2026). It also changes provisions related to Russian enrichment feedstock exported from the United States by subjecting the foreign-origin feedstock enriched in third countries and exported back to the United States to the agreement's export limits, thereby making US-origin natural uranium more competitive. Finally, the amended RSA allows for US customers' pre-existing contracts for Russian uranium (signed prior to and during US Department of Commerce negotiations to extend the agreement) to be fulfilled (i.e. the agreement's limits are designed to enable almost all of these contracts to be carried out).

Lessons learnt and recommendations

Uranium is an important revenue-earning export for a number of countries, and a significant import commodity for those with a nuclear power generation fleet. Uranium may be exported for peaceful purposes only, under national and international regulations that cover the entire nuclear fuel cycle to ensure that safety and non-proliferation objectives are met.

A primary concern of nuclear power plant operators is to ensure continuous fuel availability and the prevention of supply disruptions. Since nuclear energy is a source for low-carbon electricity and it feeds more than 30% of electricity generation in 9 of the 21 NEA member countries, ensuring nuclear fuel (uranium) supply security is of major importance.

From a security-of-supply standpoint, nuclear power plant operators should ensure supply diversification (by both supplier and country of origin) at all relevant stages of the fuel cycle. Contracts for bundled sales of fuel assemblies (i.e. that include natural uranium as well as conversion, enrichment and fuel fabrication services) should allow operators to procure natural or enriched uranium from alternative suppliers. For new reactors in particular, contracts should stipulate the disclosure of fuel compatibility data and the testing of alternative fuel assemblies to enable the licensing and use of fuel assemblies produced by different fabricators.

It is also recommended that countries and operators maintain adequate strategic inventories of nuclear materials and use market opportunities to increase stocks of these materials, depending on individual circumstances (e.g. lead times for the fuel-cycle steps involved, number of reactors, etc.). To forestall the risk of being affected by shortages in the supply chain, utilities and producers should maintain adequate inventories. Concerning a strategic inventory of materials, the appropriateness of volume, form and location should be reviewed periodically to take new (geo)political (and policy) developments into consideration. Inventories should be available in different chemical forms, and their volume and location should be adjusted regularly according to the perception of risks and in anticipation of changes to the global situation. Market players are also advised to pursue market monitoring and contractual due diligence to limit exposure to market changes and minimise security-of-supply vulnerabilities.

It must also be recognised that, with few exceptions, investments to guarantee long-term nuclear fuel supply security are insufficient. With significant technological, market and energy system changes expected in the upcoming decade, strategic industrial investments must not be delayed any longer. The results of recent years' reduced uranium production and exploration will likely become more visible in the mid to long term, and the uranium market situation curbed investment in new uranium mines. In many cases, mining companies have to contend with a number of factors that hamper uranium project development: policy and regulatory issues, financing, public acceptance and, most importantly, future demand uncertainty.

For long-term security of supply, investments should be enlarged to maintain current industrial capacity, technological levels and expertise at all points in the fuel cycle. In addition, greater effort should be made to attract skilled workers and young graduates to the nuclear sector. Strategic investments in technologies, exploration and mining development should be encouraged within the 2030 investment horizon.

An increasing tendency towards protectionism appears to be emerging. Ironically, this could provide opportunities for domestic as well as vertically integrated mining companies. However, creating an open and supportive trading environment for the uranium industry and its supply chain partners would help increase productivity, foster the transfer of technology and innovative business practices to frontier regions and, finally, ensure low-carbon electricity supply security in many countries.

References

ASNO (2019), *Annual Report 2018-2019*, Australian Safeguards and Non-Proliferation Office, www.dfat.gov.au/publications/corporate/asno-annual-report-2018-19/site/index.html.

ASNO (2016), *Annual Report 2015-2016*, Australian Safeguards and Non-Proliferation Office, www.dfat.gov.au/sites/default/files/asno_annual_report_2015-2016.pdf.

CNA (2020), *The Canadian Nuclear Factbook 2020*, Australian Safeguards and Non-Proliferation Office, Ottawa, https://cna.ca/wp-content/uploads/2019/08/2020-Factbook-EN-digital.pdf.

Department of Industry, Innovation and Science (2016), *Australia Energy Update 2016*, Australian Government, Canberra, www.energy.gov.au/sites/default/files/2016-australian-energy-statistics.pdf.

DOE (2020), *Restoring America's Competitive Nuclear Advantage*, US Department of Energy, www.energy.gov/downloads/restoring-americas-competitive-nuclear-energy-advantage.

EIA (2020), *Uranium Marketing Annual Report 2019*, US Energy Information Administration, Washington, DC.

ESA (2020a), "Analysis of Nuclear Fuel Availability at EU Level from a Security of Supply Perspective", Report of ESA Advisory Committee Working Group on Prices and Security of Supply, Euratom Supply Agency, Luxembourg.

ESA (2020b), *Annual Report 2019*, Euratom Supply Agency, Luxembourg.

ESA (2019), *Annual Report 2018*, Euratom Supply Agency, Luxembourg.

Euratom (1957), *Treaty Establishing the European Atomic Energy Community (Euratom)*, Office for Official Publications of the European Communities, Luxembourg, http://data.europa.eu/eli/treaty/euratom_2012/oj.

Executive Office of the President (2017), "A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals", Executive Order 13817, www.federalregister.gov/documents/2017/12/26/2017-27899/a-federal-strategy-to-ensure-secure-and-reliable-supplies-of-critical-minerals.

IAEA (2021), Power Reactor Information System, https://pris.iaea.org/PRIs/Home.aspx, IAEA, Vienna.

IAEA (2020), COVID-19 Operational Experience Network (OPEX) and International Reporting System for Operating Experience (IRS), IAEA, Vienna.

IEA (2020), *World Energy Outlook 2020*, IEA, Paris.

Korinek, J. and I. Ramdoo (2017), "Local Content Policies in Mineral-Exporting Countries", OECD Trade Policy Paper No. 209, OECD Publishing, Paris.

NEA (2020), *Nuclear Energy Data 2020*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_56830/nuclear-energy-data-2020-/-donnees-sur-l-energie-nucleaire-2020.

NEA/IAEA (2020), *Uranium 2020: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_52718/uranium-2020-resources-production-and-demand.

NEA/IAEA (2018), *Uranium 2018: Resources, Production and Demand*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_15080/uranium-2018-resources-production-and-demand.

NSA (2013), *2012/13 Annual report*, Namibia Statistics Agency, Windhoek.

US Department of Commerce (2020), *U.S. Department of Commerce Finalizes 20-Year Amendment to the Suspension Agreement on Uranium from the Russian Federation*, www.commerce.gov/news/press-releases/2020/10/us-department-commerce-finalizes-20-year-amendment-suspension-agreement.

US Department of Commerce (2019), *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals*, www.commerce.gov/data-and-reports/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals.

US DOI (2018), "Final List of Critical Minerals 2018", US Department of the Interior, www.federalregister.gov/documents/2018/05/18/2018-10667/final-list-of-critical-minerals-2018.

WNA (2019), *The Nuclear Fuel Report Global Scenarios for Demand and Supply Availability 2019-2040*, World Nuclear Association, London.

Conclusions

The case studies and data provided in this report show that the social and economic benefits local communities and national economies can gain from uranium mining operations are considerable. However, not all uranium-producing countries have improved their socio-economic standings at the same rate.

Although some leading practices have been proven to support sustainability opportunities (e.g. training locals for mine, non-mine and goods and services jobs; redistribution of more tax revenues to local governments and communities; and greater transparency in resource rent collection and distribution), there is no one-size-fits-all prescription. Each country or mine is endowed with different uranium resources, community skill sets and infrastructure, and each has its own historical, social and cultural characteristics.

While this report's case studies confirm that uranium mining is a powerful vehicle to bring technologies and skills to both developed and developing countries and to remote regions, governments need to enact proactive policies to ensure that uranium projects contribute to sustainable social and economic development and avoid the negative impacts. To this end, policy and decision makers in countries with uranium operations or plans to develop their uranium resources should:

- Introduce a policy framework that co-ordinates uranium mine development with a broader long-term vision for national, regional and/or local socio-economic development. Co-operation among all stakeholders (the uranium industry, federal and local governments, local communities, and education and research institutes) is essential.
- Prepare a strategy to increase local economic diversification, either in the mining value chain or in other sectors in which the country and/or region has competitive advantages. Measures to support economic diversification can range from increasing the capacity of local companies/workers to providing proactive support (for training, employment pathways and entrepreneurship, by providing information on market trends, and by offering community support grants and credits for small and medium-sized enterprises).
- Upskill the workforce and adapt the curricula of educational and research institutions to meet current and future industry and economic needs. Uranium/energy resources sector jobs are increasingly recognised as being highly technology-dependent, requiring high-level science and numeracy skills. As skills demand continues to evolve, the uranium sector must maintain its engagement with training, education, and research and development.
- Raise awareness of the potential benefits of innovation and encourage automation and digitalisation of the sector. This transformation can make the uranium mining and milling stages more productive, reduce the environmental footprint of operations, and help overcome some mining regions' demographic challenges.
- In developing a uranium regulatory system, review the methodologies and results of comparable jurisdictions to formulate a methodology that balances regulator, industry and public interests. Policymakers need to recognise that streamlining uranium industry policies and regulations will attract the investments needed for sustainable development and local and national prosperity, while also safeguarding human and environmental protection.

- Build community knowledge about uranium mining and its processes, and work with Indigenous peoples and local communities in general to integrate traditional knowledge into operational management plans and activities. Companies should also create development plans, particularly pertaining to education, economic diversification and post-closure land use, to ensure that communities do not become overly dependent on uranium mining operations for their existence, revenues and access to services and infrastructure. Policymakers should also take steps to promote and strengthen gender equality.
- Foster greater collaboration among companies, community-based organisations, civil society and governments. This will produce better and more sustainable development outcomes, higher degrees of trust and confidence in the uranium industry, and better regulatory oversight of operations.
- In designing policy, remember how significantly taxes and royalties can affect mining project economics and future investments. The overall tax system should be equitable and meet policy objectives for the country, the region, local communities and the investor while ensuring that future generations also benefit. Furthermore, all uranium-producing countries should proactively address the transparency, governance and management of revenue streams from uranium resources.
- Create an open and supportive trading environment for uranium industry participants and their suppliers to increase productivity, foster technology transfer, generate innovative business practices and enhance low-carbon electricity supply security.

Finally, for uranium projects to be successful in the broadest sense, they must deliver – *and be seen by their host communities to deliver* – real benefits to the communities and regions in which they operate. Partnering across various sectors not only creates *shared value* from uranium projects but inspires trust in the industry and the government and increases their transparency.

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Maximising Uranium Mining's Social and Economic Benefits: A Guide for Stakeholders

The transformative activity of mining has numerous economic, social and environmental impacts that can be both positive and adverse for communities, ecosystems and economies. As the uranium industry begins to address negative perceptions and legacies associated with past activities, environmental, socio-economic and governance aspects of the uranium mining life cycle are gaining increased attention from investors, communities, regulators and other stakeholders.

While environmental and human health and safety concerns often dominate stakeholder engagement programmes and public conversations about uranium operations, less public discussion and analytical research are typically devoted to the socio-economic aspects. This was the basis for this report.

Through an examination of case studies from several countries the aim is to clarify how the numerous activities related to uranium mining affect various aspects of socio-economic development – including employment, supply chain investments, exports, taxes and royalties, innovation, infrastructure, education and medical care. This report's inventory of leading practices is intended to inform public debate on uranium mine development and provide policymakers with a framework of approaches to maximise the social and economic benefits of uranium mining projects.

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