# Decarbonization and sustainability

HATCH

# Your challenges, our solutions

Today, companies like yours are facing an evolving market where decarbonization and sustainability are at the forefront of decision-making associated with financing and economics, environmental stewardship, and corporate responsibility.

Investors and lenders are seeking environmental commitments to limit exposure to climate-related risk—and without them, companies may not have access to the capital they need to sustain and grow their business.

Adding to these challenges, many organizations are realizing that they cannot sustain a large engineering team internally, or that they do not have the climate change expertise needed to manage their portfolio's performance and implement transformative, sustainable solutions. A practical, implementable climate change and decarbonization strategy requires risk management, process and technical expertise, economic analysis, access to capital, project management capabilities, and social impact considerations.

We can help.

With a focus on sustainability, we create partnerships with our clients, acting as integrators and assisting them in developing their decarbonization strategies and action plans to reduce greenhouse gas (GHG) emissions from their operations and those of their suppliers and customers. We can support you in identifying and prioritizing the right solutions and delivering a business case—looking to 2030, 2050, and beyond.

To transition from the carbon-intensive economy of today to a low-carbon future, companies need a trusted partner with:

- Proven engineering excellence
- A shared commitment to the environment
- A toolkit of implementable clean technology solutions
- Investment strategies and business planning expertise
- Sustainable finance advisory capabilities
- Environmental and social impact services

We will help drive innovation into the projects that you undertake and work with you to establish a greener corporate footprint. And, by doing the right projects with the right people and processes, you will achieve predictable outcomes and realize project benefits.

As your partner, we will provide you with knowledgeable, sound advice and our full support with:

- Decarbonization strategy and road maps
- Process development and optimization
- GHG reduction and energy management
- Access to emerging low and negative emission technologies
- Low carbon and renewable power
- Climate change, sustainable development, and economic advisory
- Sustainable finance advisory
- Environmental services
- Technology solutions
- Project implementation

The first-of-its-kind Raglan Mine wind energy project introduced a utility-scale wind turbine with energy storage integrated with diesel generators at the northern mine.

# Climate change and sustainability

## Hatch accepts the Intergovernmental Panel on Climate Change (IPPC)'s scientific findings that climate warming is unequivocal and caused by human activities.

We are committed to designing and building practical solutions that reduce the presence of GHG in our atmosphere and adapt our built and natural environments to unavoidable climate change-related impacts. This commitment encompasses the following strategies: avoiding carbon combustion; reducing and efficiently using carbon; removing carbonaceous gases from our atmosphere; and improving society's resilience to earth's changing climate. We operate our business and carry out engagements for our clients with methodologies, tools, and teams that enable us to achieve these strategies with the goal of continuous improvement.

Climate change mitigation is a global challenge that requires innovative engineering and business knowledge to create transformative change across all sectors. As part of our commitment, we have undertaken the following initiatives/partnerships:

- Member of the Green Hydrogen Consortium
- Member of the Global Mining Guidelines (GMG) Group
- Achieved ISO 14001:2015 certification
- Commitment to the UN Global Compact

*Climate change mitigation is a global challenge that requires innovative engineering and business knowledge to create transformative change across all sectors.*

# Pathways to decarbonization

We take today's best practices to the next level, optimizing processes and applying proven or new technologies to make you cleaner, greener, and more competitive. We can help drive your vision for the future through:

- Climate change strategy and risk mitigation
- GHG accounting, emission mapping, and baseline development
- Emissions reduction strategy and planning (Scope 1, 2, and 3)
- Identification, validation, and prioritization of GHG emission reduction opportunities
- GHG emission reduction road map development and forward work plans
- Scale-up, integration, and commercialization of low and negative emission technologies
- Studies, system design, and engineering
- Project implementation

Our multi-disciplinary, cross-sectoral approach integrates the four main pathways to decarbonization:

### Efficiency and energy optimization

- Efficient equipment
- Efficient processes
- Operational improvement

### Carbon capture, utilization, and storage (CCUS)

- Carbon capture
- Utilization
- Transportation and storage

### Electrification

- Electric equipment
- Electric vehicles
- Electrification of processes

### Fuel switch

- Natural gas
- Hydrogen
- Biomass
- Biofuel

Hatch will work with you to develop your decarbonization road map to achieve your carbon reduction and sustainability goals.

Non-carbon-based energy

Energy and process efficiency

Critical materials for the energy transition

Carbon capture, utilization, and storage

Clean, resilient infrastructure

Policy engagement

# Essential services, sound strategies, and optimized flowsheets

From planning and launching new technologies, to optimizing or redeveloping processes, our objective is always the same: to work with you to address your most complex challenges. With our unique skillset, we solve your toughest problems to deliver real results.

## Decarbonization strategy and road maps

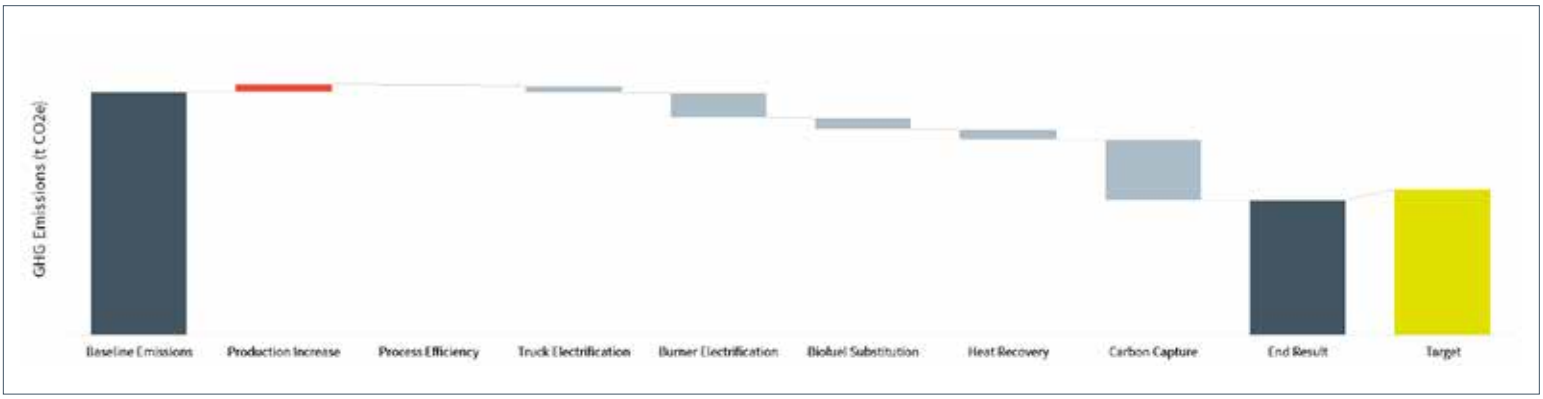
Hatch is committed to working with you to develop your decarbonization strategy and road map, and to design and build practical solutions that meet your GHG emission reduction and sustainability goals. Our clients benefit from a multi-disciplinary team of subject matter experts in low carbon and renewable energy, metals, and mining processes, resilient infrastructure, climate change policy, and decarbonization technology solutions. By integrating our diverse subject matter expertise, we are uniquely positioned to address your specific sustainability challenges.

Our approach considers Scope 1, 2, and 3 emissions and the mapping of emissions sources across your assets. Upon developing site-specific emissions profiles and a validated list of credible, viable abatement opportunities, we can accelerate the creation of decarbonization road maps to deliver maximum impact and implementable short- and longer-term abatement opportunities.

## Process development and optimization

Your processes are not like anyone else's. Neither is the work we do for you. As process specialists, we understand your operation and will help optimize your process and equipment to minimize GHG emissions and energy consumption without compromising productivity.

Whether it is development and order-of-magnitude costing of conceptual flowsheets for a new proprietary or improved GHG-free process, or modification of an existing brownfield operation to reduce the carbon intensity, we will present you with viable options. We will evaluate the workings of your flowsheet and consider process optimization, fuel switching, electrification, and carbon capture, utilization, and storage.



## Energy management and optimization

We believe energy is more than just a line item. It is a key input to your process and a fundamental resource your operations depend on every day. How energy use is tracked, managed, and optimized is critical to identifying strategic opportunities and risks, as well as ensuring quality control, and minimizing costs and environmental impact in every operational area. From developing corporate-wide strategies and energy management plans to refining business processes for energy management, we can help optimize energy management across your portfolio.

An energy management strategy also needs to be supported by the right tools. Our team can help assess, develop, and implement energy management information systems (EMIS) that ensure everyone—from management to equipment operators—has the right information to act, engage, and execute as part of the energy management team.

We combine energy and key business drivers with in-depth sector expertise to identify tailored technical energy savings opportunities as well as energy management best practices. We stay with our clients every step of the way to help them achieve their energy savings goals, supporting the project cycle from feasibility to implementation. We can help develop the project business case and support funding through incentives, financing, and transactional support to turn potential into reality and ensure that value is realized through measurement and verification.

## Clean technology solutions

Hatch is continuously scouting cutting-edge, clean technology solutions to identify those that can be integrated into your operations to provide the greatest benefit to your business. We are also experienced in the scale-up and integration of technologies, and commercialization of first-of-a-kind technologies, including pilot- and demonstration-scale facilities. In today's rapidly evolving technological landscape, you need a trusted advisor with process, integration, and scale-up expertise to minimize risk and deliver exceptional value.

## Low-carbon power

With expertise in renewables, hybrid systems including energy storage, transmission, and distribution, and grid modernization, Hatch can put you on the path towards low-carbon electrification. We offer modernization and optimization of equipment, overall energy efficiency planning and energy management systems, demand-side management and grid efficiency improvements, hybridization, microgrid, and generation resource management planning. We can also provide combined complementary solutions, such as integrating digital solutions in the form of energy management information systems. And, we're at the forefront of supporting the development of and investment in fusion power and evaluating the rollout of small modular reactors (SMRs) for our energy, metals, and infrastructure clients.

## Climate change, sustainable development, and economic advisory

We assess the potential interdependent impacts of changing weather and technological advancement on our clients and projects. Indicators of a shift to a low-carbon economy include changing requirements for access to capital, shifting policies, laws and regulations, and a change in societal expectations that impacts permitting, operations, and brand reputation. We have already observed a noticeable movement forward on a low-carbon trajectory in all three indicators and can provide you with strategic and transactional support.

## Sustainable finance advisory

We can identify and develop economic solutions to maximize the positive social and environmental impacts of your projects and other activities. We will work with you to develop Task Force on Climate-related Financial Disclosures (TCFD)-aligned climate change action plans and provide support in implementing the TCFD in your corporate functions and governance oversight mechanisms. This includes developing a robust risk assessment methodology for ongoing evaluation and TCFD reporting. We share your vision as a critical partner in the global development of an innovative, sustainable, and inclusive future.

Our sustainable finance advisors specialize in capital market engagement including due diligence and technical validation, carbon pricing analysis and trending, and transition/climate financing strategies. We can also support innovation grant applications.

## Environmental services

Our specialized Environmental Services Group (ESG) customizes our strategic regulatory approach to suit your needs, while meeting or exceeding compliance requirements. Our philosophy of "mitigation by design" emphasizes our belief that triple-bottom-line outcomes (social, environmental, and economic) are not only attainable, but a prerequisite to building a sustainable future.

## Project implementation

Successful projects proceed step by step, phase by phase. We work with our clients, planning carefully for quality outcomes that minimize the risk of harm to people, places, and things. This phased approach has stood the test of time. It is project development at its best, reducing risk and delivering predictable, consistent outcomes.

# Representative experience

## Process efficiency and energy optimization

### Integrated Steel Mill $CO_2$ Reduction Project, Algoma Steel

Canada

Technical and economic packages for a portfolio of $CO_2$ reduction projects including heat recovery, biomass usage, and by-product improvement projects. We assisted Algoma Steel with submission of government funding applications as part of the Target GHG Industrial Program. This program was intended to support demonstration projects with industrial emitters and help Ontario meet its 2020 targets for GHG emissions reduction.

### Steam Turbine Generator – Detailed Engineering Study, Confidential Client

Canada

After having previously conducted a comprehensive review of the facility's energy use and energy management practices, Hatch was selected by the client to prepare a Detailed Engineering Study (DES) for the development of a Steam Turbine Generator (STG) system. The STG system would utilize excess steam from the plant and cooling water from the nearby river to produce power. The system was chosen for study because the excess steam was being blown off into the atmosphere, causing substantial noise for the community and considerable loss of energy potential.

Through the study, energy savings of 39,000 MWh/year were quantified; equivalent to $2.3M/year as a result of reduced power purchase from the grid. Leveraging government funding, an incentive of $8.9M was uncovered, leading to a project payback of 1.7 years for the client.

# Technology development and process optimization

## Sturgeon Refinery Gasifier Burner Design, North West Redwater Partnership (NWRP)

Canada

The Sturgeon Refinery is the first new greenfield refinery in North America in forty years, designed to minimize its environmental footprint through carbon capture and storage, while producing the high-value, low-carbon products needed to meet North America's demand for energy. NWRP engaged Hatch to participate in a task team convened to resolve gasifier burner performance challenges, which was resulting in unplanned outages. We provided consulting and specialized engineering design and analysis support, including computational fluid dynamic and finite element modeling. The updated design has prolonged the campaign life of each burner and enabled capture of $CO_2$ from the gasifier syngas.

The net result is that the Sturgeon Refinery now regularly sends 2,700 tonnes per day of $CO_2$ down the Alberta Carbon Trunk Line to the Clive Enhanced Oil Recovery (EOR) project north of Red Deer. It is the largest project in the world for the utilization of man-made $CO_2$. About C$1 billion has been spent on the pipeline, compression, and injection facilities. At design capacity, it will transport 40,000 tonnes per day to Central and South Alberta. That is roughly equivalent to taking every car in Alberta off the road in terms of $CO_2$. At full capacity, about 100,000 barrels per day of light oil will be produced using this $CO_2$.

# Carbon capture, utilization, and storage (CCUS)

## Weyburn $CO_2$ Enhanced Oil Recovery, Encana

Canada

Since its inception in 2000, more than 30 million tonnes of $CO_2$ have been stored 1.5 km underground in Weyburn. In the lifespan of the project, it is anticipated that Weyburn-Midale will capture over 40 million tonnes of $CO_2$. We provided EPCM services for the installation of all surface facilities for the original Weyburn $CO_2$ miscible flood. Surface facilities at the Central Process Unit included inlet separation, FWKOs, two 6000-HP $CO_2$ recycle compressors, $CO_2$ dehydration, and produced water injection. Field facilities included all production/injection satellites and production/injection pipelines.

# Electrification

## Raglan Mine Integrated Wind-Storage-Diesel Energy, Glencore and Tugliq Energie Co.

Canada

Glencore's Raglan nickel mine in northern Québec has been installing a wind-storage system to reduce the high cost of diesel-based power generation. The project demonstrates the use of various types of storage and fast response control systems to maximize the use of wind while minimizing grid disturbances due to wind variability. Phase 1 included a 3 MW wind turbine and energy storage systems (battery, flywheel, and hydrogen system) with a microgrid controller, offsetting diesel fuel consumption by 2.4 million liters per year. Phase 2 will add 3 MW of wind power and 3 MW-1 MWh of energy storage. Hatch has been involved in the conception, engineering, commissioning, and operation monitoring of the project. We also reviewed various energy storage technologies to meet the specific needs of the mine's microgrid and to ensure a reliable supply of power, including sufficient power during diesel generator ramp-up.

## Conceptual Study, Boston Metal

USA

Boston Metal's core technology is applying molten oxide electrolysis in tandem with an inert anode, to electrochemically decompose iron oxide, producing molten Fe with oxygen gas as the primary by-product. Hatch completed a conceptual plant design, scaling the bench/pilot scale technology to the industrial scale, with both upstream and downstream operations considered. In principle, the technology could significantly decarburize the steel industry, the electrical energy input is produced using green, renewable technology.

## Onaping Depth Mine, Glencore

Canada

Through the application of new, clean technologies, Onaping Depth holds the promise of becoming one of the most advanced and safest underground mines in the world. The mine is designed to support an entire battery-powered underground mining fleet—the first of its kind. The electrification of the mine has resulted in several significant positive impacts including reduced operating costs, less ventilation, and less heat generation, along with reduced airborne contaminants and noise. As part of an integrated team with Glencore, we are providing EPCM services in the execution of the project as well as engineering selected infrastructure areas of ventilation, cooling, ore/waste handling, automation and communications infrastructure, and mine systems. The estimated total energy savings over the construction period and operating life of the mine (from 2017 to 2035) are C$24 million. The diesel-to-battery conversion opportunity would contribute an additional C$5.6 million in annual energy savings.

## Feasibility of the Potential Deployment of SMRs in Ontario, Province of Ontario

Canada

To assist the Province of Ontario with the assessment of the benefits and risks associated with deployment of SMRs, Hatch was contracted to perform a feasibility study for the Ministry of Energy to examine the deployment feasibility of SMRs in northern Ontario as a means of providing power to remote mines. The study evaluated several SMR designs against pre-determined criteria for off-grid, remote mining applications including environmental impact, economics, licensability in Canada, availability of funding to advance deployment, and the time required to achieve commercial operation. In addition, this study also examined the feasibility of SMR deployment in remote communities and remote mines in northern Canada. Key findings include that SMRs are expected to be economically competitive against the incumbent diesel energy sources with significant power cost-savings, and that SMRs represent a very low-carbon power source that can meet or exceed the reliability requirements of mining operations.

# Fuel switch

## Green Hydrogen Consortium

Global

Hatch, Anglo American, BHP, and Fortescue have formed a Green Hydrogen Consortium. The goal of the consortium is to identify green hydrogen development opportunities for the resource sector and decarbonization operations. Hatch has been appointed as the project management and governance facilitator of the Green Hydrogen Consortium. Our role is to manage the ongoing business of the consortium including managing all funds contributed to the consortium by members and external parties, preparing and organizing meetings of the Collaboration Forum, providing a main point of contact for any members and external parties who wish to engage with the consortium, and providing project management support to the members for research streams and reasonable contribution of full-time equivalents (FTE) to have equal resource effort from each company.

## Bécancour Green Hydrogen Plant, Air Liquide

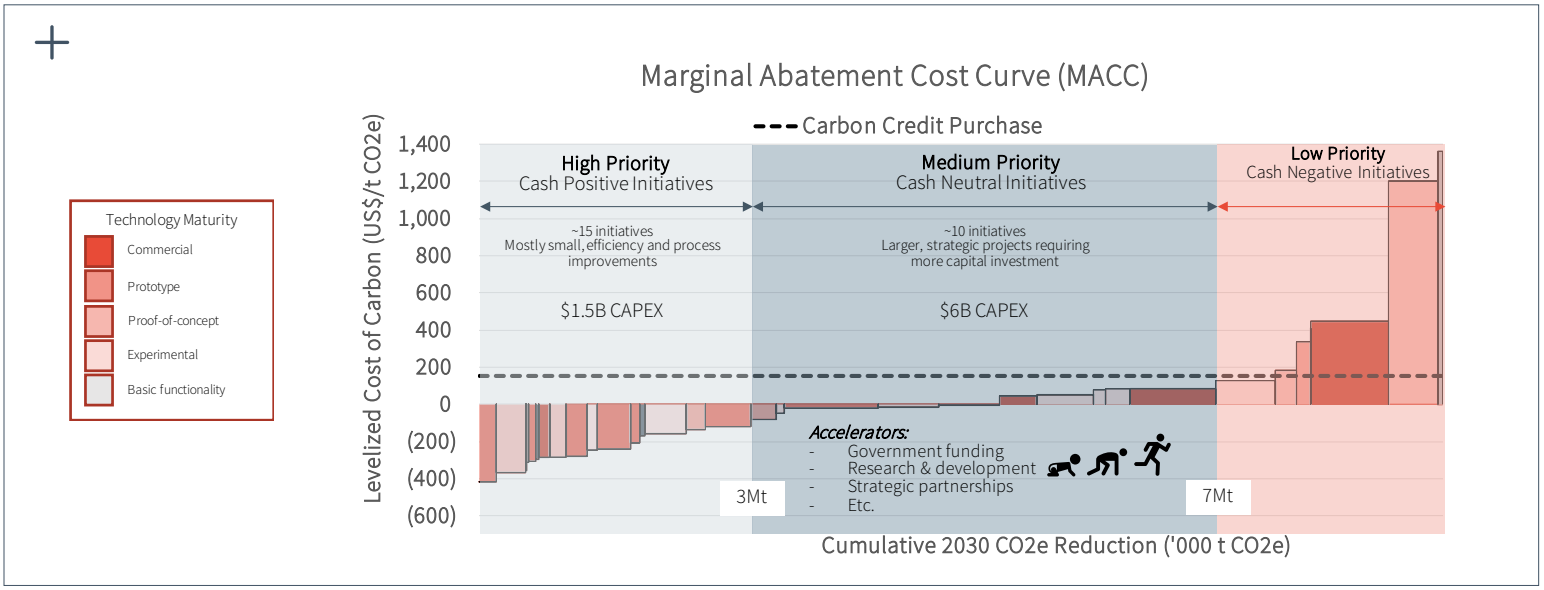
Canada

Air Liquide is installing proton exchange membrane (PEM) electrolyzers at their green-hydrogen production plant in Bécancour, Québec to form a 20 MW system, which would be the largest of its kind to produce green hydrogen. With Hatch's extensive management services and support in the structural engineering of the plant complementing Air Liquide's deep process and technology knowledge, this cutting-edge project will implement the first large-scale use of novel PEM technology. The project consists of increasing the green-hydrogen production capacity at the plant by 50%, while simultaneously reducing carbon dioxide emissions for the region by nearly 27,000 tonnes per annum. Hatch is responsible for civil, structural, and architectural engineering for the main process plant building, secondary section for electrical room and water treatment, pipe rack and cooling towers, HVAC, construction management and site preparation, health and safety management and project management, and project controls and services.

## Synthetic Fuels from Waste, Confidential Client

United Kingdom

Hatch was recently selected to support the development of an ambitious waste-to-jet-fuels facility in the UK. By converting waste that was otherwise bound for landfill or incineration, this project fills a need in the aviation industry to reduce its carbon footprint while using the existing fleet or aircraft. Hatch's role is to integrate and optimize five licensed technology packages, including gasification, syngas treatment and syngas conversion, and develop the utilities and balance of plant. The project has the potential to become the world's largest waste-to-jet fuels facility, producing up to 3,000 barrels a day.



# Emissions reduction strategy

## Decarbonization Strategy, Vale

Global

Vale Canada Limited has retained Hatch to support the development of a low-carbon transition strategy for their base metals operations. The first phase of work involved interrogation of GHG emissions data, modeling of carbon-intensive processes, and engaging with operations to identify carbon abatement opportunities. The second phase of work focuses on emissions forecasting, prioritizing opportunities and financial modeling to generate a marginal abatement cost curve (MACC), and evaluating scenarios to create a road map to meet Vale's GHG emissions reduction targets for 2030 and 2050.

## Low Emission Technology Assessment, Confidential Client

Global

As a component of its strategy to address climate change, the client had a focus to reduce its Scope 3 operational GHG emissions by investing in low emission technologies (LETs). To assist the client in achieving these objectives, Hatch was retained to identify and evaluate the potential of existing and emerging LETs in the downstream steel and copper value chains. Approximately 50+ existing and emerging LETs were reviewed based on CAPEX/OPEX impact, social and regulatory risk, technical complexity, and commercial readiness. The LETs were positioned on a value ease matrix during joint client/Hatch workshops to identify a list of priority LETs. For each priority LET, the key milestones and signposts which could drive the successful adaptation of the LET by the industry was defined. Leveraging this, the joint client/Hatch work project team documented possible opportunities for the client to unlock or facilitate the achievement of these milestones.

## Scope 1 and 2 Emissions Reduction, Confidential Client

Global

As a component of its strategy to address climate change, the client is prioritizing capital investment to grow production of commodities essential to the energy and mobility transition, limit coal production capacity broadly to current levels, and continue its reductions of GHG emissions from operations.

To assist the client in achieving these objectives, Hatch was retained to create a Marginal Abatement Cost Curve (MACC) that provides the client with a practical tool to assess the technical and economic feasibility of achieving its Scope 1 and 2 emission reduction targets.

# Financing/carbon strategy

## Energy Investment Framework, Development Bank of South Africa (DBSA)

South Africa

DBSA retained Hatch to support the Development Bank of South Africa in developing a climate-aligned energy investment framework to empower the DBSA Board to make informed decisions pertaining to the energy sector in South Africa. We assessed the strategic positioning of the DBSA as a responsible energy sector investor on the African continent as well as the implications of transition risk and the threat of stranded assets in the DBSA energy sector investment portfolio through the adoption of appropriate measures, which enable the bank to identify, quantify, and mitigate transition risk. We also helped determine a role for the DBSA in contributing and adding impetus to efforts to support a just transition to a low-carbon economy through the implementation of actionable programmatic developmental solutions. In addition to the climate-aligned energy investment framework, Hatch performed a TCFD-aligned risk assessment and developed detailed recommendations for accountability and disclosure to support DBSA's TCFD implementation.

# About Hatch

Whatever our clients envision, our engineers can design and build. With over six decades of business and technical experience in the mining, energy, and infrastructure sectors, we know your business and understand that your challenges are changing rapidly.

We respond quickly with solutions that are smarter, more efficient, and innovative. We draw upon our 9,000 staff with experience in over 150 countries to challenge the status quo and create positive change for our clients, our employees, and the communities we serve.

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