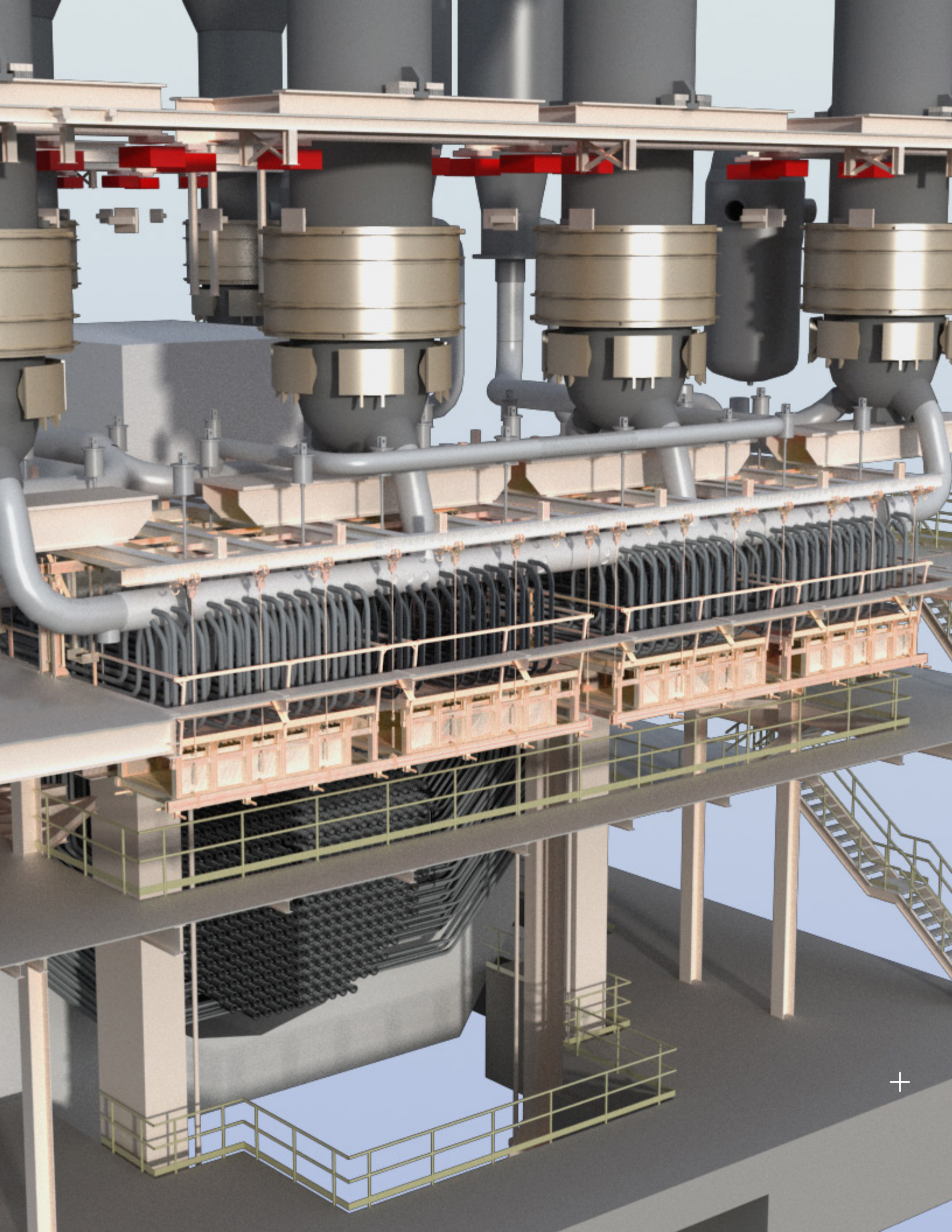




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# Nuclear Power





## It's a nuclear world



Everywhere, nuclear power is experiencing a renaissance. Reactors are being built across North America and Europe, with plans for many more. Globally, major refurbishment and life extension programs are under way to safely prolong the life of units.

Building, operating, and maintaining nuclear power facilities efficiently and reliably is no easy feat. You need a partner who understands the industry, one who's experienced with supporting your ongoing operations, refurbishments, new builds, and waste management. One who can help you meet due diligence requirements and comply with regulations, licensing, and safety legislation. One with strong connections to the procurement pipeline, able to provide all the ongoing maintenance services your facilities need.

Nuclear technology offers safe, clean, low-cost electrical power. But building the reactors, staffing them with capable, qualified personnel,

and meeting regulatory requirements is complex. It's labor intensive. The facilities must be meticulously maintained, and nuclear waste products must be dealt with — expertly, safely, and effectively.

For decades, we've worked with organizations like yours in North America and abroad. We know the full nuclear fuel cycle and scope, from cradle to grave. We have the experience and the bench strength to provide you with the very best in nuclear power-and-energy engineering, planning, and management consulting services.

Big. Small. New. Refurbished. Whatever your plans, whatever your scope.

**We can help.**

960 carbon steel feeder tubes carry the heat transport coolant from the reactor outlet and inlet headers to and from the end fitting assemblies.





## Power generation

Power producers, energy, and electricity companies all over the world trust us to advise, guide, and assist them with designing, building, and optimizing production. We're experienced with the following:

- project management and consulting
- fire protection
- corrosion services
- geotechnical
- full AE (architectural/engineering)
- 3D modeling
- building information modeling (BIM)
- engineering analysis
- asset management and optimization

## Nuclear new builds

By any standard, nuclear projects are mega projects. They're expensive, important, and technically complex; and unfortunately, they have a history of running over schedule and budget. Nuclear power generators have been looking for new ideas and best practices to help bring more project certainty—and we can help. We have fresh ideas and concepts from other industries in which we work that have brought more cost and schedule certainty.

The Westinghouse Electric Company recently completed a new AP1000™ pressurized water reactor nuclear plant. They turned to us for engineering and design services to help develop construction drawings for the containment and auxiliary buildings. We provided 3D PDS modeling and 2D CAD services for the structural, piping, layout, mechanical modules, and more.

## Nuclear fuel life cycle management

Value can be enhanced when you work with a team that's experienced in the entire nuclear fuel cycle. We understand the how's and why's of siting, uranium mine design, fuel processing, and fabrication facilities.

You need hands-on experience. Our integrated applications apply to the full scope of resource project development. We offer services from geological modeling to mine optimization and design; from process optimization, mill design, and commissioning assistance through to financial evaluation and operational support.

Then, we take it to the next level, adding our knowledge and global experience in uranium processing, including refinement, enrichment, conversion and deconversion, and nuclear fuel fabrication.

## Energy transition for industrial users

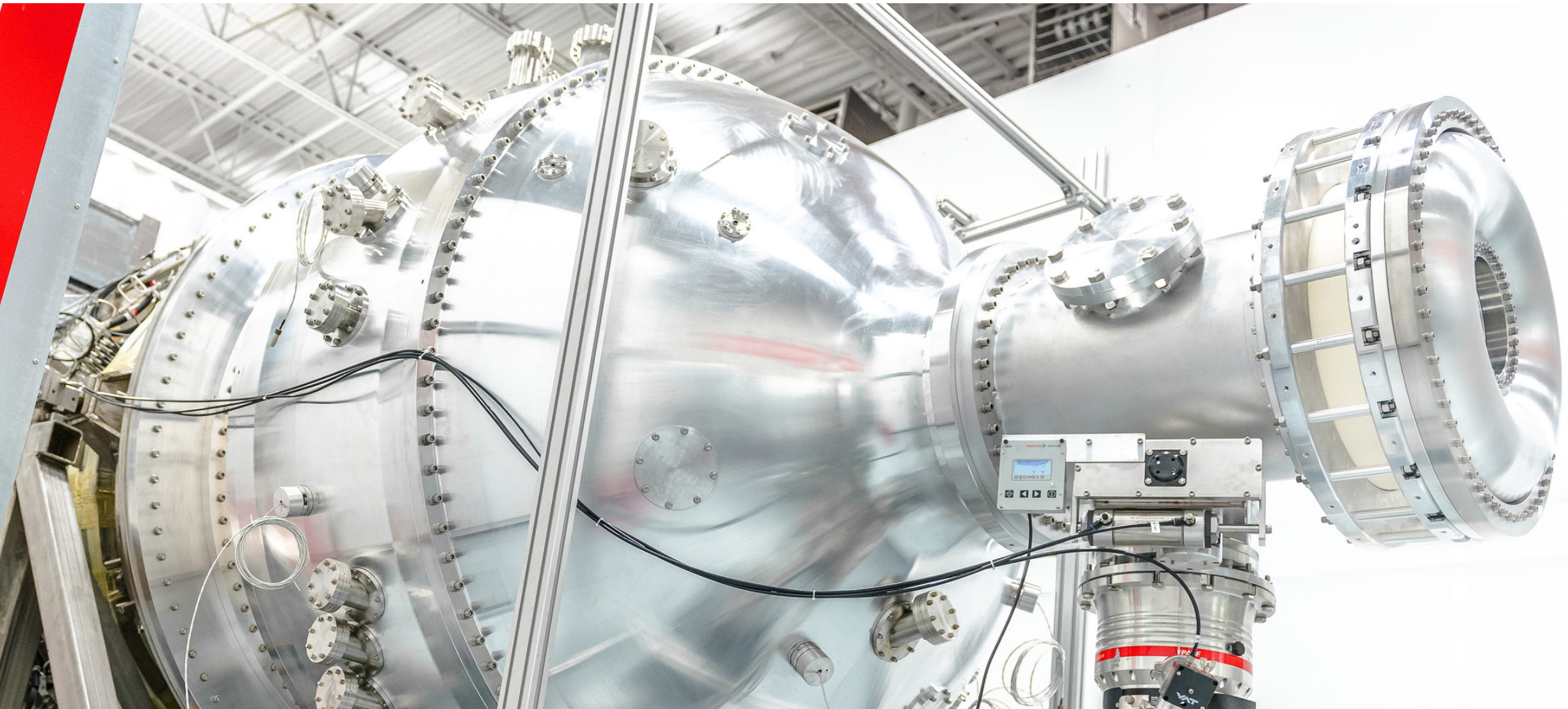
As an international community we are undertaking an unprecedented call to action to reduce our carbon footprint. For many organizations this is a major undertaking requiring a mix of multi-industry knowledge and resources.

We are able to leverage our in-depth knowledge of the various industries we support with our nuclear experience to help organizations like yours transition into using zero-emission nuclear reactors to meet your strict process and power challenges. Whether you are looking for electric power, heat, steam, or co-generation, we have the knowledge and experts under one roof to optimize your solutions and experience.

General Fusion is changing the clean-tech game with their magnetized target fusion technology



# General Fusion





## Operations support

Managing obsolescence issues, minimizing outage durations and impacts is just the beginning. Finding better, more efficient ways to handle ongoing operations can improve processes, increase production, cut costs, and enhance your bottom line.

Whether you're ramping up projects or optimizing assets and procedures, we have experienced professionals and expert services to help you. Every solution is tailored to your specific operating issues. Across the full business life cycle, from concept to closure. Across the full value chain, from exploration to market.

## Research and technology development

Your organization contributes to the worldwide nuclear industry, developing and sharing best practices, new technologies, and regulatory frameworks.

In our work with utilities, regulators, and industry associations, we have made substantial contributions to the nuclear OPEX and body of knowledge. Our research-and-technology-development experience with nuclear businesses is one of our key differentiators. Some examples are:

- the design and development of the South African Pebble Bed Modular Nuclear Reactor program
- the development of technology for radwaste volume reduction
- design development for molten salt reactors

## Refurbishment and life extension

Revitalizing much-needed assets will dominate the nuclear agenda in Canada and many parts of the world for the next decade or more. To complete these massive projects on time and on budget, you need a partner with nuclear technology knowledge and experience in nuclear refurbishment.

We've contributed to hundreds of nuclear projects over the past many years, working with Bruce Power, Ontario Power Generation's Pickering and Darlington stations, and Point Lepreau in New Brunswick.

We know your facilities, technologies, and practices. We act like owners, and that means we respect and share your values, safety culture, and priorities.

## Regulatory requirements, codes, and standards

The world's nuclear regulatory environment is complex—and for good reason. Nuclear power technology is intricate and powerful and must be managed carefully.

For many years, we've worked with organizations like yours, managing international and North American rules, guidelines, and legislation. We can help you meet legal, environmental, and safety requirements in any jurisdiction.

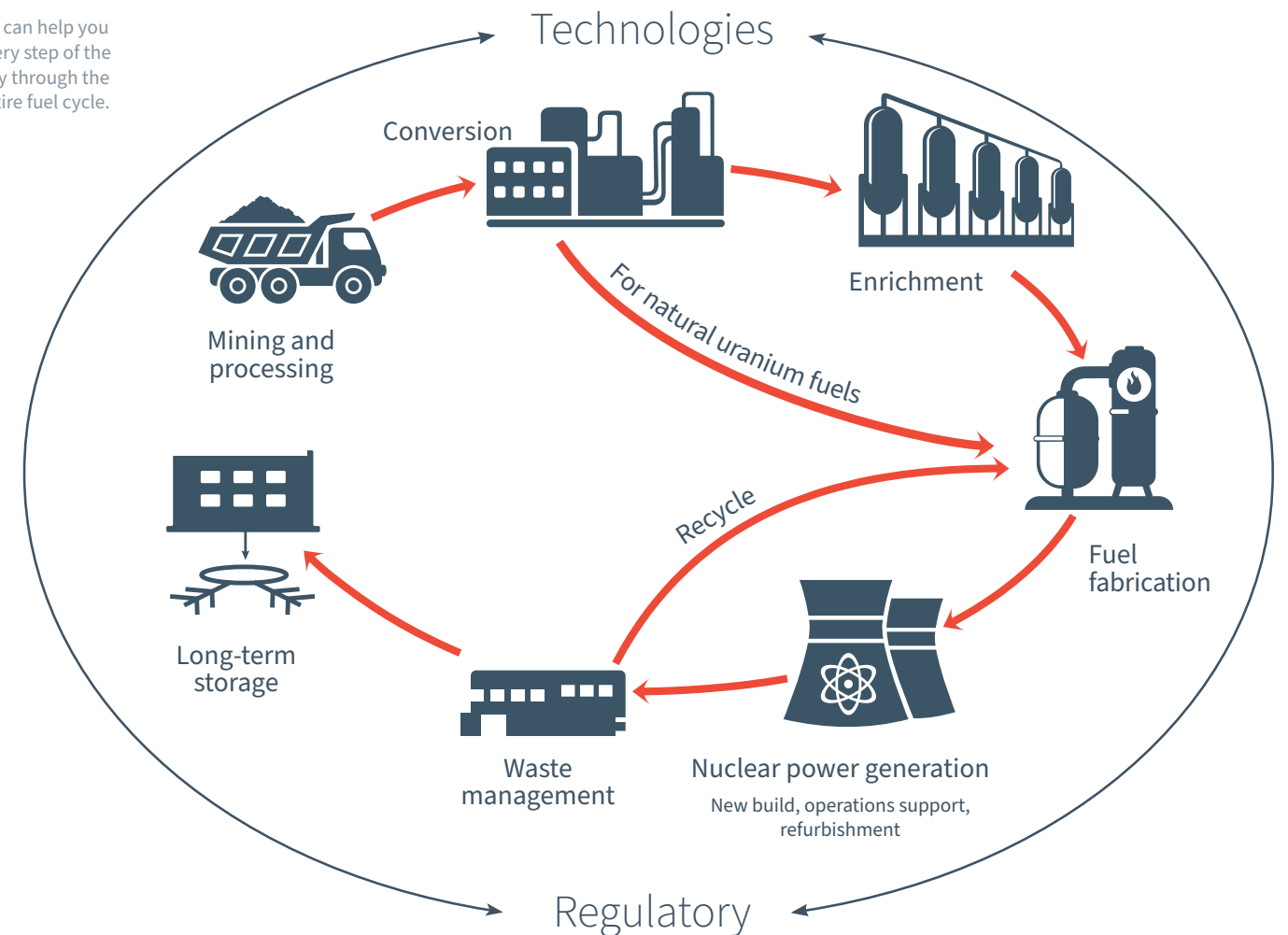
Many of our professionals contribute to technical, regulatory, and standards oversight groups such as:

- CSA Nuclear Standards Committees
- Canadian Nuclear Safety Commission
- Technical Standards and Safety Authority



Hatch has been working at the Bruce Power site for almost 20 years and has completed more than 1,000 plant mod packages.

We can help you every step of the way through the entire fuel cycle.





## Small modular reactors

As small modular reactor (SMR) development continues to evolve, clean, abundant, and reliable power has become a tangible possibility for more users across the world. For industrial organizations venturing out further and further for commodities, resources, and profits, SMRs can offer new efficiencies, cost controls, and better environmental stewardship.

In the SMR space, we've helped with:

- technology and market surveys
- investment due diligence
- site-specific economic assessments
- site-specific technology feasibility assessments
- power systems integration (nuclear and mining)
- regulatory and licensing support
- SMR plant design engineering

## Nuclear sustainability solutions

The nuclear industry needs sound, stringent processes, and facilities to manage nuclear by-products. We've assisted organizations like yours with tools and methods to handle nuclear waste and deal with issues relating to processing and storage. Bringing sustainable solutions to nuclear operations. We understand the pivotal role that waste management and storage plays in the success of the nuclear industry, and the need for solid research and robust processes to safely store and manage nuclear waste.

We have direct experience in the following areas:

- decontamination and waste-handling
- radiation protection
- isotope processing and separation
- repository and long-term management
- tritium recovery and heavy water production

## Fusion power

While technology developers close the gaps to make fusion power a commercial reality, significant challenges remain. These include the breeding and recovery of tritium fuel, improving the robustness of designs for long-term operations and maintenance, and ensuring that first-of-a-kind projects meet their execution and performance goals to support future pilot plant and commercial deployments.

We have direct experience in supporting fusion technology developers with specialized engineering, project development, and delivery. We support fusion technology developers with the design of:

- novel liquid metal systems, including lithium, lead-lithium, and molten salt systems
- detritiation and vacuum systems
- testing facilities and custom components, equipment, and tooling
- power conversion and balance of plant systems.

General  
Fusion, Fusion  
Demonstration  
Plant Culham, UK





# Project experience

People, governments, and industry all depend on the power that new nuclear construction and refurbishments will provide. Delivering work on time and on budget has never been more important.

We have a proven track record for delivering projects—large and small—on behalf of our clients using our industry-leading project management and controls systems. Our gated approach, which we have refined and finessed through all of our business sectors, provides a greater level of predictability to ensure cost and schedule certainty for our clients.

## OPG Darlington and Pickering nuclear generating stations operational support

Ontario, Canada

As part of an immense initiative that began in 2012, more than 150 projects were undertaken at these facilities. The work ranges from minor plant modifications to massive refurbishment infrastructure projects—some of the largest, most complex, and expensive work ever done at these stations.

To support the design phase of many of these projects, over 250 of our staff members received security and safety clearance, many of whom have worked on site. We completed over 1 million person-hours of work during this period. This provides a greater understanding of Ontario Power Generation's (OPG) systems, safety culture, configuration management, radiation safety protocols, and operations.

### Darlington sustaining capital and refurbishment support

- auxiliary heating steam facility
- refurbishment project office
- retube and feeder replacement island support annex
- used-fuel dry-storage building
- emergency service water-pipe replacement

### Pickering asset management portfolio

- fire code compliance
- emergency power generator and main output power-protection systems
- waste management facility expansion
- standby generator protective-relay upgrades

## Bruce Power major component replacement program

Ontario, Canada

We provided engineering and construction management services for the upgrade of units 3, 4, 1, and 2 at Bruce Power in the early 2000s. Our professionals upgraded the existing fire protection systems, installed a new station secondary-control area, and was part of a team that acted as the main contractor for the restart of units 3 and 4. We were honored with the prestigious Schreyer Award from *Canadian Consulting Engineer* magazine and the Association of Consulting Engineers of Canada, and the Project of the Year Award from *Power Engineering* magazine for our work on units 3 and 4.

With our new office in Port Elgin, Ontario, we're again strengthening our partnership with Bruce Power, helping with the latest \$13-billion life-extension program.

## Major component replacement feeder mock-up design

Ontario, Canada

In order to allow continued operations until 2064, the life-limiting components of the reactors will be replaced. As part of the major component replacement project, the 960 carbon-steel feeder tubes that carry the heat transport coolant from the reactor end fitting assemblies to the inlet and outlet headers of the steam generator needed to be replaced.

To facilitate this, Bruce Power has selected Hatch to develop mock-ups on a one-to-one scale. These will qualify tooling and measure tooling performance through work-series trials, and train and qualify the execution trades prior to field implementation.

## Upper feeder platforms detailed design

Ontario, Canada

Due to the constrained project schedule, the feeder program work will need to take place in parallel with the detube /retube work occurring below, in the vault.

Temporary work platforms must be designed above the reactor face to facilitate the feeder replacement work. The platforms and frames, both suspended from the existing plant structures, will support personnel and tooling for the removal and installation of the upper feeder tubes and associated components.

## Deep geological repository and used fuel packaging plant for the Nuclear Waste Management Organization

Ontario, Canada

Nuclear organizations everywhere need to meticulously manage and dispose of waste by-products from their operations. We're helping the Canadian industry meet this critical requirement by participating in the design development of the first high-level waste repository in North America for the storage of spent nuclear fuel.

The conceptual design of surface and underground facilities at the two prospective waste-repository site locations in Ontario will be further developed. The Nuclear Waste Management Organization (NWMO) will use these designs for the adaptive phased management of high-level nuclear waste.

Hatch was also later retained to progress the Used Fuel Packaging Plant (UFPP) conceptual design. The UFPP is an above-ground facility where used fuel is processed and repackaged before being moved into the deep geologic repository (DGR).

Previously, we contributed to the development of the DGR for low- and intermediate-level waste near Kincardine, Ontario. This long-term disposal facility will house waste produced at the Bruce, Darlington, and Pickering nuclear power generating stations. Our professionals performed preliminary engineering studies and produced the conceptual engineering design report to support the NWMO's submissions to the CNSC for environmental approval and a construction license.



### Small modular reactor study

Ontario, Canada

The benefits and risks of deploying SMRs in remote, off-grid communities and mining sites were examined. Systems were identified that best met the criteria for deployment, and the programs needed to install and operationalize potential SMRs were described. With this information, the Ontario Ministry of Energy and the Canadian Nuclear Safety Commission (CNSC) will evaluate how best to use these new tools to create new industries and grow existing ones, expanding resources, jobs, and opportunities.

### Integrating SMRs with SAGD facilities feasibility study

Alberta, Canada

Hatch completed a study evaluating the feasibility of SMRs in oil sands applications on behalf of Cenovus, TC Energy, and Alberta Innovates. The report evaluated the possible implementation of nuclear power (SMRs) in the oil sands to reduce greenhouse gas emissions and produce steam, and electricity for use at in-situ recovery facilities utilizing Steam Assisted Gravity Drainage (SAGD) for bitumen production. The intent of this report is to investigate and provide a generic guide for the deployment of SMRs in the Canadian oil sands, with a focus on supporting SAGD facilities. After this study, the findings from this report were published publicly by Alberta Innovates.

### Xe-100 technology development program engineering support services

United States

Under the U.S. Department of Energy's Advanced Reactor Demonstration Program (ARDP), X-energy and Dow are advancing efforts to deploy the first advanced small modular nuclear reactor for an industrial site in North America.

This project, a pioneering example of nuclear energy solutions, supports broad decarbonization efforts and serves as a leading example of SMR technology. We are providing engineering and project management support, contributing to the advancement of this innovative solution.

Our approach includes leveraging our expertise in project delivery, technology development, and nuclear and power conversion to enable the creation of a reliable carbon-free energy source, capable of generating 200 MW of thermal power representing up to 80 MW of electrical generation for power and heat applications.

### Westinghouse AP1000™ nuclear plant program

United States and China

The Westinghouse AP1000™ pressurized water reactor is an advanced 1100-MWe nuclear power plant. It is a modular design that uses 50% fewer valves, 35% fewer safety grade pumps, and 80% less piping than previous nuclear plants.

Hatch was retained to provide engineering and design services to help develop construction drawings for the containment and auxiliary buildings.

### Heavy water detritiation facility

Ontario, Canada

Confidential client was interested in developing the capability to remove tritium from heavy water used in nuclear reactors.

Hatch was retained to prepare a conceptual design for a detritiation facility to assess the viability for implementation.

Our design demonstrated a viable configuration with available technologies to achieve the required detritiation levels. A Preliminary Safety Analysis Report and Derived Release Limit report also found the conceptual design of the facility to be safe.

### Fusion demonstration program

Vancouver, Canada & Culham, UK

Hatch supported General Fusion with the development of a first-of-a-kind Fusion Demonstration Plant (FDP) facility to demonstrate their Magnetized Target Fusion technology. We provided engineering services from pre-conceptual design through to basic engineering for process fit-out systems in support of the machine's development and deployment. We also provided pre-conceptual through to preliminary engineering for the building and building integration.

### Metal segmentation and decontamination facility

Ontario, Canada

Processing large amounts of radioactive metallic waste is one of the many challenges faced by the nuclear industry.

To investigate this specific matter, OPG retained Hatch to prepare a conceptual design for a metal segmentation and decontamination facility to assess the viability of recycling large and small format metallic waste. Concepts were developed to process up to 3,000 tonnes of metal per year.

Hatch's conceptual design demonstrated a viable configuration to reduce the low-level radioactive metal inventory and recycle a large majority of them. The technologies proposed in the project were estimated to significantly reduce the operating cost compared to the incumbent solutions. Additionally, safety improvements and risk reduction opportunities were identified through our innovative design.

A \$12.8-billion refurbishment program will revitalize the Darlington Nuclear Generation Station.

X-energy. First of its kind advanced Gen IV SMR technology licensed for commercial use in North America



Photo courtesy of Ontario Power Generation



# Complementary services

## Construction management

You need strategies that make the best use of your people. Ones that champion technology and bring consistency to the entire range of your operations.

Our construction management experience includes site logistics and deployment, modularization, building information modeling, and constructability. We give you well-developed systems and programs that result from early involvement in construction. The goal is smooth, timely start-up of your facilities.

## Procurement

When you need a partner to manage the full range of supporting details, count on us. We're world-class experts in contracting, purchasing, expediting, vendor quality surveillance, logistics, and site materials control.

Our operational support and procurement services for EPCM projects integrate seamlessly with your business processes and objectives. Starting at the project's front-end phases, we help to increase value throughout the entire cycle.

## Security and site deployment

Before project teams can be fully mobilized, the supporting infrastructure needs to be built and operationalized. Doing this quickly and effectively can advance the project schedule and simplify the onboarding experience for contractors, suppliers, and your own personnel.

Our security and site deployment group includes experts in critical infrastructure security, cybersecurity and security assessments. We also employ former military personnel who leverage their experience in large-scale field operations and apply them to our project delivery methods. We provide engineering rigor, construction expertise, and deployment specialization that approaches site preparation with an end-to-end campaign perspective. Costs, mobilization, and demobilization times are carefully controlled and minimized with the use of prefabricated modular construction.

## Urban solutions

It is important to demonstrate to communities and stakeholders the inherent benefits they will see from the implementation of nuclear projects.

Our Urban Solutions group is comprised of a team of experts who specialize in economic and social development impact studies. Our team provides an objective analysis for clients who are looking to demonstrate that a project is worth pursuing. We specifically have looked at first-of-a-kind technology development projects as well as pilot plants and test facilities for new nuclear technologies.

## Synchro 4D modeling

This tool helps you meet key dates and milestones by integrating the project schedule with the project 3D model. It provides insight into project progress, potentially shortening schedules, reducing person-hours—both at the home office and at site—and improving field productivity.

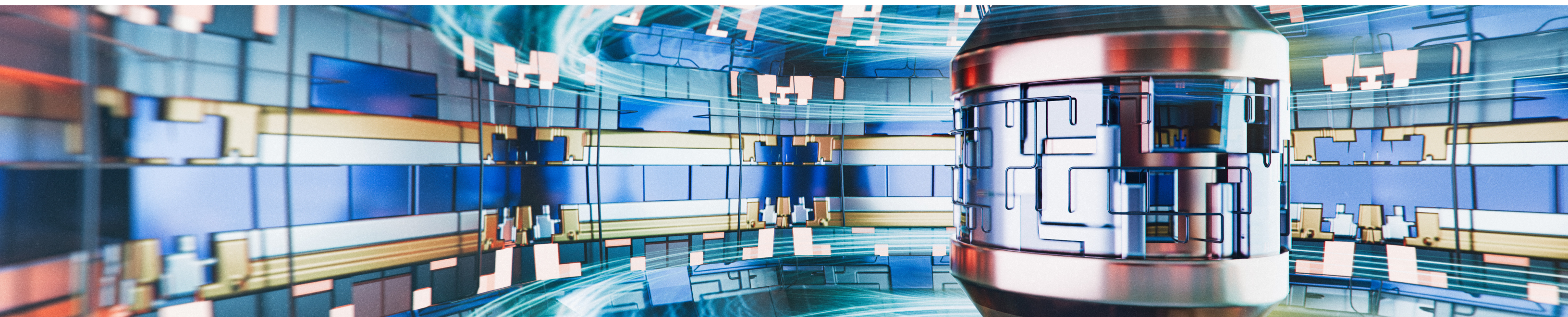
With a user-friendly 3D-model-input environment, Synchro 4D can develop virtual construction work packages using data and reporting from our internal engineering, procurement, and project control systems.

## Environment, regulatory and community engagement

Your nuclear facility and the people who work there are members of the communities in which you operate and stewards of the local environments. We share this responsibility with you by virtue of the work we do together.

Our Environmental & Sustainability group has experts on regulatory processes such as environmental and impact assessments as well as site permitting and environmental monitoring.

Throughout our history, we have partnered with First Nations and Aboriginal communities to ensure appropriate oversight is exercised and their ancestral homelands are respected. We are long-time members of the Canadian Council for Aboriginal Business. Recently we received the Workplace System Leadership (Communications) Award from the Aboriginal Human Resource Council for implementing innovative and effective strategies and practices that have advanced Indigenous inclusion in the workplace.







# About Hatch

Hatch is a global engineering, project management and construction, and professional services firm. Whatever our clients envision, our professionals can design and build. With over six decades of business and technical experience in the energy, infrastructure, and mining 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 rely upon our 10,000 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.

[hatch.com](https://hatch.com)

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