NUCLEAR INNOVATION ALLIANCE

ADVANCED NUCLEAR REACTOR TECHNOLOGY

A COMPANY COMPENDIUM

JULY 2022

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NUCLEAR INNOVATION ALLIANCE

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PHOTO CREDITS

Cover:
X-energy

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ARC Clean Energy, BWXT, GE-Hitachi, General Atomics, Holtec, International Atomic Energy Agency, Kairos Power, NuScale Power, Nuclear Innovation Alliance, Oklo, TerraPower, Terrestrial Energy, Ultra Safe Nuclear Corporation, Westinghouse, X-energy.

FOR MORE INFORMATION

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Introduction:

Advanced nuclear energy companies are completing development activities for new nuclear reactors and beginning construction and deployment in the United States and Canada. While there is significant overlap in the needs of advanced and conventional nuclear reactors, each advanced reactor will require new supply chains. Most advanced nuclear power plants will have similar power conversion systems but will require new structures, systems, and components that differ from existing large light water reactors. Clear understanding of the design and the future supply chains for different advanced reactor companies enable more effective engagement and investment in advanced nuclear energy.

This compendium highlights major advanced reactor developers and their current development and deployment status, and documents public agreements between advanced reactor companies and outside parties including the private sector, government, universities, and international organizations. The compendium is a broad summary of the advanced reactor business ecosystem and provides insight into what companies are associated with the planning, design, testing, construction, and operation of advanced nuclear energy projects. This compendium was created using publicly available information as of June 2022.

This compendium is sorted by advanced reactor company and highlights their major projects. The compendium also includes brief information about the advanced nuclear fuel cycle here in the United States and Canada. For detailed information about each reactor design and other advanced nuclear energy technologies, see NIA's report, Advanced Nuclear Reactor Technology: A Primer, to see the differences between conventional nuclear reactors and advanced nuclear reactors, as well as the differences among advanced reactor technologies themselves.

Nuclear Energy Supply Chain
Source: IAEA

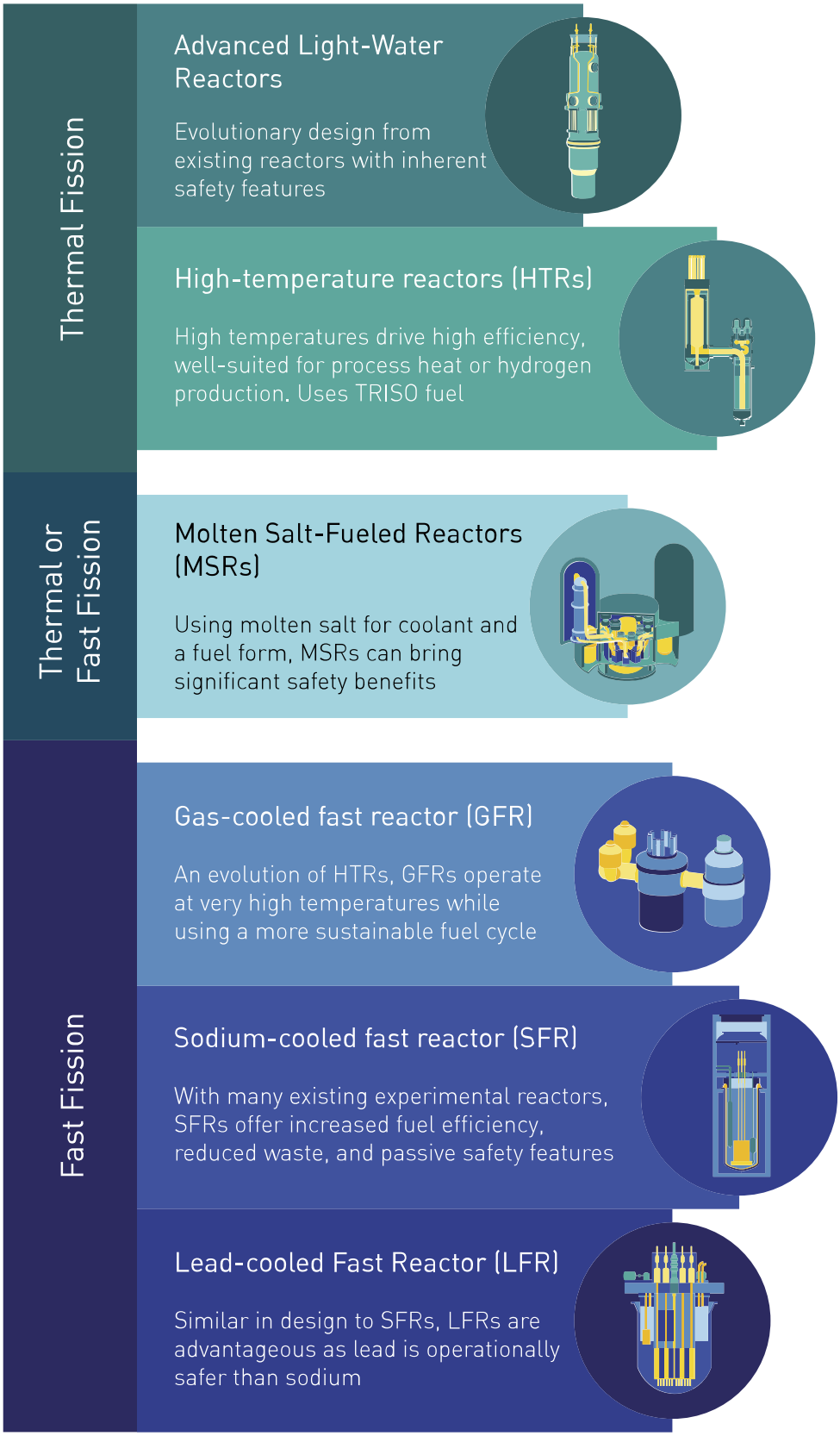
Salt or Metal Cooled Reactor

Light Water Cooled Reactor

Microreactor

Gas Cooled Reactor

Quick Reference Guide for Company Reactor Technology Type



Quick Reference Guide on Advanced Reactor Technology Types
Source: NIA

ARC Clean Energy

Major Project
Canadian Commercial Reactor: **ARC-100**; United States' Advanced Reactor Development Project (ARDP) ARC 20 Project: **First-Of-A-Kind (FOAK) Reactor**

Major Project Description
Small Modular Sodium Fast Reactor

Project Location or Headquarters
HQ: New Brunswick, Canada
Project Location: ARC-100 Commercial Demonstration: New Brunswick, Canada; ARDP ARC20 FOAK: TBD, USA

Government Funding Status
US$27.5 million awarded by US DOE ARDP ARC 20 Program; CAD30 million awarded by Province of New Brunswick, Canada

Nuclear Regulatory Commission (NRC) and Canadian Nuclear Safety Commission (CNSC) Licensing Status
NRC: Preapplication Interaction

CNSC: VDR Phase 1 complete, VDR Phase 2 in progress

Expected Deployment
ARC-100: 2029

Partners

Utility Partners
New Brunswick Power (NB Power)
New Brunswick, Canada
New Brunswick Power Corporation, operating as NB Power, is the primary electric utility in the Canadian province of New Brunswick. NB Power is a vertically-integrated Crown Corporation wholly owned by the Government of New Brunswick and is responsible for the generation, transmission, and distribution of electricity

Technology Partner
GE-Hitachi
Wilmington, NC
GE Hitachi Nuclear Energy is a provider of advanced reactors and nuclear services with deep experience in sodium cooled reactors.

Industry Partners
Hatch
Mississauga, ON, Canada..... (905) 855-7600
Hatch is a leading Canadian engineering firm with extensive history in energy project design and execution.

United Engineers & Constructors
Mount Laurel, NJ..... (844) 860-0504
United is a leading infrastructure engineering, procurement, construction, and consulting company.

Industry Partners (continued)

Kinectrics
Toronto, Ontario..... (416) 207-6000
Kinectrics is an integrated life cycle management services company providing testing, inspection, certification and engineering consulting for the electric power generation, transmission and distribution markets worldwide. ARC Clean Energy and Kinectrics will collaborate on regulatory affairs, safety analysis, and licensing support.

IHI Corporation
Tokyo, Japan..... +81 36-204-7800
IHI is a Japanese engineering corporation that produces and offers plant engineering and industrial machinery.

Cross River Infrastructure Partners
Greenwich, CT..... (203) 340-5750
Cross River will help ARC Clean Energy develop sustainable industrial projects globally that employ ARC Clean Energy's advanced Small Modular Reactor (SMR) technology.

Other Partners (continued)

Argonne National Laboratory (ANL)
Argonne, IL..... (630) 252-2000
ANL is a multidisciplinary science and engineering research center, focused on nationally important energy and environmental research.

Idaho National Laboratory (INL)
Idaho Falls, ID..... (866) 495-7440
INL, a DOE national laboratory, is the nation's leading center for nuclear energy research and development.

Sandia National Laboratory (Sandia)
Albuquerque, NM..... (505) 844-8066
Sandia is a DOE national science and engineering laboratory focused on national security and technology innovation in support of the U.S. Department of Energy's National Nuclear Security Administration (NNSA). Sandia also supports numerous federal, state, and local government agencies, companies, and organizations.

Other Partners (continued)

University of New Brunswick (UNB)
Fredericton, NB, Canada..... (506) 453-4508
UNB offers undergraduate and graduate degrees in more than 60 disciplines and continuing education in a variety of fields. ARC and UNB are collaborating on several projects in support of the commercial deployment of the ARC-100 in New Brunswick.

Canadian Nuclear Laboratories (CNL)
Deep River, ON, Canada..... (613) 584-3311
CNL is Canada's premier nuclear science and technology organization, and a world leader in developing nuclear technology for peaceful and innovative applications. CNL is focused on restoring and protecting the environment, advancing clean energy technology, and medical breakthroughs continue to improve the health of people around the world.

BWX Technologies

Major Project
BWXT Advanced Nuclear Reactor (BANR)™

Major Project Description
Small Modular High Temperature Gas Reactor

Project Location or Headquarters
HQ: Lynchburg, VA
Project Location: TBD

Government Funding Status
DOE Risk Reduction Award Winner ($106.6 million) and DOD Project Pele Winner ($300 million)

NRC Licensing Status
No Formal Interactions

Expected Deployment
Early 2030s

Partners

Other Partners
Idaho National Laboratory
Idaho Falls, ID..... (866) 495-7440
INL is providing support via irradiation of fuel specimens in the Advanced Test Reactor (ATR) and post-irradiation examinations.

Other Partners (continued)
Oak Ridge National Laboratory (ORNL)
Lemont, IL..... (303) 751-0741
ORNL is providing support via TRISO fuel research and collaborating on developing new ways to manufacture and qualify parts and materials for high-temperature reactor applications.

BWX Technologies

Major Project
Project Pele™

Major Project Description
Transportable High Temperature Gas Microreactor

Project Location or Headquarters
HQ: Lynchburg, VA
Project Location: Lynchburg, VA*
Reactor Site: Idaho National Laboratory, Idaho Falls, ID

Government Funding Status
DOD-SCO Project Pele Winner ($300 million)

NRC Licensing Status
None - DOE authorization

Expected Deployment
2024

*A majority of the work and reactor assembly on Project Pele will be performed in Lynchburg. The microreactor will then be shipped to INL.

Partners

Industry Partners

Northrop Grumman
Falls Church, VA..... (703)-280-2900
Northrop Grumman Corporation is an American multinational aerospace and defense technology company.

Aerojet Rocketdyne
El Segundo, CA..... (310) 252-8100
Aerojet Rocketdyne is a developer and manufacturer of advanced propulsion and energetics systems for customers including the U.S. Department of Defense, NASA and other agencies and companies, both in the United States and abroad.

Rolls-Royce LibertyWorks
Indianapolis, IN..... (317) 230-2000
Rolls-Royce is a leading manufacturer of highly-efficient integrated power and propulsion solutions. Their power systems are used in aerospace, naval marine, energy and off-highway applications.

Torch Technologies, Inc.
Huntsville, AL..... (256) 319-6000
Torch Technologies provides research, development, and engineering services to the Federal Government and Department of Defense.

GE-Hitachi

Major Project(s)
BWRX-300™

Major Project Description
Small Modular Boiling Water Reactor

Project Location or Headquarters
HQ: Wilmington, NC
Project Location: Toronto, Ontario, Canada and Saskatchewan, Canada;
Clinch River, TN, USA

Government Funding Status
DOE Technology Development Grant Awardee

NRC and CNSC Licensing Status
NRC: Preapplication Interaction, Constuction Permit Application Expected FY23

CNSC: VDR Phase 2 in progress

Timeline
Darlington, Canada Project Deployment Expected: 2028
Clinch River, TN Project Deployment Expected: 2032

Partners

Utility Partners
SaskPower
Regina, SK, Canada..... (306) 536-2886
SaskPower has selected the BWRX-300 for potential deployment in the mid 2030s.

Ontario Power Generation (OPG)
Toronto, ON, Canada..... (416) 592-2555
Ontario Power Generation (OPG) has selected the BWRX-300 small modular reactor (SMR) for the Darlington new nuclear site, and will work with GE Hitachi Nuclear Energy (GEH) to deploy the reactor. Canada's first commercial grid-scale, SMR could be completed as early as 2028.

Tennessee Valley Authority (TVA)
Knoxville, TN..... (865) 632-2101
In early 2022, TVA Board Members authorized a New Nuclear Program to explore innovative technologies and the company is currently in discussions with GE-Hitachi to support their BWRX-300 design.

Industry Partners (continued)

Hatch
Mississauga, ON, Canada..... (905) 855-7600
Hatch will deliver engineering, construction, and modularization services as well as the manufacturing of safety-related components. Hatch expects to provide key engineering and project delivery services.

Black and Veatch
Markham, OR, Canada..... (905) 747-8506
Black and Veatch is providing "architectural input" for GE Hitachi's BWRX-300 small modular reactors. GE-Hitachi has also partnered with Overland Contracting (a Black and Veatch company), a full-service engineering, procurement and construction contractor.

Saskatchewan Industrial and Mining Supplier's Association (SIMSA)
Saskatoon, SK, Candada..... (306) 343-0019
GEH SMR Canada and SIMSA agree to collaborate in engaging with local suppliers to maximize the role of the Saskatchewan supply chain in the nuclear energy industry.

Synthos Group
Oświęcim, Poland..... +48 33 844 18 21
In 2019, Synthos Green Energy - part of the Synthos Group - signed a cooperation agreement with GEH for the construction of the BWRX-300 reactor in Poland.

Cameco
Saskatoon, SK, Canada..... (306) 956-6294
GE Hitachi Nuclear Energy, Global Nuclear Fuel-Americas, and Cameco have entered into a Memorandum of Understanding to explore several areas of cooperation to advance the commercialization and deployment of BWRX-300 small modular reactors (SMRs) in Canada and around the world. Cameco supplies uranium, uranium refining and conversion services to the nuclear industry worldwide and is a leading manufacturer of fuel assemblies and reactor components for CANDU reactors.

Industry Partners (continued)

AECON Nuclear
Calgary, AB, Canada..... (519) 740-7477
Aecon Nuclear provides a full spectrum of Engineering, Procurement and Construction (EPC) services, in addition to maintenance and manufacturing services for the nuclear power industry.

General Atomics

Major Project(s)
Fast Modular Reactor™ (FMR)

Major Project Description
Small Modular High Temperature Gas Fast Reactor

Project Location or Headquarters
HQ: San Diego, CA

Government Funding Status
DOE ARC-20 Award Winner ($31.1 million)

NRC Licensing Status
Preapplication Interaction

Timeline
Not publicly available

Partners

Industry Partners
Framatome
Lynchburg, VA..... (434) 832-3000
Framatome signed an agreement to provide testing and analyses needs.

Holtec International

Major Project(s)
SMR-160™

Major Project Description
Small Modular Pressurized Water Reactor

Project Location or Headquarters
HQ: Camden, NJ
Project Location: Oyster Creek Nuclear Site, NJ

Government Funding Status
DOE Risk Reduction Award Winner ($147.5 million)

NRC and CNSC Licensing Status
NRC: Preapplication Engagement

CNSC: VDR Phase 1 complete, VDR Phase 2 expected

Timeline
Not publicly available

Partners

Industry Partners

Mitsubishi Electric Power Products
Warrendale, PA..... (724) 772-2555
Mistsubishi will design and engineer the digital instrumentation and control systems (I&C) for Holtec's SMR-160.

Hyundai E&C
Seoul, South Korea..... (822) 2005-0800
Hyundai will complete the Balance-of-Plant (BOP) design for Holtec's SMR-160 small modular reactor and develop the integrated 3D plant model for construction using HDEC's proven Building Information Modelling (BIM) management process.

Kiewit
Kansas City, KS..... (312) 269-2000
Kiewit has signed an agreement to construct the SMR-160 in North America under a carefully delineated work plan and will lead SMR-160 construction projects internationally.

Framatome
Lynchburg, VA..... (434) 832-3000
Holtec International has selected Framatome to develop and qualify the SMR-160 PWR fuel design.

Industry Partners (continued)

ÚJV Řež

Husinec, Czech Republic..... 420 266 172 000
This partnership will provide for technical exchange and cooperation, focusing on the licensing pathway and project assessment for SMR-160.

Mooreside Clean Energy Hub

White Haven, England
Holtec has joined a consortium with 15 major companies to establish the Moorside Clean Energy Hub in North West England. At the center of the Hub's plan is a number of nuclear projects at Moorside, including a new UK-EPR pressurized water reactor together with potentially a batch of small modular reactors and other innovative technologies.

North American ForgeMasters (NAF)

New Castle, PA..... (724) 658-4703
North American Forgemasters (NAF) is a 50-50 joint venture between Scot Forge and Ellwood Group, Inc. NAF will provide the large component forgings for SMR-160s.

Kairos Power

Major Project
Kairos Power Fluoride Salt-Cooled High-Temperature Reactor (KP-FHR)™

Major Project Description
Molten Salt Cooled (LiF:BeF2 aka "Flibe"), TRISO (TRI-structural ISOtropic particle) fueled reactor

Project Location or Headquarters
HQ: Alameda, CA
Project Location (for Hermes demonstration reactor): Oak Ridge, TN

Government Funding Status
DOE Risk Reduction Award Winner ($629 million)

NRC Licensing Status
Construction Permit Application for Hermes demonstration reactor submitted in 2022, undergoing NRC review

Expected Deployment
Hermes Test Reactor: 2026/2027
KP-FHR Commercial Reactor: 2030

Partners

Utility Partners
Tennessee Valley Authority (TVA)
Knoxville, TN..... (865) 632-2101
TVA and Kairos Power have formed a collaborative development agreement to provide defined engineering, operations, and licensing support for the Hermes low-power demonstration reactor.

KP-OMADA Advanced Nuclear Alliance
Kairos Power has assembled leading North American utilities and generating companies to form the Kairos Power Operations, Manufacturing, and Development Alliance (KP-OMADA) – the first modern advanced nuclear consortium in the U.S., which will advise on the development of KP-FHR technology, licensing, manufacturing, construction, and commercialization. Current members include:

- Bruce Power
Tiverton, ON, Canada..... (519) 361-2673
Bruce Power is Canada's only private sector nuclear generator, producing 30% of Ontario's power and employing more than 4,000 people.

Utility Partners (continued)

- Constellation
Baltimore, MD..... (410) 470-9700
Constellation is the United States' leading provider of carbon-free energy powering over 20 million homes.

- Southern Company
Atlanta, GA..... (404) 506-5000
Southern Company is an American gas and electric utility holding company serving 9 million customers through its subsidiaries.

- **Tennessee Valley Authority (TVA)**
Knoxville, TN..... (865) 632-2101
The largest federally owned utility corporation in the U.S., providing electricity for 153 local power companies serving 10 million people.

Other Partners

Materion Corporation (ARDP Partner)
Mayfield, Ohio..... (216) 486-4200
Kairos Power and Materion Corporation have partnered in a strategic collaboration to develop a reliable and cost-effective supply of salt coolant for high-temperature molten salt reactors. This coolant is a key component of Kairos Power's fluoride salt-cooled, high-temperature reactors (KP-FHR). Under the agreement, Materion supplies beryllium fluoride, expert technical consultation, and key interfaces, as well as operational support for the Kairos Power-designed Molten Salt Purification Plant. Materion is also a partner in the ARDP Risk Reduction award to support construction, operation, and commissioning of Kairos Power's Hermes demonstration reactor.

EPRI (ARDP Partner)
Charolotte, NC..... (650) 855-2121
The Electric Power Research Institute (EPRI) is a partner in the ARDP Risk Reduction award to support construction, operation, and commissioning of Kairos Power's Hermes demonstration reactor. EPRI conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally.

Other Partners (continued)

Idaho National Laboratory (ARDP Partner)
Idaho Falls, ID..... (866) 495-7440
Idaho National Laboratory (INL) is a partner in the ARDP Risk Reduction award to support construction, operation, and commissioning of Kairos Power's Hermes demonstration reactor. INL also partnered with Kairos Power on government contract awards including development of a prototype control room for an advanced reactor, among others.

Argonne National Laboratory (ARDP Partner)
Lemont, IL..... (630) 252-2000
Argonne National Laboratory and Kairos Power have collaborated on multiple government contract awards, including the development of the System Analysis Module (SAM) Reactor Analysis Code to simulate entire nuclear power plants, and the development of an analytical method to detect oxygen impurities in Flibe salt.

Oak Ridge National Laboratory (ARDP Partner)
Oak Ridge, TN..... (865) 576-7658
Oak Ridge National Laboratory (ORNL) is a partner in the ARDP Risk Reduction award to support construction, operation, and commissioning of Kairos Power's Hermes demonstration reactor. Sited in Oak Ridge, TN, Hermes will build upon research first pioneered in the lab on molten salts and the TRISO annular pebble fuel form to be used in KP-FHR. ORNL has also partnered with Kairos Power on government contract awards including fabrication and testing of corrosion-resistant alloys for use in molten fluoride salt environments, among others.

Sandia National Laboratory (ARDP Partner)
Albuquerque, NM..... (505) 844-8066
Sandia National Lab and Kairos Power have collaborated on multiple government contract awards including a DOE Advanced Valve Project grant to develop a more reliable, high-temperature molten salt valve that can safely collect, store and transfer extremely hot and corrosive molten salt.

Other Partners (continued)

Canadian Nuclear Laboratories
Deep River, ON, Canada..... (613) 584-3311
Canadian Nuclear Laboratories and Kairos Power collaborated on a grant funded through the Canadian Nuclear Research Initiative (CNRI) to engineer technologies to better separate, analyze and store tritium generated in small modular reactors.

Los Alamos National Laboratory (ARDP Partner)
Los Alamos, NM..... (505) 667-4391
Los Alamos National Lab and Kairos Power have collaborated on multiple government contract awards including a study of molten salt as a coolant for advanced nuclear reactors, working together to develop new technologies to study chemical reactions within, and thermophysical properties of, molten fluoride salt.

NuScale Power Corp

Major Project(s)
NuScale Power Module™(NPM),
VOYGR™ SMR Power Plant

Major Project Description
Small Modular Integral Pressurized Water Reactor and Power Plant

Project Location or Headquarters
HQ: Portland, OR
Project Location: Idaho National Lab, Idaho Falls, ID (Carbon Free Power Project)

Government Funding Status
DOE cost-shared financial assitance awards of over $450 million

NRC and CNSC Licensing Status
NRC: Standard Design Certification approved in 2020, Standard Design Approval for uprated NuScale Module in progress, and Combined Operating License Application for CFPP facility expected in mid 2020s

CNSC: VDR Phase 2 in progress

Timeline
CFPP Project Deployment Expected: 2029/2030

Partners

Utility Partners
Utah Associated Minicipal Power Sytems (UAMPS)
Salt Lake City, UT..... (801) 566-3938
UAMPS is a interlocal agency that provides comprehensive wholesale electric energy services, on a non-profit basis, to community-owned power systems throughout the Intermountain West. UAMPS is spearheading the Carbon Free Power Project (CFPP), which will enable the first NuScale small modular reactor (SMR) power plant to begin operation in Idaho Falls, Idaho by the end of the decade.

Societatea Nationala Nuclearelectrica SA (SNN)
Bucharest, Romania..... +40 21-203-8200
SNN, a Romanian nuclear energy provider, signed an MOU with NuScale to conduct engineering studies, technical reviews, and licensing and permitting activities at a site in Doicesti, Romania that is the preferred location for the deployment of the first NuScale power plant in Romania.

Utility Partners (continued)

Associated Electric Cooperation Incorporated (AECI)
Springfield, MO..... (417) 881-1204
AECI is owned by and provides wholesale power to a system of six regional transmission cooperatives and their 51 local distribution cooperatives, delivering electricity to 2.1 million people in the region. NuScale signed an MOU with AECI to work together to evaluate NuScale's SMR design as a part of AECI's due diligence to explore reliable, responsible sources of energy for potential deployment.

Xcel Energy
Minneapolis, MN..... (800) 481-4700
Xcel Energy, a leading energy utility provider, signed an MOU with NuScale to explore the feasibility of Xcel Energy serving as a preferred partner to provide a suite of operational power plant services to NuScale customers based on Xcel Energy's exceptional nuclear operational management systems.

Kozloduy Nuclear Power Plant – New Build Plc (KNPP-NB)
Kozloduy, Bulgaria..... +359 9-737-2611
The Kozloduy site is home to Bulgaria's only operating nuclear power plants and KNPP-NB is exploring the possibility of deploying advanced nuclear technology at this location. NuScale and KNPP-NB have an MOU to explore deploying NuScale's SMR technology at the Kozloduy site.

ČEZ Group
Prague, CZ..... +420 211-041-111
ČEZ currently operates two nuclear power plants in the Czech Republic, with nuclear power generating roughly one third of all electricity in the country. NuScale and ČEZ Group have an MOU to share nuclear and technical expertise as the two companies examine applications for NuScale's SMR technology.

Utility Partners (continued)

Energoatom
Kyiv, Ukraine
The National Nuclear Energy Generating Company of Ukraine (Energoatom) is the Ukrainian state operator for the country's four nuclear power stations. NuScale and Energoatom have an MOU to explore the deployment of NuScale Power plants in Ukraine.

Dairyland Power Cooperative
La Crosse, WI..... (608) 788-4000
Dairyland provides the wholesale electrical requirements for distribution cooperatives and municipal utilities around Wisconsin. NuScale and Dairyland Power have signed an MOU to explore safe, clean, and cost-effective energy solutions for the future.

Grant County Public Utility District (Grant PUD)
Ephrata, WA..... (509) 766-2505
NuScale and Grant PUD have signed an MOU to evaluate the deployment of NuScale's advanced nuclear technology in Central Washington, including supporting Grant PUD's due diligence process in evaluating reliable, carbon-free energy solutions.

Industry Partners

Fluor
Irving, TX..... (469) 398-7000
Fluor is a global engineering, procurement, fabrication, and construction (EPFC) company providing project services for) SMR technologies, operations support for existing facilities, and waste management. Fluor is the major investor in NuScale Power and will provide it's EPFC expertise and financial strength to support the deployment of NuScale's SMR technology.

Doosan Enerbility
Changwon, South Korea..... +82 55-278-6114
Doosan, a Korean industrial and energy company, commenced its partnership with NuScale in 2019, and has since completed the design for manufacture of the NPM and performed manufacturing trials to reduce schedule risk and increase cost certainty. Doosan has begun forging die development and will begin production of forging materials for NuScale's SMRs in 2022, with expectations for full-scale equipment manufacturing by the latter half of 2023.

Industry Partners

JGC Holdings Coporation
Yokohama, Japan..... +81 45-682-1111
JGC Holdings Corporation, a holding company of the world's leading EPC contractor group companies headquartered in Japan, will work with NuScale to secure and execute SMR EPC projects on a global basis and intends to seek opportunities in integrating SMRs with renewable energy and non-electricity applications. As part of a commercial relationship with Fluor, JGC provided a $40 million cash investment in NuScale and will partner with Fluor on the deployment of NuScale power plants.

GS Energy Corporation
Seoul, South Korea..... +82 22-005-0800
GS Energy, a Korean energy services company, will provide a cash investment in NuScale Power and support deployment of NuScale power plants. The two parties will also look to develop regional NuScale power plant service delivery opportunities.

Sargent & Lundy
Chicago, IL..... (312) 269-2000
Sargent & Lundy has experience in power and energy, and has delivered engineering, design, analysis, compliance, and project management services for nuclear power projects since 1954. Sargent & Lundy has made a cash investment in NuScale Power and will provide joint marketing and design services for the deployment of new NuScale power plants worldwide.

Sarens
Rowesville, SC..... (803) 534-1348
Sarens USA will provide both heavy crane supply for construction as well as engineering, and transportation planning, and will be the heavy haul provider that gets the NPM™ from the factory to the first site.

IHI Corporation
Tokyo, Japan..... +81 36-204-7800
IHI Corporation is a Japanese engineering company, with experience in supplying key components for the nuclear industry. IHI made a cash investment in NuScale Power and will be a preferred supplier of certain manufactured components for NuScale power plants globally.

Industry Partners (continued)

Samsung C&T
Yongin-si, South Korea..... +82 22-145-5114
Samsung C&T is a Korean construction and engineering company under the Samsung Group and has experience in design, materials procurement, and construction for more than 10 nuclear power plants. Samsung C&T has made an equity investment in NuScale Power and will serve as a strategic partner to Fluor for NuScale projects.

BWXT Nuclear Energy Canada
Cambridge, ON, Canada..... (717) 235-5469
BWXT NEC has over 60 years of experience in the design and supply of large nuclear vessels and other highly reliable nuclear equipment that is used to fuel, inspect, and refurbish reactors. NuScale has collaborated with BWXT NEC to evaluate NPM manufacturability and to develop the fabrication process for the NPMs.

Curtiss-Wright Corportation
Davidson, NC..... (704) 869-4600
Curtiss-Wright Corporation is a global provider of highly engineered, technologically advanced products and services. Curtiss-Wright Target Rock is providing design engineering, procurement, fabrication, and testing services for NuScale's Emergency Core Cooling System (ECCS) Valves.

Honeywell
Charlotte, NC..... (877) 841-2840
Honeywell is an American advanced-technology and manufacturing company. Honeywell will be providing digital control systems for the NuScale power plant.

Paragon Energy Solutions
Fort Worth, TX..... (817) 284-0077
Paragon provides supply chain management solutions and manufactures and services safety-related parts and components for the U.S. commercial nuclear industry, including utility companies with nuclear facilities. NuScale selected Paragon Energy Solutions (Rock Creek Innovations) to perform the final design and manufacturing for its Highly Integrated Protection System (HIPS) platform.

Industry Partners (continued)

PaR Systems
Shoreview, MN..... (801) 464-1320
PaR Systems is a systems engineering firm specializing in automated manufacturing and material handling equipment. NuScale selected PaR Systems to undertake engineering work for the manufacturing of its Reactor Building Crane (RBC).

Prodigy Clean Energy Ltd.
Montreal, QC, Canada
Prodigy Clean Energy is a Canadian marine nuclear power developer specializing in integrating commercial power reactors into stationary-deployed Marine Power Stations. NuScale has an MOU with Prodigy Clean Energy Ltd. and Kinectrics to explore the licensing and deployment of a Prodigy SMR MPS.

Kinectrics
Etobicoke, ON, Canada..... (416) 207-6000
Kinectrics is a leader in providing life cycle management services for the electricity industry. NuScale has an MOU with Prodigy Clean Energy Ltd. and Kinectrics to explore the licensing and deployment of a Prodigy SMR MPS.

KGHM Polska Miedź S.A. (KGHM)
Lubin, Poland..... +48 76-747-82-00
KGHM is a Polish multinational corporation producing copper and silver and is a large industrial energy user. NuScale and KGHM signed a landmark agreement to initiate work towards implementing NuScale SMRs in Poland.

Shearwater Energy Ltd.
Leamington Spa, United Kingdom .....
.....+44 0203-507-1933
Shearwater Energy is a UK-based hybrid energy developer. In early 2021, it announced NuScale as the leading U.S. SMR technology to provide the carbon-free baseload and load following energy to its planned wind-SMR hydrogen production project. NuScale and Shearwater Energy have an MOU to further advance this project.

Industry Partners (continued)

Jordan Atomic Energy Commission (JAEC)
Amman, Jordan…..+962 06-200460
JAEC is the government entity that both manages the nuclear program and leads the development and implementation of nuclear strategy in Jordan. NuScale and JAEC are collaborating to conduct a joint feasibility assessment of NuScale's SMR across Jordan.

ARES Corporation
Burlingame, CA…..... (650) 401-7100
ARES Corporation, a quantitative risk management firm, secured an equity position in NuScale Power through a strategic partnership agreement in 2012.

ENERCON Services Inc.
Kennesaw, GA…..... (770) 919-1930
ENERCON is an engineering, environmental, and technical services company serving the energy industry with particular focus on nuclear power. ENERCON has an equity position in NuScale Power. As part of this agreement, ENERCON utilized its licensing expertise to support the development of the Design Certification Application (DCA).

Precision Custom Components (PCC)
York, PA…..... (717) 848-1126
PCC is a manufacturer of custom fabricated pressure vessels, reactors, casks, and heavy walled components requiring highly specialized machining, welding, and/or fabrication. PCC will provide design engineering, procurement, fabrication, and testing services for NPMs and their components.

Sensia
Houston, TX…..... (866) 773-6742
Sensia provides measurements solutions and is supporting NuScale with pressure, level, and flow sensor technology development.

Bentley Systems
Exton, PA…..... (610) 458-5000
Bentley Systems is an infrastructure engineering software company. Bentley is on the NuScale evaluated supplier list (ESL) and verification testing for AutoPIPE is performed under the Bentley quality assurance (QA) program.

Industry Partners

Ansys
Canonsburg, PA…..... (844) 462-6797
Ansys is the largest engineering simulation company in the world. NuScale has access to the Ansys structures, fluids suites, and high-performance computing solutions. NuScale will leverage Ansys technology to simulate designs for module containment, thermal hydraulics, and structural integrity of reactor power modules.

Aras
Andover, MA…..(978) 806-9400
NuScale uses Aras's Innovator Platform to provide end-to-end solutions to support regulatory standards, configuration best practices and maintenance support for their SMR. NuScale will be the first nuclear power plant to be designed and managed with Aras Product Lifecycle Management (PLM) as the backbone for its single source of data.

Ultra
Round Rock, TX..... (512) 434-2800
Ultra Nuclear Control Systems will serve as the primary supplier for NuScale-related I&C equipment in the U.S at its Texas-based facility.

Framatome
Lynchburg, VA..... (434) 832-3000
Framatome signed an agreement with NuScale to manufacture fuel assemblies for its SMR based on conventional ceramic uranium dioxide fuel and to provide testing and analyses needed for its Nuclear Regulatory Commission design certification application.

Other Partners

Japan Bank for International Cooperation (JBIC)
Tokyo, Japan…..... +81 03-5218-3100
JBIC joined Japan NuScale Innovation, LLC (JNI) in making a strategic investment of $110 million in NuScale through a purchase of equity from Fluor Corporation. This investment in NuScale represents an expansion in U.S.-Japanese cooperation to progress the deployment of advanced nuclear energy technology.

Other Partners (continued)

SailingStone Capital Partners
San Francisco, CA…..(415) 429-5198
SailingStone provides investment solutions in the global natural resource space with a specific focus on the industrial businesses, commodities, and infrastructure assets, which will enable the energy transition. SailingStone committed to a $10 million private investment in public equity (PIPE) in furtherance of the NuScale-Spring Valley merger transaction.

State Scientific and Technical Center for Nuclear and Radiation Safety (SSTC NRS)
Kyiv, Ukraine…..... +380 (044) 450-05-00
In February 2020, NuScale and the SSTC NRS signed an MOU where both parties will collaborate on the regulatory and design gaps between the U.S. and Ukraine processes for the licensing, construction, and operation of a NuScale SMR power plant in Ukraine.

Nucor Corporation
Charlotte, NC…..(704) 366-7000
Nucor and its affiliates are manufacturers of steel and steel products, with operating facilities in the United States, Canada, and Mexico. Nucor invested $15 million via a private investment in public equity (PIPE) in NuScale Power.

Oklo

Major Project
Aurora Powerhouse™

Major Project Description
Fast Spectrum Solid Core Microreactor

Project Location or Headquarters
HQ: Santa Clara, CA
Project Location: Idaho National Lab, Idaho Falls, ID

Government Funding Status
ARPA-E ONWARDS award winner, ARPA-E OPEN award winner, DOE TCF award winner, DOE is supplying first core load.

NRC Licensing Status
Combined Operation License (COL) Application submitted 2020.
COL Application resubmission expected in 2022.

Expected Deployment
INL Demonstration: 2025/2026

Partners

Industry Partners

Deep Isolation
Berkeley, CA..... (415) 915 6505
Through a DOE-ONWARDS award, INL, Deep Isolation, and Oklo will identify transformative pathways to reduce waste material and minimize the need for disposal sites.

Centrus
Maryland, USA..... (301) 564-3200
Oklo Inc and Centrus Energy Corp have signed a non-binding Letter of Intent to cooperate in the deployment of a production facility for high-assay low-enriched uranium (HALEU) to support the commercialization of advanced fission plants, such as Oklo's Aurora.

Compass Mining
Austin, TX..... (888) 871-3071
Oklo announced a 20-year commercial partnership with Compass Mining (Compass), the world's first online marketplace for Bitcoin mining hardware and hosting.

Other Partners

Argonne National Laboratory (ANL)
Lemont, IL..... (630) 252-2000
Awards granted through the ARPA-E ONWARDS and OPEN programs, and the DOE's Technology Commercialization Fund, Oklo and Argonne are partnering on cutting-edge fuel recycling projects, including demonstrating the end-to-end fuel recycling process to develop a secure and economical domestic fuel supply chain for advanced fission.

Idaho National Lab (INL)
Idaho Falls, ID..... (866) 495-7440
DOE-INL has provided Oklo with their first core and Oklo's first Aurora Powerhouse will also be sited at INL.

TerraPower

Major Project
Natrium™

Major Project Description
Sodium Fast Reactor

Project Location or Headquarters
HQ: Bellevue, Washington
Demonstration Project Location: Kemmerer, Wyoming

Government Funding Status
DOE Demonstration Award Winner ($1.25 billion)

NRC Licensing Status
Preapplication Interaction,
Constuction Permit Application Expected FY23.

Timeline
Demonstration Reactor Operation Expected: 2028

Partners

Utility Partner
Pacificorp
Portland, OR..... (888) 740-6700
PacifiCorp is an electric power company in the western United States that will be the operator for the Natrium™ project.

Technology Partner
GE-Hitachi
Wilmington, NC
GE-Hitachi Nuclear Energy is a provider of advanced reactors and nuclear services. TerraPower's Natrium design is based off TerraPower's TWR and GE-Hitachi's PRISM reactor designs and TerraPower will collaborate with GE-Hitachi as a technology partner to build the Natrium™ project.

Industry Partners
Bechtel
Reston, VA..... (571) 392-6300
Bechtel Corporation is an American engineering, procurement, construction, and project management company. TerraPower chose Bechtel as its plant design, licensing, procurement, and construction partner in a federal grant application to build a demonstration plant for the Natrium™ reactor and energy system architecture.

Industry Partners (continued)

Orano Federal Services
Bethesda, MD..... (301) 841-1600
Orano USA is a technology and services provider for decommissioning shutdown nuclear energy facilities, managing used nuclear fuel, conducting federal site clean-up and closure, and the sale of uranium, conversion, and enrichment services to the U.S. commercial and federal markets.

Global Nuclear Fuels Americas, LLC
Wilmington, NC
Global Nuclear Fuel, a GE-led joint venture, is a leading supplier of boiling water reactor fuel and fuel-related engineering services.

Energy Northwest
Richland, WA..... (509) 372-5000
Energy Northwest is a public power joint operating agency in the northwest United States. They will provide licensing and operating experience to the TerraPower-GE Hitachi team to facilitate development of the concept, including the potential for future operation and maintenance of a commercial plant.

Other Partners

Idaho National Laboratory (INL)
Idaho Falls, ID..... (866) 495-7440
INL a DOE national laboratory, is the nation's leading center for nuclear energy research and development.

Argonne National Laboratory (ANL)
Lemont, IL..... (630) 252-2000
ANLis a science and engineering research national laboratory operated by UChicago Argonne LLC for the United States Department of Energy.

Pacific Northwest National Laboratory (PNNL)
Richland, WA..... (509) 375-2121
Pacific Northwest National Laboratory is one of the United States Department of Energy national laboratories, managed by the Department of Energy's Office of Science.

TerraPower

Major Project
Molten Chloride Reactor Experiment™ (MCRE)

Major Project Description
Liquid Fueled Molten Chloride Salt Reactor (with Southern Company as a partner)

Project Location or Headquarters
HQ: Bellevue, Washington
MCRE Project Location: Idaho National Lab, Idaho Falls, Idaho

Government Funding Status
DOE Risk Reduction Award Winner ($113 million)

NRC Licensing Status
Preapplication Interaction

Timeline
Reactor Operation Expected: 2025

Partners

Utility Partner

Southern Company
Atlanta, GA..... (404) 506-5000
Southern Company is an American gas and electric utility holding company based in the southern United States. Southern Company's Research and Development branch is also developing low- and no-carbon generation technologies, advancing renewables, energy storage and distributed generation solutions, and modernizing the grid.

Industry Partners

CORE POWER
Bethesda, MD..... (301) 564-3200
CORE POWER works on the successful deployment of advanced reactor technologies for the maritime industries.

Industry Partners (continued)

Orano Federal Services
Bethesda, MD..... (301) 841-1600
Orano Federal Services is a partner for environmental cleanup and advanced nuclear solutions with a corporate focus on climate change.

3M Company
St. Paul, MN..... (888) 364-3577
3M™ Stable Isotopes are used in a variety of nuclear power plant and research applications, including: reactor criticality control; both wet and dry, spent, and fresh fuel transportation and storage; nuclear waste containment; and neutron radiation control.

Other Partners

Idaho National Laboratory (INL)
Idaho Falls, ID..... (866) 495-7440
Idaho National Laboratory, a DOE national laboratory, is the nation's leading center for nuclear energy research and development.

Electric Power Research Institute
Charolotte, NC..... (650) 855-2121
The Electric Power Research Institute, Inc., is an American independent, nonprofit organization that conducts research and development related to the generation, delivery, and use of electricity

Terrestrial Energy

Major Project(s)
Integral Molten Salt Reactor™ (IMSR)

Major Project Description
Liquid Fueled, Molten Salt Reactor

Project Location or Headquarters
HQ: Toronto, Ontario, Canada

Government Funding Status
DOE $3M award to support licensing and commercialization of IMSR

NRC and CNSC Licensing Status
NRC: Preapplication Interaction, Standard Design Approval Application expected FY23

CNSC: VDR Phase 1 complete, VDR Phase 2 in progress

Timeline
Not publicly available

Partners

Industry Partners

Hatch
Dallas, TX..... (972) 457-9006
The agreement with Hatch provides support for engineering, component procurement, project and construction management, and power plant cost estimation relating to the development and construction of an IMSR power plant.

BWXT Canada
Cambridge, ON, Canada..... (717) 235-5469
Terrestrial Energy has signed engineering design contracts with BWXT Canada for steam generators and heat exchangers for use in the IMSR.

Westinghouse
Cranberry, PA..... (717) 235-5469
Westinghouse and the UK National Nuclear Laboratory signed an agreement for nuclear fuel development and supply to advance the industrial scale up and commercial supply of enriched uranium fuel for use in Terrestrial Energy's IMSR.

Industry Partners (continued)

KBR
Houston, TX..... (822) 200-5080
KBR, Inc. is a U.S. based company operating in fields of science, technology and engineering. Terrestrial Energy has signed an agreement with KBR to investigate the application of zero-emission thermal energy for hydrogen and ammonia production.

ANTSO Synroc
Melbourne, Australia..... +61 3 8540 4100
ANSTO will provide technical consulting services to Terrestrial Energy for the conditioning of used reactor fuel from the operation of Integral Molten Salt Reactor heat and power plants in Canada, United Kingdom, United States, and other global markets.

L3Harris
Montreal, QC, Canada..... (450) 476-4000
Terrestrial Energy signed a contract with L3Harris to develop an engineering and operator training simulator for the IMSR.

Siemens Energy Canada
Oakville, ON, Canada..... (905) 465-8000
Siemens Energy Canada will manufacture and supply steam turbines and other balance-of-plant equipment, such as transformers, switchgear, and motor drive systems, for the IMSR.

Cameco
Saskatoon, SK, Canada..... (306) 956-6294
Cameco Corporation will examine potential partnership opportunities to deploy the IMSR in North America and worldwide, and will evaluate possible opportunities for the supply of uranium, fuel and other services. As part of these activities, Terrestrial and Cameco will investigate the potential of Cameco's Port Hope uranium conversion facility.

Orano
Saskatoon, SK, Canada..... (306) 343-4500
The agreement with Orano includes uranium enrichment, chemical conversion to IMSR fuel form, its production, transportation, packaging, and logistics. This scope covers analysis for full-scale commercial production and supply of IMSR fuel and applies to major markets for IMSR power plant deployment today, including Canada, the US, the UK, and Japan.

Industry Partners (continued)

ENGIE Laborelec
Linkebeek, Belgium
ENGIE Laborelec will perform confirmatory electrochemical and thermophysical measurements as well as confirmatory corrosion testing. The tests will be performed under conditions compliant with quality assurance protocols of nuclear codes and standards, as is required to advance a nuclear power plant design through the regulatory process. To perform this wide range of testing, ENGIE Laborelec will work in close collaboration with its partners, John Cockerill, CRM Group and IJCLab-CNRS.

Aecon Group
Calgary, AB, Canada..... (519) 740-7477
Aecon will review Terrestrial Energy's construction costs and schedules for IMSR, as well as undertake constructability, modularization, and supplier assessments for a broad range of activities including plans for site development and heavy civil construction.

KSB Pump
Mississauga, ON, Canada..... (905) 568-9200
KSB Pumps will supply, develop, and manufacture primary pumps.

Other Partners

Argonne National Laboratory (ANL)
Lemont, IL..... (630) 252-2000
Terrestrial Energy USA, Inc. has extended its testing program at Argonne National Laboratory (ANL) for measurements of fuel salt properties used in the IMSR.

First Nations Power Authority (FNPA)
Regina, SK, Canada..... (408) 621-0337
Terrestrail Energy and First Nations Power Authority (FNPA) have signed a Memorandum of Understanding (MOU) to explore opportunities to build Indigenous capacity for the future advanced small modular reactor (SMR) industry. Potential collaborative activities include the development of skills training, employment and commercial opportunities that could spur multi-generational Indigenous economic wealth.

Industry Partners (continued)

UK Nuclear National Laboratory

Sellafield, UK..... +31 (0)224 56 4950

Westinghouse and the UK National Nuclear Laboratory signed an agreement for nuclear fuel development and supply to advance the industrial scale up and commercial supply of enriched uranium fuel for use in Terrestrial Energy's IMSR.

Ultra Safe Nuclear

Major Project(s)
Micro Modular Reactor (MMR®)

Major Project Description
Micro High Temperature Gas Reactor

Project Location or Headquarters
HQ: Seattle, WA
Project Location: Chalk River Laboratories, ON, Canada; and University of Illinois, Urbana-Champaign, IL

Government Funding Status
DOE GAIN Voucher Awardee

NRC and CNSC Licensing Status
NRC: Preapplication Engagement

CNSC: VDR Phase 1 complete, VDR Phase 2 in progress, License To Prepare Site submitted in 2021

Timeline
UIUC Project Deployment Expected: 2026
Chalk River National Lab Project Deployment Expected: 2026

Partners

Utility Partners
Ontario Power Generation (OPG)
Toronto, ON, Canada..... (416) 592-2555
OPG has partnered with USNC to create a joint venture called Global First Power (GFP) , which will which will build, own, and operate the Micro Modular Reactor (MMR®) Project at the Chalk River Laboratories site, and is scheduled for operation 2026.

Construction Permit Partner
University of Illinois, Urbana-Champaign
Champaign, IL..... (217) 333-1000
UIUC will apply for a license to construct a research and test reactor facility on the UIUC campus based on USNC's MMR technology

Industry Partners
Nuclear Research & Consultancy Group (NRG)
Netherlands..... +31 (0)224 56 4950
NRG will implement a program to analyze performance and safety attributes of the company's proprietary Fully Ceramic Micro-encapsulated (FCM™) fuel designed for use in its Micro Modular Reactor (MMR®).

Industry Partners (continued)

Hyundai Engineering Company, Ltd.
Seoul, South Korea..... (822) 2005-0800
Hyundai Engineering announced that it has signed a contract with USNC to provide a detailed design of a micro modular reactor (MMR®) to be built at Chalk River Laboratories.

Howden
Renfrew, UK
USNC has contracted with UK-based Howden to design a helium circulator for use in the company's Micro-Modular Reactors (MMR®). Ultra Safe Nuclear is investing in submerged helium blowers to maximize heat transfer in the MMR's power plant.

Korea Atomic Energy Research Institute (KAERI)
Daejeon, South Korea..... +82 42868200
This partnership will provide for technical exchange and cooperation. The five-year agreement outlines goals for development of technologies that enhance the USNC Micro-Modular Reactor's (MMR®) ability to produce and deliver carbon-free power, heat, and hydrogen in future MMR installations. This agreement includes investigating applications for the MMR technology in South Korea.

Reed College
Reed, OR..... (503) 771-1112
USNC-Tech and Reed College of Portland, OR have reached an agreement to irradiate material for the company's first-of-its-kind commercial radioisotope heater. The irradiation is an important step in the development of a commercially viable heating solution for space systems.

Synthos Group
Oświęcim, Poland..... +48 33 844 18 21
In November 2020, Synthos signed a cooperation agreement with Ultra Safe Nuclear Corporation (USNC). USNC and Synthos jointly applied to the Polish Ministry of Development for financing from the IPCEI mechanism (Important Projects of Common European Interest) for projects within the scope of the value chain of hydrogen technologies and systems.

Westinghouse

Major Project(s)
eVinci Microreactor™

Major Project Description
Thermal Spectrum Solid Core Heat Pipe Microreactor

Project Location or Headquarters
HQ: Cranberry, PA

Government Funding Status
US: DOE Risk Reduction Award Winner ($9.3 million)
Canada: C$27.2 million from the Government of Canada's Strategic Innovation Fund (SIF)

NRC and CNSC Licensing Status
NRC: Preapplication Interaction, Standard Design Certification Application expected FY23

CNSC: VDR Phase 2 Application under development

Timeline
Not publicly available

Partners

Industry Partners
Saskatchewan Research Council (SRC)
Saskatoon, SK, Canada..... (306) 933-5400
Westinghouse and SRC will jointly develop a project to locate an eVinci™ micro-reactor in Saskatchewan for the development and testing of industrial, research, and energy use applications.

Bruce Power
Tiverton, ON, Canada..... (519) 361-2673
The work between the two companies will focus on furthering the public policy and regulatory framework; assessing the economic, social and environmental contribution of the eVinci technology compared to alternates such as diesel or other fossil fuels; identifying potential industrial applications; and accelerating the roadmap for Canada to host a globally recognized demonstration as part of the federal small modular reactor (SMR) action plan.

Other Partners

Southern Company
Atlanta, GA..... (404) 506-5000
Southern Company is an American gas and electric utility holding company based in the southern United States. Southern Company's Research and Development branch is also developing low- and no-carbon generation technologies, advancing renewables, energy storage and distributed generation solutions, and modernizing the grid.

Idaho National Laboratory (INL)
Idaho Falls, ID..... (866) 495-7440
INL will qualify the fuel and will perform site assessments of the eVinci microreactor design from Westinghouse.

Penn State University
Valley, PA..... (814) 865-4700
Penn State and Westinghouse will partner on research and development focused on exploring and applying nuclear engineering and science innovations to societal needs. They will also begin discussions about siting Westinghouse's eVinci™ micro-reactor at University Park.

Los Alamos National Laboratory
Los Alamos, NM..... (505) 667-4391
Westinghouse and SRC will jointly develop a project to locate an eVinci™ micro-reactor in Saskatchewan for the development and testing of industrial, research, and energy use.

X-energy

Major Project
Xe-100™

Major Project Description
Small Modular High Temperature Gas Reactor

Project Location or Headquarters
HQ: Greenbelt, MD
Project Location: Richland, WA

Government Funding Status
DOE Demonstration Award Winner ($1.25 billion)

NRC and CNSC Licensing Status
NRC: Preapplication Interaction, Constuction Permit Application Expected FY23

CNSC: VDR Phase 2 in progress

Timeline
Demonstration Reactor Operation Expected: 2027

Partners

Utility Partners
Energy Northwest
Richland, WA..... (509) 372-5000
Energy Northwest is a public power joint operating agency in the northwest United States and will be the operator for the Xe-100 project in Washington.

Grant County Public Utility District (Grant PUD)
Ephrata, WA.…..... (509) 766-2505
Grant County PUD, is a public utility district in north central Washington state.

Industry Partners
Kinectrics
Naperville, IL..... (416) 207-6000
X-energy and Kinectrics will collaborate on regulatory affairs, safety and licensing, and equipment qualification and testing.

Hatch
Dallas, TX..... (972) 457-9006
X-energy signed a collaboration agreement for engineering and project management with Hatch Ltd for projects in Canada and globally.

Industry Partners (continued)

Cavendish Nuclear
Birchwood, UK..... (571) 392-6300
Cavendish Nuclear, part of Babcock International Group, has signed a Memorandum of Understanding (MoU) with X-energy to act as its deployment partner for High Temperature Gas Reactors in the UK.

Amstead Graphite Material
Anmoore, WV..... 304-624-1200
Amsted Graphite Materials (AGM) and X-energy announced a partnership to establish an integrated domestic supply chain for nuclear-grade graphite to reduce dependence on foreign sources, bolster advanced manufacturing capabilities, and secure the nuclear energy supply chain in the United States.

BWXT Nuclear
Lynchburg, VA..... (434) 522-3800
BWXT Nuclear Operating Group provides a complete range of nuclear components and services, including the manufacturing of nuclear reactor components for U.S. Navy submarines and aircraft carriers and other nuclear and non-nuclear R&D and component production.

Centrus
Kennewick, WA..... (509) 627-4300
Centrus Energy Corp has helped with the design of X-energy's TRISO-X Fuel Faciility that will be sited in Oak Ridge, TN.

Southern Company
Atlanta, GA..... (404) 506-5000
Southern Company's Research and Develop-
Southern Company is an American gas and electric utility holding company based in the southern United States. Southern Company's Research and Development branch is also developing low- and no-carbon generation technologies, advancing renewables, energy storage and distributed generation

Joseph Oat Corporation
Camden, NJ..... (571) 392-6300
Joseph Oat Corporation is a designer and fabricator of pressure vessels, reactors, columns, heat exchangers, and other specialty items for the chemical, petrochemical, nuclear power, and other commercial industries.

Industry Partners (continued)

Lehigh Heavy Forge Corporation
Bethlehem, PA..... (603) 601-0450
Lehigh Heavy Forge produces a full range of forgings for the commercial nuclear power industry including: steam generators, pressure vessels, reactor vessels, and storage casks. All of these components are forged, heat treated, tested, and machined finished in accordance with a quality system compliant with the ASME Code Section III, NCA 3800 and RCC-M specifications.

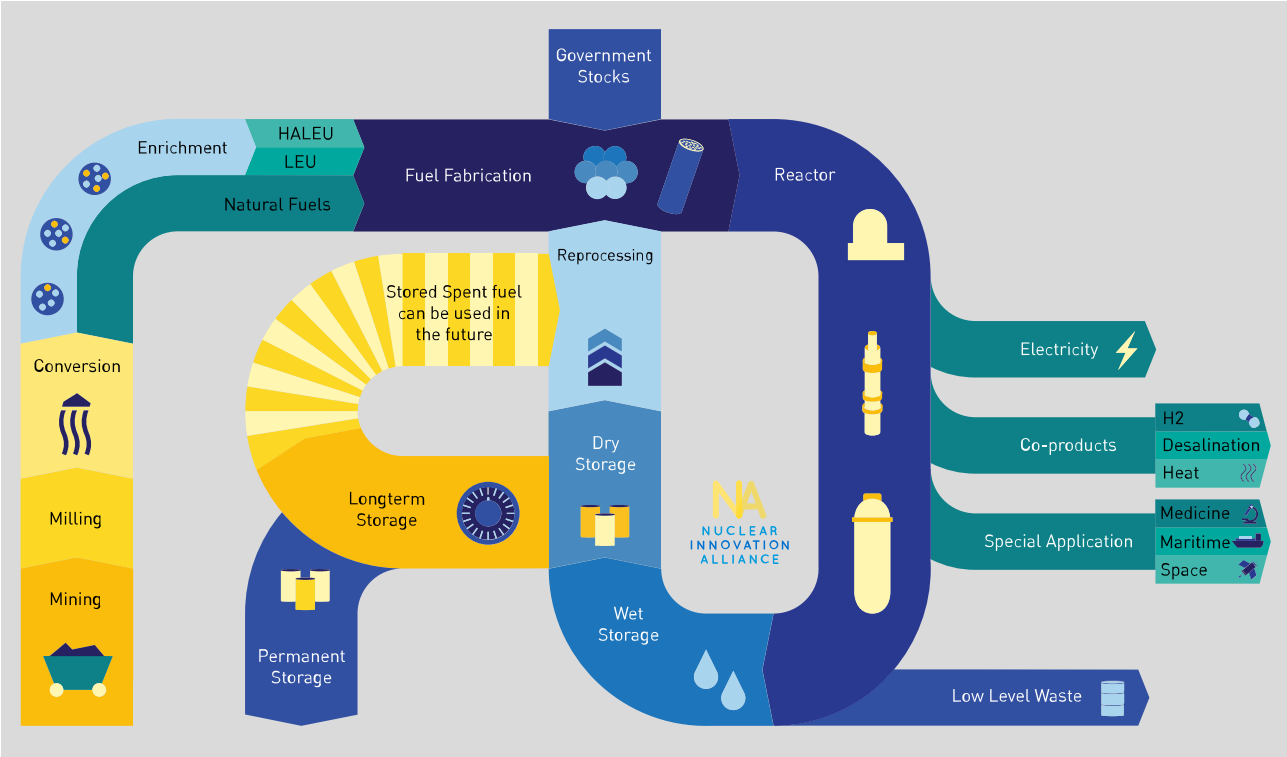
Sargent and Lundy
Chicago, IL..... (312) 269-2000
Sargent & Lundy will provide joint marketing and design services.

Marlyand Energy Adminstration
Baltimore, MD..... (908) 580-1119
MEA has awarded grants to X-energy and Frostburg State University to work together to evaluate the economic viability and social-economic advantages of repurposing a specific Maryland coal-fired electric generating facility with X-energy's Xe-100.

Other Partners

Oak Ridge National Laboratory
Oak Ridge, TN..... (303) 751-0741
Through an ARC15 awards, X-energy was able to demonstrate a commercial-scale TRISO fuel line at ORNL to demonstrate their fuel technology. Now X-energy will be creating their TRISO-X fuel fabrication facility near ORNL in Oak Ridge, TN.

First Nations Power Authority
Regina, SK, Canada..... (408) 621-0337
X-energy Canada and First Nations Power Authority (FNPA) have signed a Memorandum of Understanding (MOU) to explore opportunities to build Indigenous capacity for the future advanced SMR industry. Potential collaborative activities include the development of skills training, employment and commercial opportunities that could spur multi-generational Indigenous economic wealth.



Fuel for Advanced Nuclear Reactors

Most advanced reactor companies will need to use HALEU fuel for their designs. This requires a mature, commercial HALEU market with adequate conversion, enrichment, and deconversion capabilities to meet fuel fabricator demands. These steps take mined and milled uranium ore and process it into a form that is suitable for use in fuel fabrication processes and eventual use in reactors.

Conversion is the process of taking uranium oxide and then reacting it with fluorine to create uranium hexafluoride gas (UF6). This gaseous uranium can then be used in different uranium enrichment operations. Conversion is identical for all nuclear reactor fuels, regardless of enrichment level or final fuel form. There is one commercial uranium conversion plant in the United States. The plant is Honeywell International Inc. and it is located in Metropolis, Illinois. This plant is currently in "idle-ready" status.

Enrichment is the process of raising the concentration of U235, the fissile isotope of interest for advanced reactor fuels. The primary commercial technology to enrich uranium is gas centrifuge technology. The only gas centrifuge commercial production plant currently operating in the United States is the URENCO USA (UUSA) facility in Eunice, NM licensed as Louisiana Energy Services (LES). A small scale pilot plant developed and operated by Centrus was constructed to demonstrate scalable HALEU production. The facility has an initial production capacity of 600 kgU of HALEU per year and is expected to come online in 2022. Uranium enrichment using laser separation technology has been proposed as an alternative to gas centrifuge technology. Commercialization of uranium laser separation technology in the United States has been led by Global Laser Enrichment (GLE). This process has not yet been deployed at a commercial scale for the enrichment of uranium.

Deconversion is the process of taking gaseous UF6 and chemically processing it into a solid form. These solid forms may include uranium metals, oxides, salts, or other solid forms. The deconversion process can facilitate simpler transportation of HALEU between facilities or prepare HALEU for use in a fuel fabrication process. Different advanced reactor designs will utilize a variety of different deconverted HALEU forms that will vary in both form and final enrichment. Some advanced reactor developers may need additional processing facilities to downblend deconverted HALEU to decrease the concentration of U235 if HALEU fuel is only enriched to higher than needed concentrations.