NUCLEAR INNOVATION ALLIANCE

Advanced Nuclear Energy for Minnesota

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Minnesota Senate Energy Committee

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Who is Nuclear Innovation Alliance (NIA)?

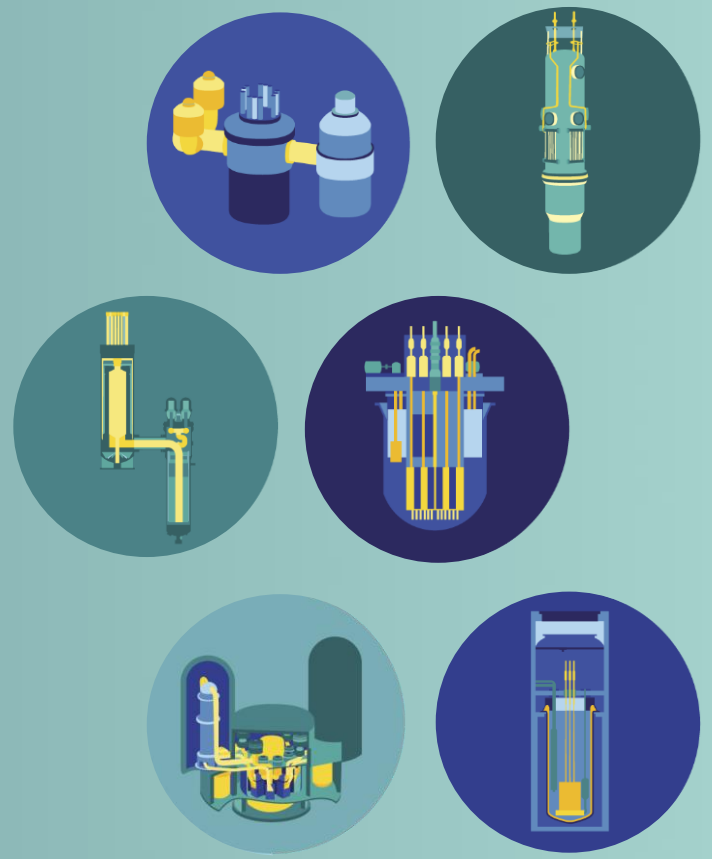
- NIA is a "think-and-do" tank working to ensure advanced nuclear energy can be a key part of the climate solution.
- NIA identifies barriers, performs analysis, engages with stakeholders and policy makers, and nurtures entrepreneurship through its Nuclear Innovation Bootcamp.

Three Takeaways on Advanced Nuclear Energy

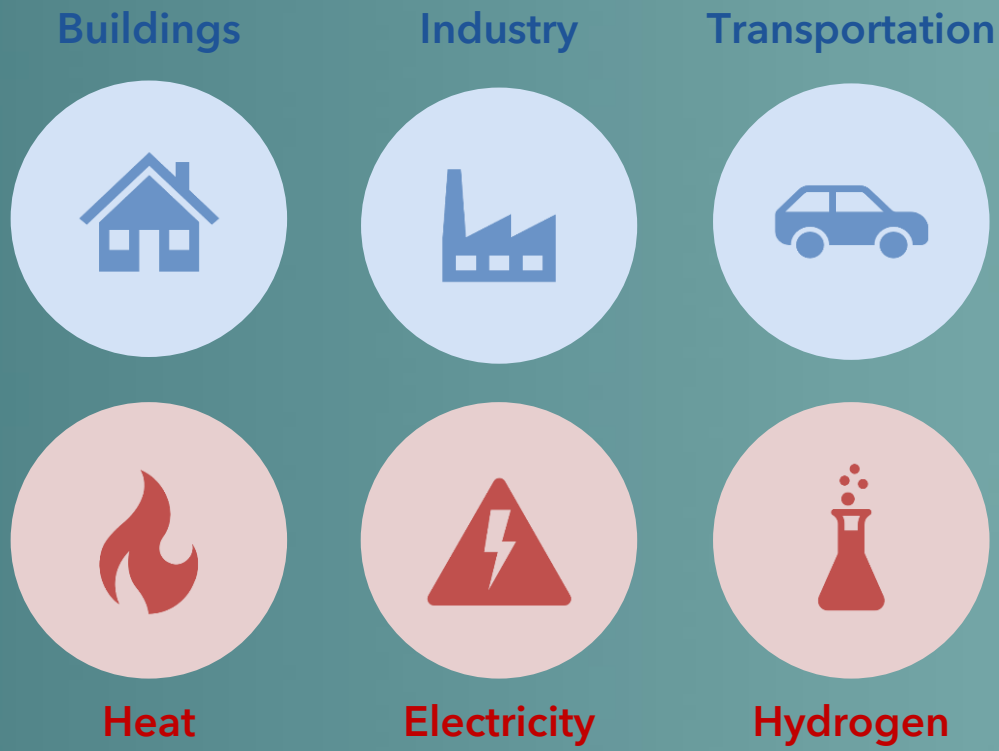
Nuclear energy can play a major role in creating a clean energy economy

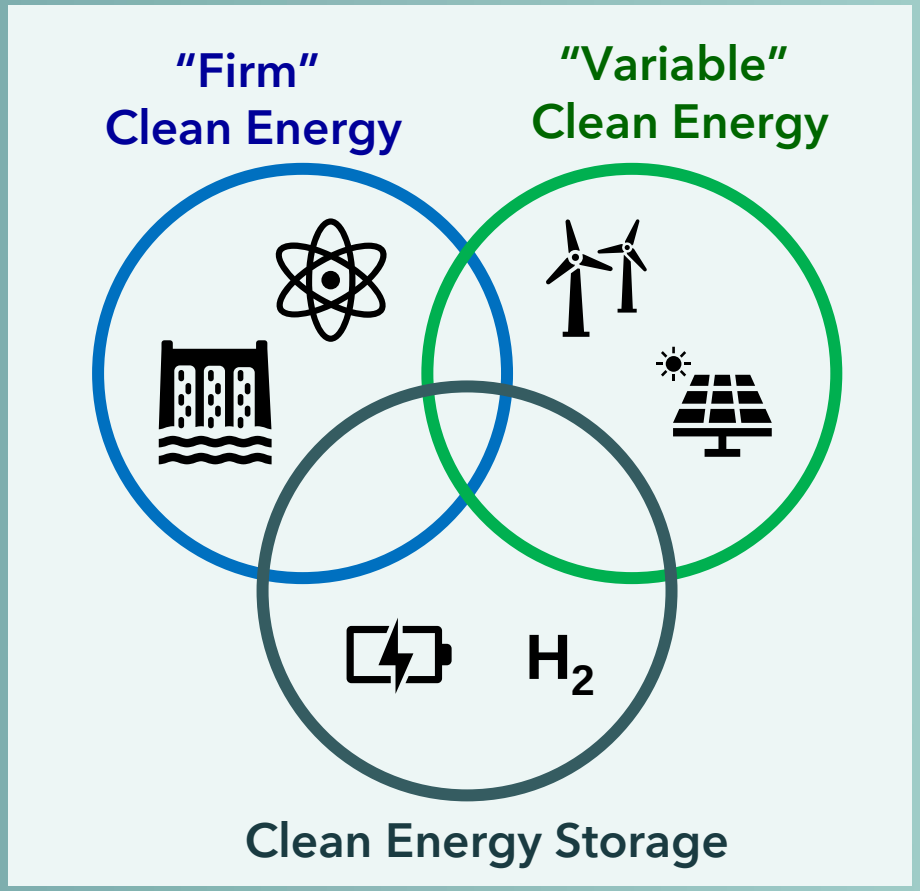
Advanced reactors have a wide array of different commercial use cases

Advanced reactor developers are preparing for reactor demonstrations



Nuclear energy is an important complimentary clean energy source to help fully decarbonize Minnesota energy production





Advanced nuclear energy adds flexibility and versatility in comparison to conventional nuclear through innovative design

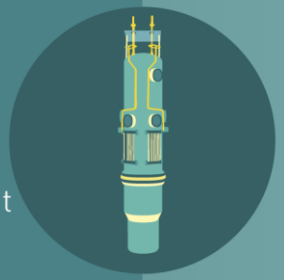
Conventional Nuclear Energy		Advanced Nuclear Energy
Predominantly Large: More than 1000 MW_e	Reactor Size	Versatile: 1.5 MW_e to 300+ MW_e
Predominantly Light-Water Reactors	Reactor Technology	Wide Variety of Reactor Technologies
Primarily Baseload Generation	Generation Type	Flexible and Dispatchable Generation
Designed with Active Safety Systems	Safety Approach	Designed with Inherent Safety Systems

Definition of advanced nuclear energy includes a variety of nuclear technologies with different advantages

Thermal Fission

Advanced Light-Water Reactors

Evolutionary design from existing reactors with inherent safety features



High-temperature reactors (HTRs)

High temperatures drive high efficiency, well-suited for process heat or hydrogen production. Uses TRISO fuel

Thermal or Fast Fission

Molten Salt-Fueled Reactors (MSRs)

Using molten salt for coolant and a fuel form, MSRs can bring significant safety benefits

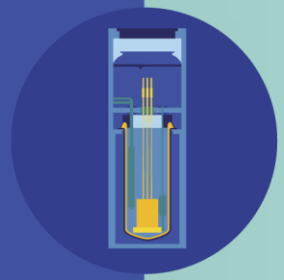
Fast Fission

Gas-cooled fast reactor (GFR)

An evolution of HTRs, GFRs operate at very high temperatures while using a more sustainable fuel cycle

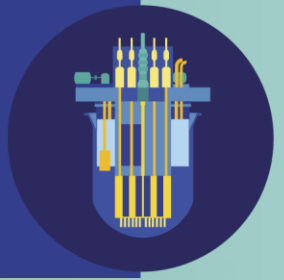
Sodium-cooled fast reactor (SFR)

With many existing experimental reactors, SFRs offer increased fuel efficiency, reduced waste, and passive safety features



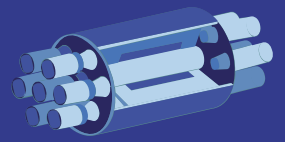
Lead-cooled Fast Reactor (LFR)

Similar in design to SFRs, LFRs are advantageous as lead is operationally safer than sodium



Variety of reactor sizes and low-carbon products enable integration of advanced nuclear into future energy systems

Electricity Production

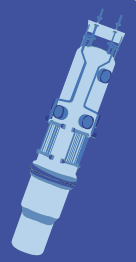


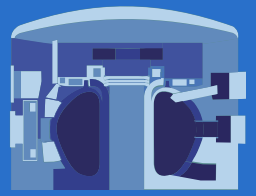
Microreactors

Can provide decentralized power and co-products to rural and off-grid locations

Small Modular Reactors

Scalable power small enough to be available to co-ops, munis, and industrial users for the first time





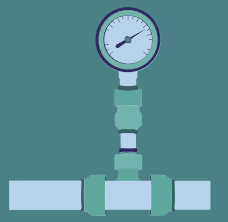
Large Reactors

Advanced designs can play the traditional role of large, base-load nuclear power while providing improved operations, safety, and economics

Co-Products

Heat

Through cogeneration, advanced nuclear can provide district heating or process heating for industrial applications, allowing for decarbonization of non-electric sectors



Hydrogen

Advanced nuclear power can produce hydrogen, potentially enabling a hydrogen economy to decarbonize non-electric sectors

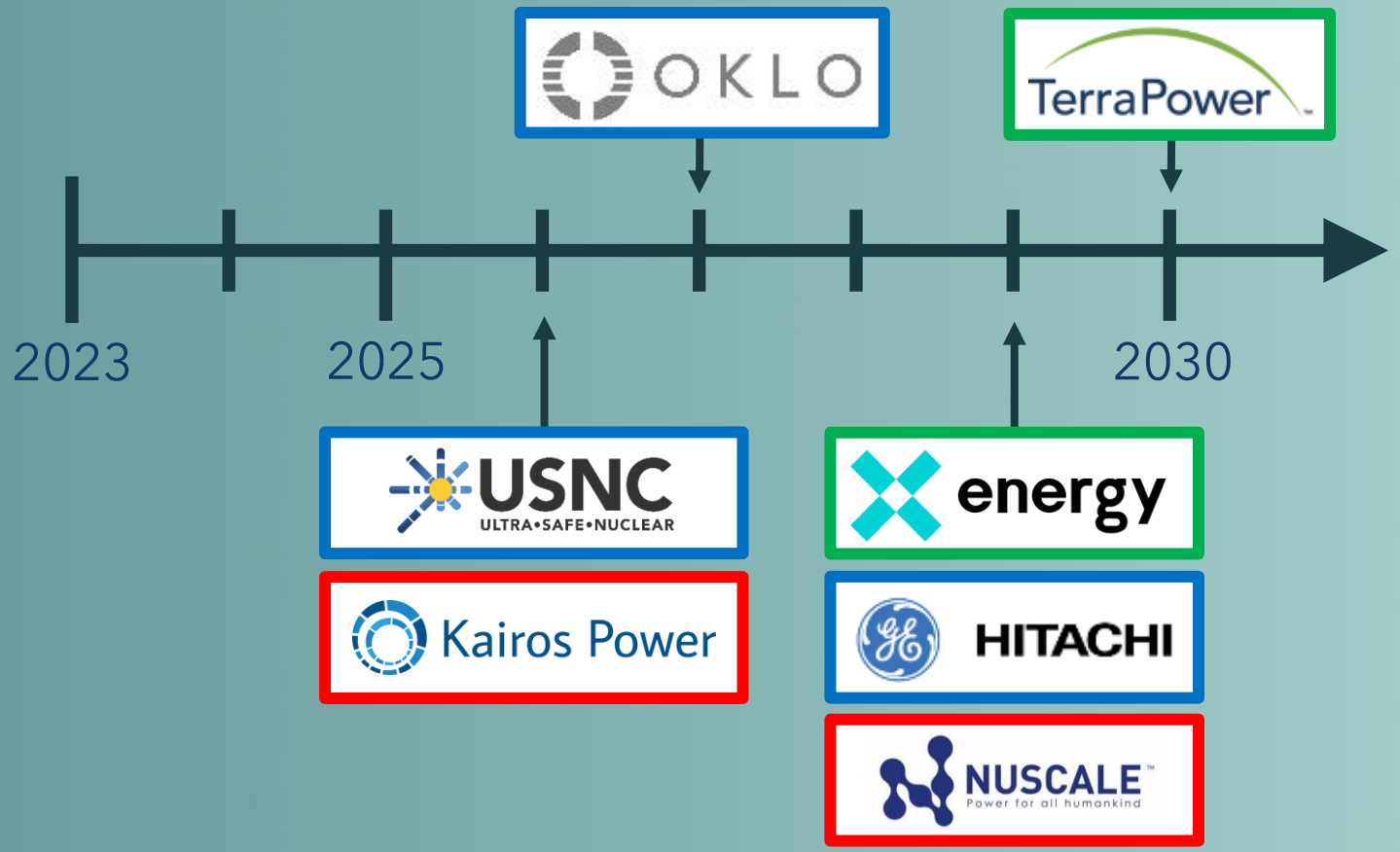
Desalination

Some advanced designs can produce fresh water

Public-private partnerships are accelerating the demonstration and deployment of advanced reactors

Federal Partnerships with Private Companies

- Advanced reactor demonstration award
- Advanced reactor development award
- Enabling technology development award



Stakeholders can get up to speed on the opportunities for advanced nuclear energy to help meet clean energy needs

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July 2022 Update
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Advanced Nuclear Compendium
July 2022
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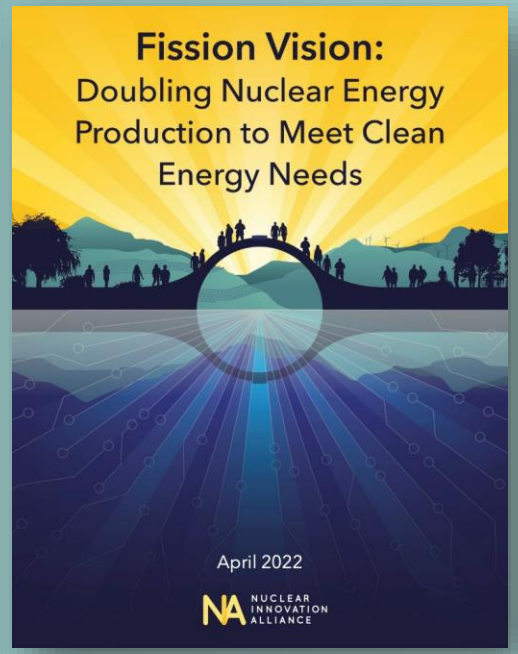

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April 2022
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