U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

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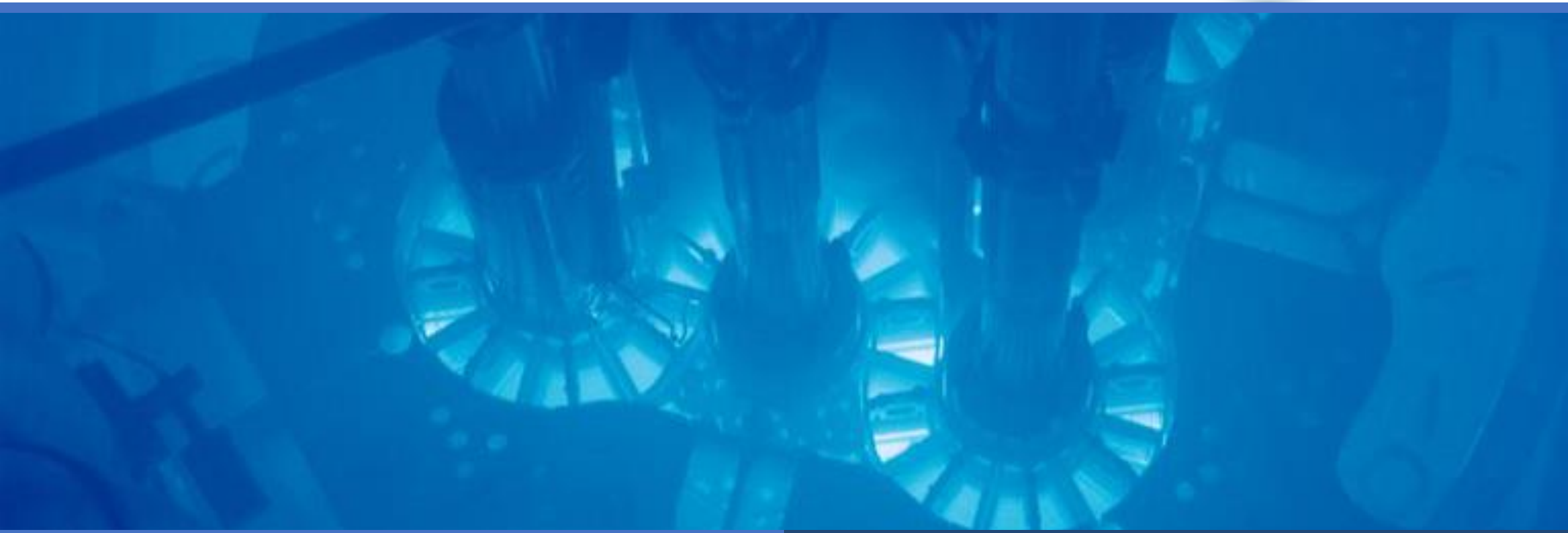

Nuclear Energy Data Needs

January 25, 2021

David Henderson

Program Manager, Advanced Modeling & Simulation
DOE Office of Nuclear Energy

Office of Nuclear Energy – Mission Pillars

- Advance nuclear power to meet the nation's energy, environmental, and national security needs.
- Resolve technical, cost, safety, security and regulatory issues through research, development and demonstration.

Existing Fleet

Advanced Reactor Pipeline

Fuel Cycle Infrastructure

Global Competitiveness

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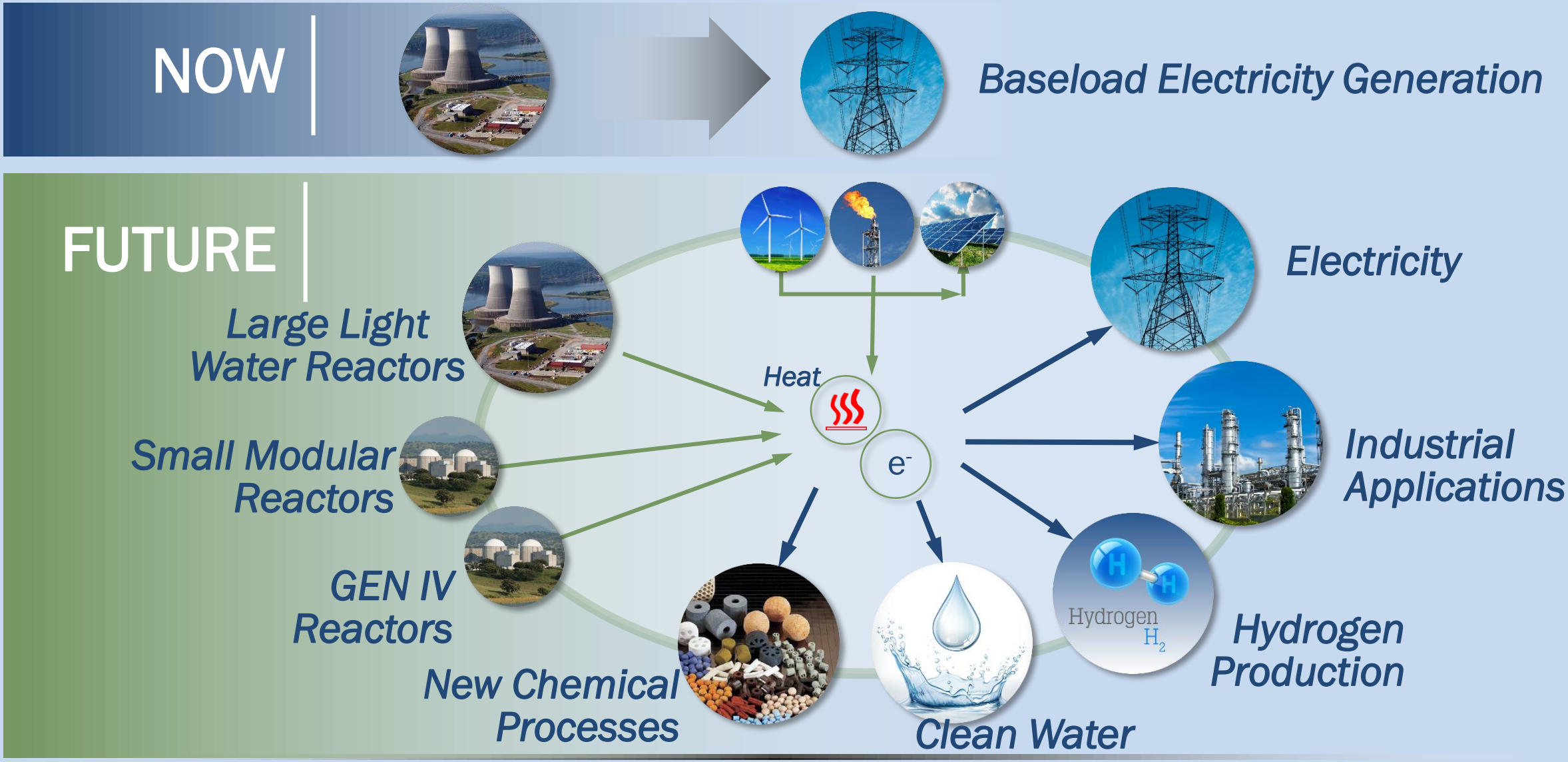
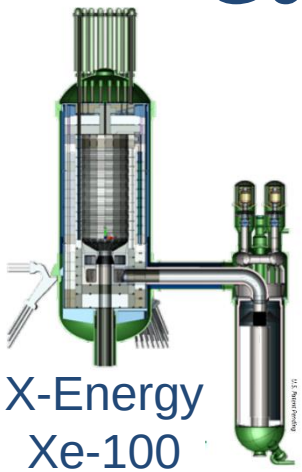
Nuclear Beyond Electricity

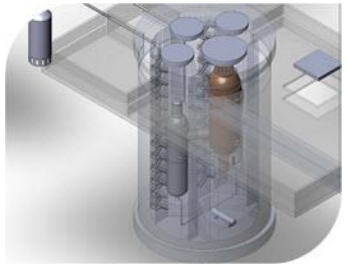


Examples of Different Advanced Reactor Industry Designs

Gas Reactors



X-Energy
Xe-100

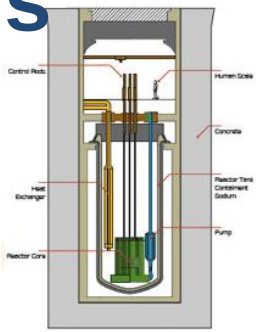


Framatome
SC-HTGR

Fast Reactors

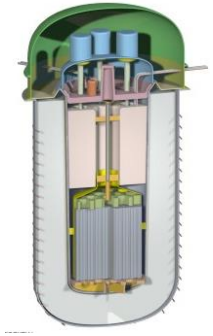
GE Hitachi
PRISM

TerraPower
TWR

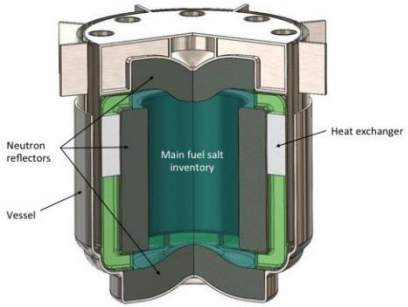


Advanced Reactor
Concepts LLC
ARC-100

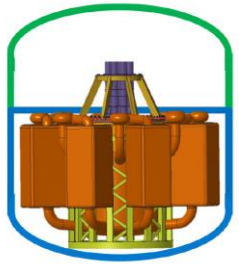
Molten Salt Reactors



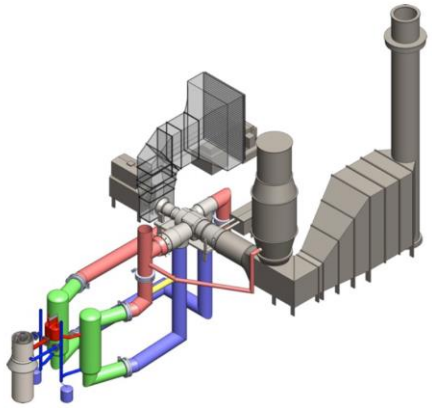
Terrestrial Energy
USA IMSR



TerraPower
MCFR



Elysium USA
MCSFR



Kairos Power
UCB PB-FHR

Nuclear Data Needs

- Driven by the anticipated materials and reactor flux spectrum comprising advanced nuclear reactor and fuels technologies
- Materials includes:
  - Coolants (e.g. FLiBe, molten chloride salts)
  - Moderators (e.g. graphite)
  - Control materials
  - Advanced fuels and clad (e.g. UN, SiC, etc.)

		Reactor Coolants							
		Water		Liquid Metal		Molten Salt		Gas	
	Spectrum →	Fast	Thermal	Fast	Thermal	Fast	Thermal	Fast	Thermal
Fuel Form	Ceramic		■	■				■	
	Metallic		■	■				■	
	Molten Salt					■	■		
	TRISO		■				■		■

*Chart not necessarily an exhaustive list

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Nuclear Data Needs Priority

- Data needs priority should be driven by the requirements to accurately predict reactor behavior during steady-state and transient operation as well as postulated accident scenarios
  - Uncertainty quantification in the context of risk important to NRC licensing
  - Depends highly on the quality of covariance data for uncertainty propagation

- Priorities needs to be based on:
  - Identification of isotope data of significance as relates to the prediction of key parameters of interest
  - Parameters of interest include (to name a few):
    - Core reactivity
    - Decay heat
    - Power distribution
    - Feedback response due to material changes during anticipated and postulate transients
    - Source term for offsite dose

- For priority nuclear data, efforts need to generally focus on:
  - Missing data and “unphysical” artifacts in evaluations
  - Missing covariance data
  - Large covariance data

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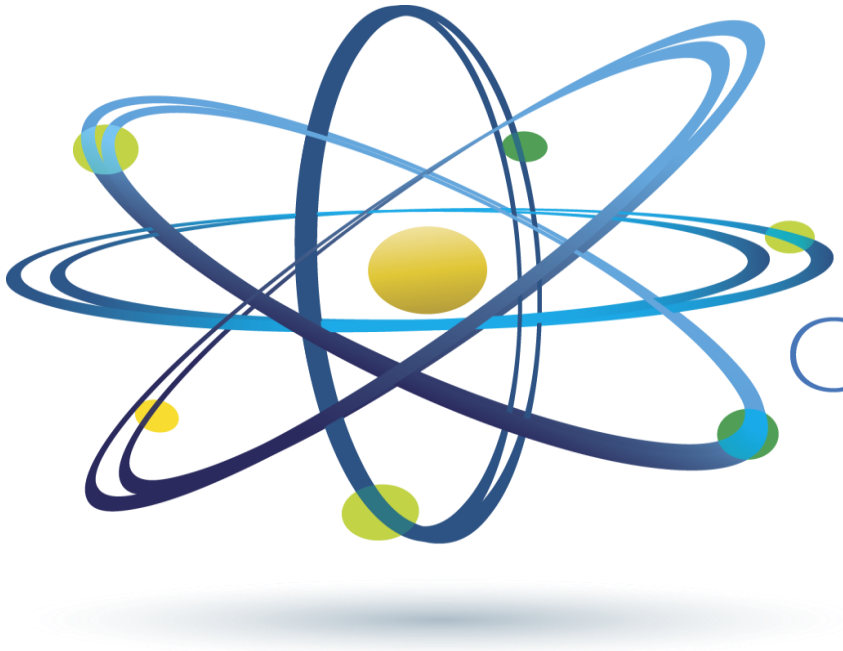
Thank you



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