IOWA STATE UNIVERSITY
Department of Electrical and Computer Engineering

Senior Design Poster Session
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New Nuclear Design for Electric Power Systems

The objective of our project is to identify a "new nuclear" design that provides the highest benefit to cost ratio under a high renewable future. Here are the requirements of our project:

1. Identify all reasonably practical "new nuclear" designs that have been suggested so far.

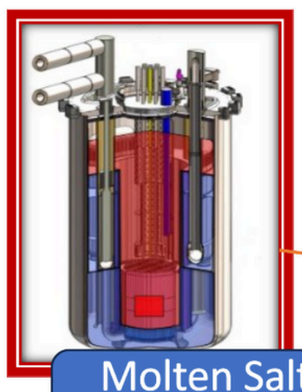
2. Identify a "recommended design" (RD).

3. Illustrate and describe the RD in detail. Provide a convincing argument that the RD's Benefit to Cost ratio is better than all other

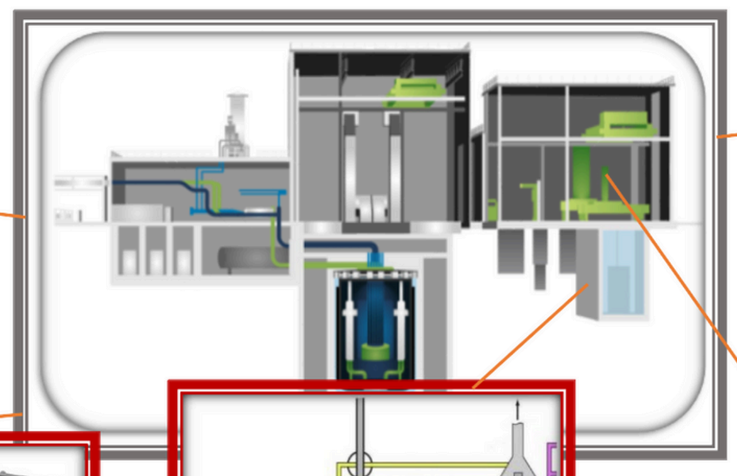
4. Identify and evaluate tools useful in designing and assessing the performance of the nuclear power

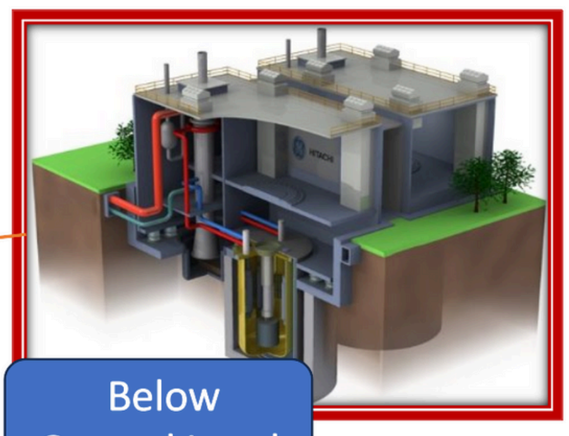
The intended users of our project would be Utilities, Independent System Operators, Investors, and Energy Consumers

Recommended Design

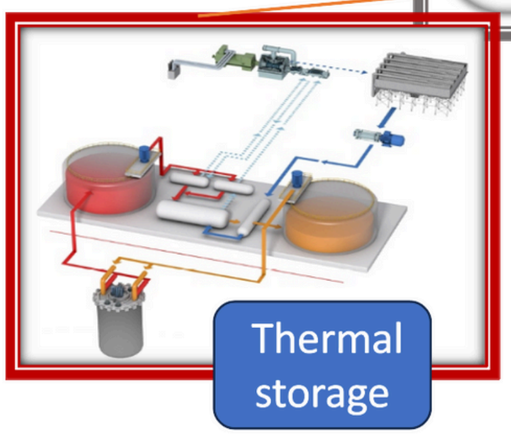


Molten Salt Fast Reactor

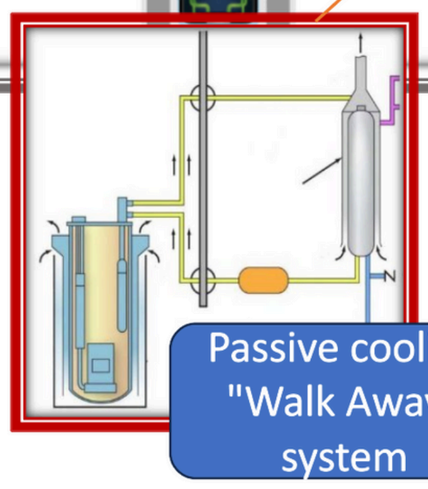




Below Ground Level



Thermal storage



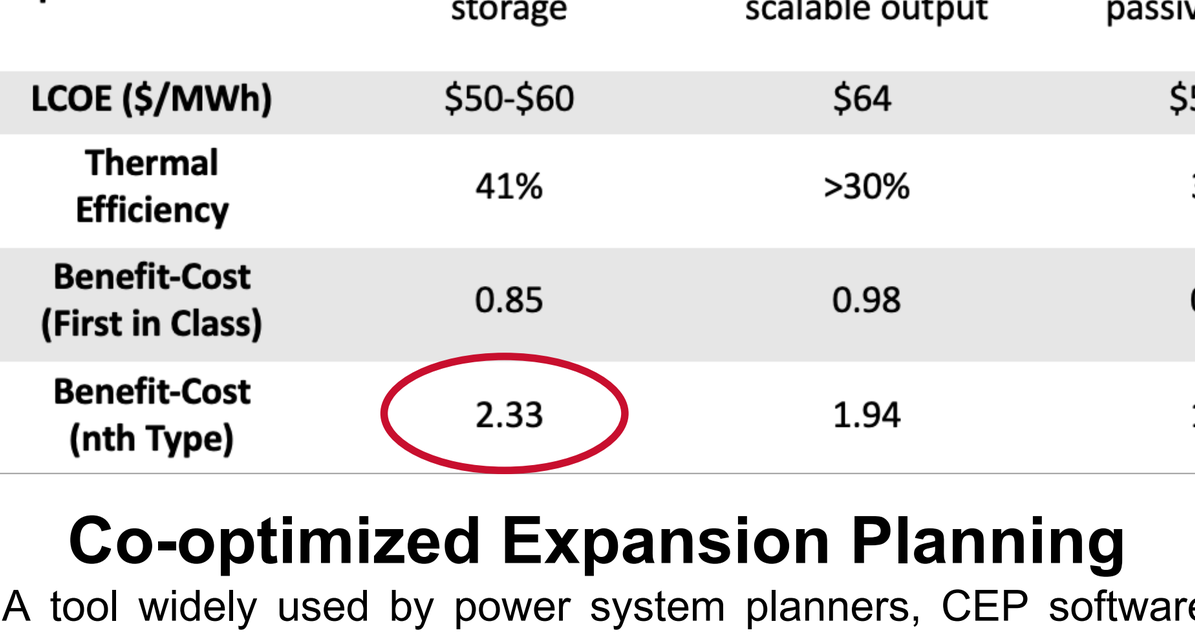
Passive cooling "Walk Away" system

Conventional Fuel, U-235

	Natrium by TerraPower	VOYGR by Nuscale	Prism by GE Hitachi	SMR-160 by Holtec International	BWRX-300 by GE Hitachi	ARC-100 by ARC Clean Technology
Reactor Type	Sodium fast Reactor	Pressurized Water-Cooled Reactor	Sodium fast Reactor	Pressurized Water Reactor	Boiling Water Reactor	Sodium Cooled Reactor
Power Output (MWe)	345	308 (4 modules), 462 (6 modules), 924 (12 modules)	311	160	300	100
Overnight Cost (First in Class)	$4 billion	$9 billion	$3-4 billion	$1 billion	$1 billion	$400 million
Overnight Cost (nth Type)	$1 billion	$3.6 billion	$1.5-2 billion	$1 billion	$700 million	$400 million
Estimated Construction Period	36 months	36 months	36 months	36 months	27 months	34 months
Refueling Cycle	18 months	12-24 months	12-24 months	24 months	12-24 months	20 years
Operational Date	2030	2029	2026	2029	2028	2030
Important Features	Thermal energy storage	Passive cooling, scalable output	Modular construction, passive cooling	Air-cooled condensers	Natural circulation cooling, simple design	Passive cooling, cheaper metallic fuel
LCOE ($/MWh)	$50-$60	$64	$58-60	$81.50	$35-50	$55
Thermal Efficiency	41%	>30%	37%	~30%	~34.5%	38%
Benefit-Cost (First in Class)	0.85	0.98	0.99	1.39	2.14	1.91
Benefit-Cost (nth Type)	2.33	1.94	1.68	1.39	2.62	1.91

Co-optimized Expansion Planning

A tool widely used by power system planners, CEP software provides recommendations for system expansion by answering the questions of **what to invest it, where to invest, when to invest, and how much to invest.** CEP also provides recommendations for how to best utilize preexisting power generation capacity.



Benefit-Cost Analysis

A benefit-cost ratio is a financial metric that compares the total expected benefits of an investment to its total costs, helping to evaluate its economic feasibility. The higher the ratio, the more economically attractive. Ratios below 1 are not economically feasible.