

UIUC Microreactor Project

iSEE Energy iCAP Team Meeting



UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN

Illinois and UIUC legacy



Illinois leadership

- 1942: Chicago, IL, First sustained fission
- 1946: Lemont, IL, Argonne National Laboratory
- 1959: Morris, IL, First commercial nuclear power
- Today: Majority of Illinois electricity is nuclear

UIUC TRIGA®

- In heart of UIUC campus
- 38 years of safe operation
- Thousands of public visitors
- 6,000 MW transients, 1MW steady state power
- Shutdown in 1998 and returned site to greenfield
- ANS National Historic Landmark



UIUC TRIGA® Image provided by University of Illinois

TRIGA® is a registered trademark of General Atomics

Education, training, and outreach:

- general public,
- undergraduate,
- graduate,
- professional,
- operator training.

Research capability:

- leverage strength areas across campus
- reactor testing, research, & development
- critical enabling & synergistic technologies

Production demonstration:

- electricity,
- district heat,
- hydrogen production,
- other high value processes.

“The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of citizens in Illinois, across the nation and around the world through our leadership in learning, discovery, engagement and economic development.”



Siting



East of Abbott Power Plant



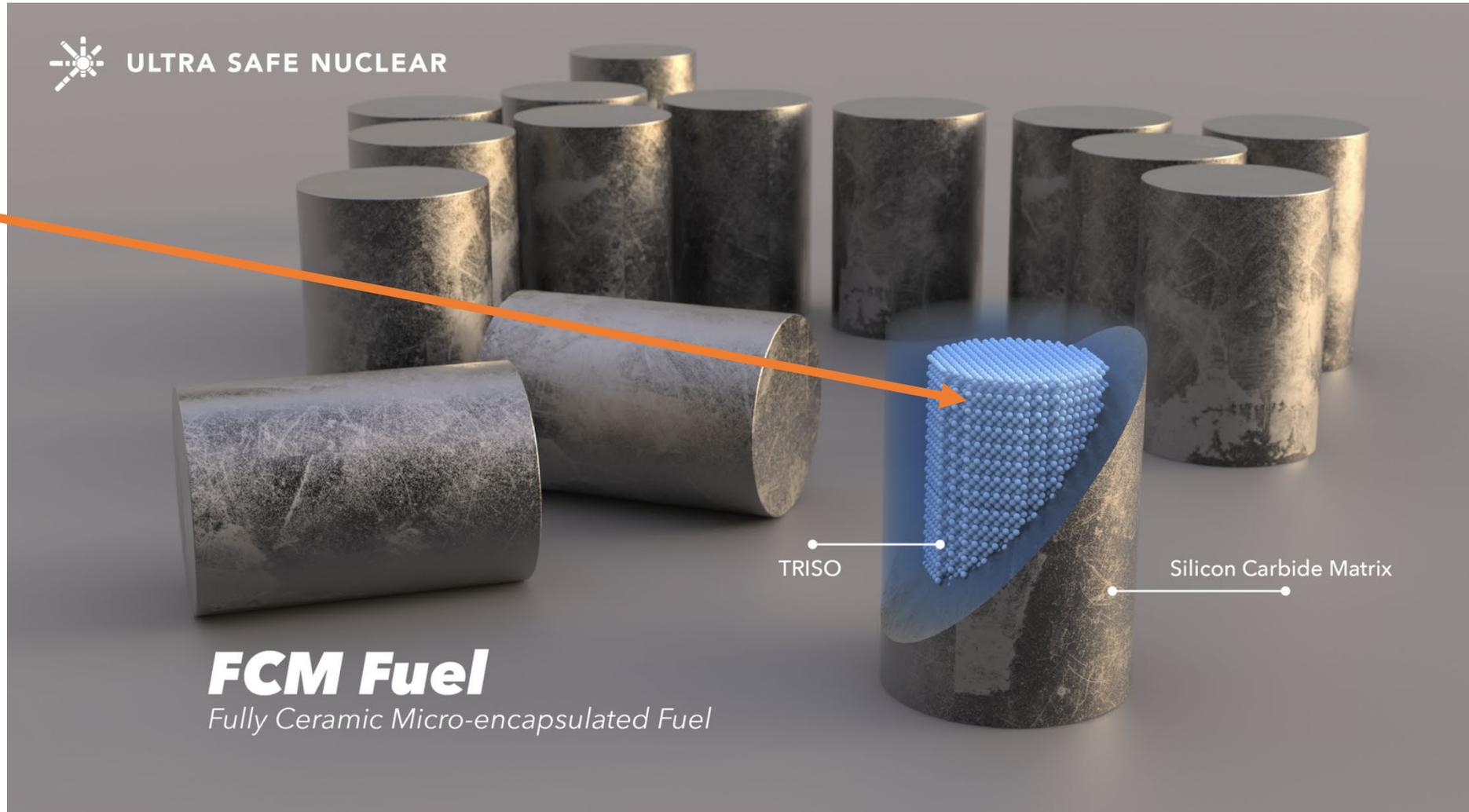
North of Abbott Power Plant



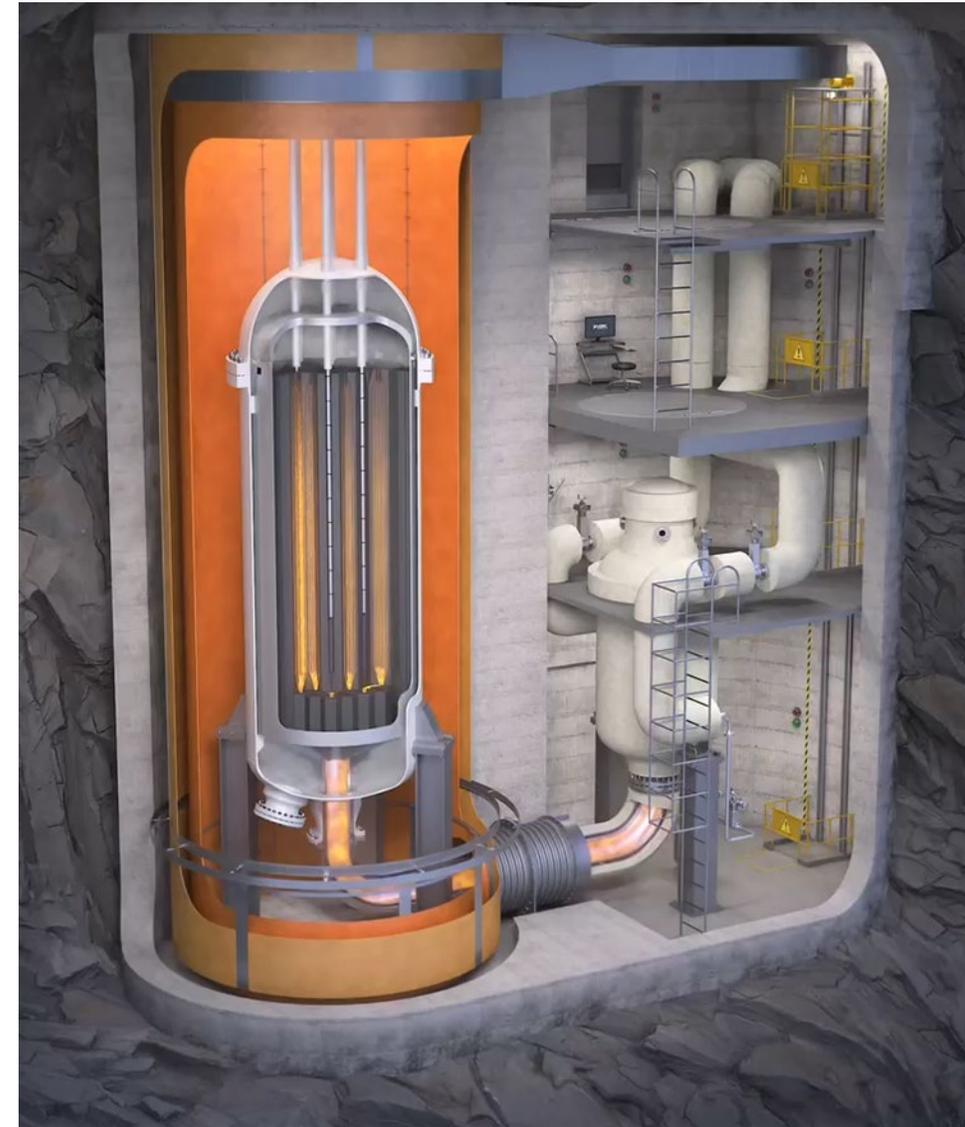
Google Earth, 10/2021



Fuel Compact



Reactor



Micro-Modular Reactor (MMR)

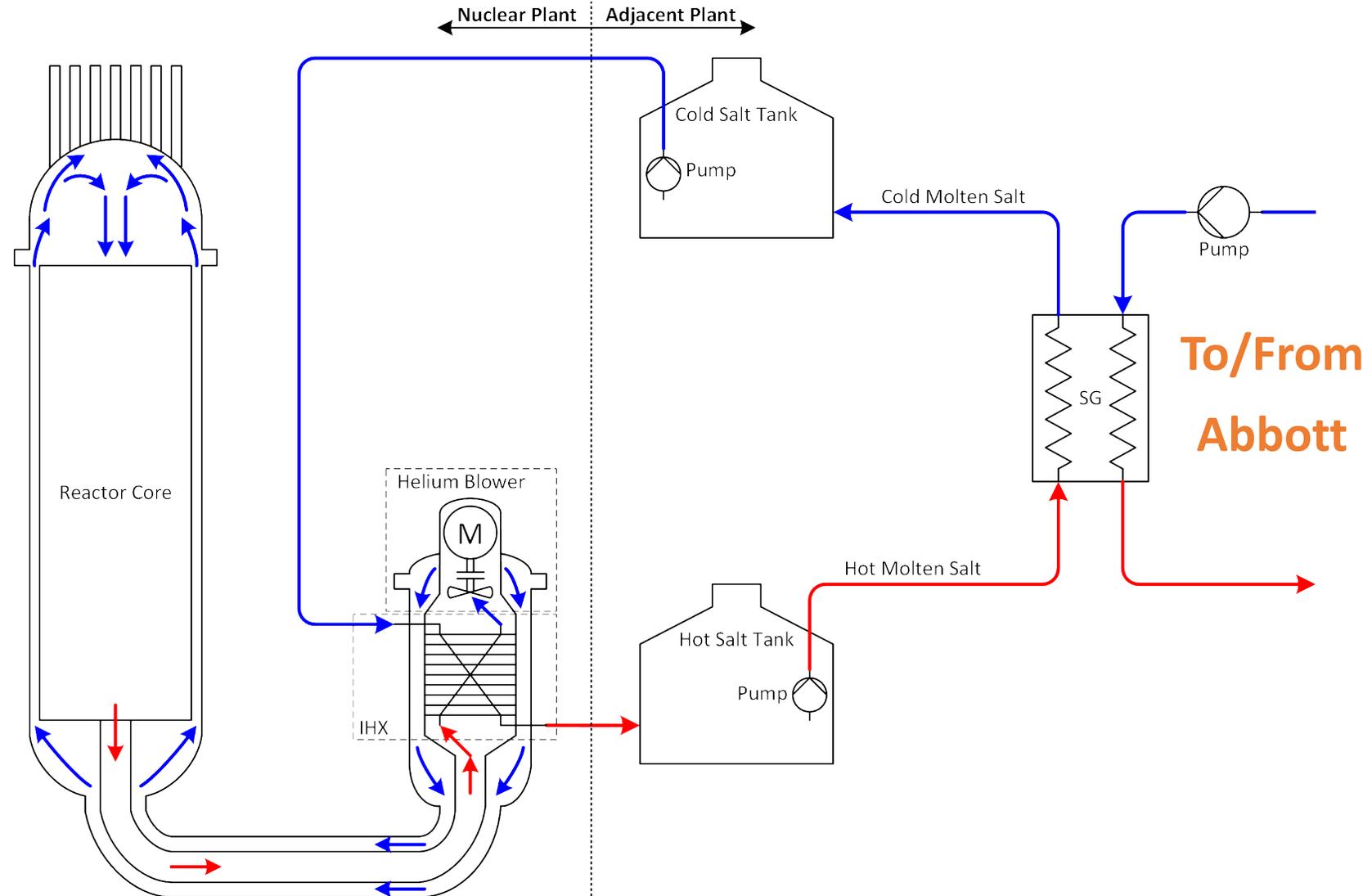


Fluid Characteristics:

- Helium
 - 3 MPa,
 - 300°C - 630°C
- Molten Salt
 - 0.5 MPa,
 - 270°C - 565°C

Safety Methodology:

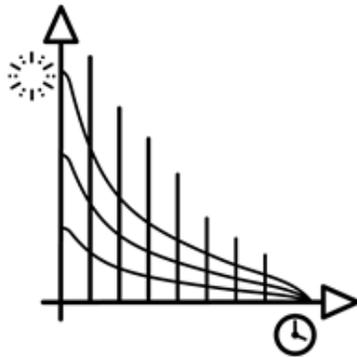
- Strong negative feedback with Temp.
- Cooling through natural forces (passive)



Micro-Modular Reactor (MMR)

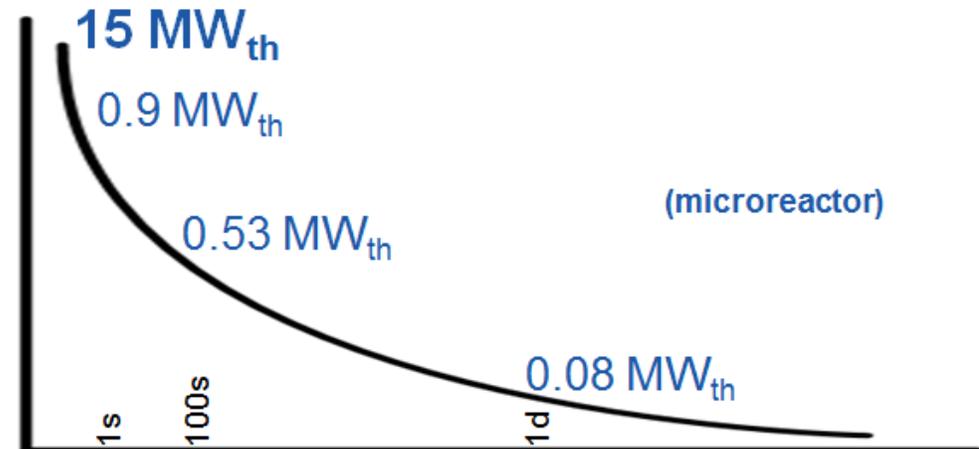
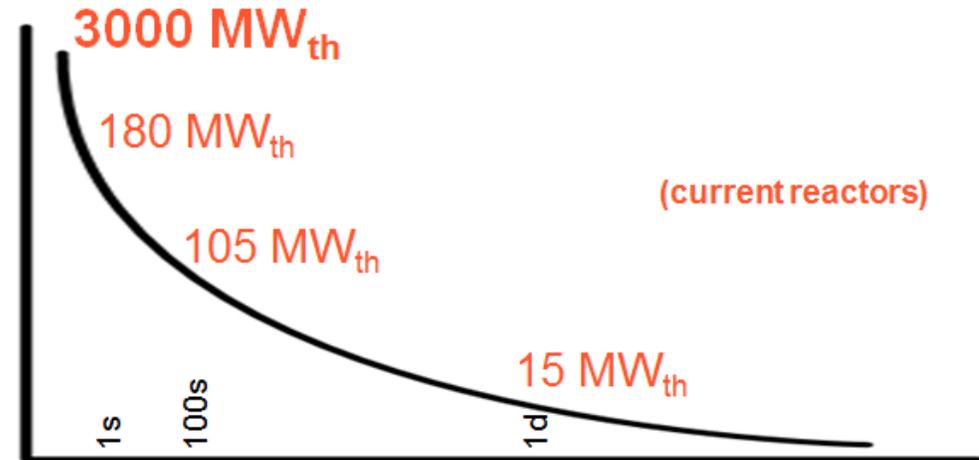


Conventional nuclear systems must be actively cooled after shutdown to remove residual power.

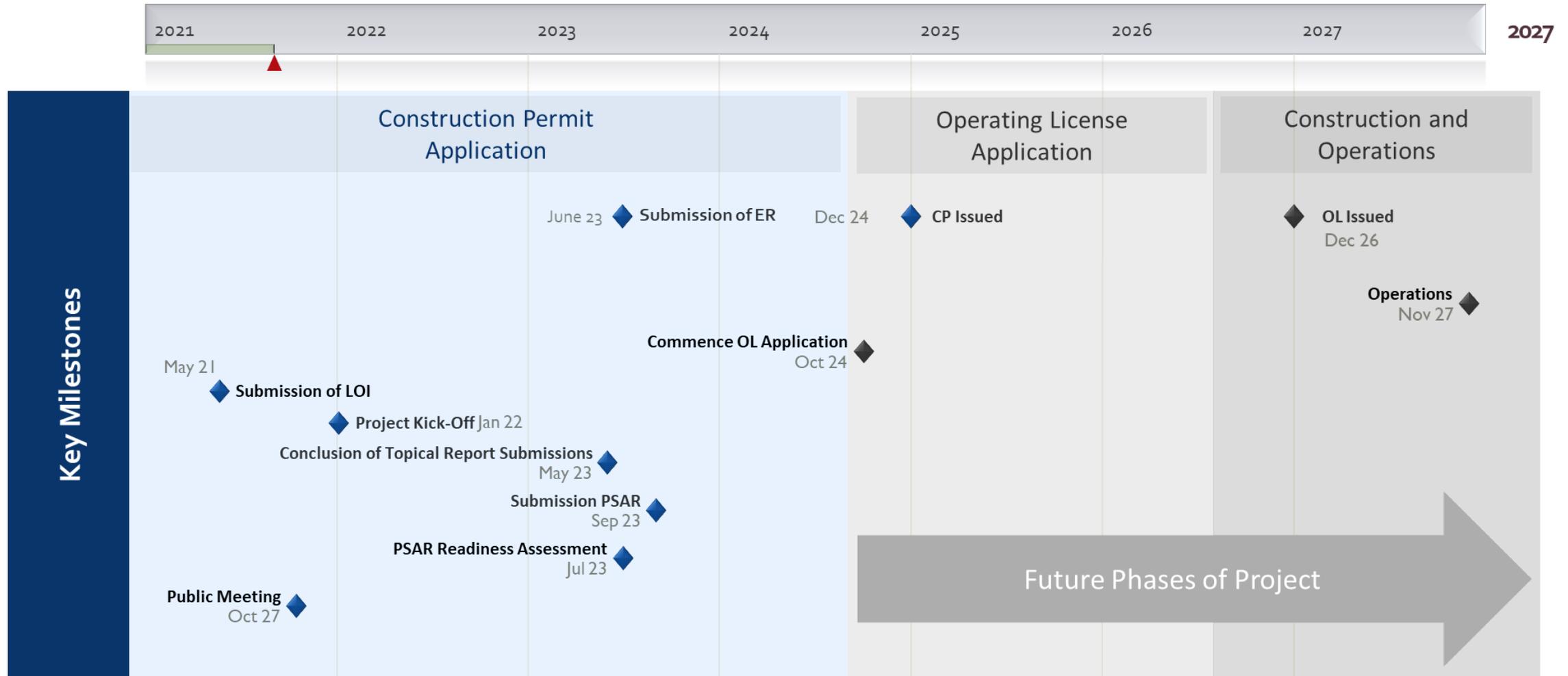


Micro-reactors are so small, they cool naturally, with all heat dissipating passively into the surrounding structures.

200x lower power means 200x less residual power after shutdown.



Proposed Milestone Schedule

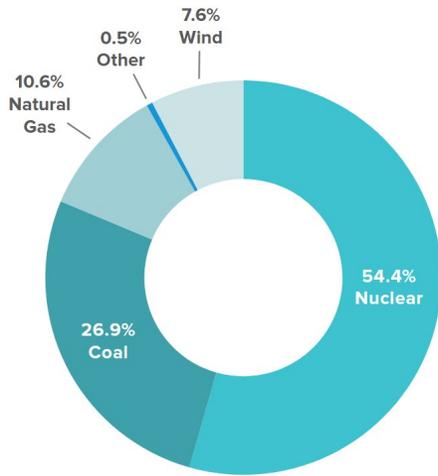


micro-reactor@illinois.edu
<https://npre.illinois.edu/about/nuclear-powered-uiuc>

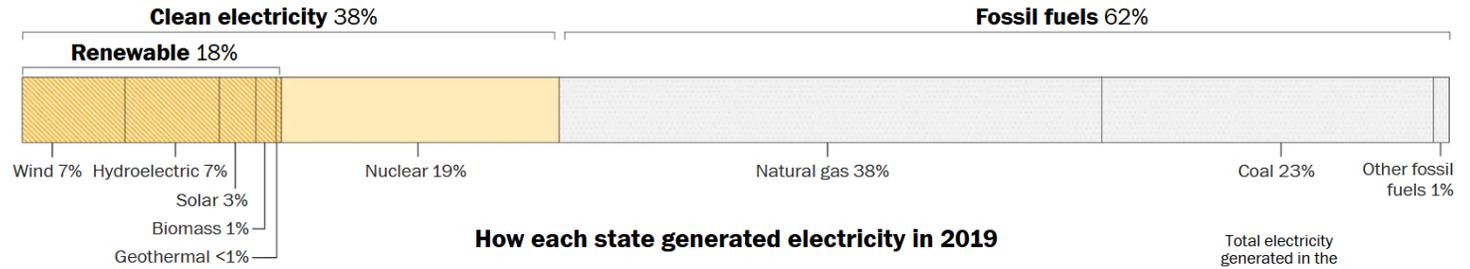


Questions?

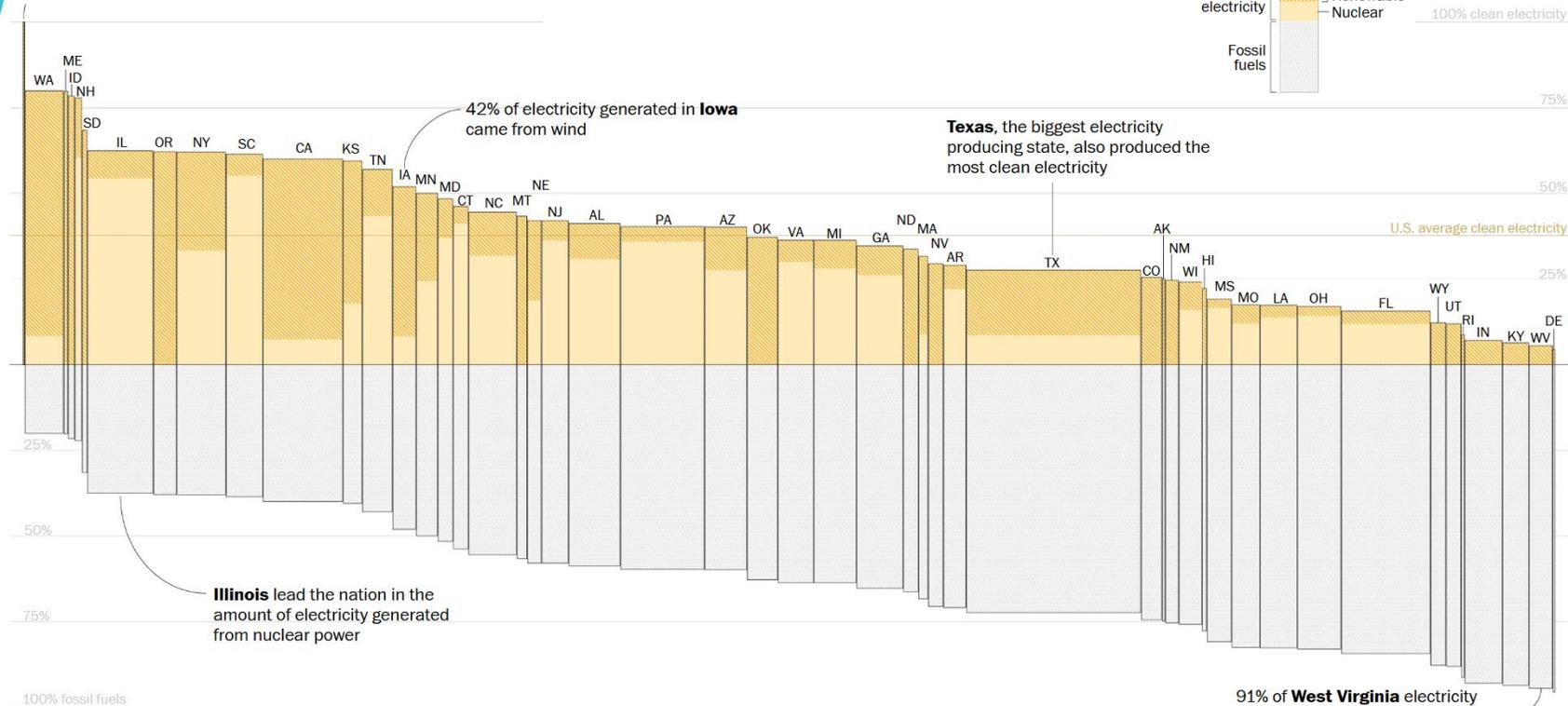
Nuclear Power Basics - IL



Credit: [NEI, Illinois nuclear energy fact sheet, 2020](#)



How each state generated electricity in 2019



Credit: [Washington Post, July 30, 2020](#)

Nuclear Energy Facility	Company	Location	Capacity (MW)	Capacity Factor (%) ¹
1 Braidwood 1	Exelon	Braceville	1,183	97.7
2 Braidwood 2	Exelon	Braceville	1,154	96.2
3 Byron 1	Exelon	Byron	1,164	97.8
4 Byron 2	Exelon	Byron	1,136	98.5
5 Clinton	Exelon	Clinton	1,065	89.7
6 Dresden 2	Exelon	Morris	902	95.3
7 Dresden 3	Exelon	Morris	895	99.8
8 La Salle 1	Exelon	Marselles	1,131	98.1
9 La Salle 2	Exelon	Marselles	1,134	95.6
10 Quad Cities 1	Exelon	Cordova	908	96.3
11 Quad Cities 2	Exelon	Cordova	911	97.7
State Totals			11,583	96.6

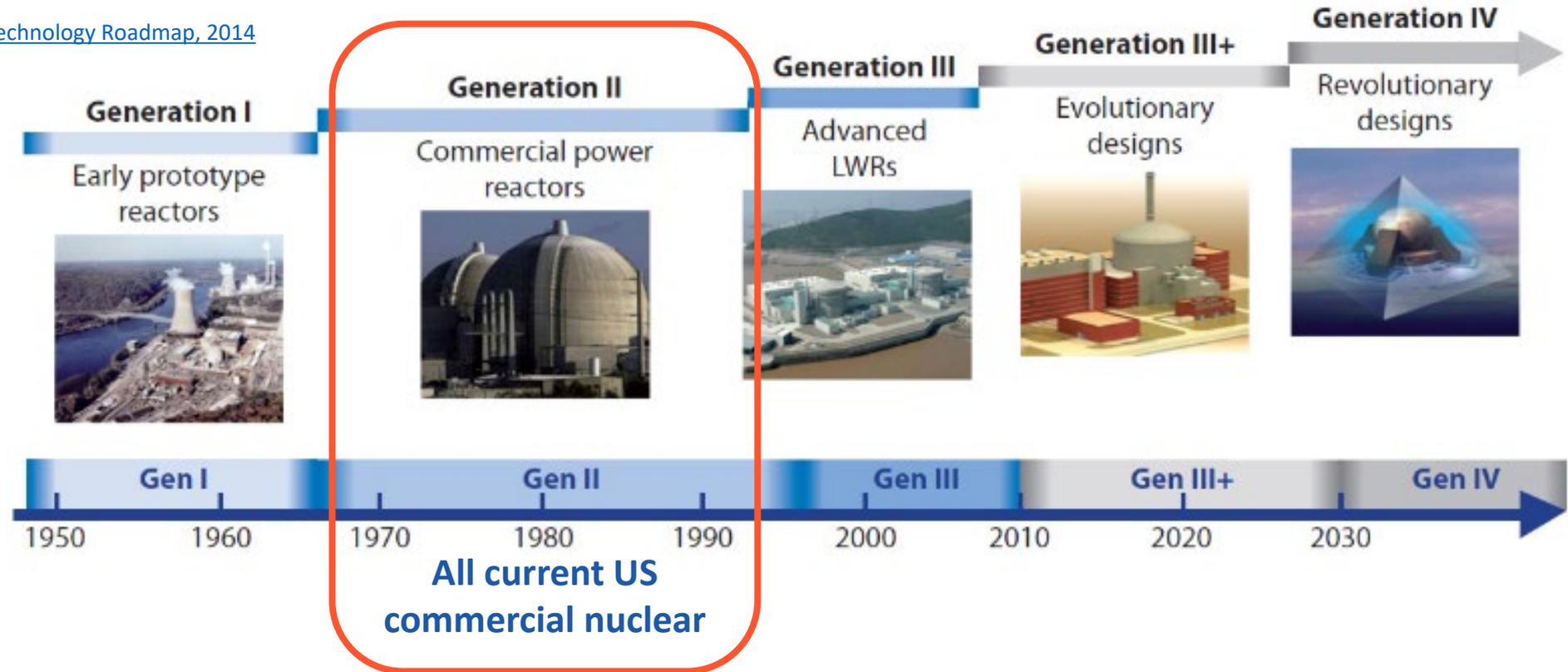
Nuclear Power Basics: History of nuclear technology



Credit: [GENIV IF, Technology Roadmap, 2014](#)



1942
First sustained fission reaction



1940s
First Calls from car radiotelephone

1970s
First cell phone (4.4 lbs)



2000s
Modern 'smart' cell phone





	Unit size	Factory fabrication?	Licensing (testing)	High return product?
Fossil-fuel Plant	Large	No	Short	No
Chemical plant	Large	No	Medium	Yes
Jet engines	Small	Yes	Long	No
Robotics	Small	Yes	Short	Yes
Satellites	Medium	Yes	Long	No
<i>Current Nuclear</i>	<i>Large</i>	<i>No</i>	<i>Long</i>	<i>No</i>
<i>Advanced Nuclear</i>	<i>S, M, L</i>	<i>Yes</i>	<i>Long</i>	<i>Yes</i>