Licensing the NEXT Molten Salt Research Reactor

Powered by Natura Resources

TRTR 2024 Annual Conference

by

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ACU ABILENE CHRISTIAN UNIVERSITY

Abilene Christian University

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- ACU's mission is to educate students for Christian service and leadership throughout the world.
- Main Campus in Abilene, Texas population 123,000
- Fall **2023 marked the sixth consecutive year** for a record number of students enrolling at ACU: 6,219

ABILENE CHRISTIAN UNIVERSITY

NATIONALLY RANKED

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Nuclear Energy eXperimental Testing Lab

Finding global solutions to the world's critical needs

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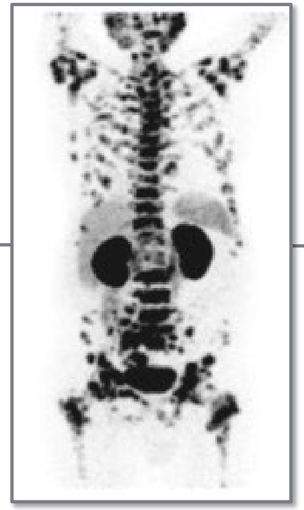
1 in 2 do not have access to the **energy** needed to lift them out of poverty

1 in 2 will develop **cancer**



1 in 3 do not have access to clean drinking **water**

*"**Nuclear energy is indispensable for** achieving global sustainable development and has a crucial role in decarbonizing the energy sector, as well as **eliminating poverty, ending hunger, providing clean water, affordable energy,** economic growth, and industry innovation."* - United Nations Economic Commission for Europe (UNECE) Expert Group on Resource Management (EGRM)

Molten Salt Reactors (MSRs) provide answers to critical global needs

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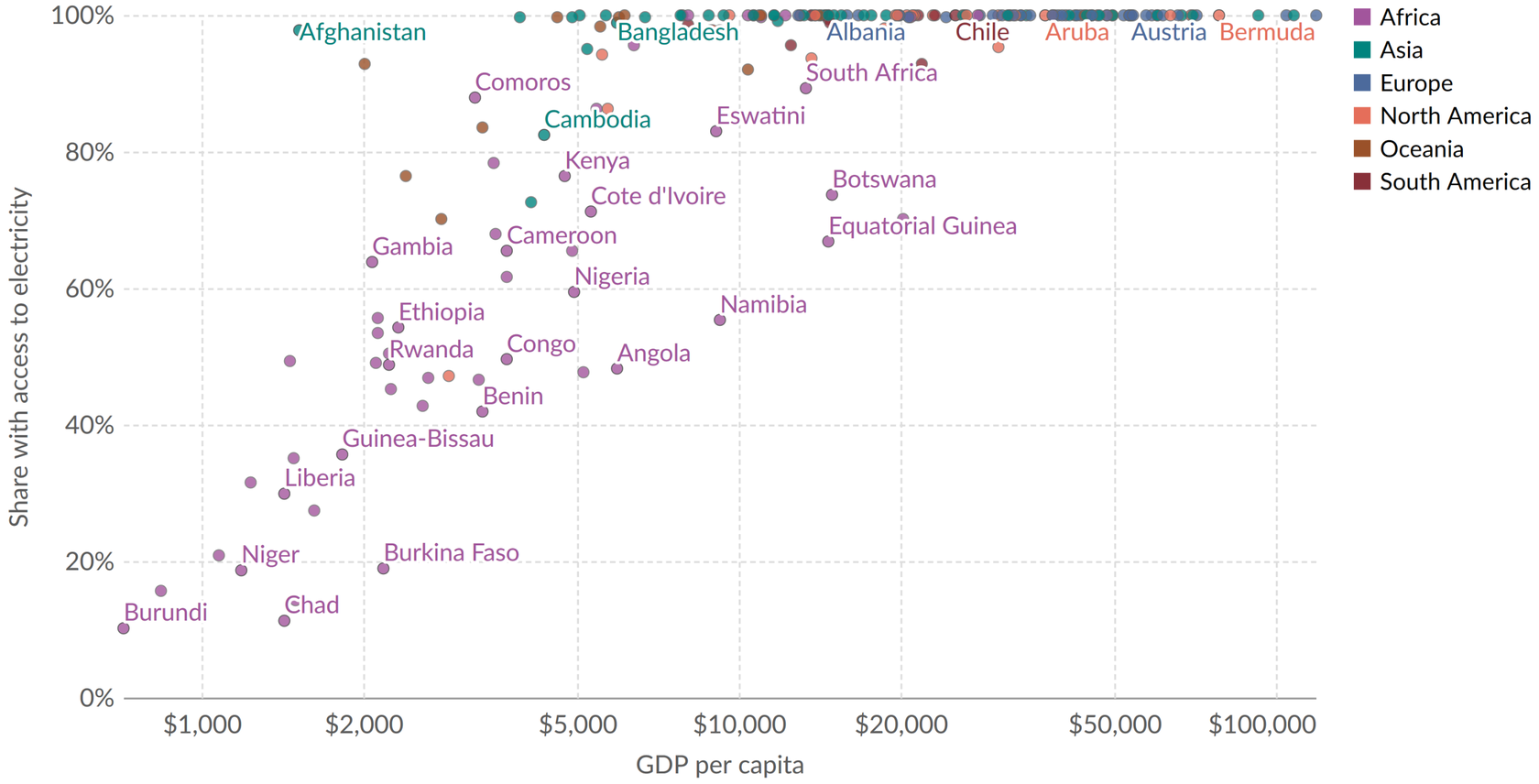
Access to electricity vs. GDP per capita, 2021

Our World in Data

Having access to electricity is defined in international statistics as having an electricity source that can provide very basic lighting, and charge a phone or power a radio for 4 hours per day. GDP per capita is adjusted for inflation and differences in the cost of living between countries.



Data source: Data compiled from multiple sources by World Bank
Note: GDP per capita is expressed in international-$[1] at 2017 prices.

OurWorldInData.org/energy | CC BY

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Natura Resources, LLC is committed to answering the world's increased demand for **reliable energy**, **medical isotopes**, and **clean water**, by developing commercially deployable molten salt reactors

MSRR is a Simplified MSRE

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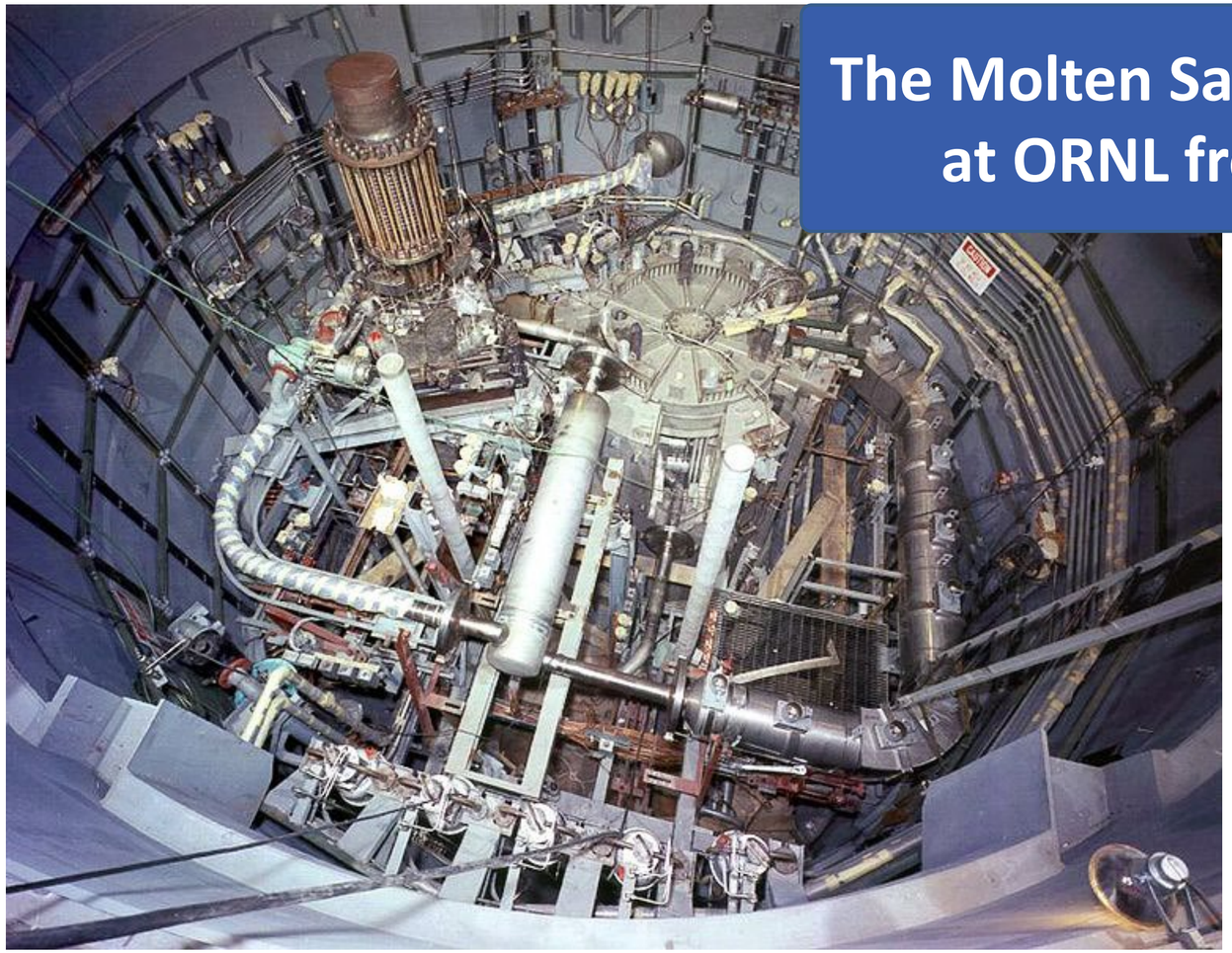
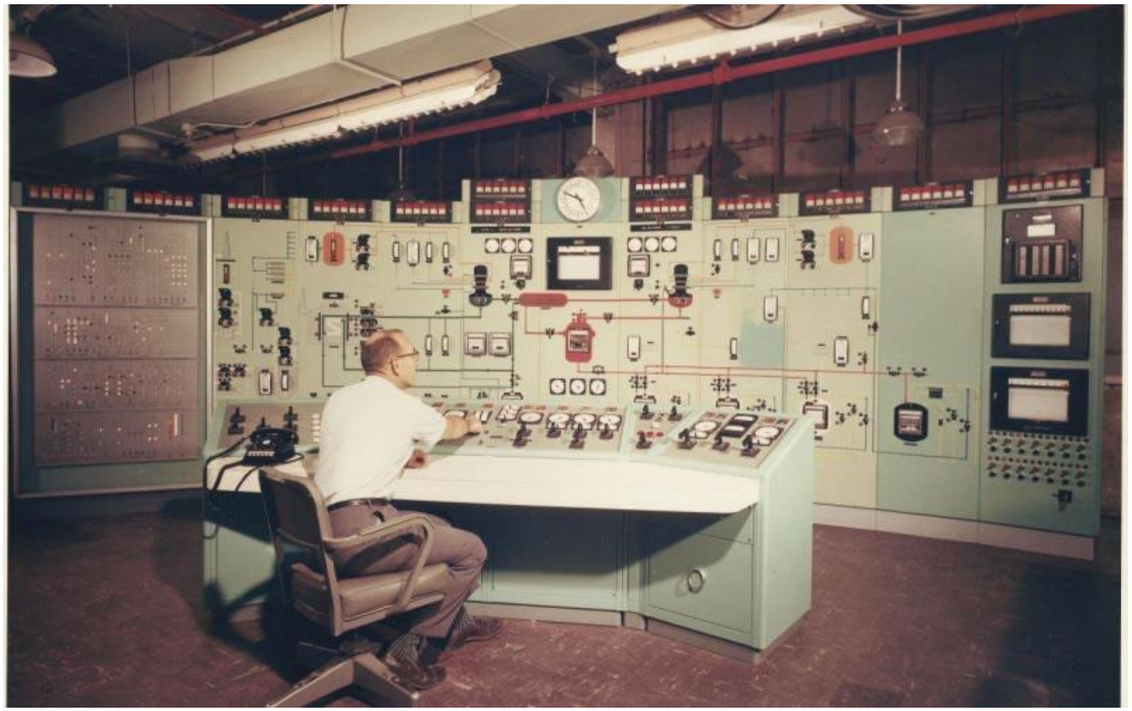


The Molten Salt Reactor Experiment (MSRE) operated at ORNL from 1965-1969 on U-235 and U-233.



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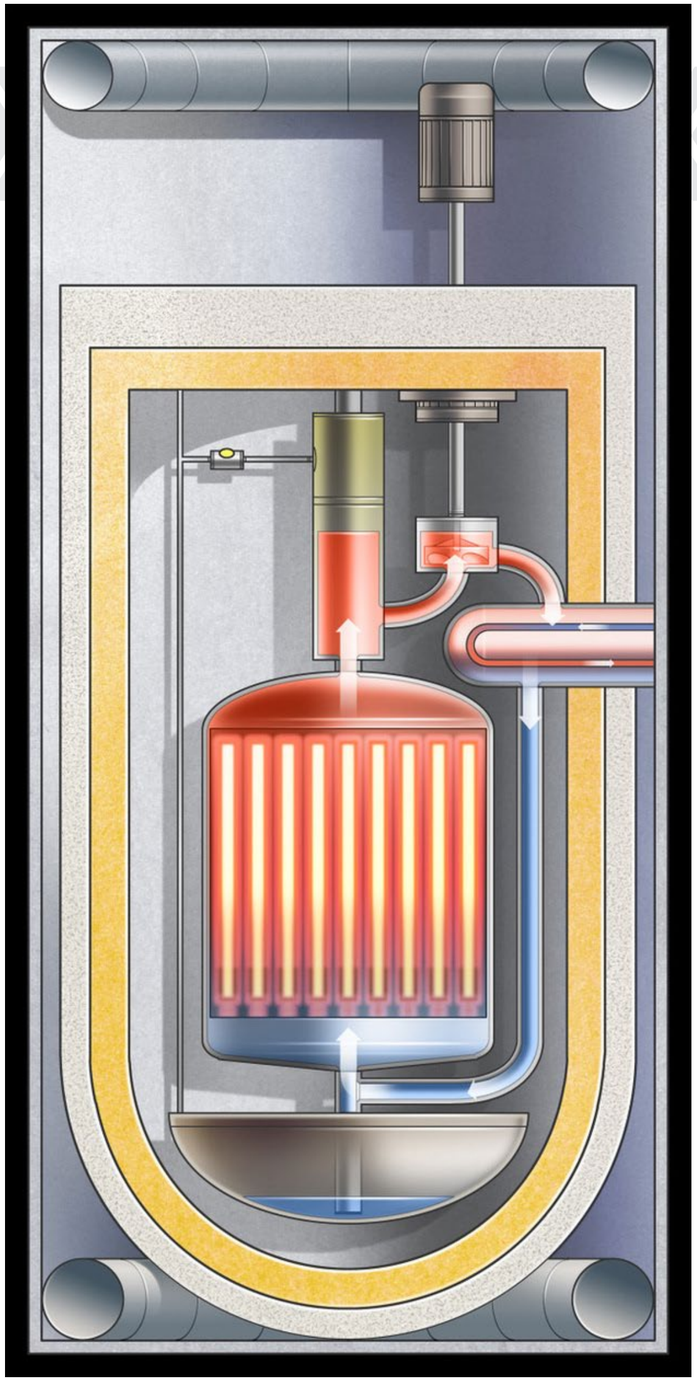
Molten Salt Research Reactor (MSRR)

Thermal Output:	1 MW_{th}
Electric Output:	n/a
Fuel:	19.5% enriched HALEU
Moderator:	Graphite
Carrier Salt:	LiF-BeF_2-UF_4 (FLiBe)
Const. Material:	SS 316H
Deployment:	2027
Features:	Passive shut down & cooling Off-site, modular construction
Commercial Benefits:	Demonstrates licensing with NRC Produces experimental data, improves analytical codes, and develops models



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MSRR Comparison to MSRE

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Shared concepts

- Same Salt and Fuel Form: UF_4 , $LiF\text{-}BeF_2$
- Loop design
- Graphite moderator
- Drain tank
- Trench-based radiation protection
- Short expected lifetime
- Low pressure

MSRR Simplified concepts

- 19.75% instead of 33% ^{235}U
- 1 MWth instead of 8-10 MWth
- SS-316 instead of Hastelloy-N
- No freeze valve
- Control rods not safety related
- No cooling water

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Construction Permit Application Review

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- Aug 2022 – CP Submitted
- Nov 2022 – CP Docketed
- Sep 2024 – CP Issued

(25 months from submission, 22 months from acceptance)

- Jan 2023 - First audit question
- Jan 2024 - Last audit question

- 311 Audit questions with many follow-ups
- 1 Request for Supplemental Information
- 2 Requests for Additional Information
- 3 Requests for Confirmation of Information
- 92 NRC staff supported the review
- ~15,000 NRC staff hours (projected) (equivalent to $4.5M)
- Weekly meetings with NRC project managers
- ~270 NRC audit meetings

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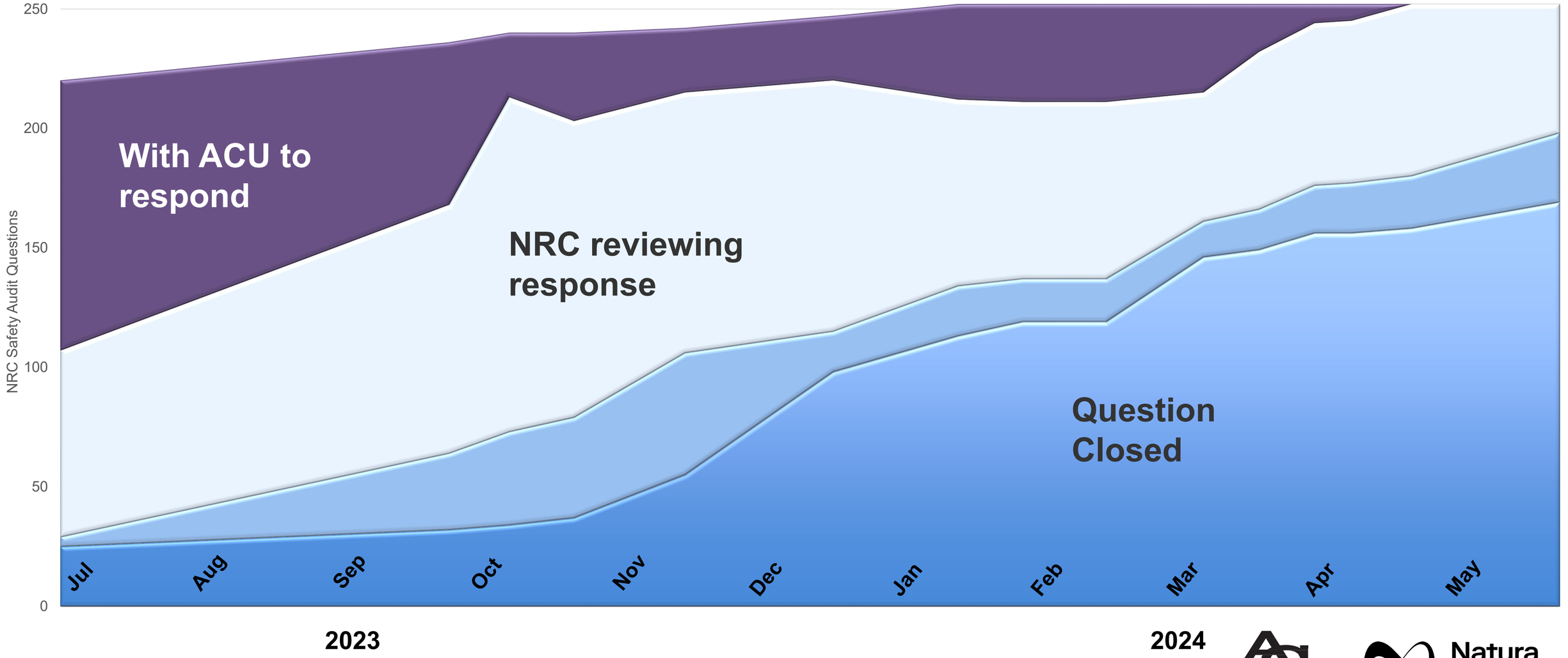
MSRR Safety Audit Open Questions



Key Aspects of the Review

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- Maximum Hypothetical Accident
- Functional containment?
- Use of power reactor reviewers
- Need for data on material performance

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MSRR Timeline

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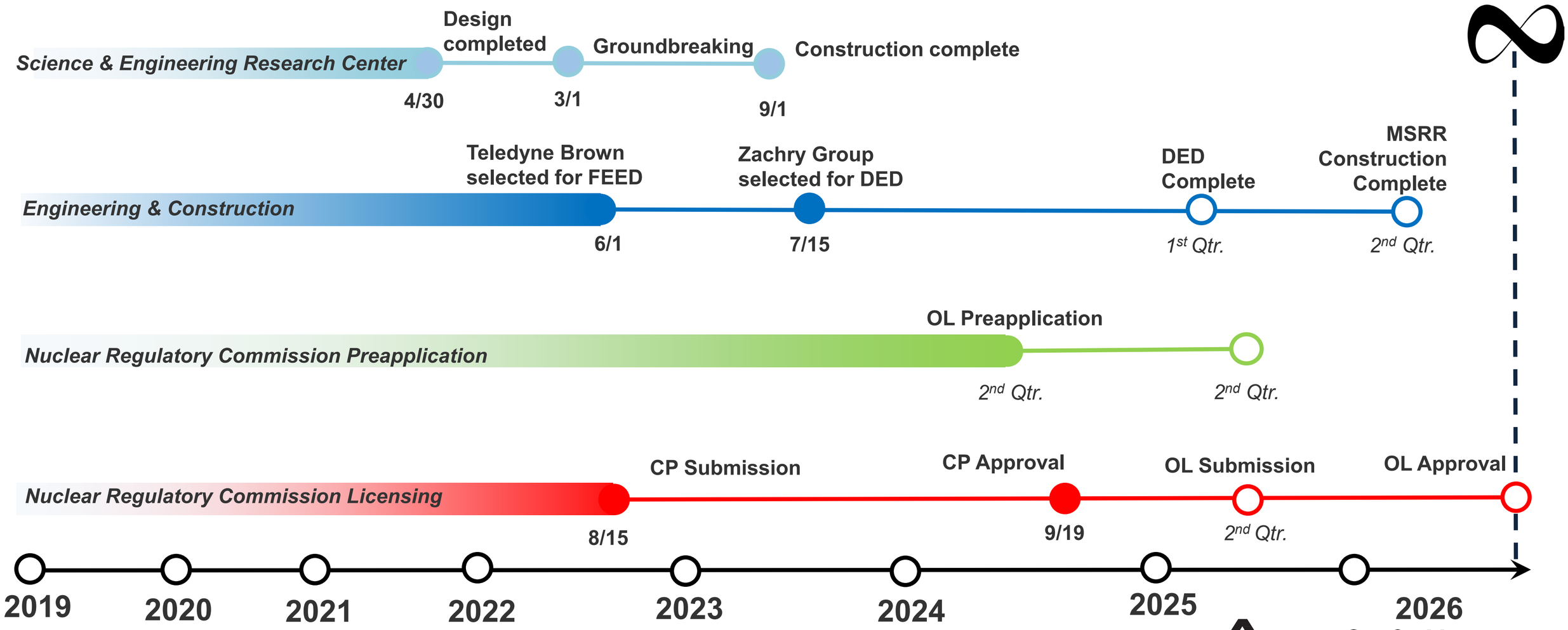

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MSRR at ACU

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The Natura Resources Research Alliance is leading the way in MSR development and deployment.

1. ACU has completed the SERC to house the Natura MSR-1.
2. ACU has a permit from the NRC to build the first advanced (Gen-IV) university research reactor.
3. We are on a path to be the first operating liquid-fueled molten salt reactor in the nation since the MSRE.

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ACU Abilene Christian University
TEXAS The University of Texas at Austin
TEXAS A&M UNIVERSITY
Georgia Tech

THANK YOU

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