



LULEÅ
UNIVERSITY
OF TECHNOLOGY



SUNRISE: state of the art SMR development in Sweden

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SSF Agenda 2030 Research centre



• Goals

★ Meeting the sustainable energy challenge of the UN Agenda 2030

• Objectives

★ Design a lead-cooled research reactor that may be in operation by 2030

• Means

★ KTH, LTU and UU forms a centre funded with 50 MSEK by SSF and supported by in-kind contributions from national and international stake-holders

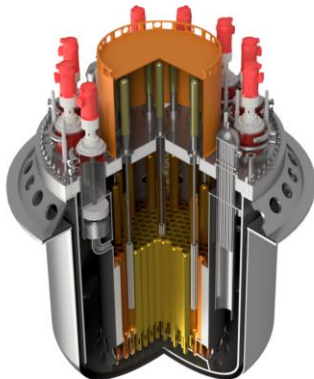
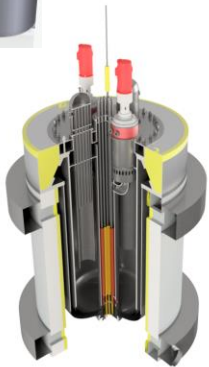


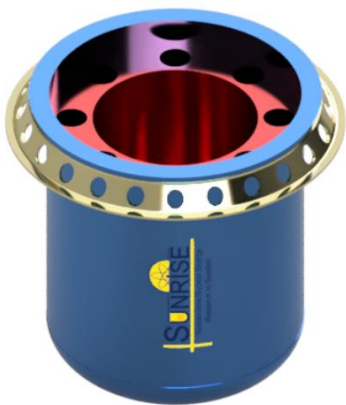
- We propose that the Swedish strategy towards a sustainable energy system that includes nuclear power should start with the construction of a lead-cooled research and demonstration Gen-IV reactor

- **3-stage rocket towards goal**

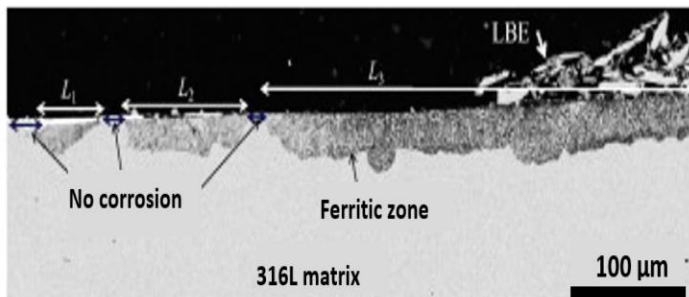
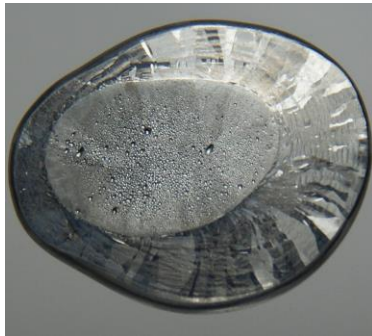
- 1) Design & safety analysis of research reactor and supporting R&D on materials and fuels (**SUNRISE**)
- 2) Construct and operate an electrical mock-up reactor (**Solstice**, co-funded by Energimyndigheten)
- 3) License, build and operate the research reactor (SUNRISE-LFR; ~1500 MSEK)

- We are off to a running start but political will and further resources are needed!





- Passive safety in most compact format
- High temperature, efficient operation, opening up for beyond-electricity capability
- Fast neutron spectrum → Gen-IV capable
- Optimal safety parameters:
 - Operation at ambient pressure
 - High boiling point (1740°C)
 - No violent exothermic reaction with water
 - Efficient decay heat removal by natural convection
 - Binds iodine and caesium
 - Provides in-situ shielding of gamma radiation



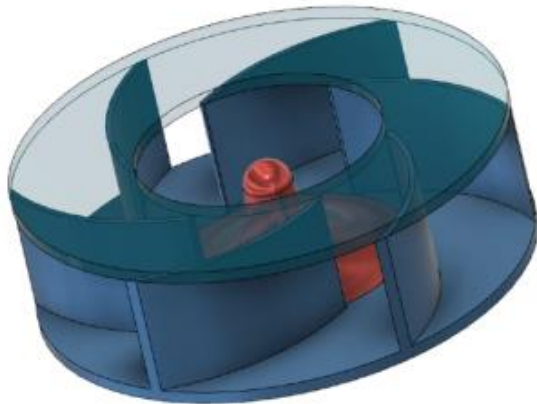
- Opacity makes visual inspection and instrumentation challenging
- High melting point (327 °C)
 - Maintenance challenges
 - Potential freezing issues
- Highly corrosive and erosive for standard steels and materials at high temperatures
- Liquid metal embrittlement at low temperatures
- Fuel qualification for lead cooled reactors



- **Pump impeller**

Design, test and qualify pump impellers for the research reactor

New materials solutions will be tested in an advanced experimental rig



- **Fuel and cladding**

Advanced nuclear fuel is developed and tested.

Clad materials are developed and will be tested in an integral test rig as well as in separate effect experiments



- **Primary vessel**

Advanced welding, deposition and surface coating techniques are developed, tested and qualified





SUNRISE team



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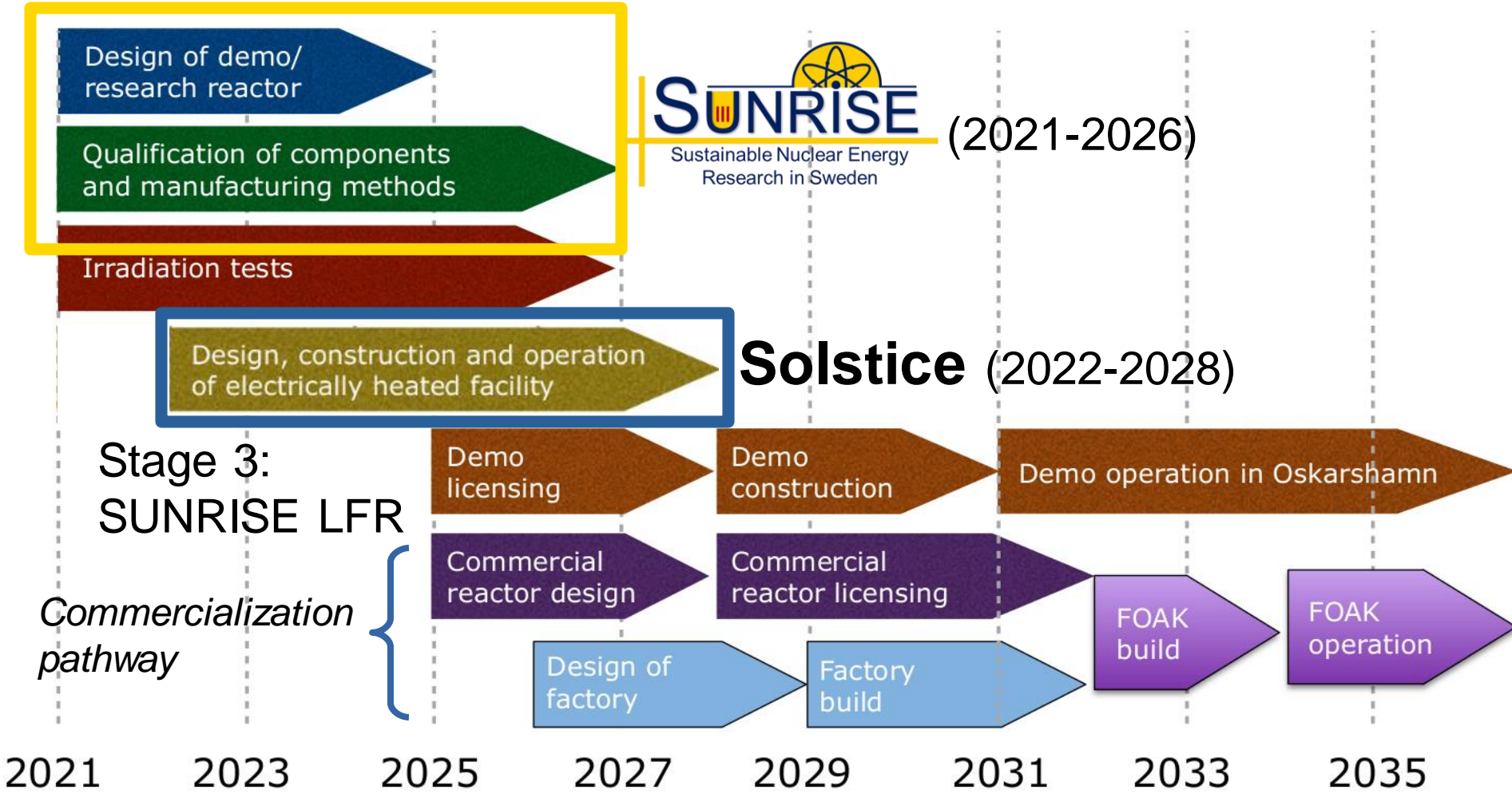


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... and more!



More information can be found at



- SUNRISE: www.sunrise-centre.se
- Solstice: [SMR AB](#)



- ANItA: SMR competence centre hosted by Uppsala University

Converging Energy
Technologies

Conference CET2022

September 21-23, at Oskarshamn Sweden

- [CET-2022](#) – conference on SMR in a converging energy technology landscape, Oskarshamn 21-23 Sept 2022: cet2022.org
 - *Register already now!*