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Framatome Fuel Portfolio for Light Water based SMRs

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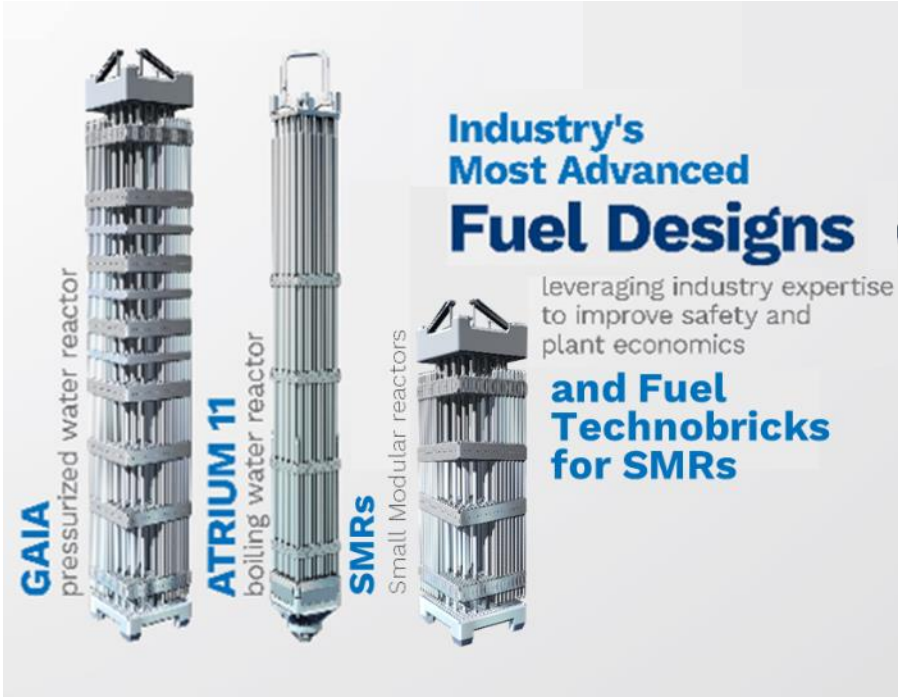
Introduction

- Small Modular Reactors (SMRs) require tailored fuel solutions to meet diverse design and deployment needs
- Framatome leverages its decades of experience and builds on its qualified PWR and BWR fuel products to accelerate SMR fuel development:
  - Proven technologies
  - Supply chain readiness
- Framatome's portfolio of solutions relies on existing standard techno bricks while maximizing technical and economic performance
  - Modular approach allows adaptation to various SMR designs, reactor sizes, and customer needs and requirements
  - Development of value-adding features
  - Engagement with SMR developers to ensure alignment with reactor needs and optimize SMR economics



Framatome solution portfolio supports near-term deployment while improving SMR value proposition

Adaptation of Framatome PWR fuel product to SMR design

- SMRs benefit from proven fuel products, enabling fast-track manufacturing, licensing, and market deployment
  - GAIA Fuel as starting point, made possible thanks to the use of the standard 17x17 array in non boiling LW-SMR

- Some SMR core-cavity heights deviate from the current industry standards (e.g. 12ft)
  - Fuel and core components adaptation to various heights, incl. shipment solutions
  - Framatome has capabilities for the analytical modelling and testing to support the qualification of SMR-tailored products

Fit-to-need Fuel architecture and design based on proven products and technologies

GAIA 12ft and illustration of height adaptations for SMRs

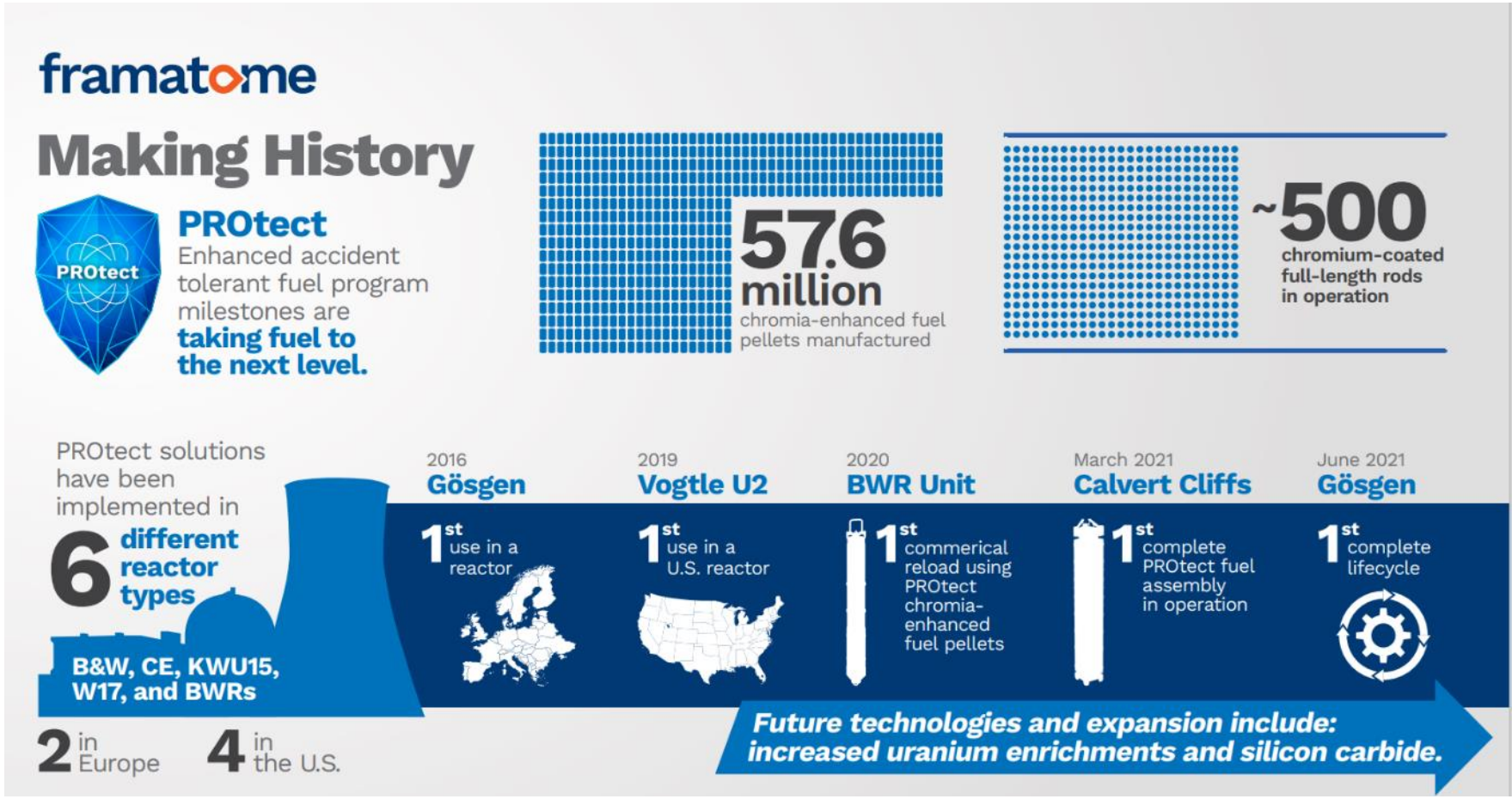
Advanced core design for better economics

- **High resolution neutronic design** to optimize fuel utilization and improve reactor economics thanks to fine enrichment and burnable absorber zoning
- **Advanced Fuel Management (AFM)** aims to deliver fuel with enrichment above 5% to support increased cycle length and plant efficiency
  - Framatome's AFM program includes fuel, design, licensing, fuel fabrication, and shipment
  - AFM is an additional lever for SMRs to improve their fuel cycle economics thanks to the added flexibility in nuclear fuel management
- **Digital tools** support core design optimization, scenario analysis, and performance prediction
  - Framatome's FARGO loading pattern optimization and lattice optimization system, using the ARCADIA code system, is adapted to various core sizes from SMRs to EPRs

Supporting reactor economics

Enhanced Accident Tolerant Fuel for SMRs

- Demonstrated performance in commercial reactor up to burnup of ~73GWD/tU
- Demonstrated compatibility in PWR and VVER environments → compatible with LW-SMRs

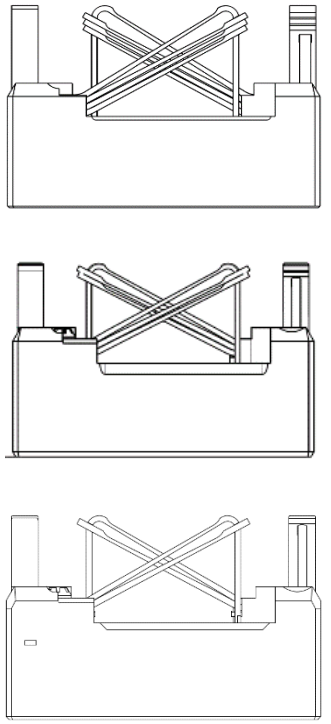


PROtect-Cr is the leading E-ATF solution supporting reactor safety & economics: available for SMR applications

Value adding features for SMR-Specific Conditions: Natural Convection

Illustration

- Core contribution to primary loop pressure loss is typically of ~40%
- Improvement of the fuel assembly hydraulic resistance improves heat exchange efficiency and therefore the overall plant efficiency and safety
  - Top and bottom nozzles design optimization to reduce their pressure loss
- The assembly mass flow rate is of the order of 1/20 of a typical PWR one:
  - Reduced solicitations on the fuel assembly in terms of liftoff → Reduced number of spring leaves



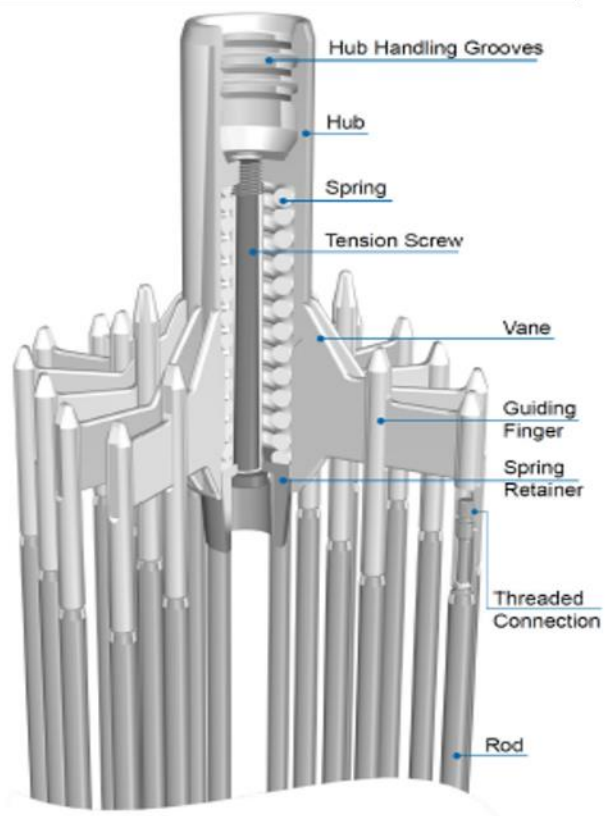
Top nozzle simplification for SMRs

Improving value: modularity to meet specific need

Value adding features for SMR-Specific Conditions: Boron-free cores

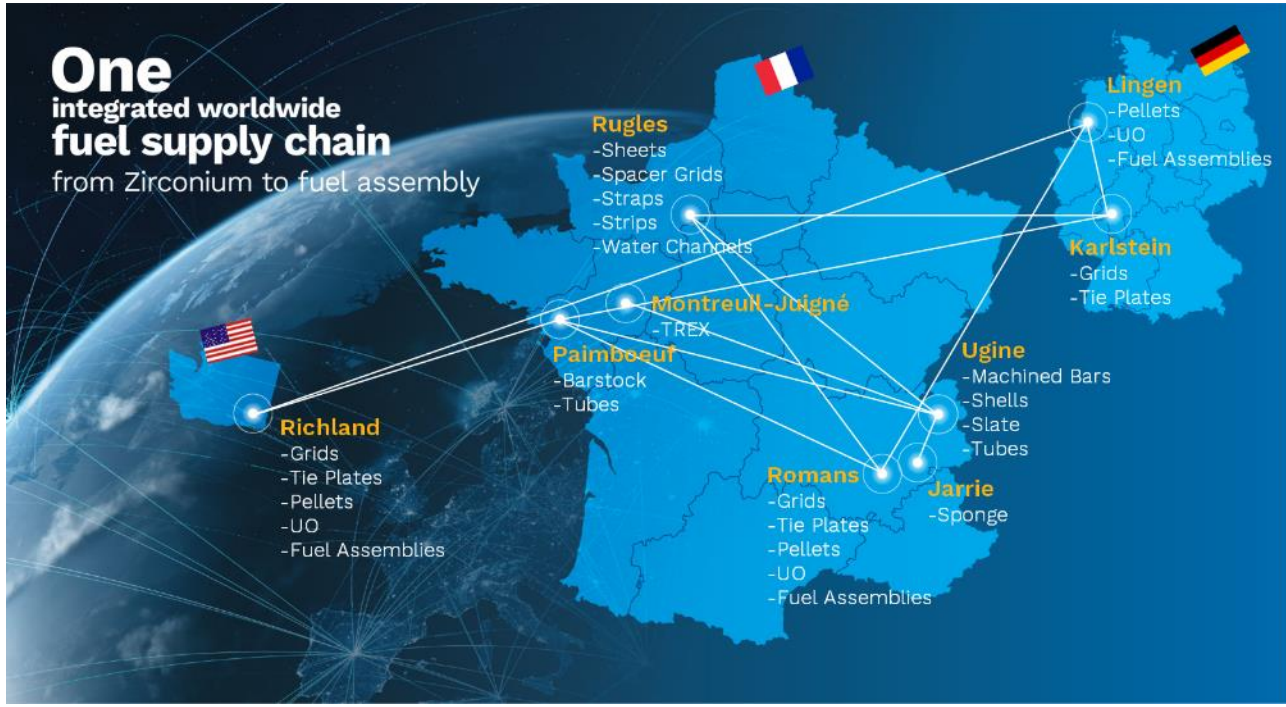
- Reactivity control is ensured thanks to burnable absorber and control rods and calls for:
  - High-resolution neutronic design to ensure flat power profiles
  - RCCAs including hybrid RCCAs to allow controlling reactivity with reduced axial power peaking
    - design-to-need in terms of geometry and neutronic worth
    - As required: mix of stainless-steel and absorber rods (Ag-In-Cd / B4C)

Proven technologies with large Operating Experience Feedback



Supply Chain and Qualification capabilities

- Framatome's global supply chain and manufacturing facilities enable rapid development, qualification, and delivery of SMR fuel solutions
  - Relying as much as possible on standard materials and components
  - When applicable, compatibility or value-driven adjustment still allow use of proven manufacturing technologies & process
  - Robust qualification process
- In-house analytical modeling, simulation, and testing capabilities ensure compliance with regulatory and performance requirements
- Available fuel services portfolio for SMRs



Relying on proven technologies & infrastructures to allow fast market implementation

Conclusion

- Framatome's SMR fuel portfolio of solutions combine proven technologies, tailored adaptations, and a robust supply chain
- The adaptability of Framatome's fuel products and technologies allows maximizing SMR value proposition
- Leveraging its expertise and worldwide supply chain, Framatome can provide fast tracked fuel design and supply, and full scope of licensing support

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Thank you