



EAGLES-300

Program and Design Options

IAEA National training course on Heavy Liquid Metal Cooled Fast
Reactors: Benefits and Challenges – 18/02/2026 – RATEN ICN
Pitesti Romania

Safe Scalable Sustainable



Key features



Easy grid adaptability

Around 350 MWe & suitable for industrial heat and hydrogen production



Modular design

Lower construction costs, faster build, flexible deployment



Optimized fuel management

Advanced fuel including recycled materials, reducing waste and enhancing sustainability



Extensive passive safety

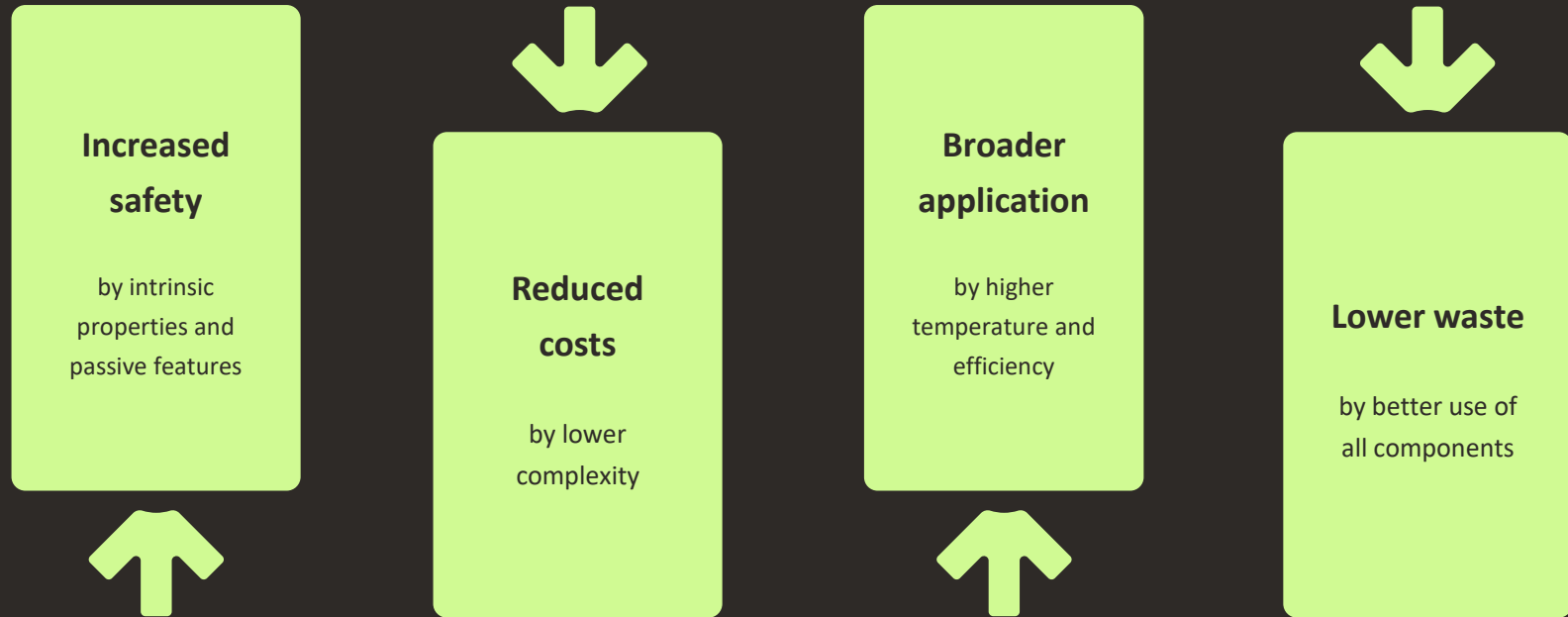
Simple & proven features



Competitive economics

Lower capital cost, simple operation

Lead-Cooled Technology advantages



Lead-Cooled Technology main challenges

**Coolant
chemistry**

and purification

**Protective
measures**

against corrosion
and seismic loads

Maintenance

inspection and
repair strategy

**Self
regulating**

and anti-
freezing DHR
passive system

EAGLES-300

- Competitive economics
 - LCOE looking at future EU energy mix
 - Replacement of fossil fired plants
- Proven passive safety features
 - Enhanced grace time
 - Limitation of EPZ
- Sustainable closed fuel cycle
- High temperature heat
 - 520°C baseline / >600°C prospect
 - Hard-to-abate sectors
- Customers oriented
 - Utilities
 - Industrial districts
- Commercial fleet deployment by 2039

Reference design

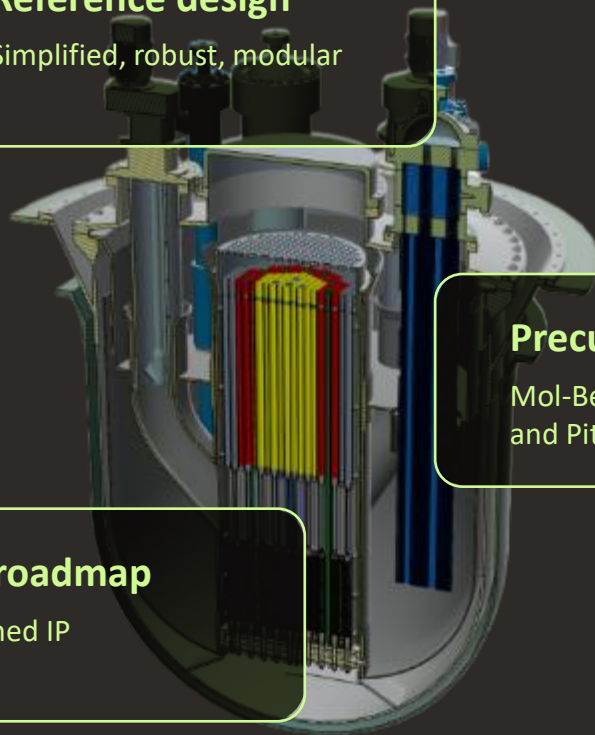
Simplified, robust, modular

Precursor sites

Mol-Belgium
and Pitesti-Romania

Shared roadmap

Jointly owned IP



A solid European Consortium

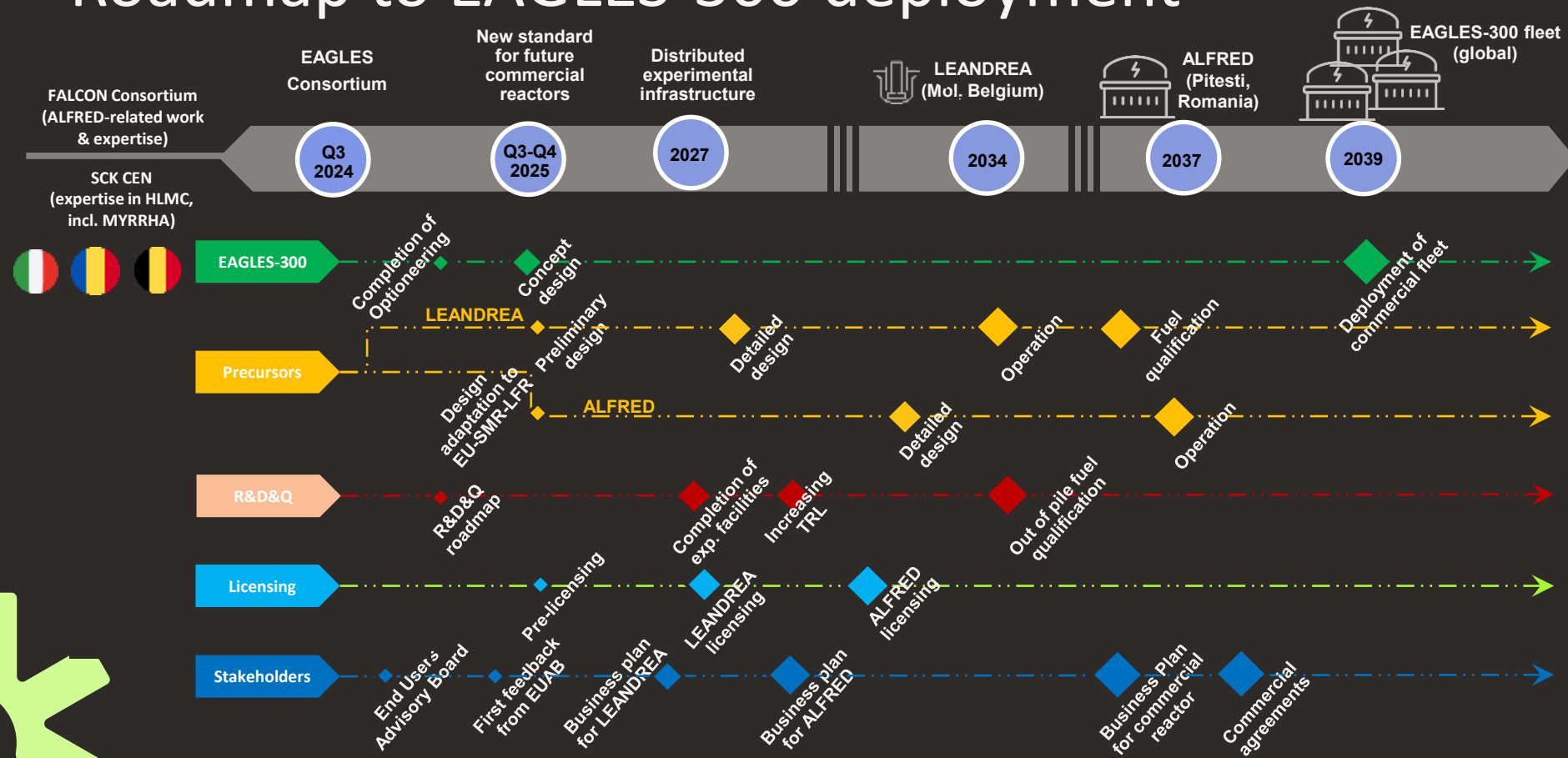
- Focused on feasibility & competitiveness
- Research excellence & industrial reliability
- Industrial know-how & liquid-metal expertise
- Decades of experience in major nuclear programs
- Bridging science and industry for robust, deployable solutions



EAGLES signature ceremony in Luxemburg, June 2025



Roadmap to EAGLES-300 deployment



Enabling Assets

To ensure technological and engineering maturity, the EAGLES Consortium will leverage two key precursors:



LEANDREA

The test reactor will provide an **irradiation capability** and technology **viability demonstrator**, with **focus on fuel and material testing**.
Mol, Belgium



ALFRED

The prototypical pilot plant will serve as reference for temperature conditions: a steppingstone toward commercial deployment of EAGLES-300.
Pitesti, Romania

Precursors to unlock critical data...

Private capital to accelerate market entry



Research infrastructure in Romania

ATHENA & CHEMLAB

2020 – 2025

- Operational Programme Competitiveness + National co-financing
- 2025 – Construction completed
- **Largest lead test facility in the world**



ATHENA

The LARGEST POOL FACILITY IN THE WORLD, for large-scale components testing in representative conditions.



ChemLab

A broad-scope laboratory on the chemistry of HLMs and materials science.

4ALFRED Project

2025 – 2027

- Operational Programme for Smart Growth, Digitization and Financial Instruments (POCIDIF from ERDF)
- Facilities construction and R&D activities
- 2022, funding confirmation
- 2024, ICN award expected
- 2025, public tenders being launched



Meltin'Pot

A hot facility to characterize radioisotopes behavior in Lead.



ELF

A pool facility for long-term experiments.



HELENA-2

A loop facility for full-scale testing and complete thermal-hydraulic characterization of fuel and absorber assemblies.



Hands-ON

A facility devoted to the testing and qualification of systems and procedures for the handling of core elements.

ALFRED

Status of experimental infrastructure in Romania

- ATHENA and ChemLab, goes into operational stage in 2026.
- HELENA2, ELF, Hands-On, Meltin'Pot - will start implementation in 2025; are planned to enter the operational stage in 2027.



Experimental park at ENEA Brasimone (Italy)



RACHEL Lab



BID-1



NACIE



CIRCE – Pool TH



LIFUS5



HELENA



CIRCE - SGTR

Future installations in Belgium

- **LFR-SMR Materials and Chemistry**

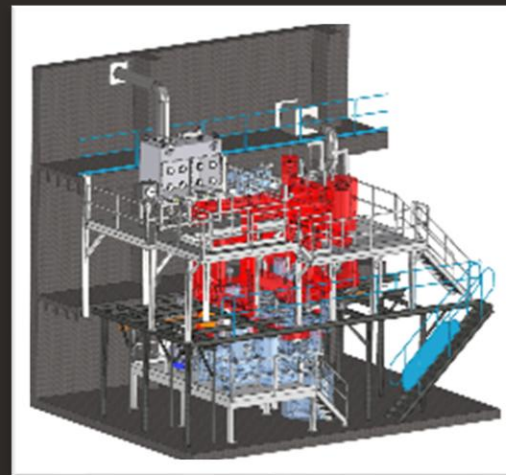
- **CAMILLE loop**: Corrosion tests, oxygen control studies, fuel assembly integral tests
- **HELIOS**: Pool-type system behavior with oxygen control strategy testing

- **Full-Scale Component Testing**

- **PULSAR**: Full-scale investigation of LFR-SMR lead pump configurations
- **HYDROBEAR**: Full-scale investigation of LFR-SMR pump hydrostatic bearings

- **Mechanical testing**

- **POLTERBEAR** → Small scale robotics and long-term bearing tests in lead
- **LIMETS 5 and 6** → Tensile and fatigue tests in lead
- **Erosion and creep set-ups** → liquid lead erosion and creep investigations



Ansaldo Nucleare experimental rigs



Versatile Loop Facility

1. Loop type plant – 500 kW
2. Design up to 650°C
3. Provided with diffusion bonded heat exchanger and supercritical water circuit

Passive Heat Removal Facility

1. Reactor cavity section – 500 kW
2. Design up to 700°C
3. Tests natural circulation and convection in reactor cavities with water and air and all heat transfer modes



Fuel strategy

Focus on the differences:

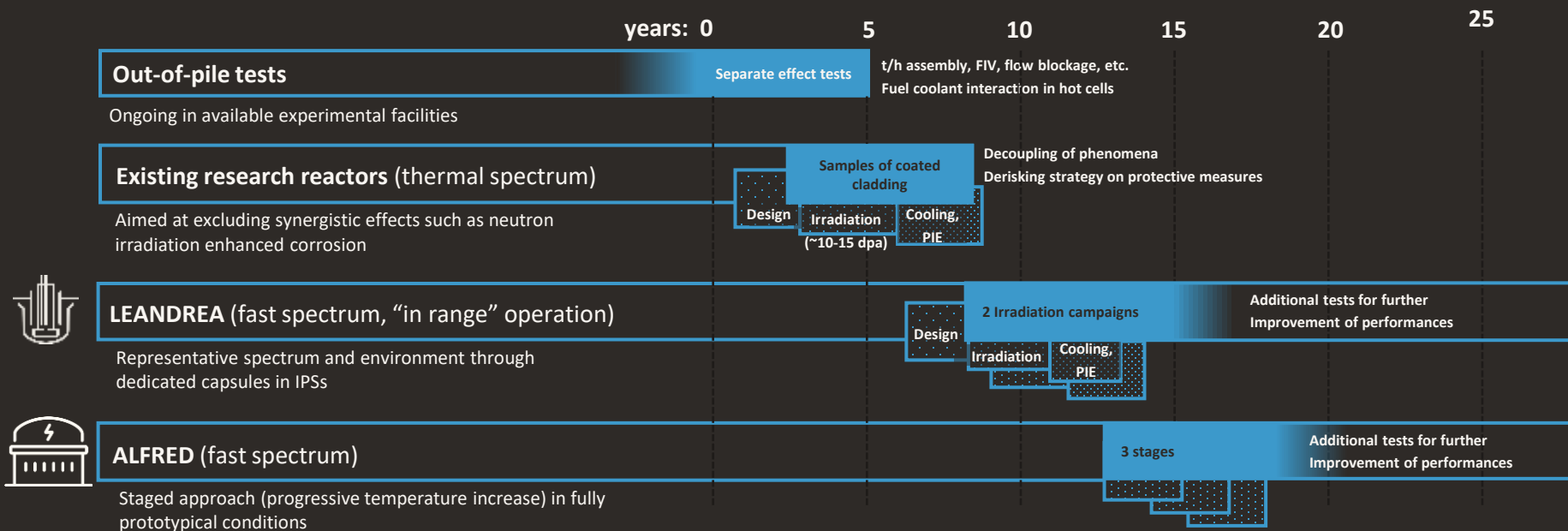
- Coolant-clad interaction: lead corrosion inhibited through a coating. What neutron irradiation effects?
- Fuel performances: minor deviation with respect to past EU experience. How is qualification affected?

Fuel	Material	MOX
	Pellet geometry	Solid, annular
	Inner diameter	In range
	Outer diameter	(+30.0%)

Fuel	Enrichment (Pu/HM)	In range
	MA content	In range
	Stoichiometry	In range
	Porosity	In range

Clad	Material	In range
	Outer diameter	(+25.0%)
	Thickness	(+3.0%)

Operat	Peak linear heat rating	In range
	Peak burnup	In range
	Peak clad temperature	In range
	Peak clad irradiation damage	In range



EAGLES - Licensing strategy

Concept

Initial design validation
R&D&Q roadmap
Time-to-market driven solutions

Pre-licensing

Multilateral engagement
IAEA extra-budgetary project
BE, RO, IT involved

Early Permits

Harmonized standards
LEANDREA as pathfinder
ALFRED for standardization

Serial FOAKs

Building on a standardized approach
Opening to an EU framework
Exploiting serial effect



LEANDREA pre-licensing application officially started in May 2025, leveraging previous experiences.



In 2017, a preparatory phase to the authorization process of ALFRED was started with CNCAN.



ISIN joined the EAGLES international pre-licensing programme in September 2025 as observer

Three regulators, one file: towards EU harmonization

International Pre-licensing Pilot Project

- Organization

- Multi annual 2025-2027 NHI pre-licensing pilot project through an IAEA Extra-Budgetary Project;
- Implemented by the Regulatory Authorities of Belgium (FANC/Bel V), Romania (CNCAN) with the participation of Italy Regulator (ISIN)
- Technical input and funding provided by the EAGLES Consortium
- Managed by the IAEA Regulatory Activities Section (RSA) in the Division of Nuclear Safety on Nuclear Installations (NSNI)
- Governing body - EBP Steering Committee with EAGLES Consortium, IAEA, FANC and CNCAN

International Pre-licensing Pilot Technical Scope



Select and agree with the regulators on the **requirements, codes and standards** applicable to the technology.



Define, agree with the regulators on, and implement a robust **safety approach** in the concept designs of the precursors and EAGLES-300.



Define and agree with the regulators on the **approach for security and safeguards by design**.



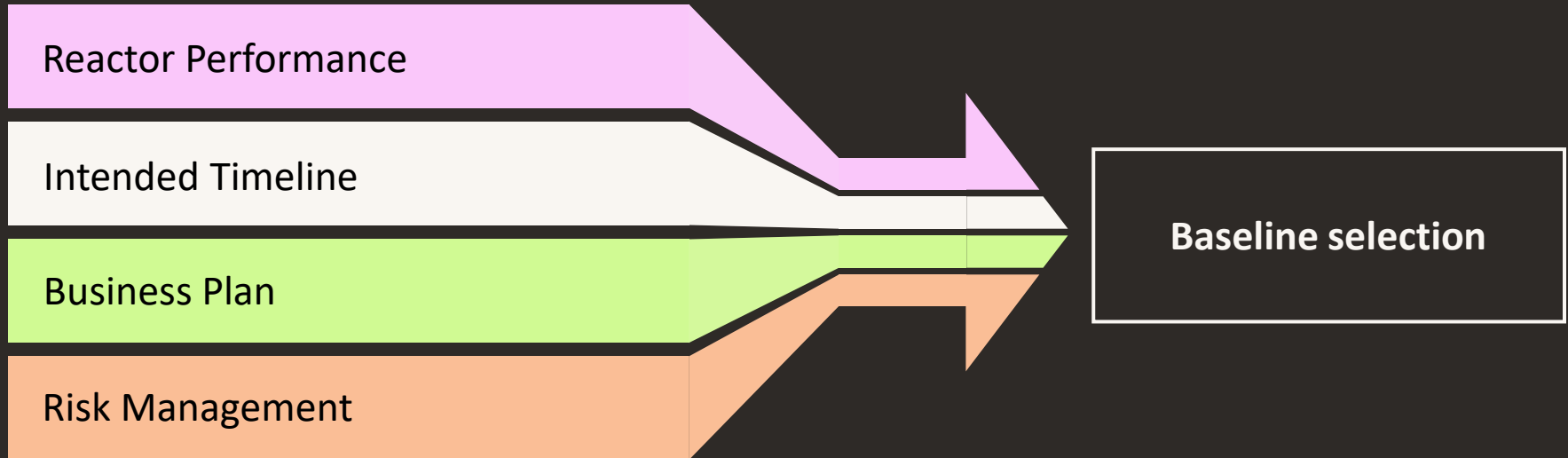
Present and agree with the regulators on a comprehensive **R&D road map**, covering all relevant areas to support the design and safety assessment needs.



Present and agree with the regulators on the EAGLES -300 **fuel qualification programme**.

Design option – what does it mean?

Optioneering is the systematic evaluation of alternative design configurations to identify the reactor components that best meet safety, performance, and feasibility targets.

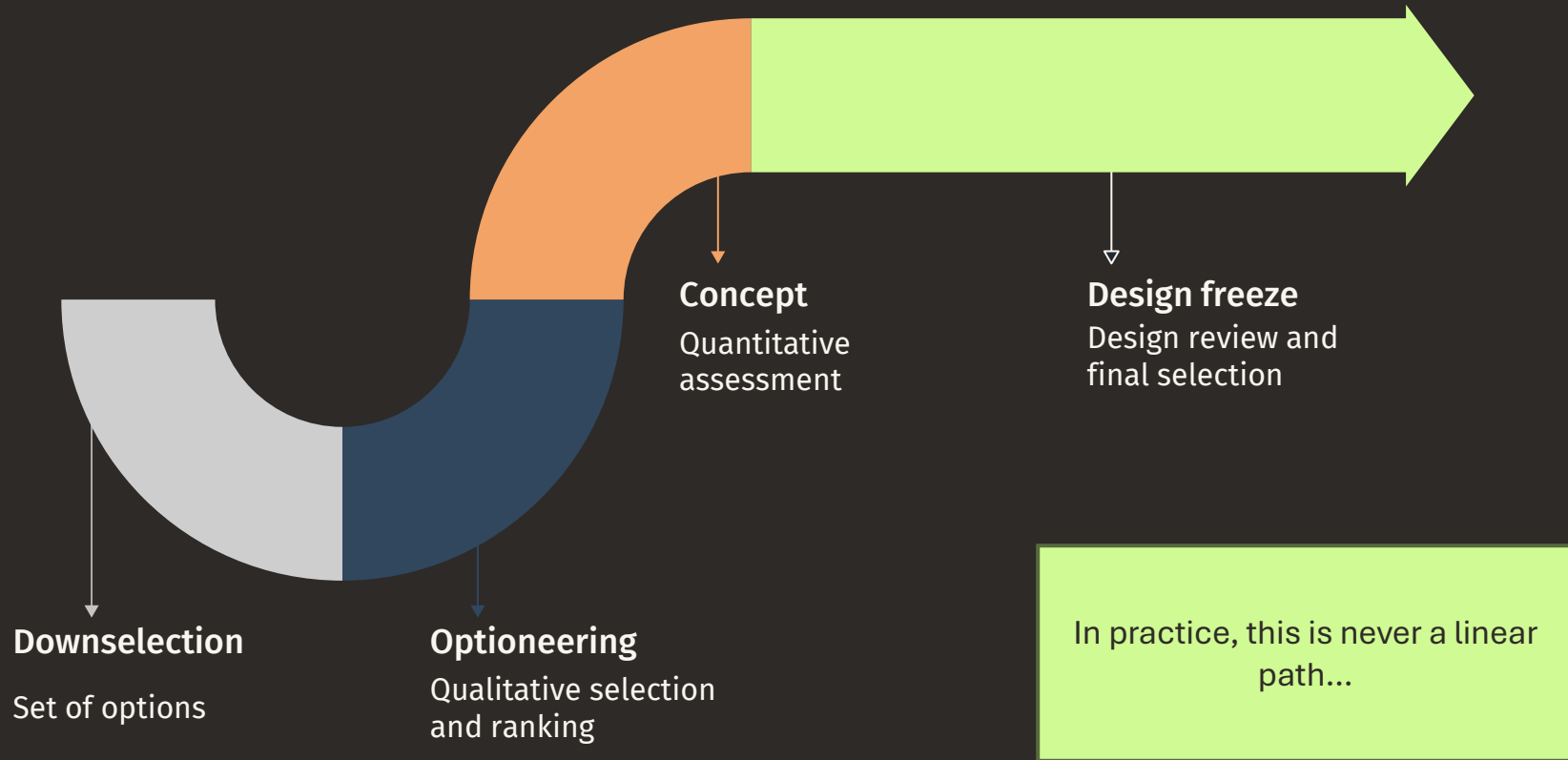


Optioneering Process



We actually make optioneering everyday...

Optioneering Example – work stream



EAGLES-300 take aways

- EAGLES-300 is a latest-generation, nuclear lead-cooled SMR: safe, scalable, sustainable.
- It supports electricity, hydrogen, and industrial heat applications.
- Strong European partners, governmental and EU recognition, and IAEA cooperation.
- Qualified nuclear sites available for the precursors.
- Early engagement with regulators accelerates deployment.
- Stakeholder support through the End Users Advisory Board
- Foundation signed in June 2025.
- Pre-licensing collaboration launched in September 2025.
- EAGLES-300 is advancing step by step towards commercialization by 2039.

Eagles-300

Powering Europe's clean, safe and competitive future.

Discover the future of nuclear innovation:

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