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May 28, 2026

Enabling Large Power Uprates

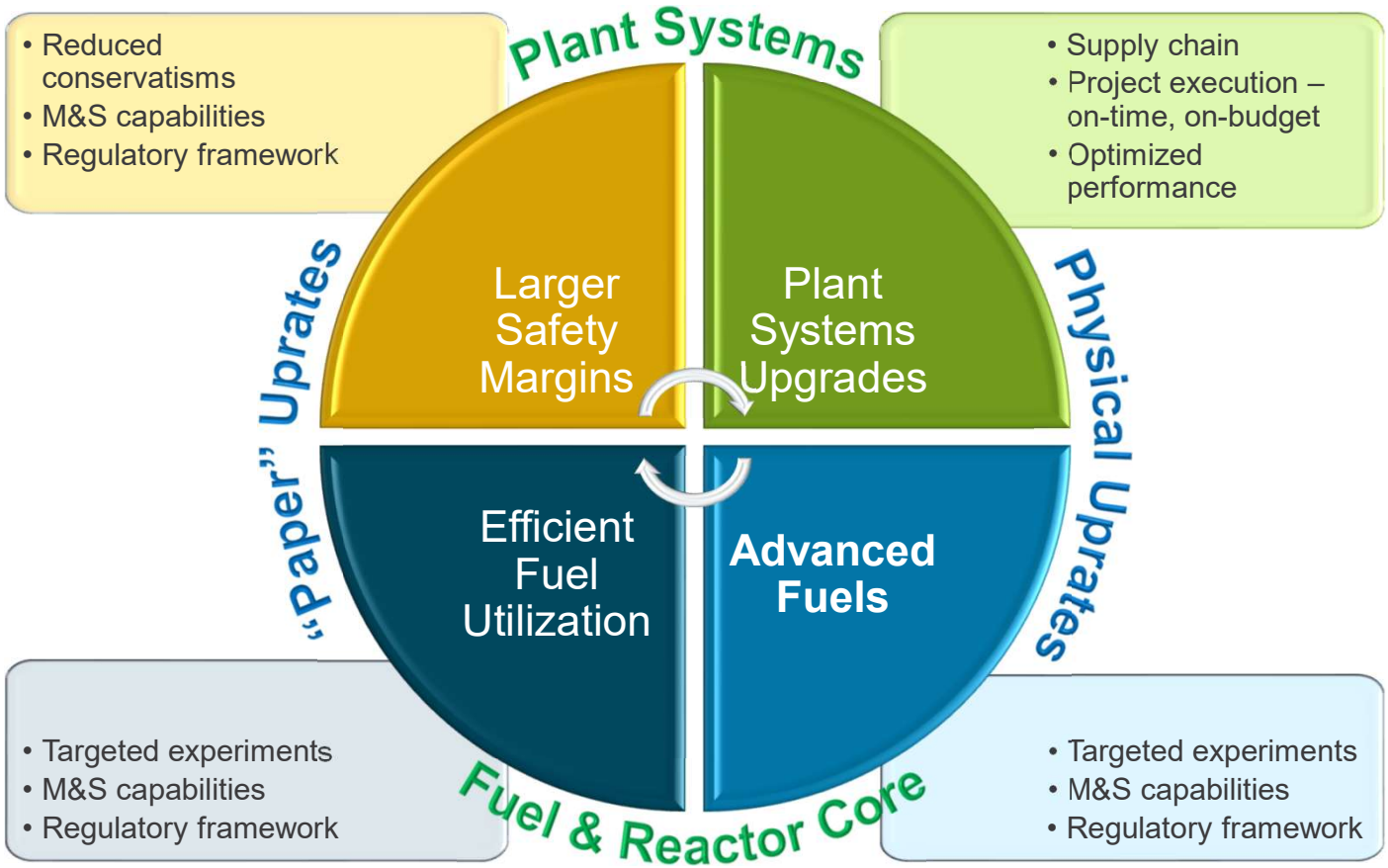
Systems Integration

Goal/Outcome:

Expand the electricity generation capacity of the operating commercial nuclear reactor fleet by 5 GWe in 5-7 years and 10 GWe in 7-10 years

FOCUS AREAS:

- Enhanced modeling and simulation tools
  - Systems analyses
  - Fuel performance analyses
- Demonstration of adequate safety margins
  - Reducing conservatisms
  - Detailed analyses
  - Reducing uncertainties
- Artificial Intelligence and Machine learning (AI/ML) technologies
- Risk-informed licensing pathways



Reduced Conservatisms → Risk-Informed Safety Analyses

THE IMPERATIVE

- Plants hold significant hidden margin imbedded in deterministic rules used to license the operating reactors
- 50+ years of operating data (>20,000 reactor-years) demonstrate history of safe performance
- Defense in Depth provide assurance of safe performance of nuclear plants beyond the design requirements
- **Advanced modeling and simulation tools, probabilistic methods, and modernization of regulations** now enable accurate, risk-informed safety margin characterization

IMPACT OF EXCESS CONSERVATISMS

CONSTRAINED SYSTEMS

- Oversized ECCS, containment, EDGs, cooling systems
- Containment – very small margin for DEGB accidents
- EDGs sized for DEGB – no room for larger loads
- Ultimate Heat Sink – very little margin already

OPERATIONAL CONSEQUENCES

- Limits size and scope of power uprates
- Higher uprate licensing and capital costs
- Forced capacity derates in hot weather
- Higher fuel cycle and aging management costs

Vision: Risk-Informed Regulations as an Enabler for Large Power Uprates

- ➢ Unlock larger power uprates by expanding accessible safety margins across multiple systems
- ➢ Reduce the cost and complexity of uprate licensing and implementation
- ➢ Improve capacity factors by resolving operational constraints driven by imbedded conservatisms

LWRS
LIGHT WATER REACTOR SUSTAINABILITY