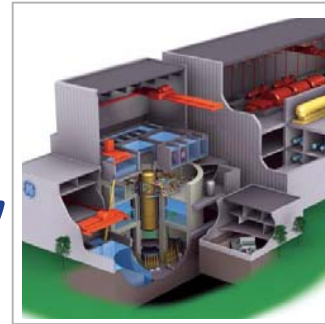
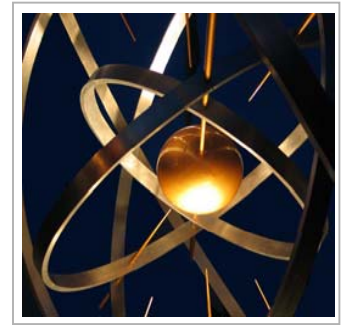
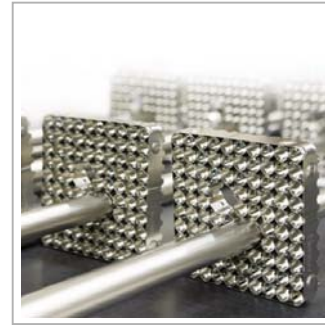


RIC 2007: Advanced Reactor Designs

Eric P. Loewen Ph.D

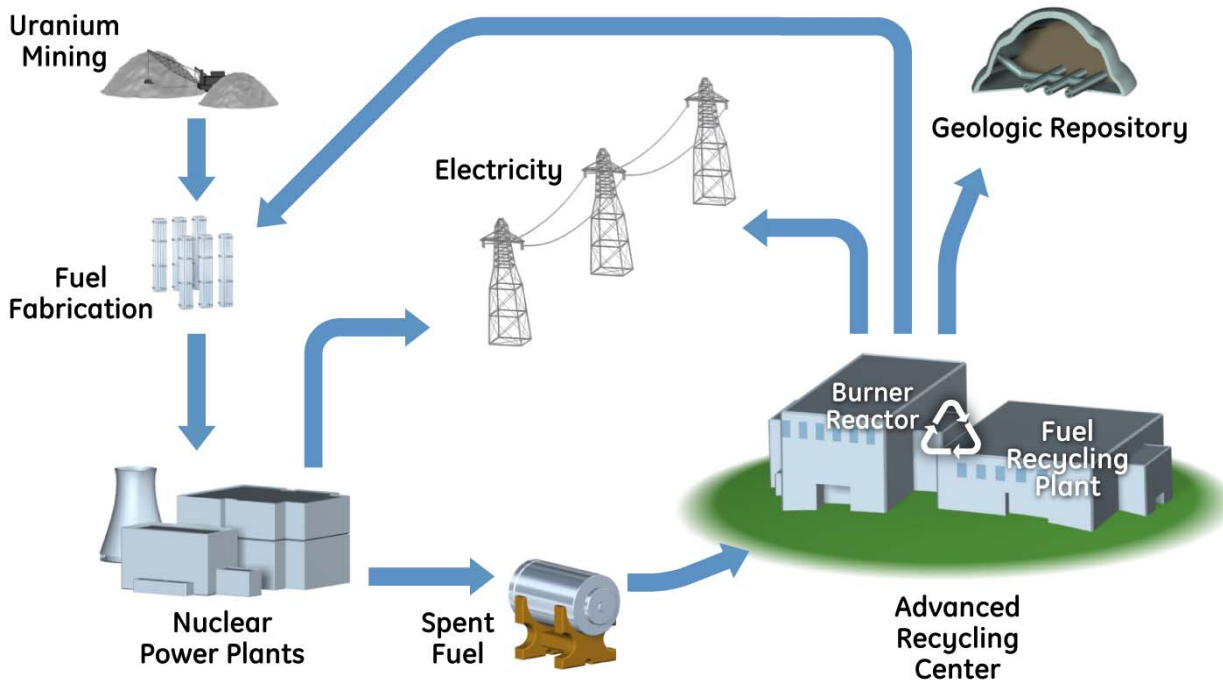
Advanced Reactors: NUREG-1368 Applicability to Global Nuclear Energy Partnership

March 15, 2007



imagination at work

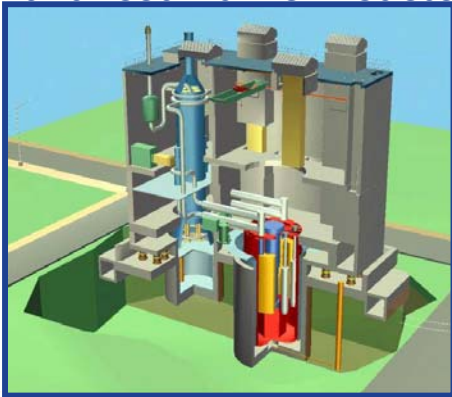
Advanced Recycling Center (ARC)



The Advanced Recycling Center...

- Integrated ABR (PRISM) and CFTC (ER)
- Separates LWR SNF
- Fabricates ABR TRU fuel
- Converts TRU to SL isotopes
- Produces electricity & other products

Advanced Burner Reactor

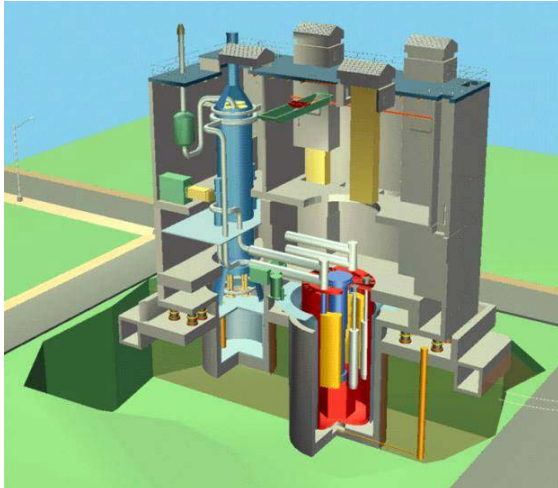


Advantages...

- Closes the fuel cycle
- Available technology
- Safe and economical
- Modular and scalable
- Proliferation resistant
- Previous USG R&D investment

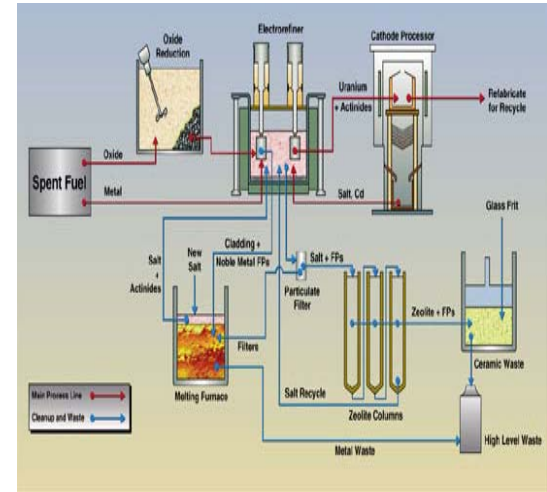
ARC Technology Solution

PRISM



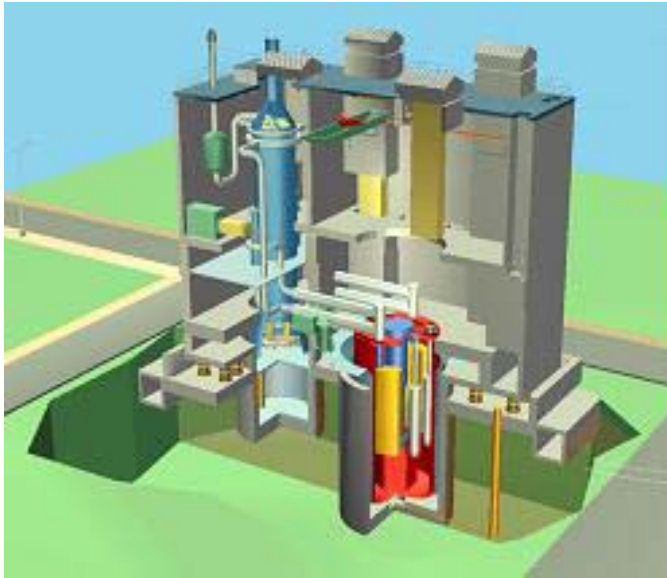
- + 840 MWth & 311 MWe
- + Na cooled fast reactor
- + Passive safety
- + Modular/scalable
- + Factory built
- + Flexible fuel cycle (broad input composition)
- + Metal or oxide fuel (metal pref.)
- + Extensive component testing

Electro Refining



- + Modular/scalable
- + Sized to support ABR
- + Proliferation resistant
- + Removal of volatile FP through voloxidation
- + Continuous or batch process
- + Extensive testing in the U.S., Russia, Japan, and Korea
- + Used by industrial refiners

Recycling Reactor ... PRISM



✓ Advanced Conceptual Design

- Already paid for by USG
- Available today
- Spent fuel is an energy asset

✓ Nuclear Regulatory Commission

- No obvious impediments to licensing

1981-1984
GE Program

GE funded

1985-1987
PRISM

DOE funded \$30M

1988
PRDA

DOE funded \$5M

1989-1995
ALMR

DOE funded \$42M

1995-2002
S-PRISM

GE Funded

2007-2014



NRC's NUREG-1368 Concluded

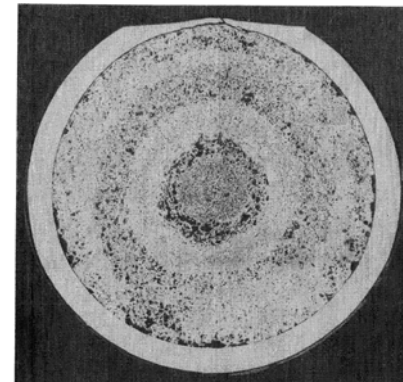
- No obvious impediments to licensing the PRISM (ALMR) design have been identified
- There are eight design features that deviated from LWRs
 - accident evaluation
 - calculation of source term
 - containment
 - emergency planning
 - staffing
 - heat removal
 - positive void
 - control room design



PRISM ... Optimized for Metal Fuel

Metal Core Advantages ...

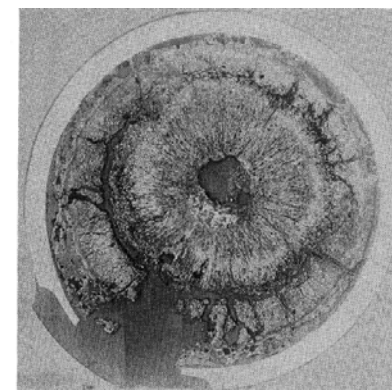
- ✓ Fuel is denser and has a harder neutron spectrum
- ✓ Compatible with coolant, RBCB demonstrated at EBR-II
- ✓ Axial blankets are not required for break even core
- ✓ High thermal conductivity (low fuel temp.)
- ✓ Lower Doppler and harder spectrum reduce the need for GEMs for ULOF (6 versus 18)



RBCB Test of Metal Fuel
with 12% Burnup (ANL)

Electro-Refining ...

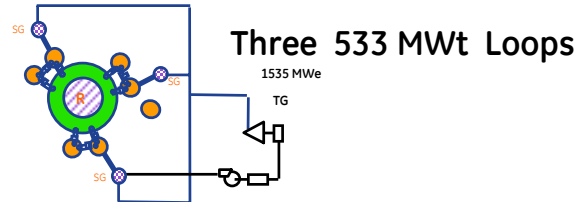
- ✓ Diversion resistant
- ✓ Compact
- ✓ Less complex
- ✓ Fewer waste streams than conventional aqueous (PUREX) process



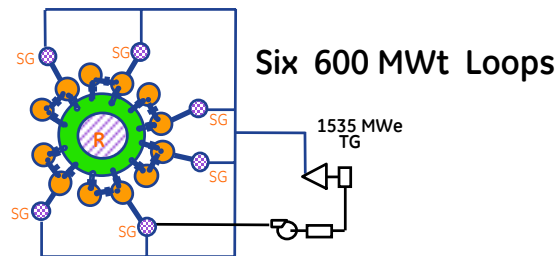
RBCB Test of Oxide Fuel
with 9% Burnup (ANL)

Size: LWR vs. FR

1600 MWt Sodium Cooled Fast Reactor

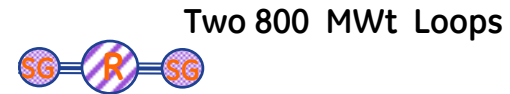


3600 MWt FR

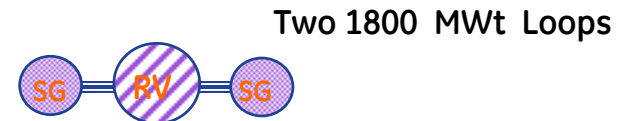


Rating Limited by:
IHTS Piping: < 1 m diameter

1600 MWt Light Water Cooled Reactor



3600 MWt PWR

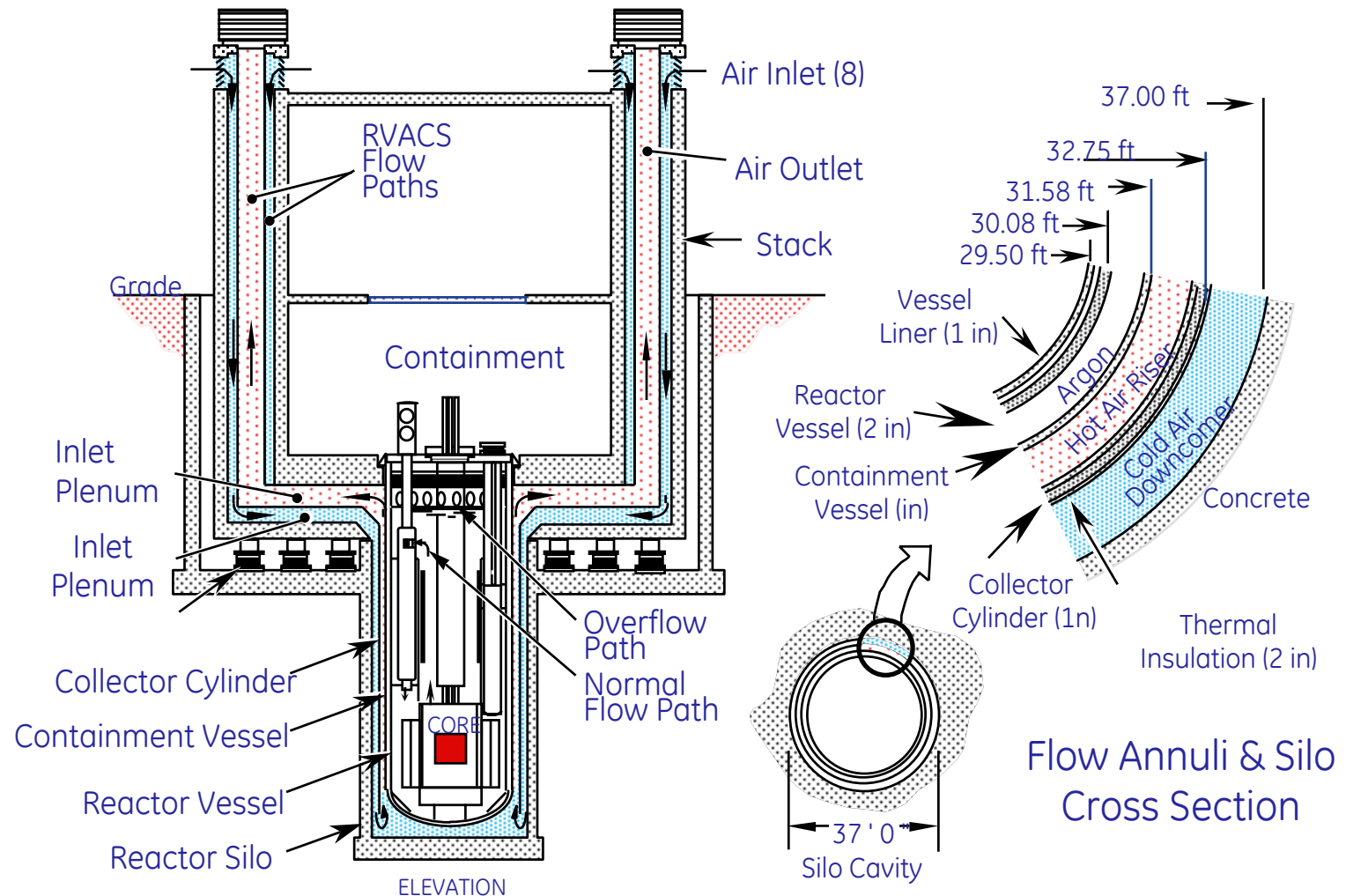


Two Loops Viable Because:
Specific heat of water 5 x sodium
at operating temperatures

- The complexity and availability of a PWR is essentially constant with size
- Due to the lower specific heat of sodium, six or more loops are required in a large FR.

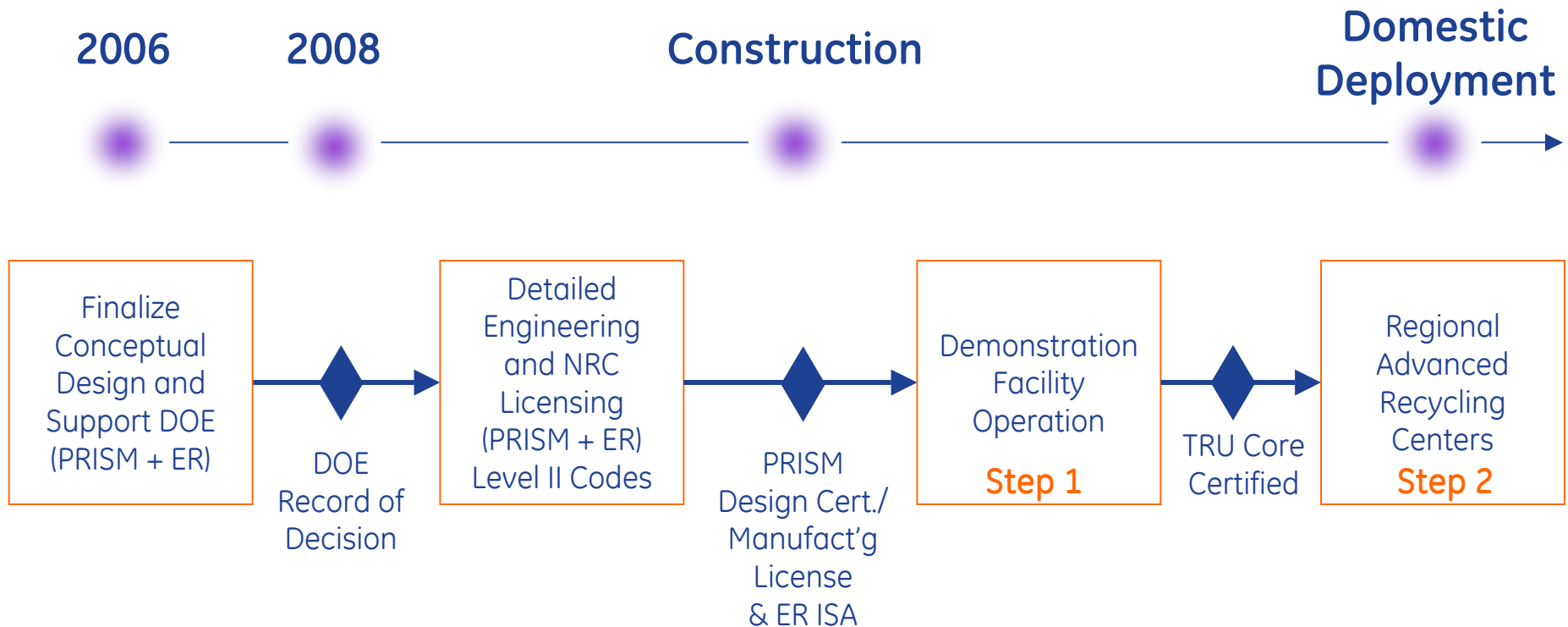
The Economy of Scale is Much Larger for LWRs than FBRs

PRISM Reactor Vessel Auxiliary Cooling System



imagination at work

High Level ARC Deployment and Licensing Plan



NRC License options

Step 1:

- Prototype technology and safety demonstration Part 50/52

Step 2:

- Part 52 Standard Design Certification (specific site)
- Part 52 Manufacturing License
 - PRISM modules manufactured by GE,
 - CL applicants reference and purchase "off the shelf")

PRISM Design Approach

Simple Conservative Design

- Passive decay heat removal
- Passive accommodation of ATWS Events
- Automated safety grade actions

Simplified O&M

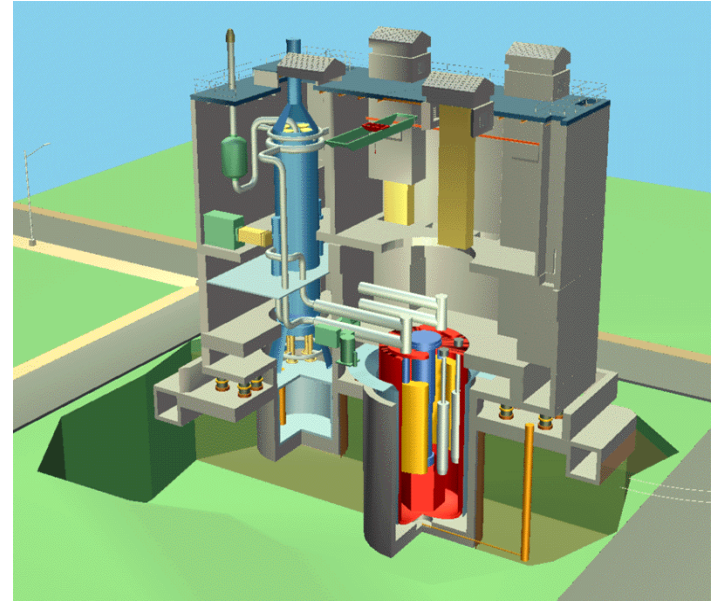
- Safety grade envelope confined to NSSS
- Simple compact primary system boundary
- Low personnel radiation exposure levels

Reduced Capital and Investment Risk

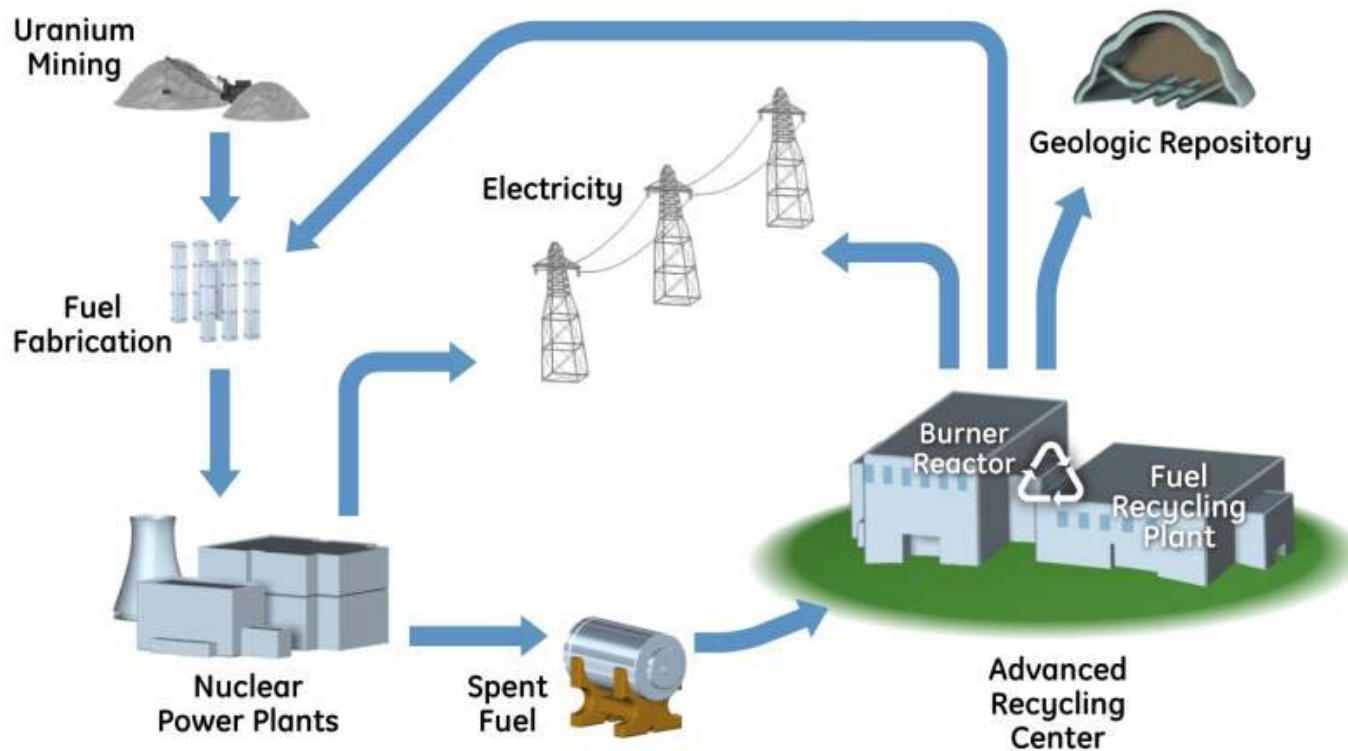
- Factory fabrication of standard certified design
- Modular Construction and seismic isolation

Minimized Required R&D

- Low Temperature
- Small and Simple System Configuration



GE's GNEP Integrated Solution



PRISM...

- Simple Operation
- Highly Reliable and Passively Safe
- Simplified Operations and Maintenance
- Modular/Scalable Deployment

GE's Approach...

- Integrated solution
- Available technology
- Excellent site for deployment