Invent the Future

ADNA & Virginia Tech

GEM STAR

Green Energy-Multiplier

Subcritical Technology for Alternative Reactors

under development by

ADNA Inc.

(Accelerator Driven Neutron Applications)

in a research partnership with

Virginia Tech

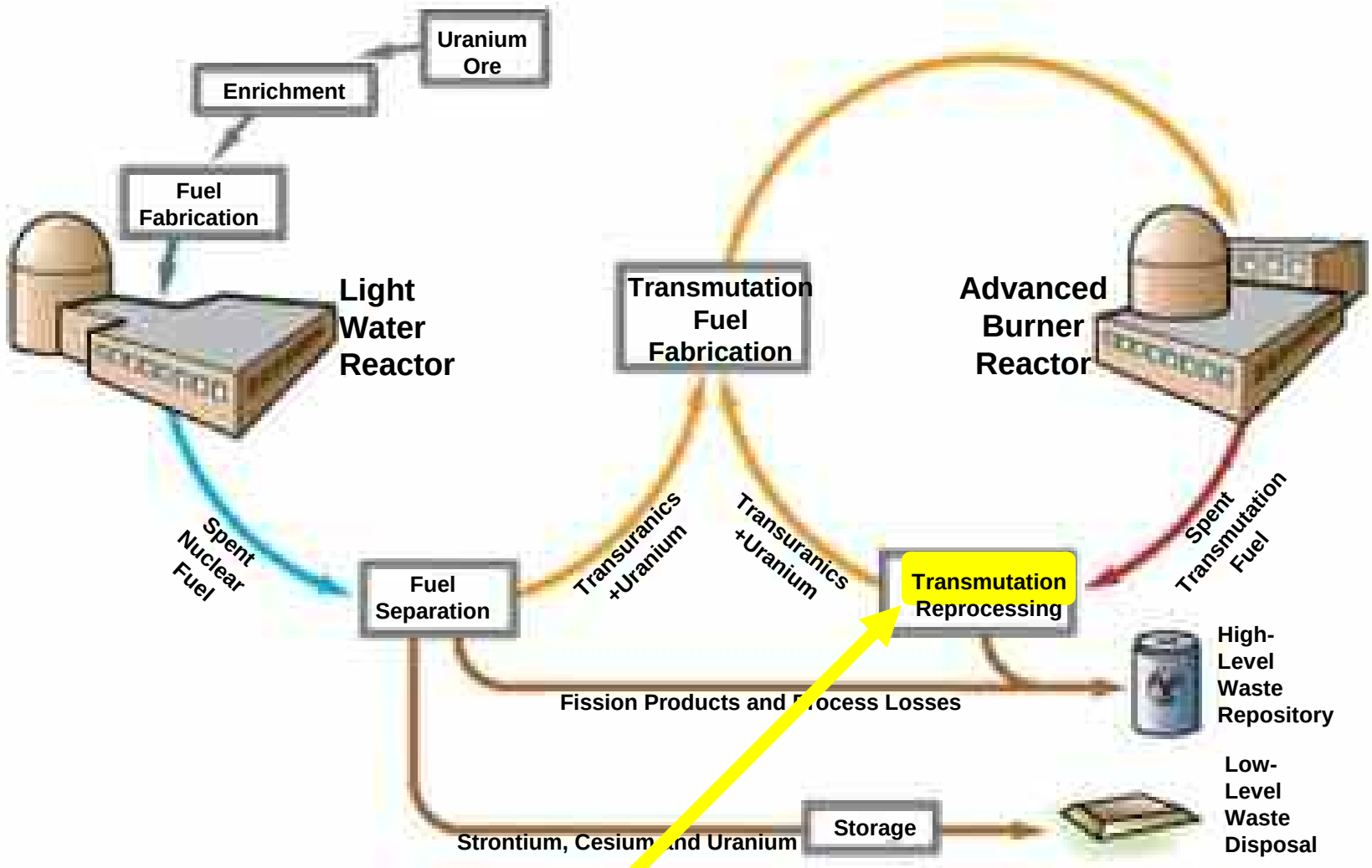
Transforming the Nuclear Landscape

Lay Nam Chang, Ph.D.

Dean, College of Science

CSIS October 7, 2009

Where do Accelerator-Driven Systems "fit" ?



Traditional Answer (ATW)

GEM STAR

ADNA: "re-frame the question"

In what context can one freely ask:

"What would an optimized accelerator-driven nuclear-energy *program* look like?"

- private sector

ADNA

- partner with a major research university

Virginia Tech

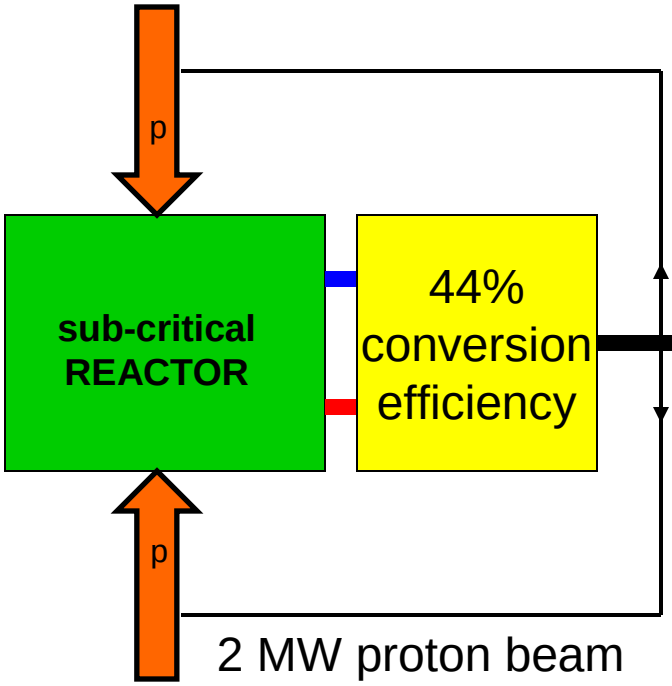
- we are finding the answer to this question…

PROMISES TO BE TRULY TRANSFORMATIVE

GEM STAR System

- **sub-critical graphite moderated reactor driven by supplementary neutrons**
  - intrinsic safety: no critical mass ever present
  - thermal neutrons: better tolerance to fission products
- **molten-salt fuel in equilibrium throughout reactor life**
  - exceptional neutron economy: allows deeper burning
- **high-temperature & low pressure operation**
  - higher thermal to electric conversion efficiency
  - no high-pressure containment vessel

Typical GEM✵STAR System (appropriate for next 40 years)



400 MW electric output

2 MW proton beam per accelerator (35% efficiency)

Electrical Multiplication of Accelerator (or other Green Energy) Input:
(400+12) / 12 = 34

Achieved using

- **Natural Uranium** ⇨ **no enrichment**
- **Light Water Reactor Spent Fuel** ⇨ **no reprocessing**

GEM STAR

will transform the nuclear energy landscape:

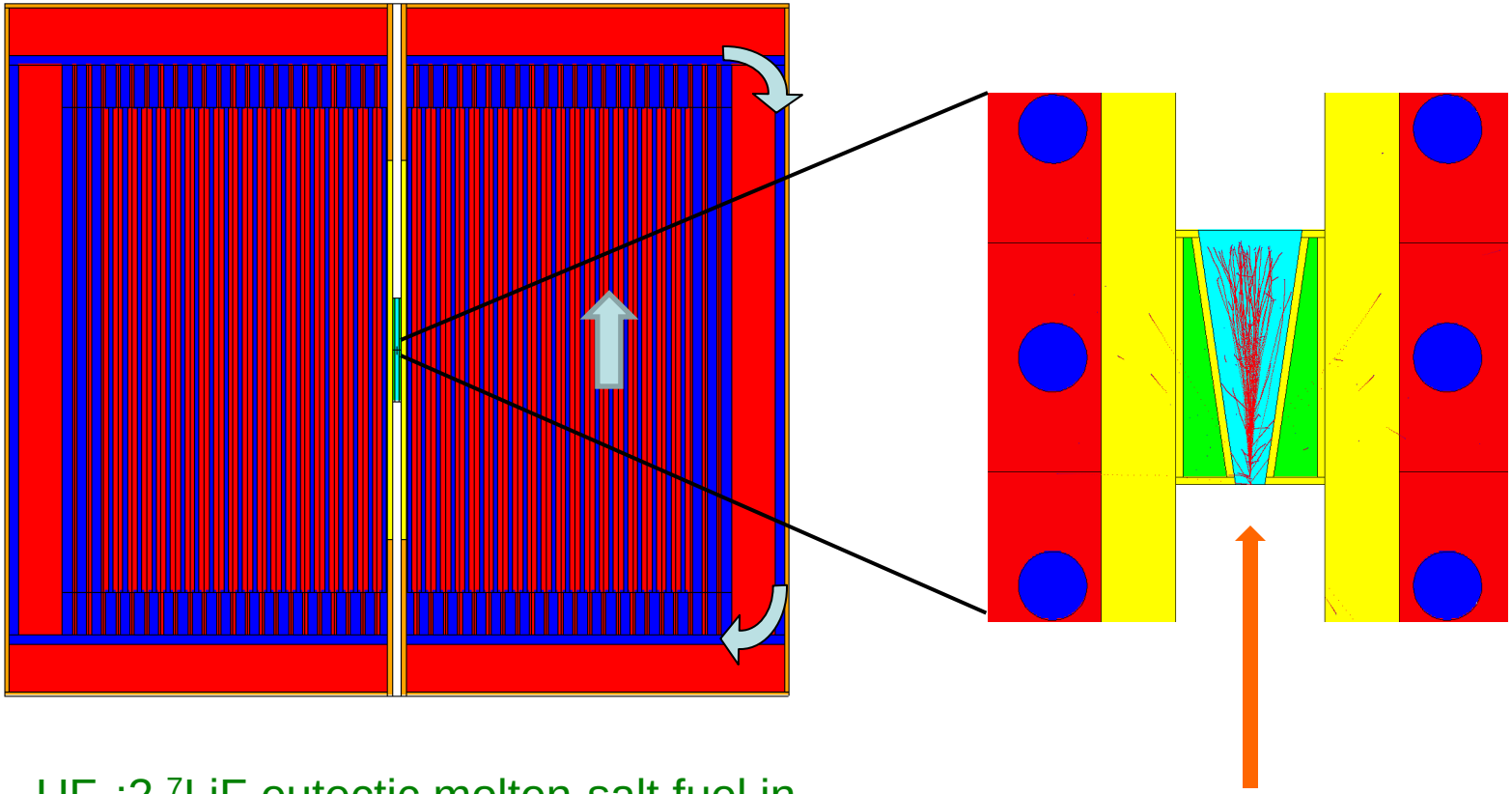
- not a ‘niche’, but rather base-line capable (green) energy source
- burns Light-Water-Reactor spent fuel directly (including fission products and higher actinides)
- low-cost electricity for consumer (est. 5-9 ¢/kWh depending upon desired multiplication)

GEM STAR

will transform the nuclear policy landscape:

- provides new nuclear energy option for developing countries
  - no need for Uranium enrichment
  - no need for reprocessing
- breaks the perennial links between nuclear energy and nuclear proliferation concerns

Preliminary GEM✵STAR design studies



UF_4:2 ^7LiF eutectic molten-salt fuel in graphite matrix; rapid circulation between core and internal primary heat exchanger; continuous low-volume feed-and-overflow permits equilibrium operation

600 MeV protons on uranium spallation target provides neutrons to initiate fission chains (used target can be added to fuel)

GEM✵STAR