ARC – 100

INTRODUCTION

Innovation for Cool Earth Forum
A Compelling Assertion

The developing countries only want what we have…which translates into **massive electricity demand**
The Only Rational Conclusion

“Global demand for energy is growing rapidly and must continue to grow to provide the needs of developing economies. At the same time, the need to sharply reduce greenhouse gas emissions is becoming ever clearer...in the real world there is no credible path to climate stabilization that does not include a substantial role for nuclear power”

- Open letter COP 21 from the leading climate scientists: Ken Caldeira, Kerry Emanuel, James Hansen, Tom Wigley – Nov.3, 2013
Case for Advanced Reactors

ARC-100 delivers Affordable and Competitive clean energy ... Wins in Deregulated Markets

A general comparison

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Advanced Reactors</th>
<th>Water-Cooled Reactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>~1 atm*</td>
<td>153 atm</td>
</tr>
<tr>
<td>Temperature</td>
<td>500-750ºC*</td>
<td>350ºC</td>
</tr>
<tr>
<td>Fuel Utilization</td>
<td>99%*</td>
<td>~1%</td>
</tr>
<tr>
<td>Passive Safety</td>
<td>Indefinite</td>
<td>3-7 days</td>
</tr>
<tr>
<td>Emergency Planning Zone (EPZ)</td>
<td>Site boundary</td>
<td>10 mi.</td>
</tr>
<tr>
<td>Capital Cost</td>
<td>&lt;$3500/kW*</td>
<td>$5000+/kw</td>
</tr>
<tr>
<td>LCOE</td>
<td>&lt;$60/MWh*</td>
<td>$85-95/MWh*</td>
</tr>
</tbody>
</table>

* Not all Advanced Reactors

Water-cooled SMRs

Large Gen III Rx

aSMRs

Levelized Cost of Electricity

Overnight Cost

$100/MWh

$70/MWh

$30/MWh

$1B

$5B

$10+B

$30/MWh

$1B

$5B

$10+B

ARC-100 delivers Affordable and Competitive clean energy ... Wins in Deregulated Markets

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Sodium Fast Reactor Background
Sodium Reactor Development: Path to ARC-100 & GE PRISM
EBR-II

The original aSMR

30+ years of operation and success:
- Demonstrated Inherent safety
- Sodium coolant ... operated with high capacity factor
- Metal fuel fabrication, load following and pyroprocessing ... all demonstrated
EBR-II Safety Demonstration
Complete Loss of Power and Failure to SCRAM

Pump coastdown without scram... causes transient temperature rise
EBR-II Safety Demonstration
Negative Reactivity Leads to Decay Heat Levels

introducing negative reactivity...

reducing reactor power to decay heat
Advanced Reactor Concepts, LLC.
Advanced Reactor Concepts, LLC

- Formed in 2006 to commercialize $7B U.S. investment in SFR technology
- U.S. based company / Canadian registered subsidiary
- **ARC-100** is based on technology proven by over 30 years of successful operation of EBR-II, an experimental program operated by the U.S. government
- ARC technical team includes scientists and engineers who were senior participants in the EBR-II program
- **ARC-100** proprietary design features protected by U.S. and foreign patents
- Recent Developments:
  - Partnered with GEH to capitalize on GEH’s SFR expertise and accelerate the **ARC-100** design
  - Selected by U.K. BEIS to participate in AMR feasibility study
  - Collaborating with NB Power entities to commercialize in New Brunswick Province
  - Entered a strategic relationship with AECOM to serve as A/E
  - Entered cooperative agreement with IHI for engineering support of design and NEXIP participation
Strategic Fit - GEH and ARC Reactors
The Commercialization of EBR-II

EBR II
- 20 MWe
- Variable fuel cycle
- Test/demonstration

PRISM
- 165 MWe and 311 MWe
- 12-24 month fuel cycle
- Power gen, heat, used nuclear fuel & Pu disposition
- Sodium cooled
- Fast neutron
- Small
- Pool design
- Metal fuel
- Passive safety

ARC-100
- 100 MWe
- 20-year fuel cycle
- Power generation & industrial heat

Shared innovation
General Electric – Hitachi (GEH)
Product: PRISM
Launch Date: early 1980’s
Capacity: 165-330MWe
Status: Being Developed as Versatile Test Reactor by GEH & US Government

Oklo Inc.
Product: Micro Size SMR
Launch Date: 2012 est.
Capacity: 2MWe est.
Status: Being Commercialized in US

Terrapower (Bill Gates)
Product: Traveling Wave Reactor
Launch Date: 2007 est.
Capacity: 600-1200MWe
Status: Development in China Recently Terminated
ARC-100 Design Simplicity Enables Cost Competitiveness
ARC-100 Design compared to LWR

Sodium Fast Reactor

Large Light Water Reactor
Inherent Safety and Simplicity Yield Cost Competitiveness

- Inherent safety
  - No time critical equipment and/or operator response
  - No active Decay Heat Removal Systems
- Pool-type reactor with metallic fuel
  - No credible LOCA - no ECCS, no EDG’s
  - Operates at atmospheric pressure - no forged vessel
  - Large heat capacity - significant safety margins
  - No energetic accident scenario - no robust containment required
- Simplistic and highly reliable design
  - Highly automated design enables modest staffing
- Small site footprint with below grade Primary System
  - Simple and cost-effective security strategy
- Sodium coolant chemical properties
  - Enables EPZ to be coincident with site boundary
ARC-100 Ultimate Solution to Used Nuclear Fuel
SFR recycles used nuclear fuel ... ultimate solution

Benefits include:

• ‘Short’-term Waste: ~300 years versus 10,000+*
• Non-proliferation: no Pu separation
• Environmentally responsible: dry process

* Time to reach the same level of radiotoxicity as natural uranium
Thank you.