



NRC RIC 2014
Small Modular Reactor (SMR) Licensing—Transition
from Concept to Implementation

DOE's SMR Licensing Technical Support Program

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Series of horizontal lines for notes



Meeting the President's Climate
Change Priorities

- The President's Climate Action Plan issued in June 2013
Proposed rule strictly limiting carbon emissions from new fossil
plants introduced by EPA in September 2013
More regulation impacting existing plants expected over the
next decade

...the debate is settled. Climate change is a fact. And
when our children's children look us in the eye and
ask if we did all we could to leave them a safer, more
stable world, with new sources of energy, I want us to
be able to say yes, we did.



President Obama's 2014 State of the Union Address

SMRs are an obvious choice for replacing aging fossil plants that
may need to be retired under impending carbon legislation

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Stages of Commercialization

- Certification and Licensing
First Movers and Early Adopters
Factory scale production of SMRs



Challenge to SMR fleet deployment:
Prove economy of mass production is competitive
with economy of scale

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Certification and Licensing Support

- Provide financial assistance for design, certification and licensing of promising SMR technologies with high likelihood of being deployed at domestic sites
- Accelerate commercial SMR development through public/private arrangements
- 6 year/\$452 M program
- Funding Opportunity Announcements (FOAs) were issued
- Funding being provided to industry partners through cooperative agreements



The U.S. Government wants to support the safest, most robust SMR designs that minimize the probability of any release

DOE Selected mPower America Team for the Initial SMR Partnership

- Cooperative Agreement with mPower signed on April 12, 2013
- mPower Team
 - B&W – Design of primary components and systems
 - Bechtel International – Design of secondary side and plant layout
 - TVA – Site characterization and licensing for deployment at Clinch River Site
- Project design and licensing milestones remain on track: 2022 deployment appears achievable



Success of this project will be an enabling factor for the follow-on programs and policies supporting broader SMR deployment

mPower America Making Progress on Certification & Licensing Scope

- Commissioned Integrated Systems Test facility in 2012
- Established fuel fabrication & testing facility in early 2013
- Conducting component prototype testing on reactor coolant pumps & control rod drive mechanisms
- Site characterization at Clinch River Site ahead of schedule
- Significant pre-application interactions with NRC, including a number of topical reports
- In the process of final design reviews to “freeze design”
- DCA Section Review in progress and on schedule
 - Final drafts of Chapters - Summer 2014
- Applications for Design Certification (Q3 2014) & Construction Permit (Q2 2015) proceeding on schedule



DOE Selected NuScale Power for Award Negotiation in December 2013

■ **NuScale selected under second SMR FOA focused on innovative technologies**

- Supports design development and design certification
- Extends licensing horizon to support deployment in 2025 timeframe



■ **NuScale's proactive pre-application engagement with NRC provides DOE confidence in their licensing pathway**

■ **DOE hopes to complete cooperative agreement negotiations at the end of March 2014**

■ **Design Certification application submittal to NRC estimated Q3 2015**



NuScale design provides proven technology in a simple and innovative framework

Efforts to improve commercialization potential for SMRs

■ **SMR Utility Requirements Document (URD)** – Define owner-operator requirements to ensure successful and sustainable commercialization

■ **Economics** – Supported several studies to examine SMR competitiveness

- University of Chicago EPIC study
- Update and refinement of EPIC study based on lower price of natural gas
- Cost impacts of manufacturing learning
- Wall Street interest in and opinions about SMRs
- Business case study to look at potential program and policy affects and utility interest
- **New:** Study potential improvements in modular manufacturing

■ **Source Term** – Evaluate experimental and analytical efforts required to quantify SMR source terms

■ **DoD** - Engaging with the Pentagon and specific DoD locations to identify potential interest as customers

First Movers and Early Adopters

■ **Encouraging investment in the first few SMR builds**

■ **Manufacturing still using existing fabrication capability**

■ **Government sites could be the logical users**

- Meets both clean energy & energy security requirements



■ **International market**

- Niche markets that could anchor initial deployments

■ **Policy tools may involve**

- Power purchase agreements
- Loan guarantees
- Production tax credits
- Clean energy credits



Factory Scale Production of SMRs

Nuclear Energy

- Broad deployment of SMRs may depend on clean energy policies
- Output on the order of dozens of SMRs per year by 2040 or sooner based on clean energy policy
- Factories established in the U.S. with the potential for future export markets
- Sustained factory manufacturing needed to achieve competitive costs



10

Next Steps?

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- Continue supporting efforts to reduce technological and regulatory risks to SMR licensing and deployment
- Continue economic analysis to understand market conditions and evaluate appropriate financial vehicles and economic incentives to promote SMR deployment
- Continue cultivating Government agency interest and support for SMRs
- Support U.S. manufacturing and supply chain development to enable near- and long-term SMR deployment visions
- Examine regulatory issues pertinent to fleet operations and maintenance
- Develop SMR export strategy to promote U.S. designs and manufacturing capabilities in global markets

11

Conclusion

Nuclear Energy

- NE has the full support of the Administration to aggressively promote SMRs
- SMRs are needed in our clean energy portfolio to meet U.S. energy and environmental needs and to remain competitive in the global marketplace
- DOE funding should have a significant impact on accelerating the first movers and building the momentum for the subsequent builds
- Achieving mass production environment should ensure SMR competitiveness

"I think [SMRs are] a very promising direction we need to pursue. It's where a lot of innovation is going on with nuclear energy. There's a great potential payout there along with very strong safety considerations associated with these reactors."
 Dr. E. Moniz Confirmation Hearing
 April 9, 2013



12
