



## Joint Select Task Force on Nuclear Energy



# Small Modular Reactor Hanford Site Analysis

## *Preliminary Report*

September 25, 2014

# Small Modular Reactor Hanford Site Analysis Overview

- In March 2014, the state of Washington awarded TRIDEC a \$500K grant to study the benefits of locating an SMR on the Hanford Site
- URS was selected to lead the study
- The Study looked at:
  - current state of nuclear power in the U.S. and the SMR industry,
  - Power needs of DOE and the region, and,
  - the feasibility and cost savings that could be realized by siting an SMR on the Hanford Site
    - More specifically at Energy Northwest's WNP-1 site (the site of a full-scale reactor that was terminated in the 1980's before it was completed)



# Major Conclusions of the study

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- **Siting an SMR at Hanford would:**

- Meet future Hanford and Northwest electricity needs with assured base load, carbon free power
- Hanford is the ONLY DOE site being considered where DOE itself needs additional power (of some 100 Mwe)
- Save between \$300 and \$465 million and reduce construction schedule by 1 year
  - ~\$300 million in WNP-1 'site-specific' savings
  - ~\$165 million in FEMP funding (*recognize other uses for at least some of these FEMP fund savings will likely have a higher priority on the Hanford Site*)

# Help is needed from DOE and States

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- **DOE should:**

- Provide up to \$1 Billion of cost sharing for first of a kind plants
- Mandate power from initial SMRs to be purchased at DOE sites.
- Use Loan Guarantee programs, PPAs, and/or SMR energy credits to support SMR deployment, and,
- DOE could ask Bonneville Power Administration to “meld” the cost of power from new Northwest SMRs with current average costs of power

- **States should:**

- Include SMR-generated power in mandated clean energy portfolios
  - Comparable to ‘Renewable Energy’ sources like wind or solar
- Offer tax incentives for SMR generated power – carbon free power
  - Meets Governor’s goal for reducing carbon emissions throughout the State

# Conclusions

## National Deployment of SMRs would meet -

- **Major objective of the U.S. Department of Energy (DOE)**
  - Inherent safe design
  - Carbon free base load power
  - Siting flexibility
  - Smaller capital investment than larger nuclear plants
- **Cost to design, test, and achieve Nuclear Regulatory Commission design certification of first SMRs could be ~\$1 billion per each SMR vendor**
- **Potential to incur additional \$1 billion or more in first-of-a-kind costs for each SMR vendor**
- **First unit costs difficult for vendors and utilities alone to overcome. Need federal support.**



### **Base Cost of SMR Construction and Operation**

- ✓ Current US SMR designs are projected to cost about \$2.5B for 500-600 MWe multiple module plants.
- ✓ Costs will be higher for the first plants built due to design, licensing, supply chain, and construction development.

# Conclusions (cont'd)

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## National Deployment of SMRs (cont'd)

- **Current DOE funding \$452 million for SMR Design and Licensing -- and this support only addresses part of the licensing process and is insufficient**
  - Funds do not substantially offset reactor design certification for multiple vendors
  - Does not assist utilities with costs for developing and licensing designs of initial SMR generating stations
- **Assistance of up to 50% for first-of-a-kind costs may be necessary to enable deployment of SMRs**

***Energy Secretary Moniz recently called “...acceleration of the timelines for commercialization of small modular reactors through cost sharing arrangements with industry partners...” one of his key goals***

# Conclusions (cont'd)

## National Deployment of SMRs (cont'd)

- **DOE is positioned to assist with deployment of SMRs**
  - Expand current cost sharing to provide up to \$1 billion for first of a kind SMR generating plants
  - Use existing loan guarantee program for PPAs and provide SMR energy credits
  - Mandating DOE (and other federal agencies) purchase power generated by SMRs (currently done for renewables)

### Individual states can assist in reducing business risks for SMRs

- Include nuclear power in mandated clean energy portfolios
- Tax incentives
- Recognition that SMRs provide a stable carbon free base load to the grid and complement renewables

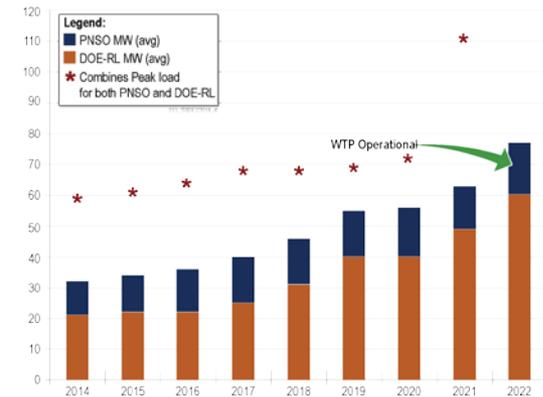
#### Deployment of SMRs

- ✓ Capital risks are high for the first SMRs constructed in the US.
- ✓ Federal and state support will likely be needed to enable financing of the nation's first SMRs.
- ✓ Cost sharing between DOE, reactor vendors, and utilities will be necessary.
- ✓ DOE should use its Loan Guarantee program, PPAs, and/or SMR energy credits to further support SMR deployment.

# Conclusions (cont'd)

## Siting an SMR at Hanford

- **Clear need for additional electric power**
  - Hanford Site and Pacific Northwest National Laboratory
  - Power consumption estimated to increase by 150% by 2022
- **Siting an SMR at the Washington Nuclear Power Plant Unit No. 1 site is technically feasible and financially advantageous**
  - Over \$300 million site-specific savings can be applied to capital costs
  - Significant advantages exist because of current operating commercial nuclear plant and assets, documentation (i.e., NEPA), and cost avoidances



### WNP-1 Site Utilization and Estimated Cost Savings

- ✓ Use of the WNP-1 site for construction of an SMR is feasible and will benefit from existing infrastructure and licensing documentation.
- ✓ WNP-1 site was previously issued a Nuclear Regulatory Commission construction license.
- ✓ Seismic reports and other site characterization data and environmental studies have been performed for the WNP-1 site.
- ✓ Recently updated documentation for the Columbia Generating Station is beneficial to locate an SMR at the WNP-1 site.
- ✓ Conservative estimate of capital cost avoidances by using WNP-1 site: \$140-165M.
- ✓ Licensing documentation cost avoidances: \$30-50M.
- ✓ Schedule improvement cost savings (1 year): \$80-110M.
- ✓ Total cost savings/avoidances: \$300M.

# Conclusions (cont'd)

## Siting an SMR at Hanford (cont'd)

- **Siting an SMR generating station near an operating commercial nuclear power plant offers attractive advantages**
  - Shared services and infrastructure
  - Hanford is only DOE site currently under consideration that has an operating commercial nuclear power plant nearby
- **Hanford and Tri-Cities region offer major resource**
  - Large nuclear-trained workforce
  - Nuclear qualified emergency services
  - Local business base of nuclear engineering and manufacturing services
  - Local nuclear fuel fabrication at AREVA (*can develop new SMR fuels*)



### Other Regional Assets

- ✓ Approximately \$3B in federal money comes into the Tri-Cities every year.
- ✓ Large engineering and construction companies anchor the nuclear construction, treatment, and remediation contracts at the Hanford Site, performing nearly \$2B per year.
- ✓ Robust local base of small engineering, fabrication and testing consulting firms support nuclear work.
- ✓ PNNL provides a national laboratory service that provides a scientific and analytical foundation to the community.
- ✓ Columbia Basin College and Washington State University Tri-Cities provide educational opportunities and growth.
- ✓ Documented political support from the Washington State Governor and Legislature facilitate the development of SMRs at the Hanford Site to advance carbon-free energy.

# Conclusions (cont'd)

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## Siting an SMR at Hanford (cont'd)

- **The state of Washington could further reduce business risk for an SMR at Hanford**
  - Including SMR-generated power in mandated clean energy portfolios
  - Offering tax incentives for SMR generated power or for construction
- **SMR would offer a carbon-free base load alternative to offset generation fluctuations associated with wind energy and future solar plants**
- **Preliminary Federal Energy Management Program (FEMP) assessment identified Hanford operations savings that could avail \$70-165 million for other energy initiatives, such as a Hanford SMR**
  - *Although other Hanford infrastructure needs could capture most of these savings before they became available for use on an SMR*

# Path Forward

**TRIDEC should work with the DOE, state of Washington, and electrical utilities to further promote and assist in siting SMRs at the Hanford Site and across the US**

## DOE

- Develop cost sharing strategy with vendors, purchasing utilities, and financiers that would fund up to \$1 billion (from DOE) to support costs and support deployment of most viable of the designs (applicable across US)
- Mandate power from initial SMRs to be purchased by BPA and/or at DOE sites using power purchase agreements and extend cooperative agreements to reactor vendors to utility owners
- Revise DOE guidelines to require agencies to incorporate reduction of greenhouse gasses through all clean energy sources
- Pursue converting the WTP steam plant from diesel to natural gas using resulting FEMP savings to support an SMR
- Enable use of Loan Guarantee program for SMRs

## State of Washington

- Revise existing energy policy to require power portfolios of major utilities to be no less than 15% clean energy (meets intent of a renewable energy source)
- Develop legislation to revise priorities of the Pacific Northwest Electric Power Planning and Conservation Act to include nuclear power as a means of reducing greenhouse emissions
- Propose an exempt privilege or tax preference for use of energy generated from SMRs

## Energy Northwest

- Become operator for SMR plant sited at WNP-1
- Evaluate pursuing a loan guarantee with DOE for cost sharing of required capital
- Work with Pacific Northwest Electric Power Planning and Conservation Act in promoting the use of SMRs as a potential new technology

# Small Modular Reactor Hanford Site Analysis

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***“Small modular reactors represent a new generation of safe, reliable, low-carbon nuclear energy technology and provide a strong opportunity for America to lead this emerging global industry”***

*Energy Secretary Ernest Moniz*

**Hanford is a feasible first-of-a-kind SMR site based on future electricity requirements of DOE and utilities, and more than \$300M in cost savings**