Outlook for Nuclear Power Deployment in the United States

NRC Regulatory Information Conference 2009

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Future of Nuclear Energy in the United States

- Phase I: Sustainability
  - Support continued operation of largest fleet of operating nuclear reactors worldwide
  - Enhance and enable the performance and safe operations of commercial nuclear technology
- Phase II: First movers and second wave
  - Address regulatory, financial, and technical challenges faced by first movers
  - Enhance confidence of public, owners, vendors, investors, and others
- Phase III: New markets and applications
  - Support research and development for other applications of nuclear energy beyond electricity markets
  - Develop technology to meet energy demands of emerging markets

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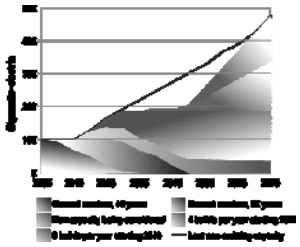
A Need to Rely on Current Nuclear Plants

- 60 year extended licenses means current plants shut down starting in 2030.
- Steep reduction in generation if current fleet operations are not sustained.
- Without today's nuclear plants, we lose:
  - 100 GWe of low-carbon generation over about 20 years
  - Low cost generation



Extending operation of existing reactors will avoid ~12 billion metric tons CO_2 and provide enough electricity for 70 million homes during an additional 20 years of operations.

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LWR Sustainability Program Objectives

- Understand aging phenomena
  - Develop fundamental scientific basis to understand, predict, and measure changes in materials, systems, structures, and components as they age in environments associated with continued long term operation of existing LWRs.
- Establish research and development partnerships
  - Apply this fundamental knowledge in collaborative public-private partnerships, developing and demonstrating methods and technologies supporting safe and economical long-term operation of existing LWRs.
- Validation of new technologies
  - Identify and verify efficacy of new technology to address obsolescence while enhancing plant performance and safety.

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Nuclear Power After First Movers

- Regulatory, financial, technical and design/construction challenges faced by first movers are addressed by industry, DOE and NRC and will benefit follow-on builds.
- Financial institutions will see value in nuclear power and will invest based on increased confidence and lower risk profile.
- State regulators (and State re-regulators) will support partial cost recovery before start up.
- Congress, public and other stakeholders will recognize need for and benefits of nuclear power.

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Broader Markets with Diverse Needs

- Demand for localized electricity or process heat.
- Load projections are less than 1,000 MWe.
- Loads are in remote locations with limited or no access to a main grid.
- Need for smaller units with less upfront capital costs
- Business or mission critical need for power or energy that is independent of the grid or needed 24/7.
  - Department of Defense critical missions
    - » Distributive generation
  - Petro-chemical industry critical operations

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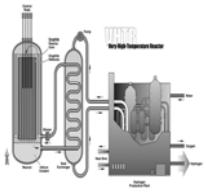
Gen IV Nuclear Energy Systems Initiative

- Purpose
  - Lead a global partnership to perform the R&D needed to develop the next generation reactors.
- Gen IV Program focused on long-term R&D.
  - Very High Temperature Gas Reactor (VHTR)
    - » Next Generation Nuclear Power Plant (NGNP)
  - Sodium-cooled Fast Reactor (SFR)
    - » Advanced Fuel Cycle Initiative (AFCI)



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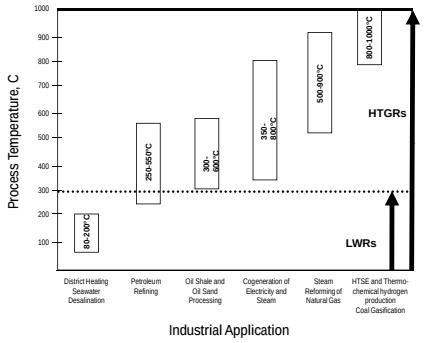
High-Temperature Gas Reactors Applications



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Next Generation Nuclear Power Plant (NGNP)

- Provide basis for commercializing new generation of advanced nuclear plants.
- Supply competitive, emissions-free, high-temperature process heat, co-generate electricity and/or hydrogen.
- NGNP commercial demonstration facility at INL scheduled for NRC licensing by 2017 and start-up by 2021 (EPAct 2005).
- Public-private partnership is key to success of executing NGNP.

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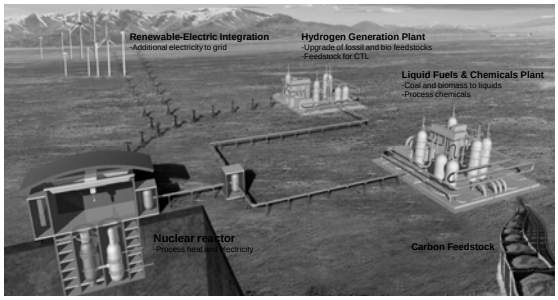
Hybrid Energy Parks



Diverse Carbon Resource → Nuclear Hybrid Energy Systems → Strategic Energy Parks = ***Resilient & Secure Energy***

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Small Modular Reactors

- Small (<350 MWe) Modular Reactors (SMRs) offer alternative to larger LWR designs
- Benefits
  - Reduced financial risk
    - » Total Smaller investments may reduce financial risk.
  - Flexibility
    - » Provide power to meet localized demand or remote locations.
  - Portability
    - » Built offsite and transported to location via barge, rail, or train.
  - Modular construction
    - » Replicate in factory setting may lead to economies.

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Small Modular Reactor Applications

- Smaller markets
  - » Limited financial resources
  - » Small electricity grids
  - » Scalable nuclear power alternative
- Broader applications
  - » Power production
  - » Process heat applications
    - – Oil refining and extraction
    - – Desalination
    - – Chemical and hydrogen production

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Back-Up Slides

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Domestic Nuclear Industry Support for SMRs

- Light-Water Reactors
  - Babcock & Wilcox – Global Energy Module (GEM50)
  - NuScale Power, Inc
  - Westinghouse Electric Company
- High-Temperature Gas-Cooled Reactors (HTGRs)
  - Areva – New Technology Advanced Reactors for Energy Supply (ANTARES)
  - General Atomics – Modular High-Temperature Reactor (MHR)
  - Westinghouse Electric Company – Pebble Bed Modular Reactor (PBMR)
- Liquid-Metal-Cooled Fast Reactors (LMCFR)
  - Advanced Reactor Concepts (ARC)
  - General Electric – Power Reactor Innovative Small Module (PRISM)
  - DOE Laboratory Consortium – Small, Sealed, Transportable, Autonomous Reactor (SSTAR)
  - Toshiba – 4S (Super Safe, Small and Secure)
- Uranium Hydride Reactor
  - Hyperion Power Generation

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