

From Giga to Mega: Miniaturize Nuclear Power Plants

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Why nuclear is essential?

The New York Times *The New Atomic Age We Need*

Forbes Paris COP21 and the Urgent Need for More Nuclear Energy

Four top climate scientists James Hansen, Tom Wigley, Ken Caldeira, and Kerry Emanuel urged a major expansion of nuclear power.

“to avoid climate change, nuclear must play a role.” *Moniz*

Carbon-free baseload/“standby” power to balance the intermittent solar & wind

Challenges to the Development of US Nuclear Energy

Uncertainty in costs

- >200% cost overrun (av.)
- Cost up to \$5 to \$8 / W

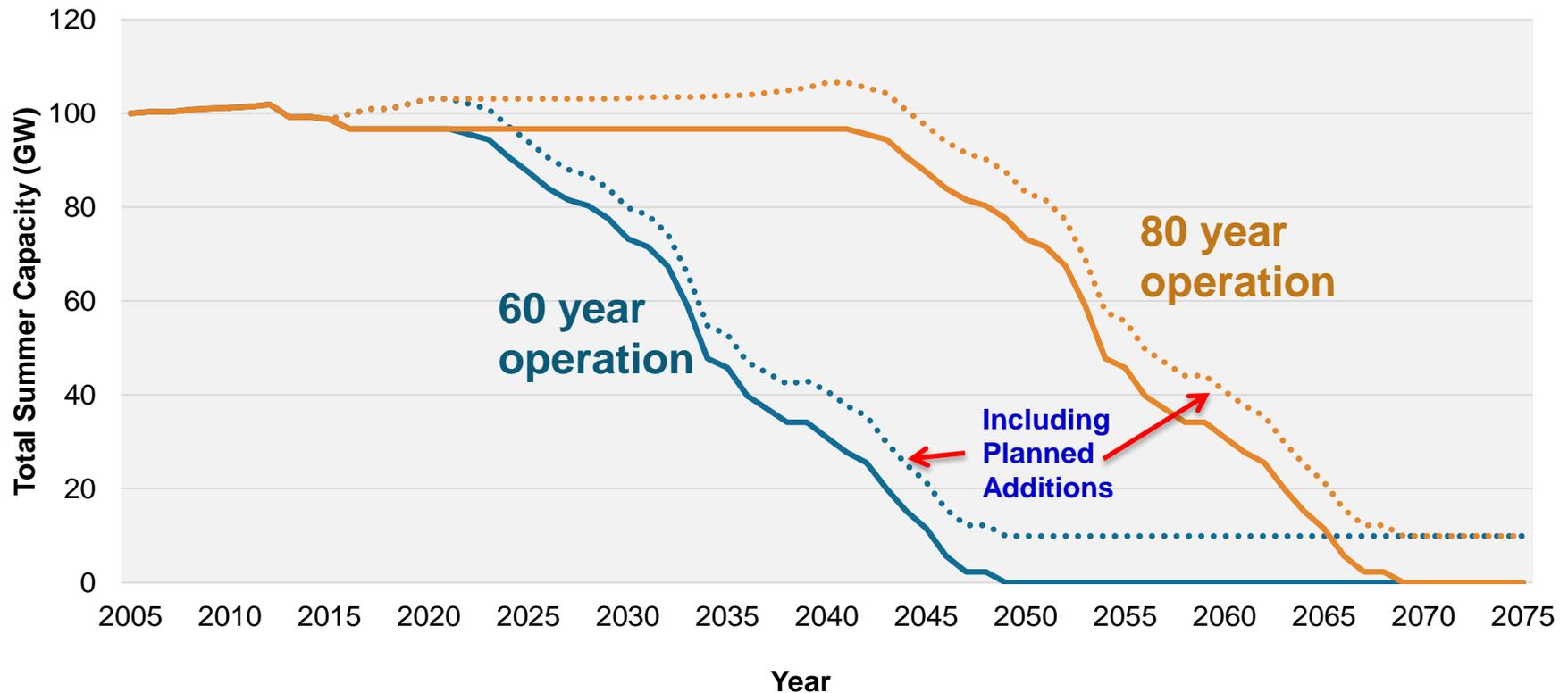
Construction delays

- Economic stresses
- Replacement power

Public concerns

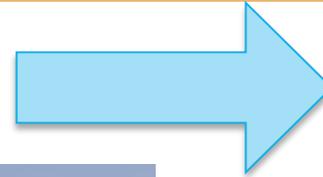
- Safety & proliferation
- Spent fuel disposal

U.S. Nuclear Fleet Retirements & Capacity Additions (w/ and w/o License Extensions)



An idea ... from Giga to Mega

On-site certification



In-factory certification

Make in factories
Certify in factories
Transport to sites

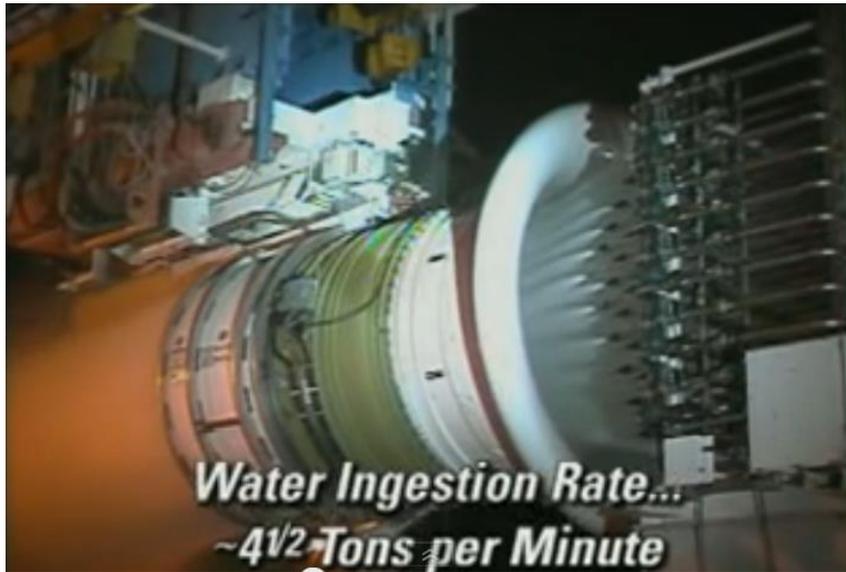
- Inherently safe
- Proliferation resistant
- Facile spent-fuel disposal
- Made to order



MW reactor

For visual effect only

MW-size enables more rigorous safety tests like jet engines



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GE has accumulated 62,000,000 flight hours of the composite fan blades without a single incident



We have the foundations...



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ARPA-E workshop
March 16-17
Washington, DC

Test capabilities

**Controls & monitoring
& robotics technology**

Simulation excellence

Nuclear excellence

**Rigorous regulatory
practice**

**Materials science
excellence**

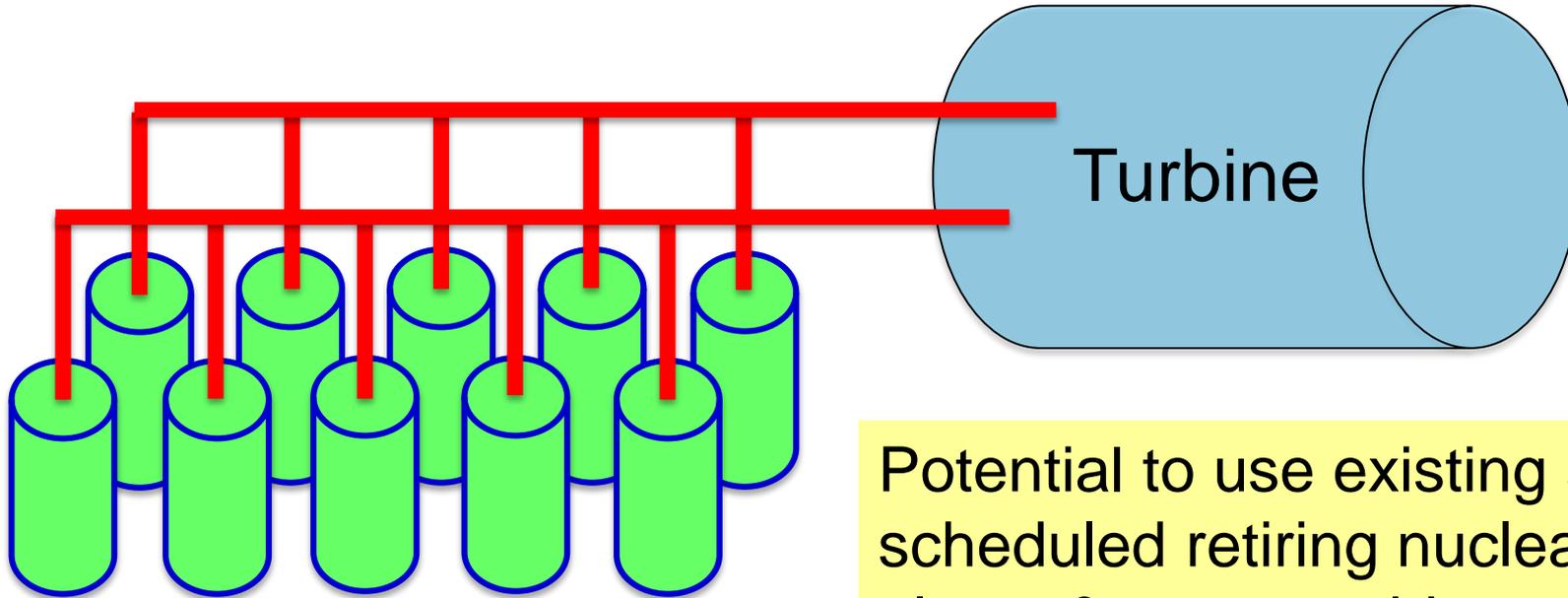
Engineering prowess

**Commercial aviation safety
design & experience**

Space technologies

MW-size provides flexibility & modularity

- Remote, energy-lean areas
- Backup power
- Rapid response needs
- Micro-grids
- Cogeneration (e.g., heat, desalination)
- Critical infrastructure
- Hybrid with renewables
- Maritime shipping
- Military installations
- Space missions



Potential to use existing sites of scheduled retiring nuclear power plants & steam turbines (?)

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In-factory certification

Make in factories

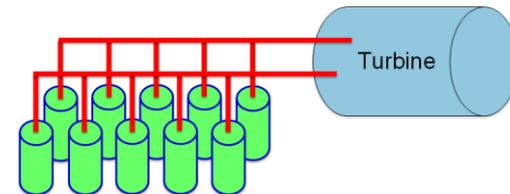
- *Inherently safe & secure designs such as solid core*
- *Deployment of advanced materials, sensors & controls*
- *Proliferation resistance using low-enrichment fuels*
- *Made to order - minimal delay & much reduced capital*

Certify in factories

- *Licensing/certification once only for each type of reactor*
- *Safety tests (earthquake shake tables...faulty tests)*
- *Much reduced certification/licensing cost*

Transport to sites

- *Minimal site requirements (emergency planning zone)*
- *No need for on-site spent fuel storage*
- *Much expanded use with size flexibility/modularity*
- *Minimal decommission cost*



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Thank you !



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