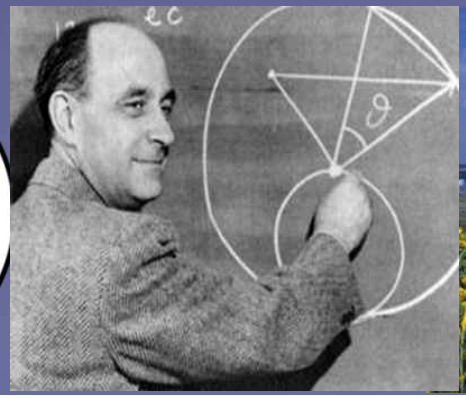
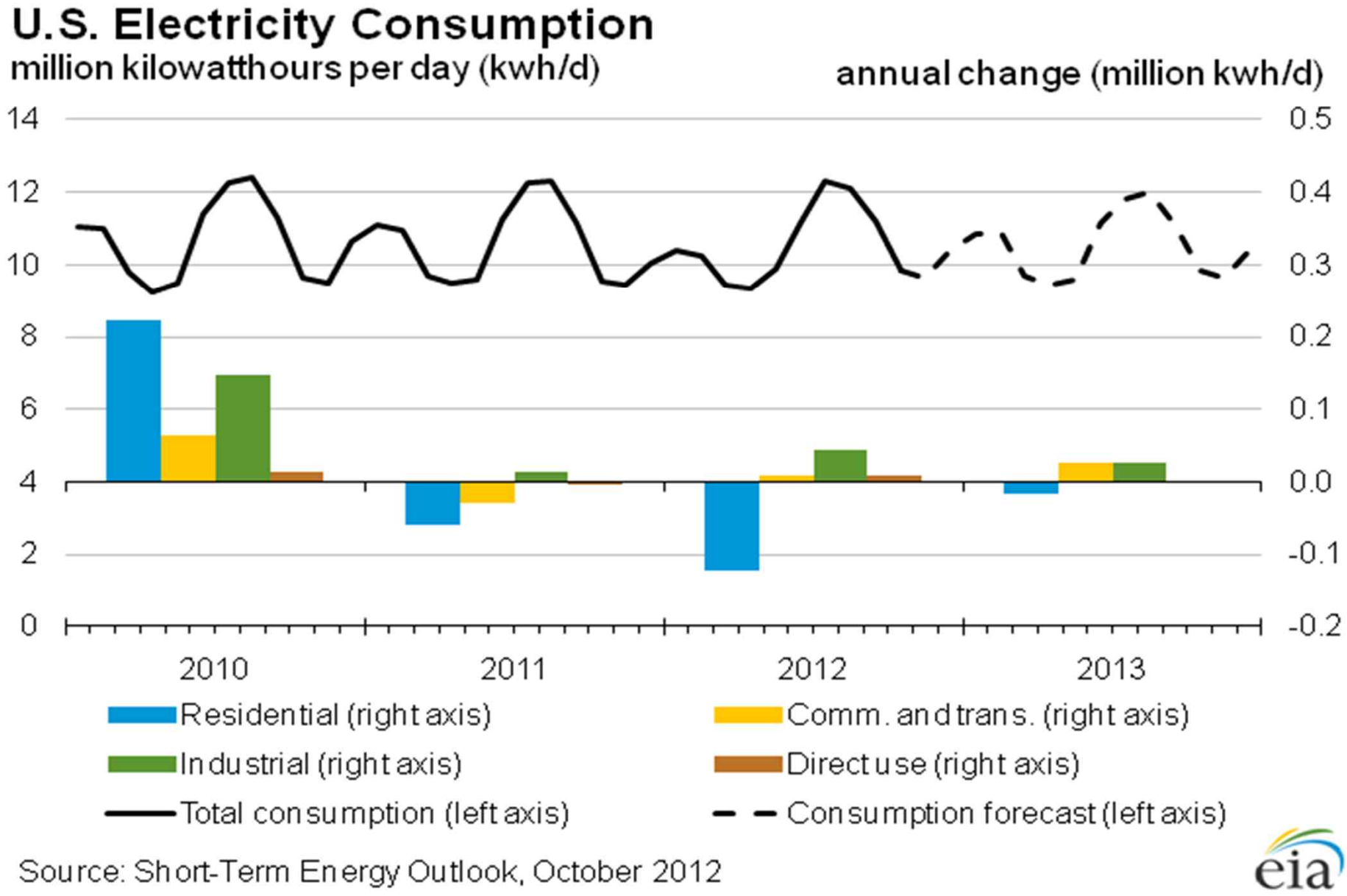
America's Energy Challenge: Why the U.S. Needs Nuclear Energy

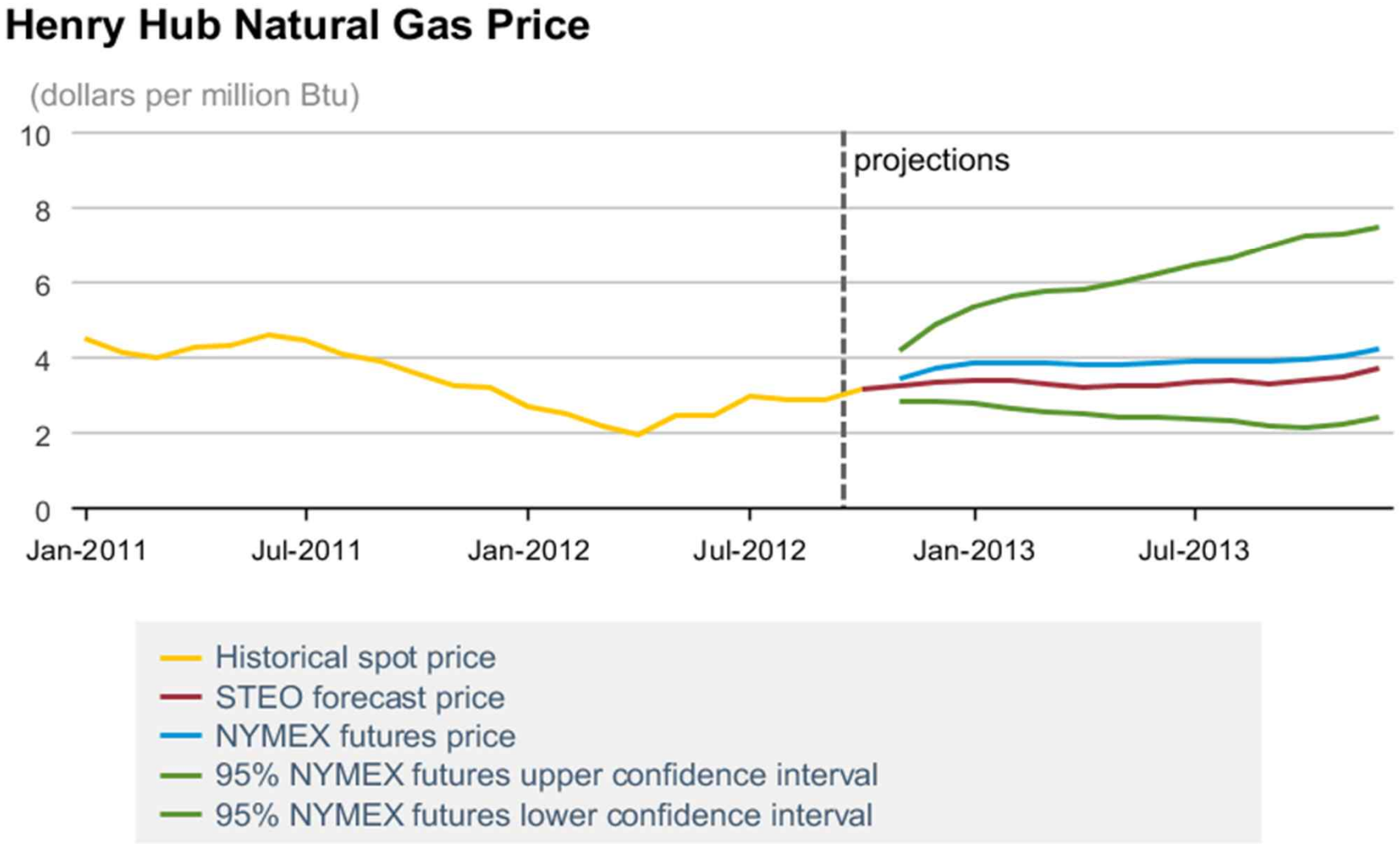
Michael Corradini, President
American Nuclear Society



Reality: US Electricity Demand is soft

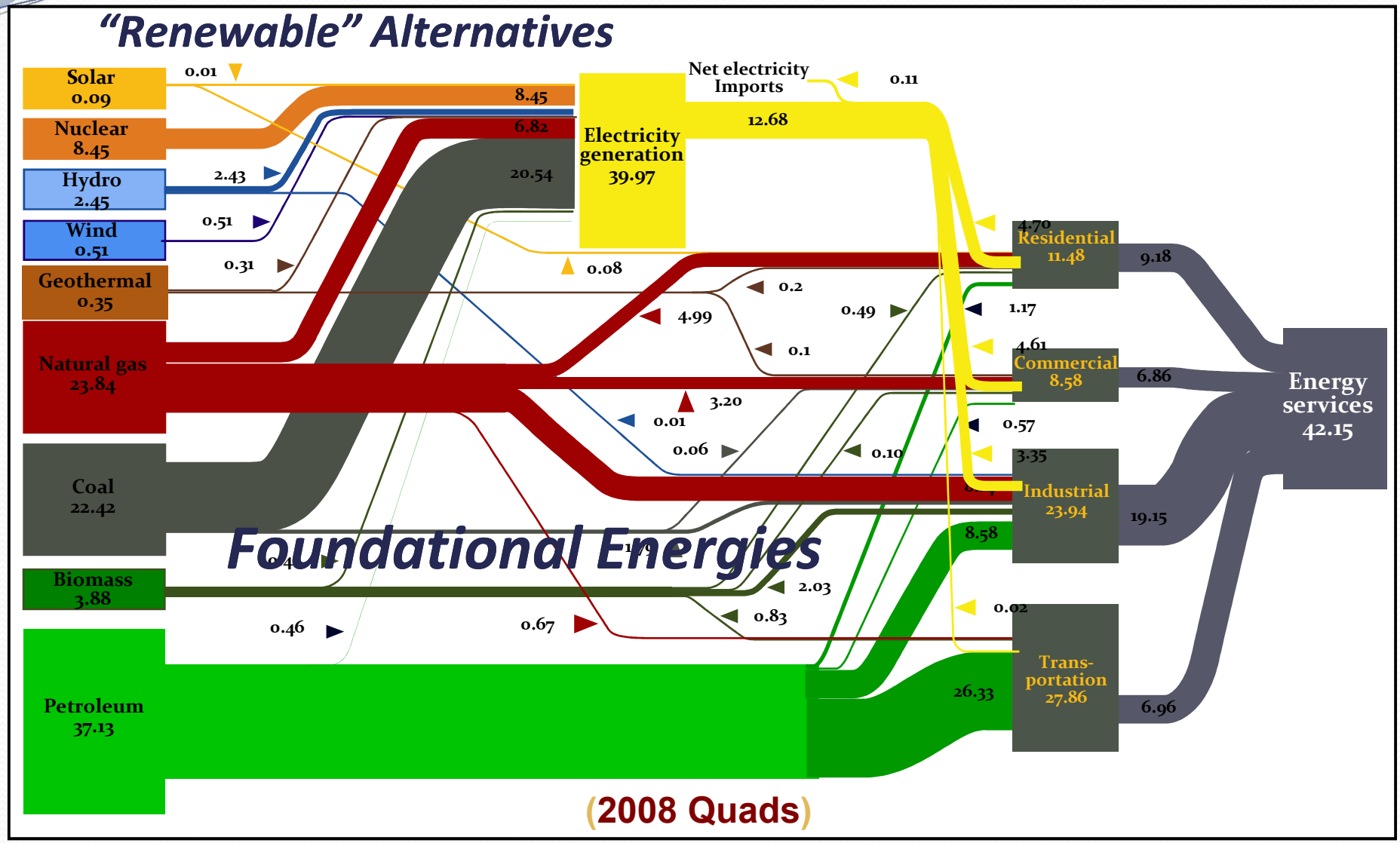


Reality: Natural Gas is *'Now'* Cheap



Source: U.S Energy Information Administration: EIA Short Term Energy Outlook

U.S. Energy Flows



Source: Lawrence Livermore National Laboratory and U.S. DOE based on Annual Energy Review, 2008 (EIA, 2009)
From National Academies Press, *America's Energy Future*, 2009

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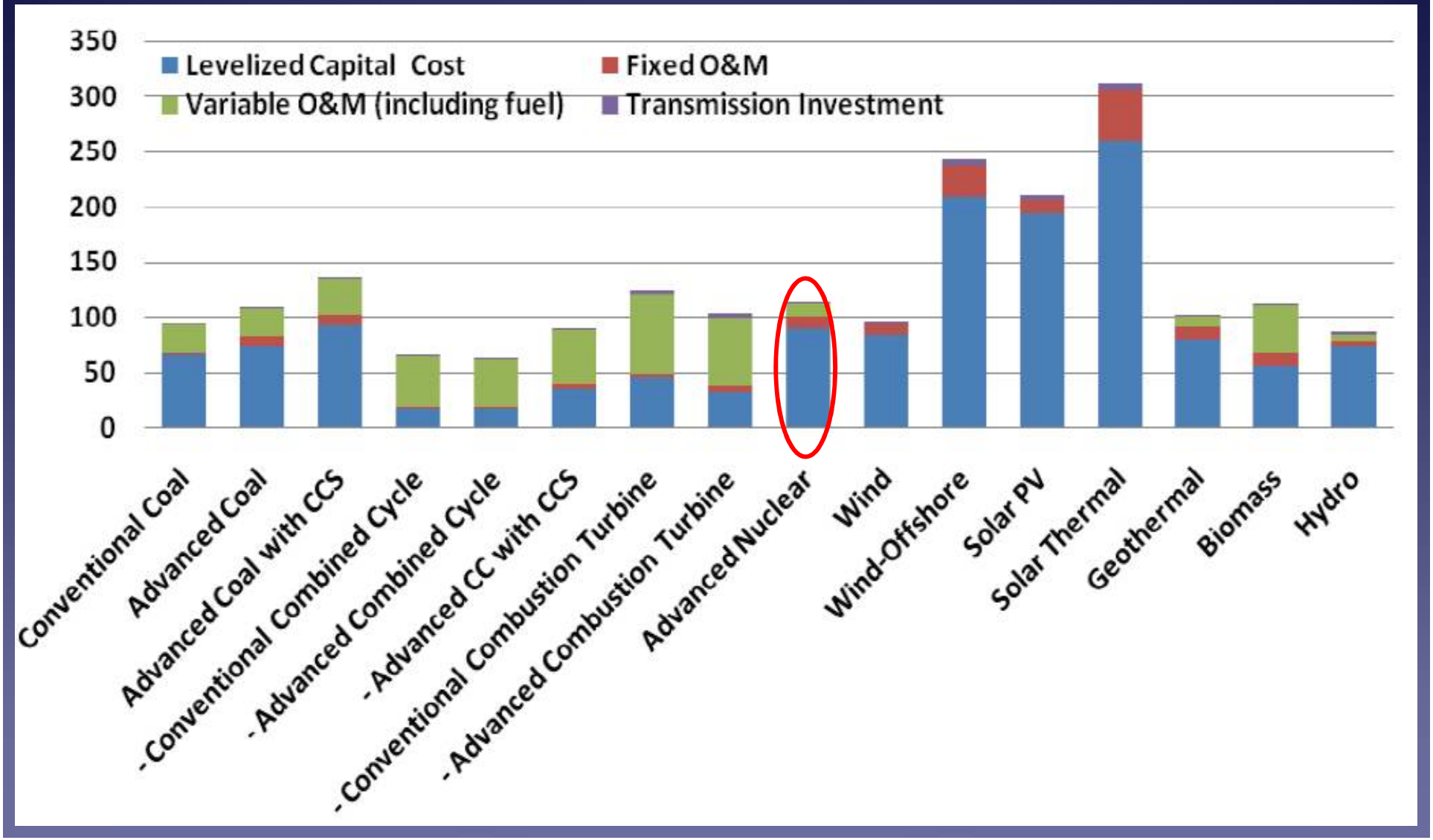
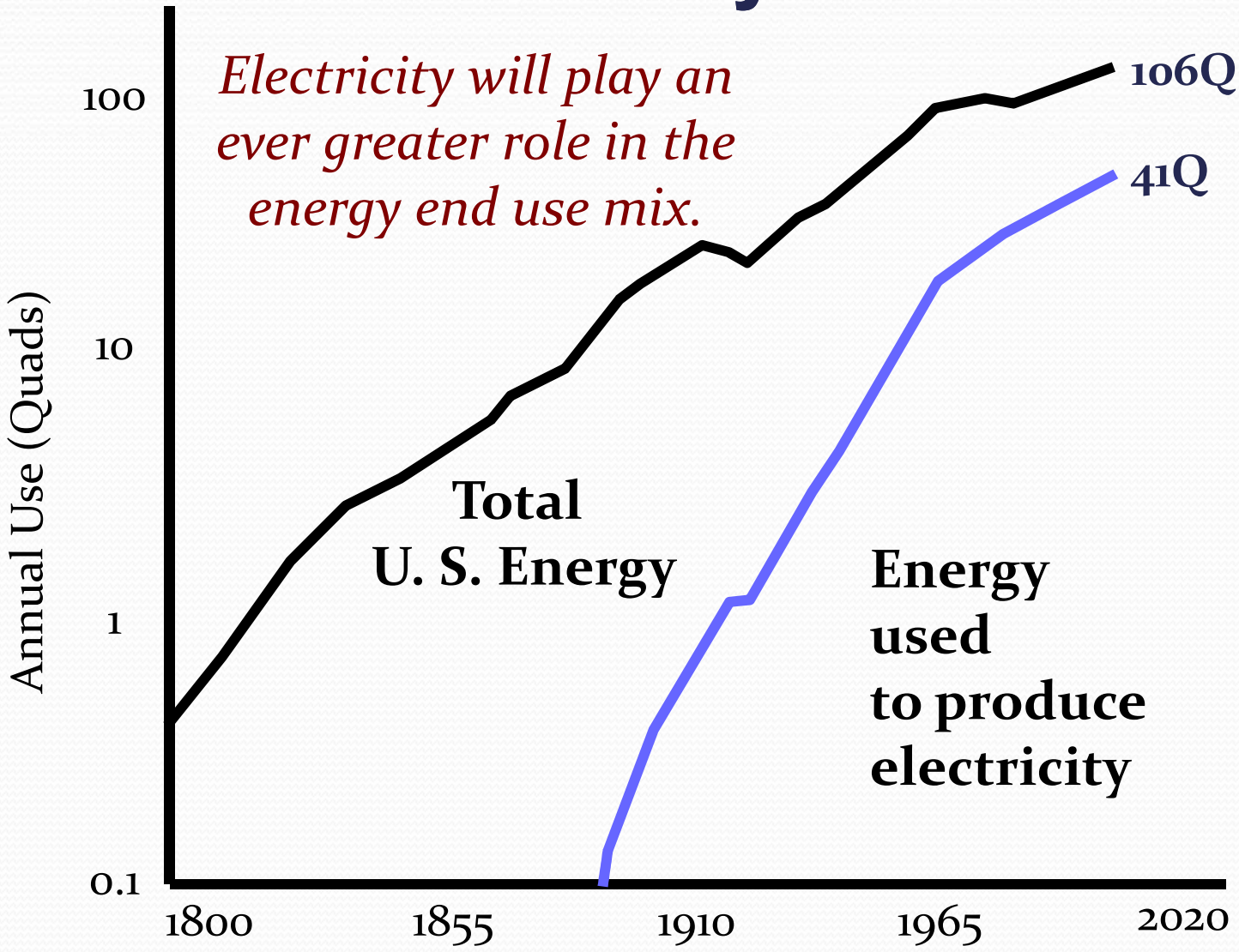
Reality: New Nuclear is not Cheap

Levelized Cost of New Electricity Generating Technologies in 2016 (2009 $ per Mwh) Energy Information Administration, 2011



Electricity's Role



Data: EIA, Annual Review, 2003. US Census Bureau, Historical Statistics of the US Colonial Ties to 1970

What We Really Want…

Energy Security

Available	**Access to substantial, national resources**
Affordable	**Electricity: produced Kwh is inexpensive**
	Facility: inexpensive to build the plant
	Volatile: stable fuel price
Reliable	**Intermittent: source consistent**
	Safe: potential harm from natural/human causes
Green	**Dense: small land footprint to collect/produce**
	Dry: minimal water use or potential risk
	Clean: free release emissions minimal

Energy Security (S.Tinker 2011)

	Available	Affordable			Reliable		Green		
	US	Elec.	Facility	Volatile	Intermit.	Safe	Clean	Dense	Dry
Solar	2	1	1	2	1	3	3	1	3
Hydro	2	2	2	2	2	2	3	2	3
Wind	2	2	2	3	1	3	3	1	3
Geother	2	1	2	2	3	3	3	2	3
Nuclear	3	3	1	3	3	2	3	3	2
Nat Gas	3	3	3	2	3	3	2	2	2
Coal	3	3	2	3	3	2	1	2	1
Biomass	2	1	1	1	3	3	2	1	1
Petrol	2	2	2	1	3	2	1	3	2

Energy Security

Source	Available	Affordable	Reliable	Green	Total
Solar	2.0	1.3	2.0	2.3	1.9
Hydro	2.0	2.0	2.0	2.7	2.2
Wind	2.0	2.3	2.0	2.3	2.2
Geothermal	2.0	1.7	3.0	2.7	2.3
Nuclear	3.0	2.3	2.5	2.7	2.6
Natural Gas	3.0	2.7	3.0	2.0	2.6
Coal	3.0	2.7	2.5	1.3	2.4
Biomass	2.0	1.0	3.0	1.3	1.8
Petroleum	2.0	1.7	2.5	2.0	2.0

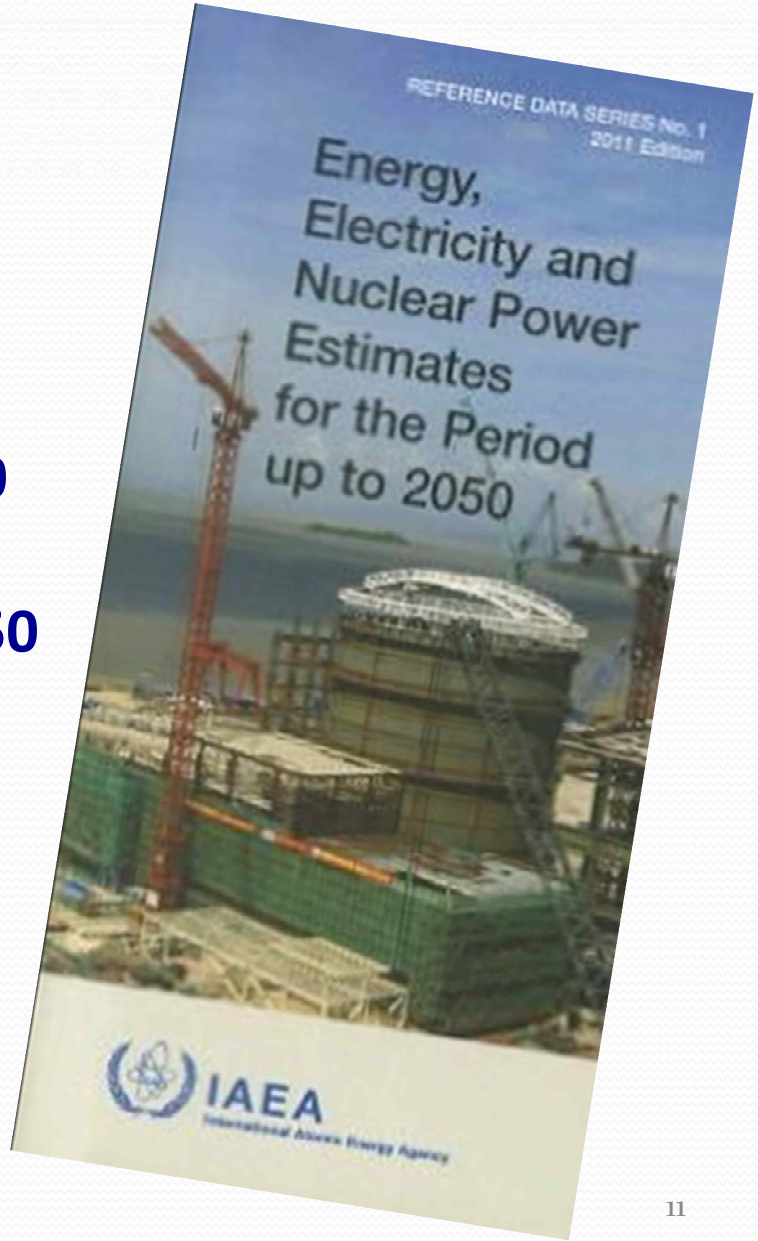
U.S. nuclear energy is not just a domestic energy option…

It is an international safety and security imperative.

Reality: International Nuclear Energy Growth

International Atomic Energy Agency (IAEA) annual report:

- "Low Case" nuclear power capacity is expected to expand 200 GW(e) by 2050
- "High Case" increase 850 GW(e) by 2050
- Currently 70 nuclear plants under construction



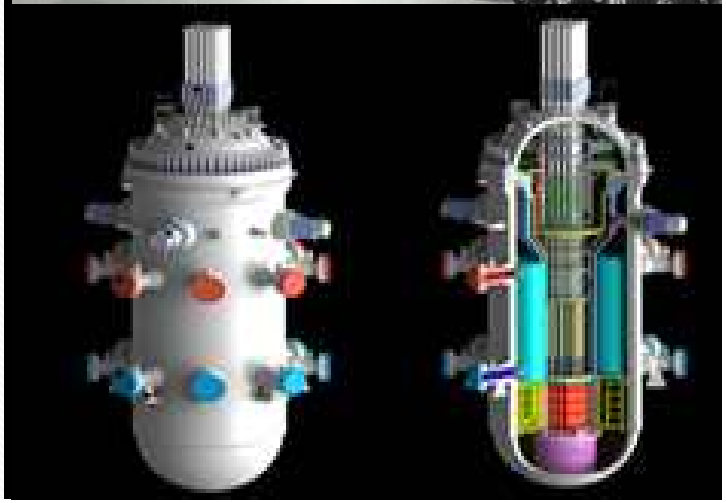
The US has to stay in the game…

Export of US technology maintains US nuclear safety and security leadership around the globe…

- US safety and regulatory system is the "Gold Standard”
- US needs to maintain innovation in nuclear systems and fuel cycles
- Create appropriate controls for enrichment and reprocessing activities
- Greater overall US influence in global nonproliferation policies (Pu disposition)

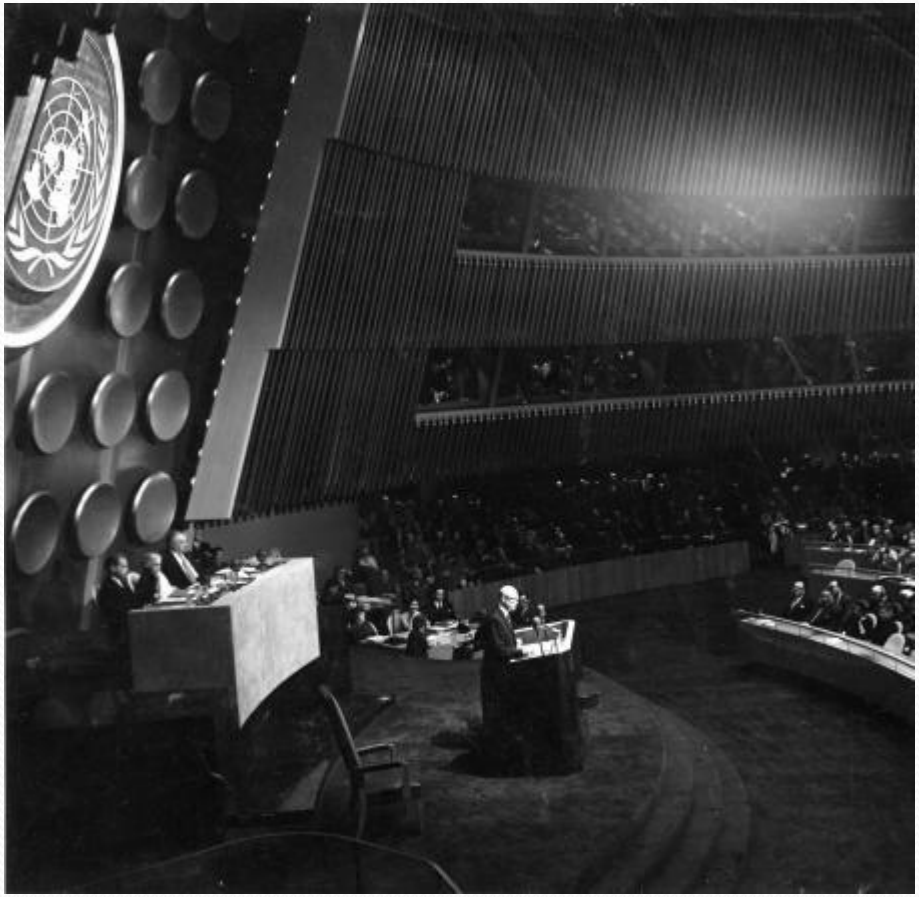
… and this leads to

- High paying jobs and great diversity
- Protect our nuclear investment



U.S. nuclear export policy must evolve from an approach predicated on control to one based on *influence*.

Atoms for Peace



- *… "the United States pledges before you--and therefore before the world--its determination to help solve the fearful atomic dilemma--to devote its entire heart and mind to find the way by which the miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life."*

President Dwight D. Eisenhower
UN General Assembly
December 8, 1953

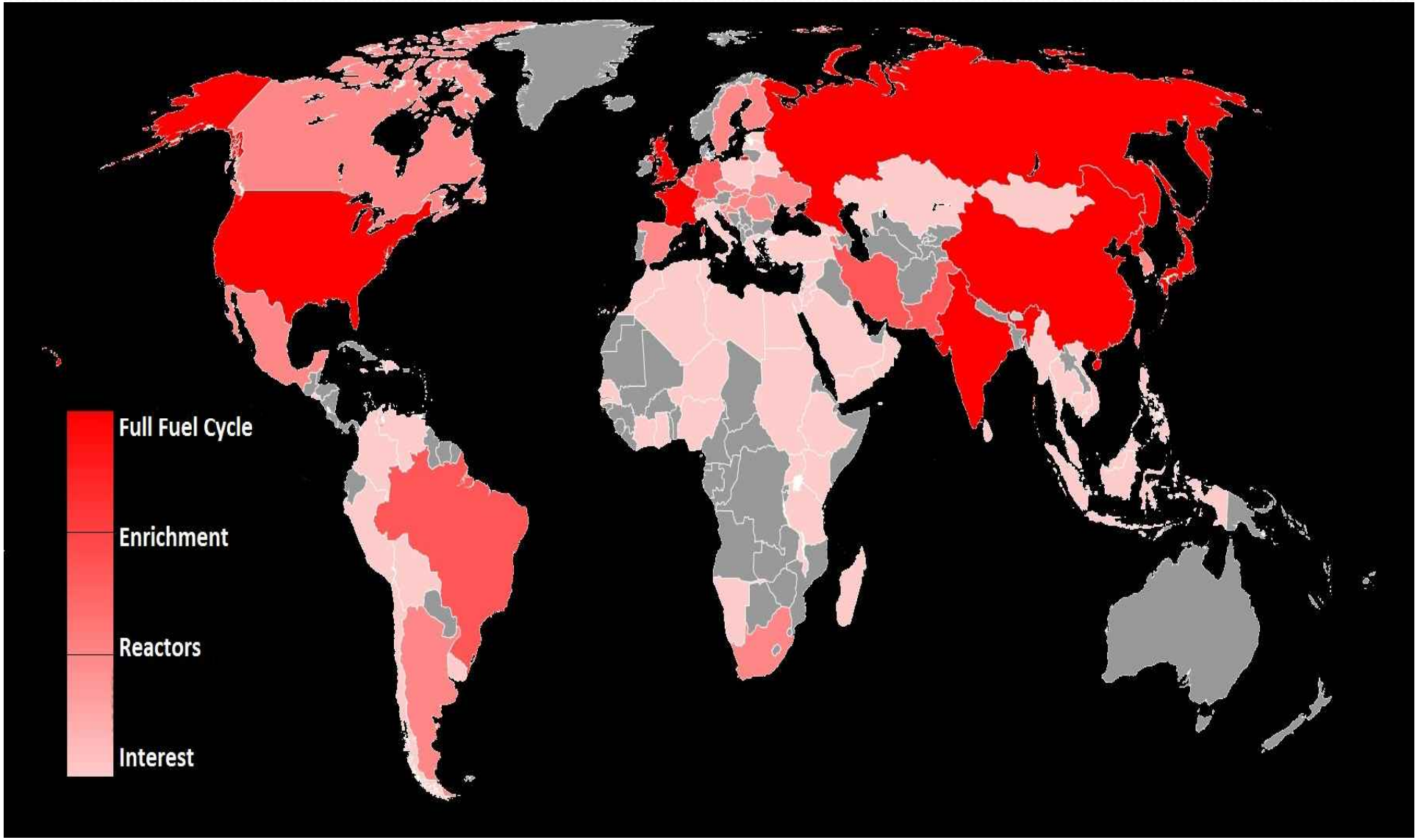
NPT *(Treaty on Non-Proliferation of Nuclear Weapons)*

- June 12th, 1958
- Largest ratified arms limitation and weapon disarmament treaty (190 states)
- Five Nuclear Weapon States (NWS) commit to disarmament

  China, Soviet Union, United States, France, United Kingdom

- NWS are NOT allowed to transfer weapons or weapon technology to non nuclear weapon states (NNWS)
- NNWS have the "inalienable right" to pursue safe civilian nuclear technology

Reality: Multi-polar Nuclear World

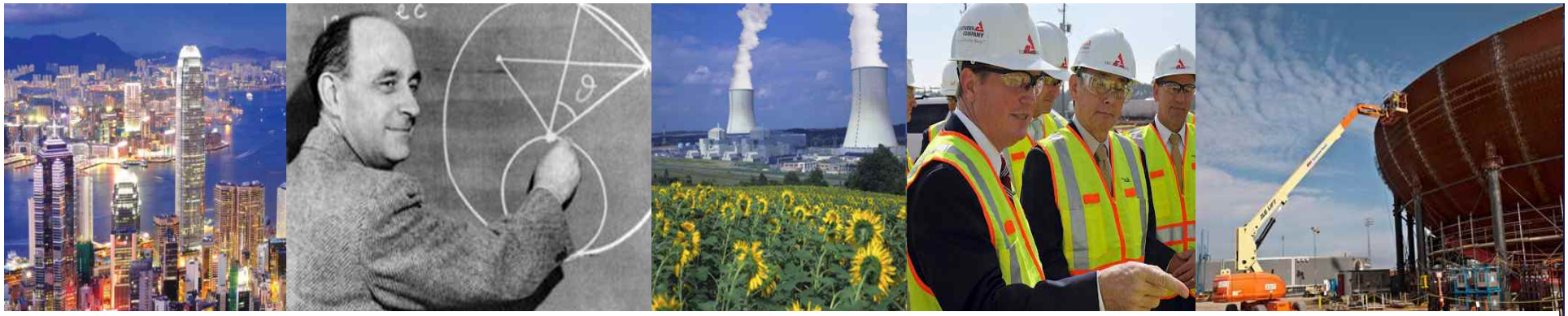


An “influence-based” policy

The Federal Government needs to act on multiple fronts to leadership

- Collaborate with industry in LWR sustainability programs
- Achieve license certification of advanced reactor systems
- Support advanced nuclear technology R&D
- Implement BRC recommendations on SNF
- Forge international partnerships
- Be flexible in negotiations - 123 agreements
- Continue to invest in human element

AMERICAN NUCLEAR SOCIETY



Thank You

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ANS 2013 Agenda

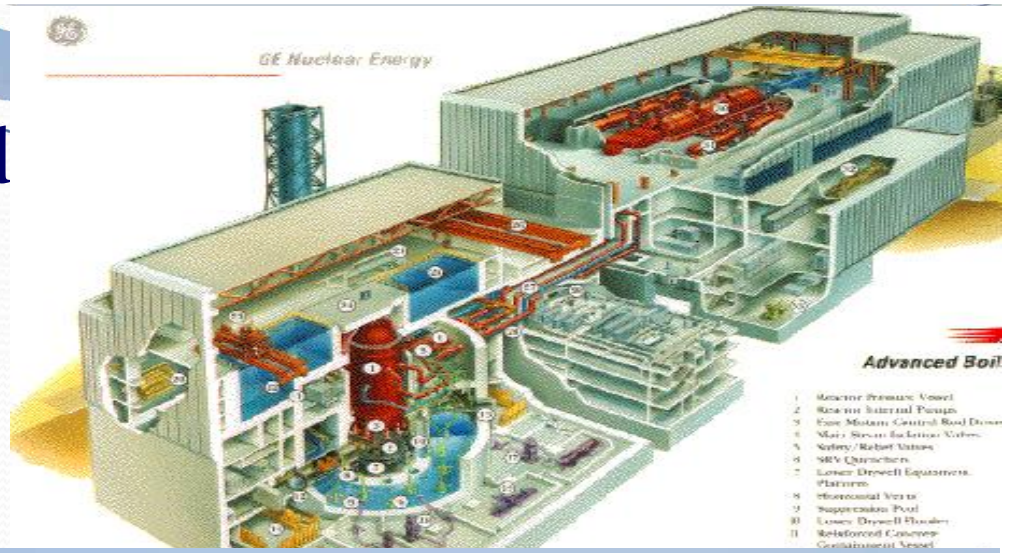
- Frame the challenge
- Support for sustained federal investment in nuclear energy and its human element
- Educate and inform decision makers in government & industry
- Advocate for an influence-based export policy

American Nuclear Society

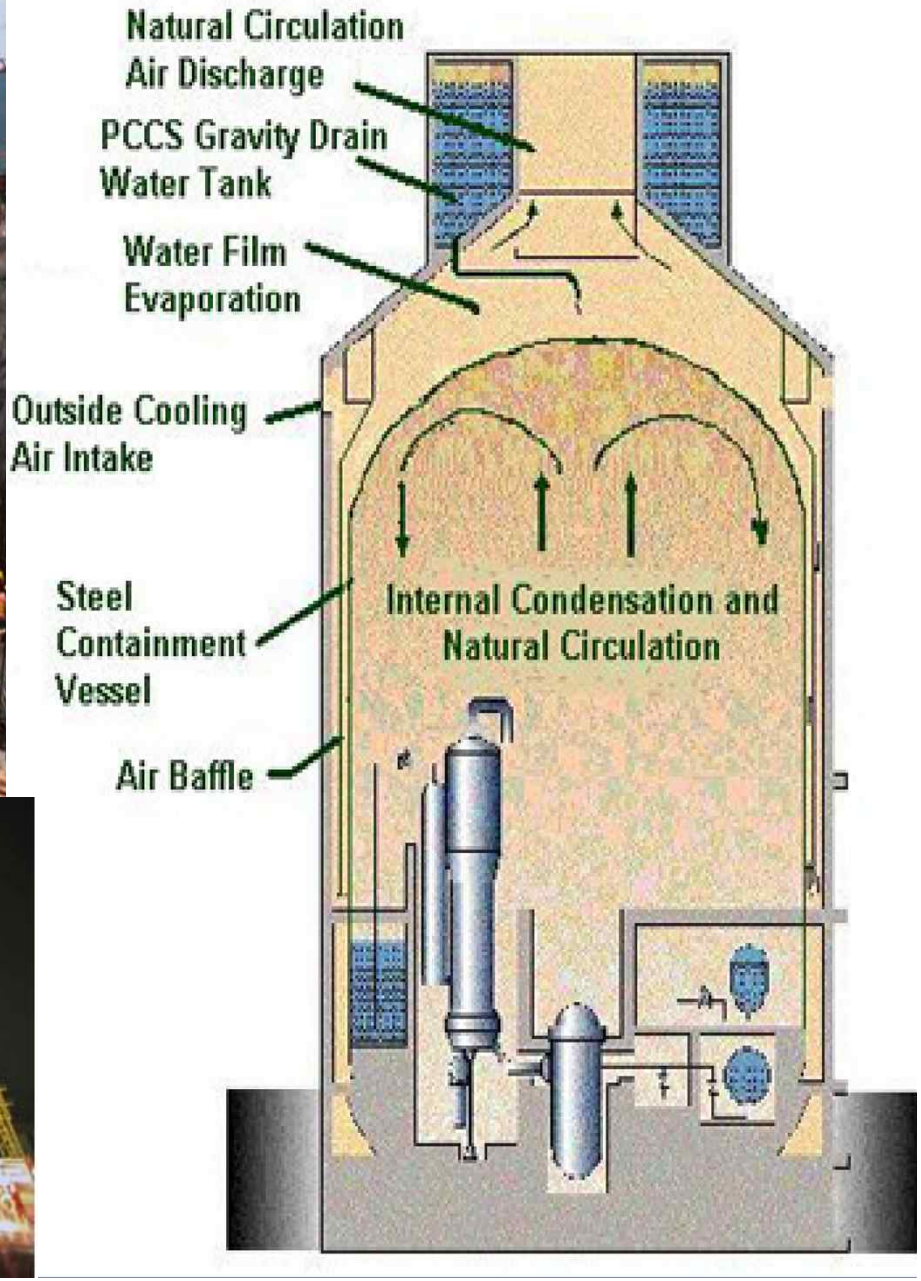
THE PRIMARY PROFESSIONAL ORGANIZATION OF THE NUCLEAR COMMUNITY

- 12,000 men and women
- Industry, Government, Universities, Labs
- Focused on nuclear engineering and related disciplines
- Local sections across the US and in Europe, Asia and Latin America

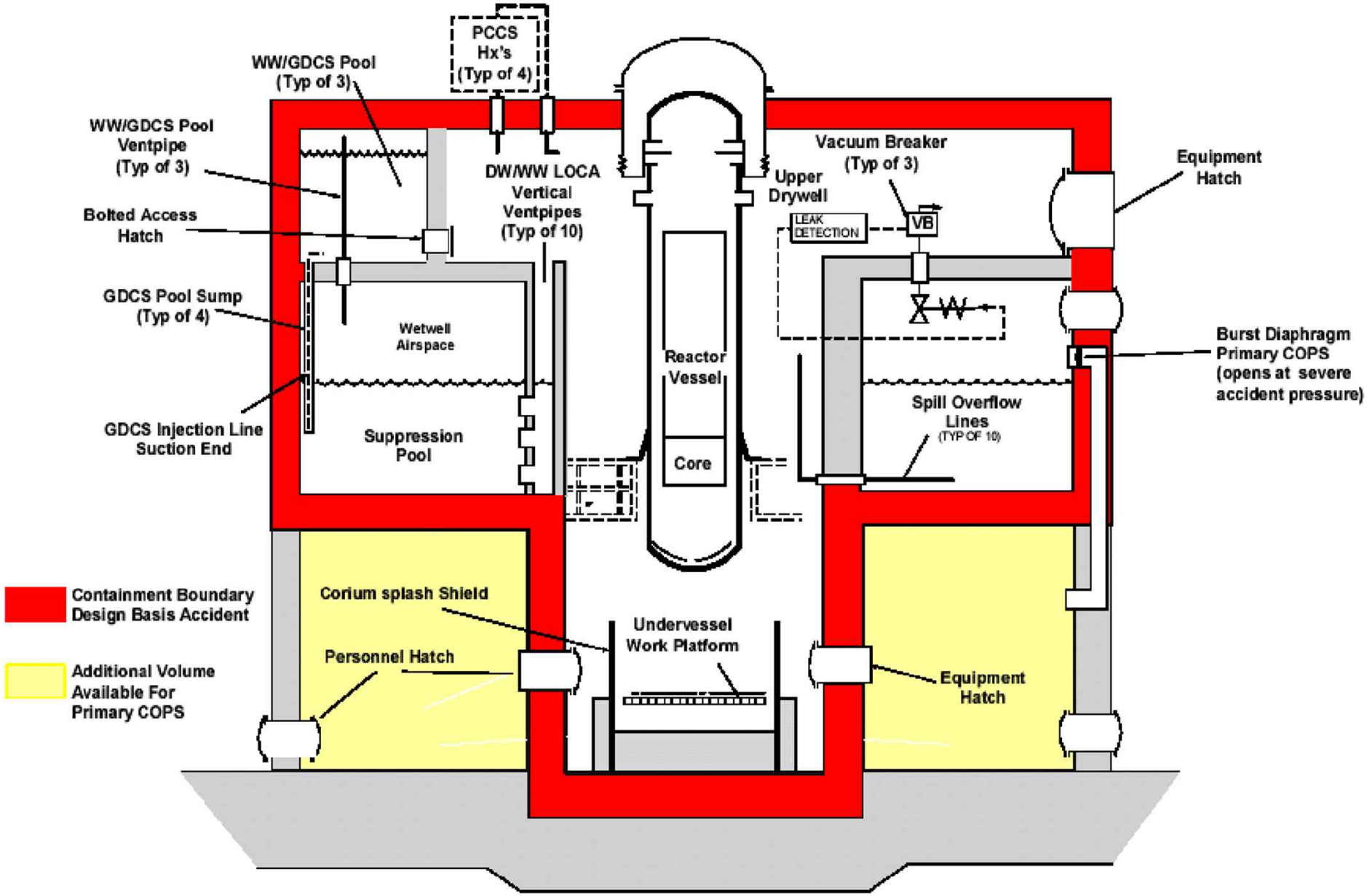
Advanced LWR: ABWR



Advanced LWR: AP-1000



Advanced LWR: ESBWR

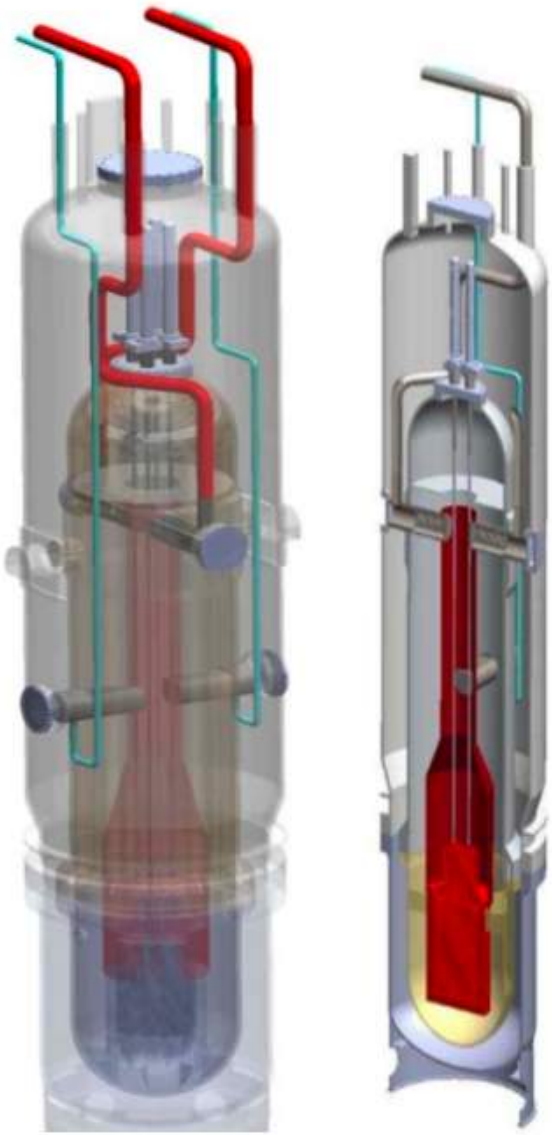


GenIV SMALL MODULAR REACTORS

Name/ TYPE	(MWe)	Vendor	Design Feature
m-Power (PWR)	180	Babcock & Wilcox	Modular, integral SGs; refuel 5 yrs; store SF
NuScale PWR	50	NuScale Power, Inc.	Modular; integral SGs; refuel 3-5 yrs;
Small West. PWR	200	Westinghouse	Modular, integral SGs; scaled down AP600
NGNP (Gas-cooled) (Next Generation Nuclear Plant)	~200	DOE Design Competition	Modular; demo hi-temp process heat
Sodium-cooled Fast Burner Reactor	150-300	General Electric – Hitachi and ASTRID CEA design	Modular; integral SGs; pool type; U-Pu-Zr fuel
4S / Liquid Metal (Super safe, small & simple)	10-50	Westinghouse - Toshiba	Remote locations; 30 yr refuel; U-Zr fuel
Hyperion	25	Hyperion Power Generation	Modular; U-hydride fuel; K-heat pipes PCS
Traveling-Wave / LMR	300-600	TerraPower, LLC	Pool-type LMR;U-238

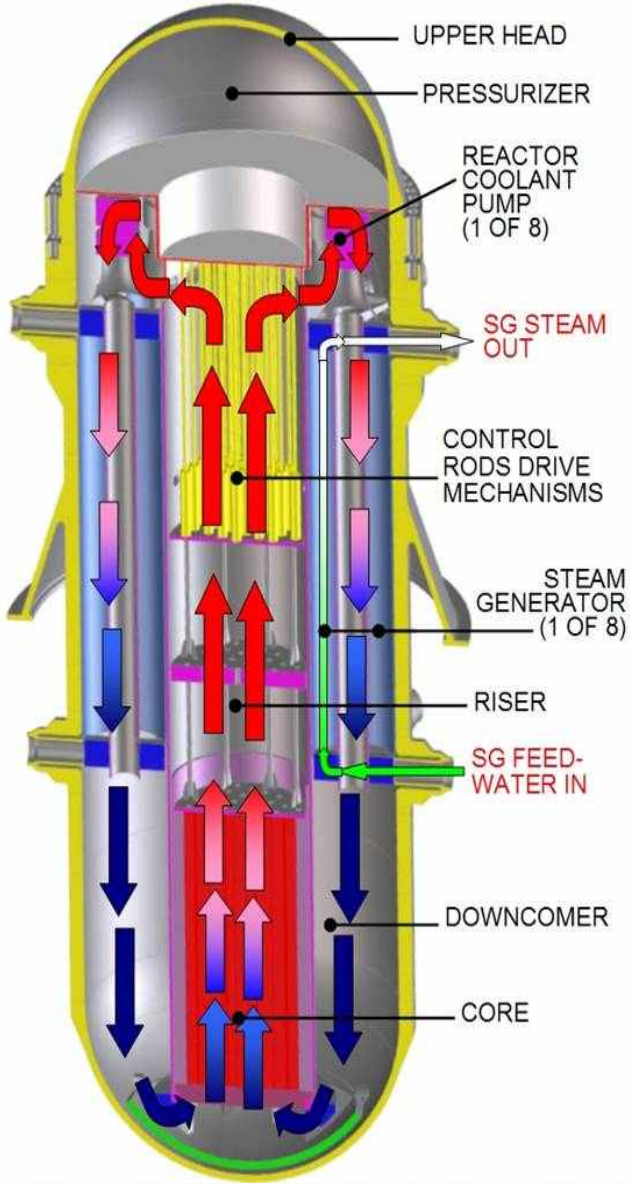
Modular Advanced Reactor LWR Designs

NuScale PWR



mPower – B&W

Westinghouse



Control

Influence