

Nuclear Power Looking Forward: the Opportunity and the Implications

The only way to predict
the future is to create it



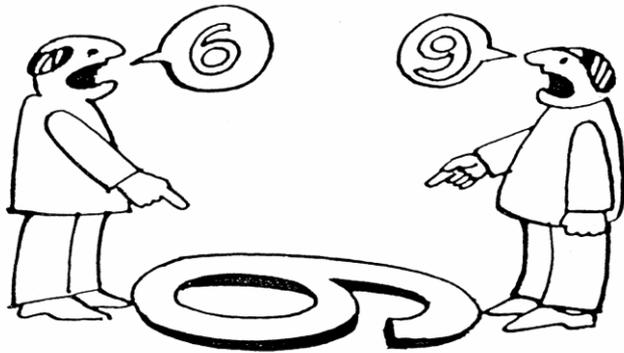
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2018

Topics for Today

- Perspective
- Situation
- Opportunity
- Implications

And then let's talk some...





Perspective

What Frames My Views?

Perspective – Where I Come From

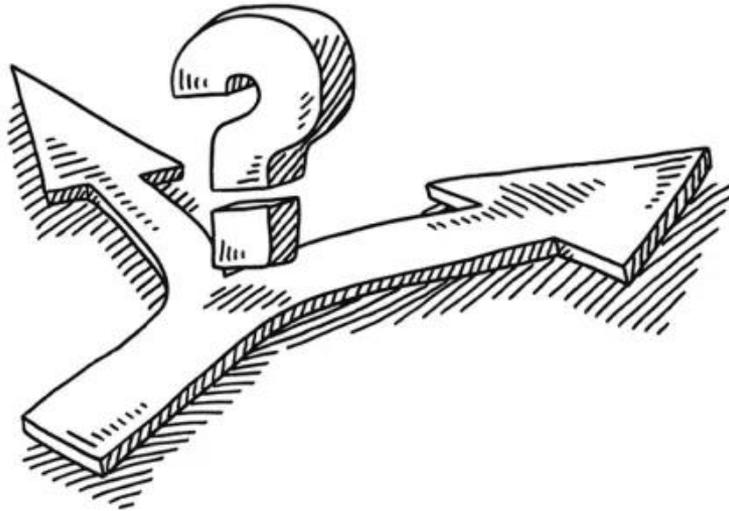


- Principal Officer (co-President) of MPR
 - World leading specialty engineering and project management services company
 - High value and innovative engineering and project/risk management solutions to domestic and international clients in Energy, Defense & National Security, and Health & Life Sciences
- MPR was founded by the chief leaders of Admiral Rickover's organization; they instilled a culture that remains today:
 - Technical Rigor
 - Discipline
 - Integrity
- We own, safeguard, and apply the Rickover legacy for excellence
- We work for:
 - Every US nuclear power plant
 - Numerous others world-wide
 - All major NSSS vendors and many other industry companies
 - DOE and DOD



I'm a "nuclear power guy", and have been my entire career:

- A believer in it's benefits and the potential for even more
- Proud of the industry I help lead



Situation

Where do Things Stand Today?

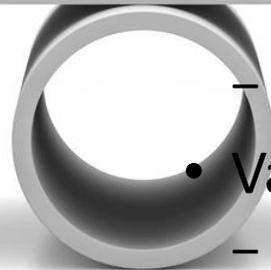
Two Ways to Look Life?

Looking Up

- The numbers:
 - 450 operating reactors in 30 countries
 - 60 under construction in 15 countries
- The interest:
 - US political interest highest in decades
 - Growing interest in SMRs
 - Especially strong interest in Advanced Reactors
- Value:
 - Increasing appreciation for value of nuclear to climate and health, and as economic engines

Anxious

- The numbers:
 - 6 US reactors recently closed
 - 8 more closures planned
 - ~10+ threatened
- The trends:
 - Long term natural gas prices remain low
 - Renewable subsidies continue to impact markets
 - Struggles to execute new builds
- Value:
 - Do policy makers care enough to set needed priorities?



COP 21 (2015 Paris Agreement)

- All countries pledge to pursue all measures to limit Earth's temperature rise to $<2^{\circ}\text{C}$, while aspiring to $<1.5^{\circ}\text{C}$
- Each country will provide a detailed, structured plan to reduce CO_2 emissions every year
- The developed world will assist developing countries to achieve their targets, including financial, technological, or other support



Even with questions regarding the reality of anthropogenic climate change, the potential consequences are so large that proactive action is warranted

Don't Forget About the Air We Breathe



“And so the cleaner and safer future depends, in my opinion, on having carbon neutral power, baseload power...”

We have to be a country that steps up and says it has to be renewable new advanced nuclear energy. It has to be there if by 2050 we are to be a carbon neutral country.

For me, this is about the kids in my city. For me, this is about kids in Camden and Patterson who are suffering not just because we have a polluted atmosphere, but it's also about creating an America for them that is bold and courageous again...”

Beyond climate change, nuclear power also improves the air around us, setting the foundation for an improved standard of living for everyone

View from the Boardroom

- Reality We Can't Ignore:
 - US Nuclear Power Plants becoming non-competitive in open markets
 - additional shut-downs likely
 - Struggles to complete new build projects
 - particularly Westinghouse and Areva
 - Projects deferred around the globe
 - Toshiba/Westinghouse financial meltdown
- > Evolving perception of “*nuclear is good for environment, but perhaps bad business*”
- Signs of success:
 - Illinois and New York programs
 - UAE Nuclear Power Program
 - SMRs as mitigation to some of the financial challenges facing large plants



We need to fight back the perception by building on our successes and delivering on our commitments

Leaving Us ...



Why Should we be Excited?

disrupt

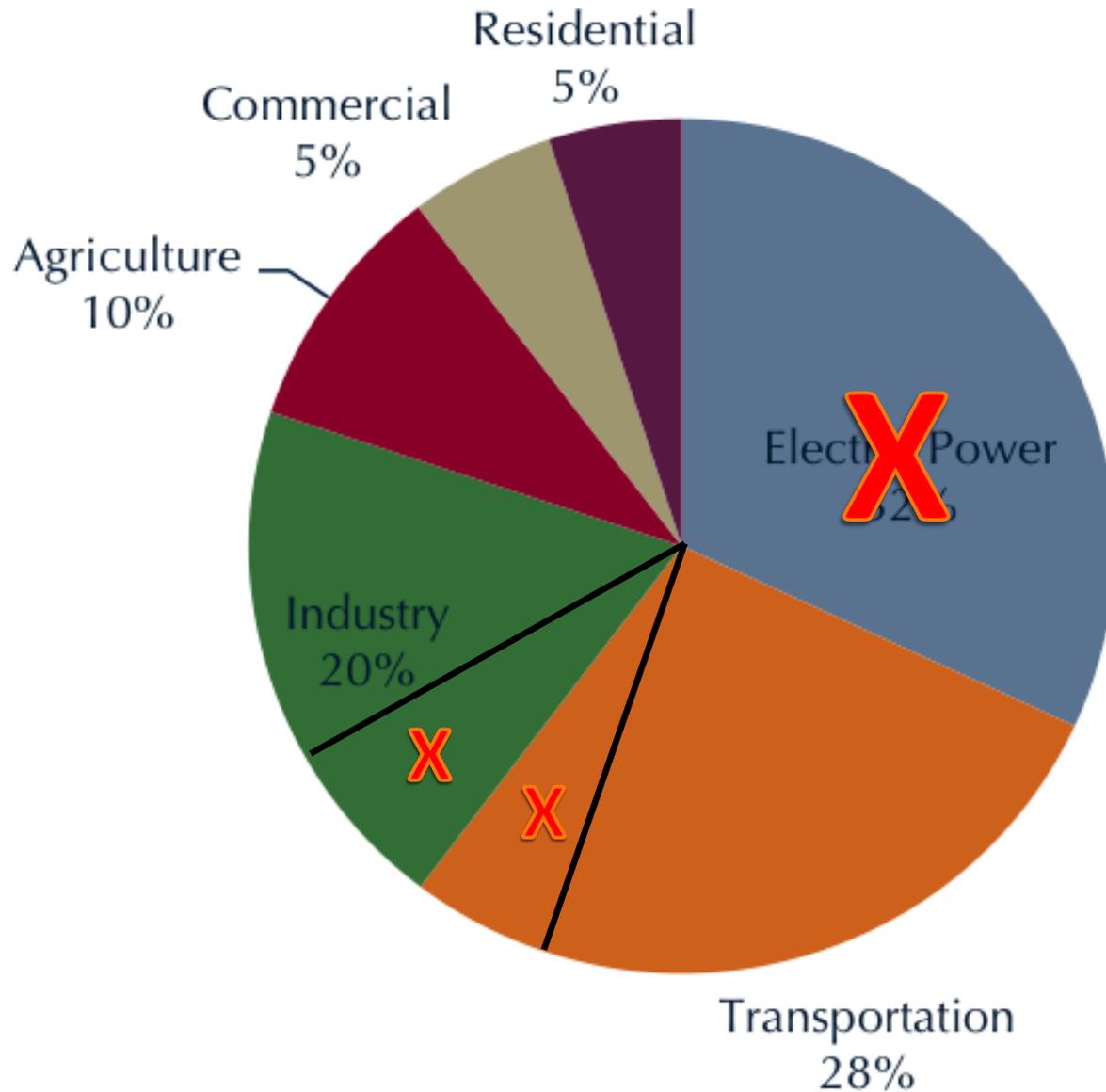


**THIS
MOMENT
IS AN
OPPORTUNITY**

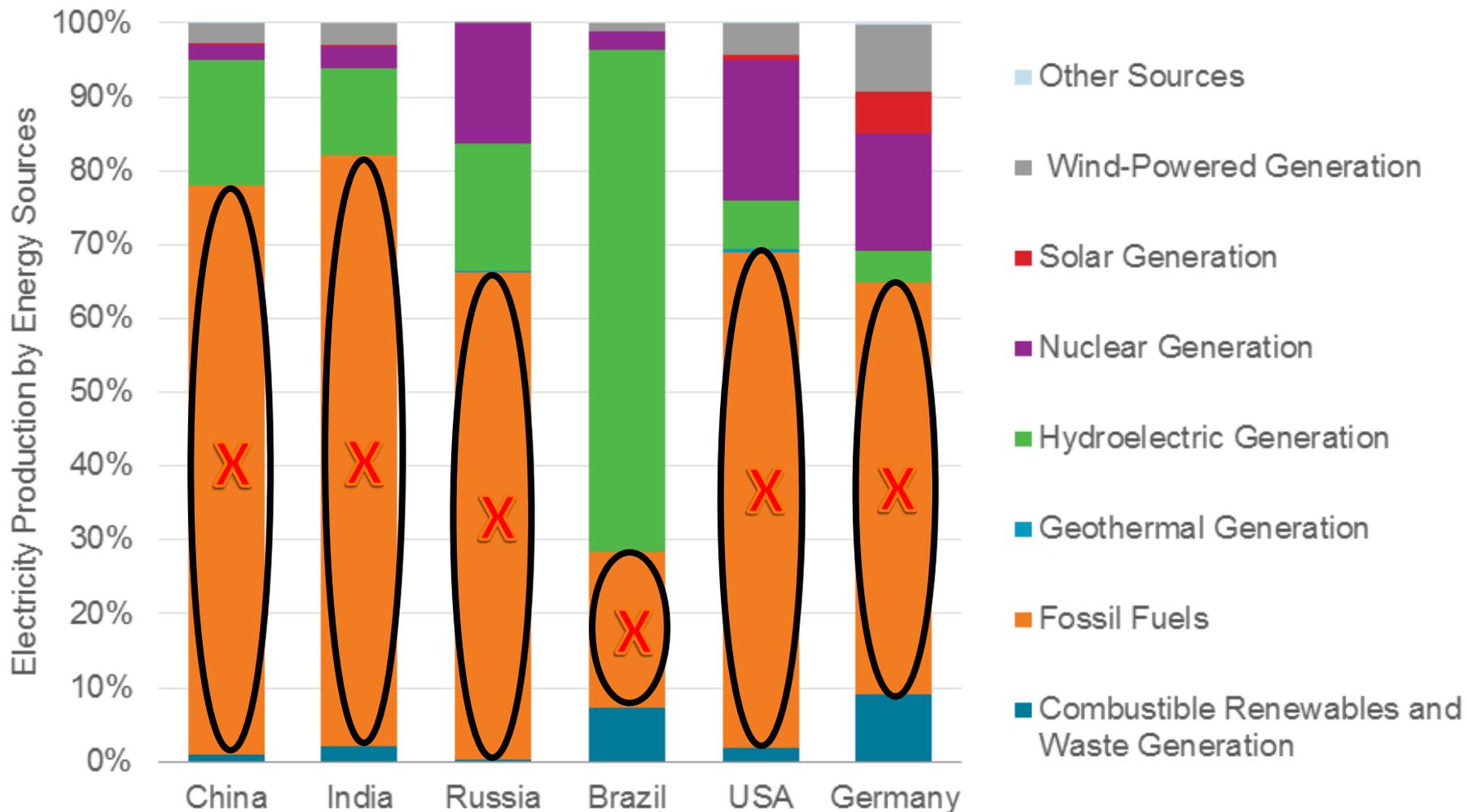
Opportunity

What is Possible (and Needed)?

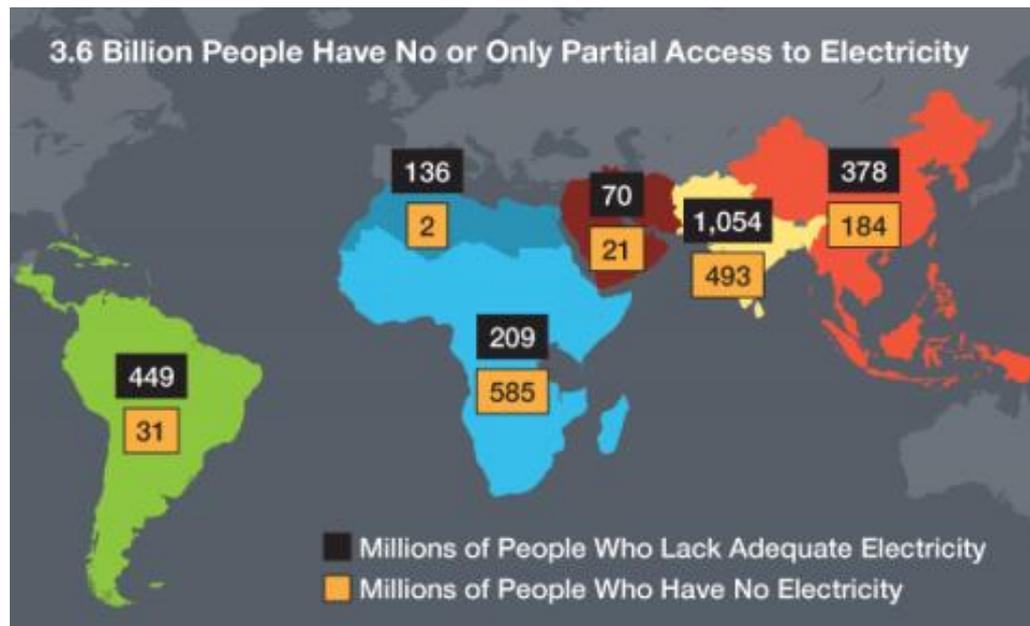
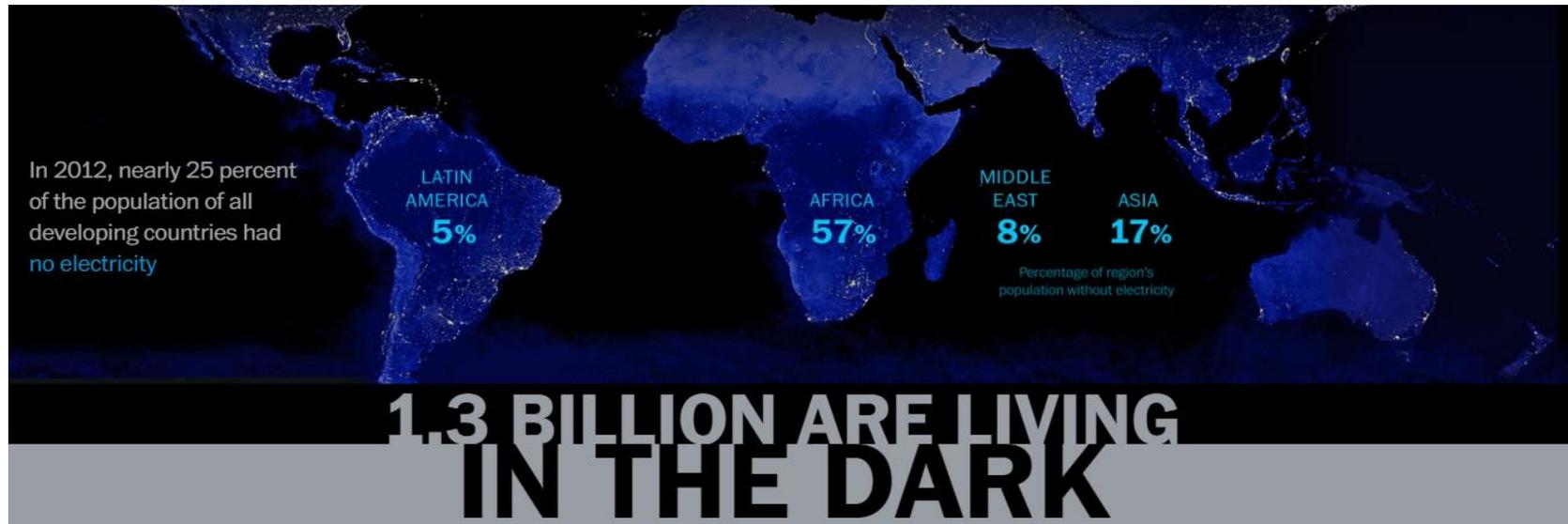
Sources of Greenhouse Emissions (US)



Electricity Production Sources

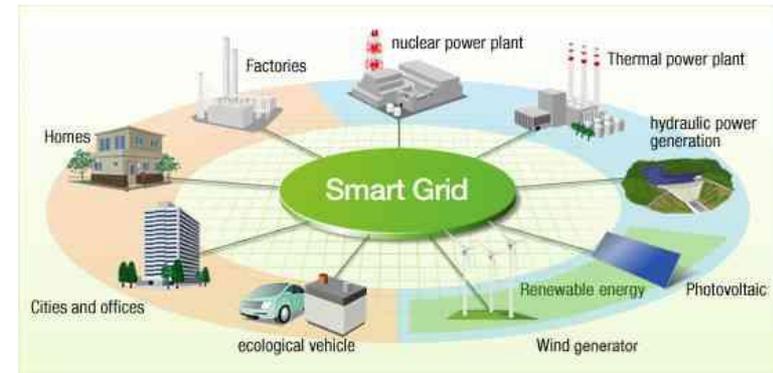


But the Challenge is Even Greater...



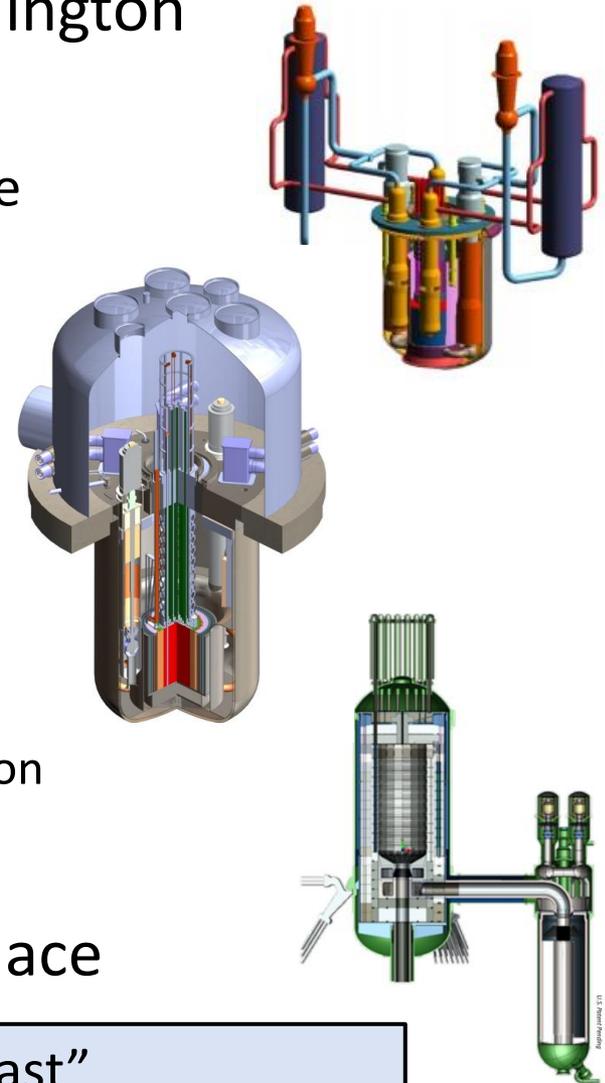
Opportunity and Need

- One, or more likely, both of two things must occur to achieve de-carbonization goals (in US and world-wide):
 - Significant expansion of nuclear power
 - Orders of magnitude advances in energy storage and energy delivery
- “Advanced Nuclear” is widely considered a key opportunity to anchor the grid of the future
- Aging infrastructure must be addressed in parallel with implementing new technology
- Balancing technology development, reliability, cost, safety, and NIMBY, BANANA, and NOPE issues will be critical



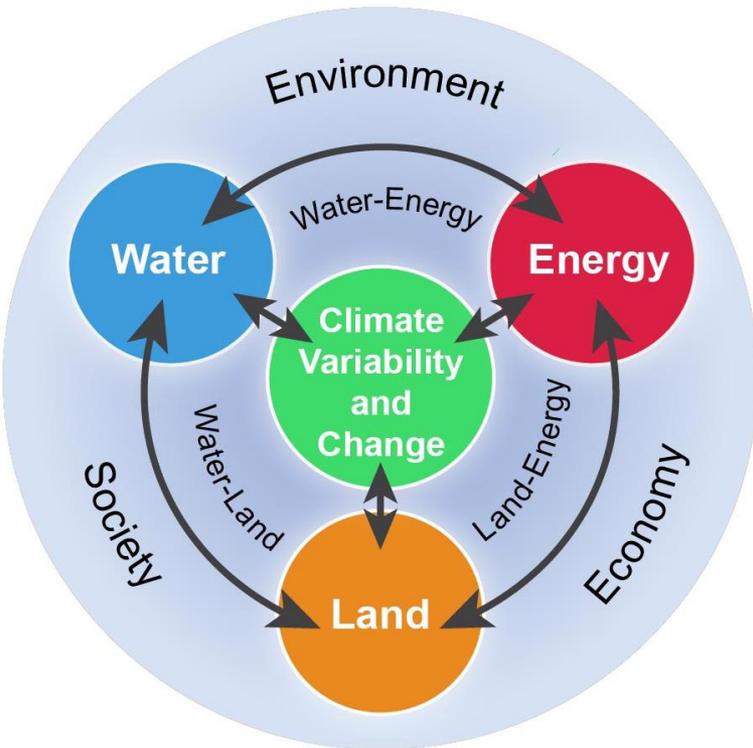
Advanced Reactors

- Currently a “bright shiny object” in Washington
 - Wide and strong bi-partisan support (by Washington standards)
 - Seen as foundation element of effort to reduce emissions and clean air
- What is an “Advanced Reactor”?
 - Gas cooled, sodium cooled, molten salt, very high temperature gas, super-critical water?
 - Typically:
 - “Walk away safe”
 - High temperature (500° - 900°C)
 - Proliferation resistant
 - Heat applications in addition to electricity generation
 - Many low pressure
 - Many closed fuel cycle
- Little to no regulatory infrastructure in place



Goal: “Half the cost, twice as fast”

Looking for Solutions



- There is a complex relationship between:
 - Energy
 - Environment
 - Water
 - Food
 - Land Use
- We must balance these competing factors to achieve sustainable access to all needed resources

As stewards, we must consider all aspects of how we use our resources effectively and sustainably

5,000 MWe ?



3 or 4 “large”
nuclear reactors



15 to 100 SMRs



5 to 8 combined cycle plants



1670 to 2500 Wind Turbines
(over 300 to 400 miles²)



40 to 50 miles² of
solar panels



5 to 8 coal boilers

Creating the Future – You and Me



- This is a “Leadership Moment” – embrace it and influence those around you
- We need to be aligned and coordinated... *and understand the big picture*
- This will be long and hard, so it is important to:
 - Have patience
 - Be diligent
 - Stay on task
 - Stay on message
 - Be a team
- Deliver on commitments – build trust, then build more trust!
- Continue to grow as professionals:
 - Learn and experience
 - Improve communication and leadership skills
 - Adapt and apply yourself



Why is This So Damn Important?

- Nuclear power plants provide important benefits and address equally important national challenges:
 - Economic engines
 - Climate/environment
 - Energy independence
 - Diversity of energy resources
 - Stability and reliability of the electric grid
 - Predictability of electricity costs
 - National Security
- As leaders in industry and our communities, we have the obligation to make investment decisions for the best overall approach for long term energy & environment stewardship



We need to create the future for nuclear power and we need to be successful... ***Together!***



***“If you want to go fast, go alone,
if you want to go far, go together”***

African Proverb



Discussion

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