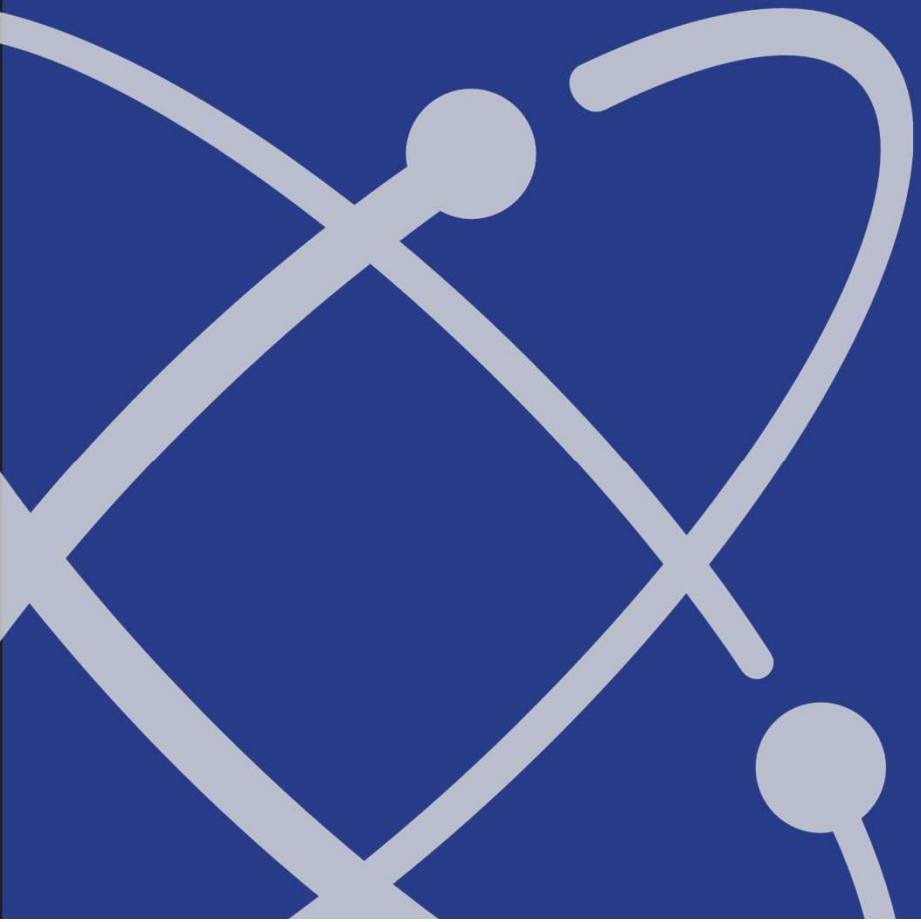


Mary Lou Dunzik-Gougar

President American Nuclear Society

27/28 May 2021

American Nuclear Society



Part 1. American Nuclear Society

Part 2. Why isn't nuclear loved as clean energy source?

Part 3. What can we do about it?

A stylized graphic of an atomic symbol, consisting of three intersecting elliptical orbits and two circular nuclei, rendered in a light blue color against the dark blue background.

American Nuclear Society

Part 1: American Nuclear Society Update

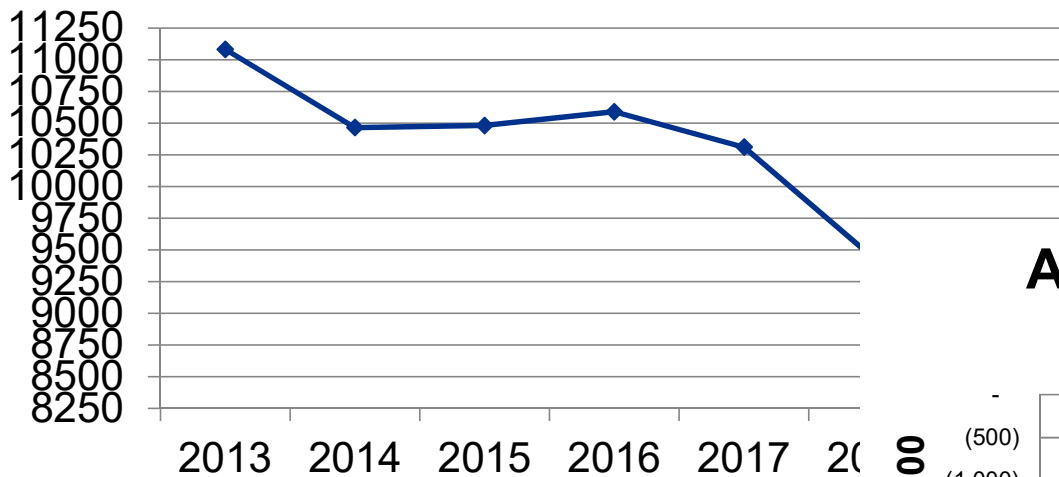
- Professional technical society
 - Professional and student members, national and international
- Organize and conduct technical conferences
- Communicate about nuclear topics with
 - Members
 - Trade publications, technical journals, proceedings/transactions, webinars, Nuclear SmartBrief, website
 - General public
 - Navigating Nuclear K-12 curriculum
 - Policy makers
- Provide networking opportunities for members

ANS Change Plan 2020

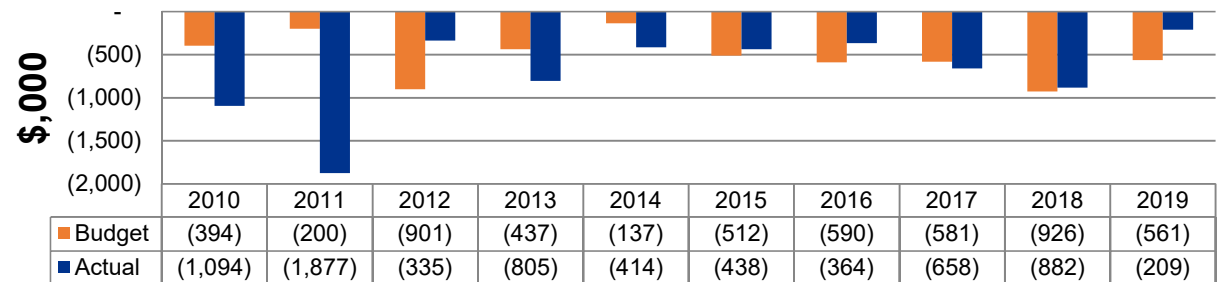


- Continuing downward trend in membership and upward trend in budget deficit demanded change

Total Membership as of December 31, 2019



ANS Operations - (Budget, Actual) 2010 - 2019



ANS Change Plan 2020

- Continuing downward trend in membership and upward trend in budget deficit demanded change
- Developed by group of past Presidents and Board members in 2018
- Passed by Board of Directors in 2019, implemented 2020 - present
- Overall objectives
 - More strategic fundraising and targeted spending to serve members
 - Stabilize and grow membership numbers
 - Improve member benefits (e.g. new member service center)
- New Executive Director/CEO, Craig Piercy, hired late 2019
 - operational review and reorganization of staff
 - IT upgrades

2020 virtual meetings very successful

- June 2020 Annual meeting
 - More than 2300 registrants, recorded plenary and technical sessions for later viewing, high quality audiovisual
- November 2020 Winter Meeting
 - More than 2600 registrants, including 2 embedded topical meetings, better quality audiovisual for plenaries, recorded sessions

Going forward . . .

Inward facing (members and societal function)

June 2021 meeting will be virtual

Continuing implementation of Change Plan 2020

Outward facing (members and the public)

Changing the way nuclear is viewed, especially in the clean energy arena

Part 2. Nuclear: Why the Resistance?

Nuclear energy has become the cleanest, safest, most reliable and scalable source of energy on the planet.

Even in the age of Climate Alarmism, nuclear is not considered THE answer . . . WHY????

Some quotes....

NASA

Although NASA's main focus is not on energy-technology research and development, work is being done around the agency and by/with various partners and collaborators to find viable alternative sources of energy to power our needs. These sources of energy include the *wind, waves, the Sun and biofuels*.

<https://climate.nasa.gov/solutions/adaptation-mitigation/>

EPA

- Green Power Partnership
- Coal, oil, natural gas, nuclear are “**least beneficial**” to the environment (interesting standard)
- Solar, wind, geothermal, biogas, biomass, and low-impact hydropower are “most beneficial” to the environment

(<https://www.epa.gov/greenpower/what-green-power>)

And not just government

Google

Committed to buy “enough wind and solar electricity annually to account for every unit of electricity our operations consume, globally”

(<https://sustainability.google/projects/announcement-100/>)

Amazon

“Committed to using 100% renewable energy across our global infrastructure”

Supports 70 renewable energy projects

- Solar
- Wind

(<https://sustainability.aboutamazon.com/environment/sustainable-operations/renewable-energy>)

And of course

Sierra Club

“Ready for 100” campaign advocates for communities to commit to “transition to 100% clean, renewable sources of energy, like wind, solar, and battery storage.”

<https://www.sierraclub.org/ready-for-100>

Greenpeace

Recommends, “The path forward is an immediate halt to new oil, gas, and coal development in the U.S. and a managed phase out of existing fossil fuel production consistent with safe climate limits.”

<https://www.greenpeace.org/usa/reports/fossil-fuel-phaseout/>

What's going on? What's behind the animosity?

Consider the environmentalist premise . . .

The natural world is good.

Changing the natural world is bad.

Humans change the natural world, so *humans are bad*.

Premise evidenced by statements such as . . .

Humankind “would not rest content until the earth is covered completely, and to a considerable depth, with a writhing mass of human beings, much as a dead cow is covered with a pulsating mass of maggots” (Harrison Brown, *The Challenge of Man’s Future* in 1950)

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Premise evidenced by statements such as . . .

Brown's view was an extension of the ideas of 19th Century economist Thomas Malthus who lusted for the extermination of his fellow man, particularly the poor and the Irish. "Instead of recommending cleanliness to the poor," Malthus argued, "we should encourage contrary habits...and court the return of the plague."

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Premise evidenced by statements such as . . .

Such anti-humanist ideas came full bloom in Stanford biologist Paul Ehrlich's 1967 Sierra Club pamphlet, *The Population Bomb*, which depicted poor people in India as animals "screaming...begging...defecating and urinating."

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Premise evidenced by statements such as . . .

The small-world, zero-population-growth, soft-energy-path faction of the environmental movement that emerged across the 1960s and 1970s knowingly or unknowingly incorporated the antihumanist ideology of the neo-Malthusians into its arguments... “more power plants create more industry,” [the Sierra Club’s executive director complained,] “that in turn invites greater population density.” (From Richard Rhodes’ in *Energy: A Human History*, 2018)

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Premise evidenced by statements such as . . .

”Our campaign stressing the hazards of nuclear power will supply a rationale for increasing regulation and add to the cost of the industry.” Sierra Club President (1974)

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Premise evidenced by statements such as . . .

David Graber, biologist with National Park Service, “Human happiness, and certainly human fecundity, are not as important as a wild and healthy planet. I know social scientists who remind me that people are a part of nature, but that isn’t true. Somewhere along the line – at about a million years ago, maybe half that – we quit the contract and became a cancer. We have become a plague upon ourselves and upon the Earth. Until such time as Homo Sapiens should decide to rejoin nature, some of us can only hope for the right virus to come along.

<https://www.forbes.com/sites/michaelshellenberger/2018/06/11/if-nuclear-power-is-so-safe-why-are-we-so-afraid-of-it/#3e1cd4c96385>

<https://play.google.com/store/books/details?id=OUfHLQ84KjMC&rdid=book-OUfHLQ84KjMC&rdot=1>

Which stands in stark contrast to promise of nuclear

“Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world.”

President Eisenhower, Atoms for Peace speech (1953)

Patrick Moore

- Co-founder of Greenpeace
- Left Greenpeace because emphasis changed to strategy of
 - Misinformation
 - Sensationalism
 - Fear
 - Natural world better without humans
- Believes in strategy based on
 - Science
 - Logic
 - Recognizing needs of 7 billion people on planet
 - Humans are part of nature and are part of the solution

Humans *are* natural!

- We are part of this world
- We evolved over time, along with other species
- However, different from other species, our evolution included developing the capability to reason, to think
- THAT is why we thrive
- We don't have the physical attributes to thrive and nature doesn't provide what we need to thrive
- We understand and harness nature to create benefits
- We thrive because we are able to “change nature”

“Changing nature” is what scientists and engineers do!

- Harness otherwise useless resources and change them to make them useful (Alex Epstein, industrialprogress.com)
- Extract coal/oil/natural gas and uranium to make electricity
- Wind, solar and hydropower also not possible without resource extraction
 - petroleum for wind turbines
 - rare earth elements for solar panels
 - iron for hydroturbines
- Wind and solar not viable without backup from hydro, fossil, nuclear

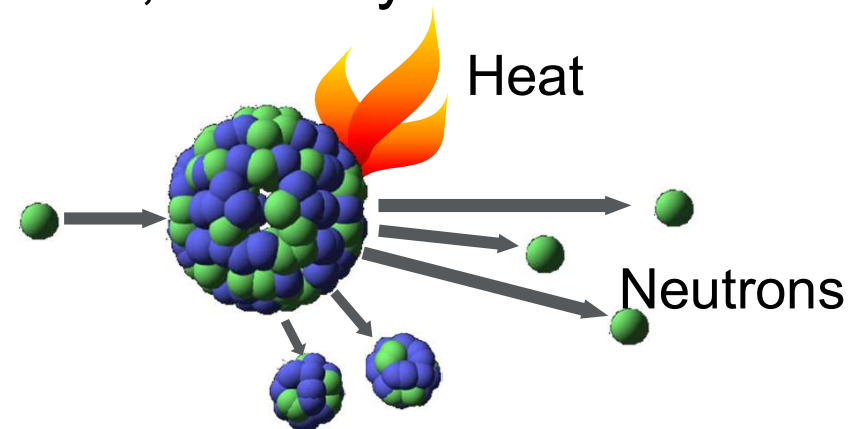
The anti-human flourishing worldview leads to . . .

Pressure to increase regulations

Associated litigation

The “criminalization of nuclear”*

- Nuclear is offensive to some because we understand and exploit the energy of the nucleus, the very foundation of all matter



(*Alex Epstein, Industrial Progress)

If Mary Lou were Ruler of the Universe



(Disclaimer: not ANS views) . . .

1. No more subsidies for any kind of power production
2. Truly free energy market with consumer choice of power source and associated cost
3. Privatize nuclear waste management
4. Make regulations commensurate with risk, rather than based on Linear No Threshold (LNT) hypothesis, which is unsubstantiated for low doses at which we regulate, and put “reasonable” back into implementation of ALARA
5. Nuclear taught in every school at every level

Part 3. What can we do?

Nuclear Power: The Clean Energy Source

- Clean comparison with other sources
- How to communicate about benefits of nuclear

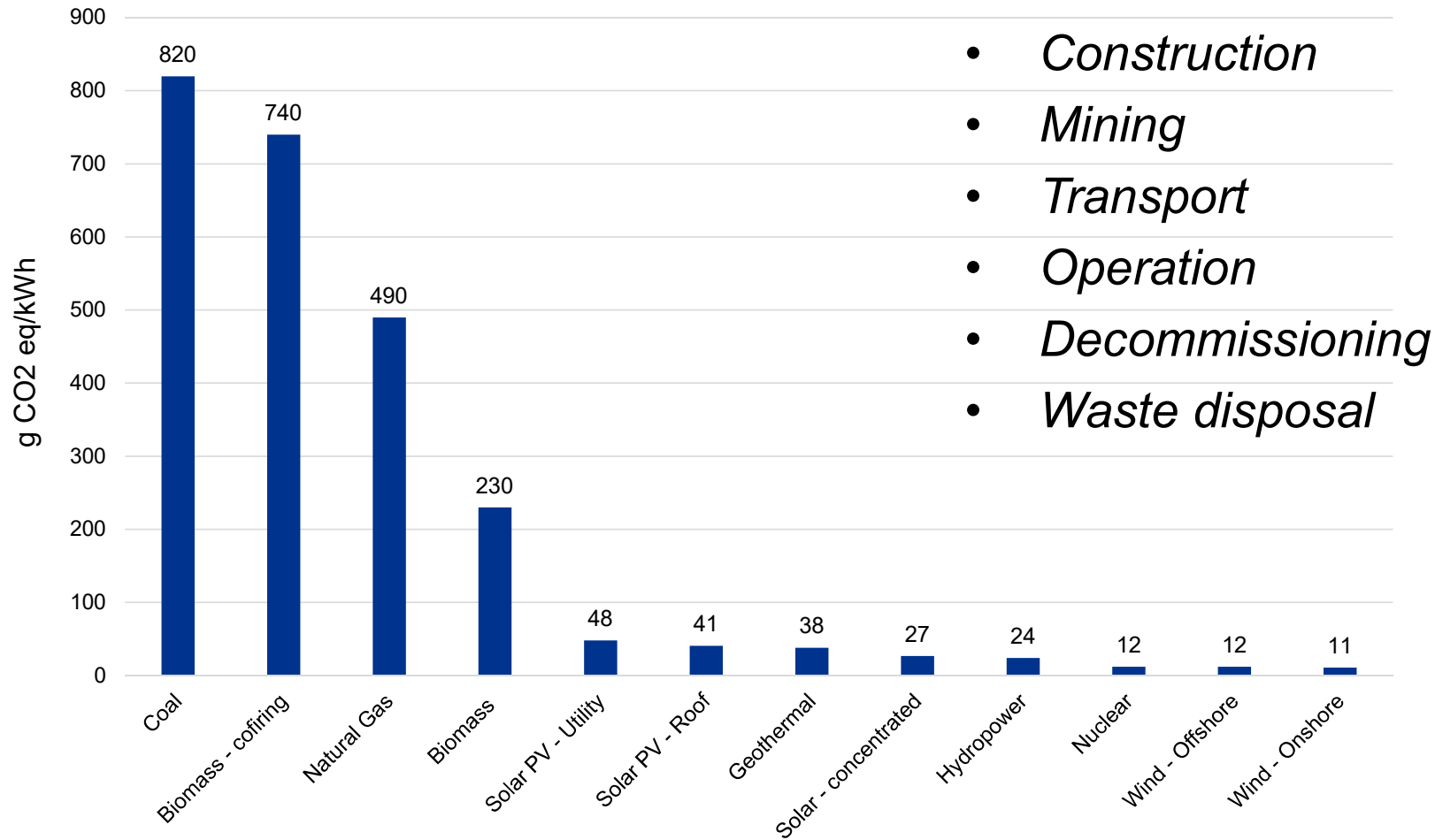
Are you convinced nuclear is clean?

- Scientists and engineers are convinced by statistics

What are the clean criteria?

- Gas emissions
- Land usage
 - Fuel footprint
- Material usage
- Waste production

Lifecycle emissions



- *Construction*
- *Mining*
- *Transport*
- *Operation*
- *Decommissioning*
- *Waste disposal*

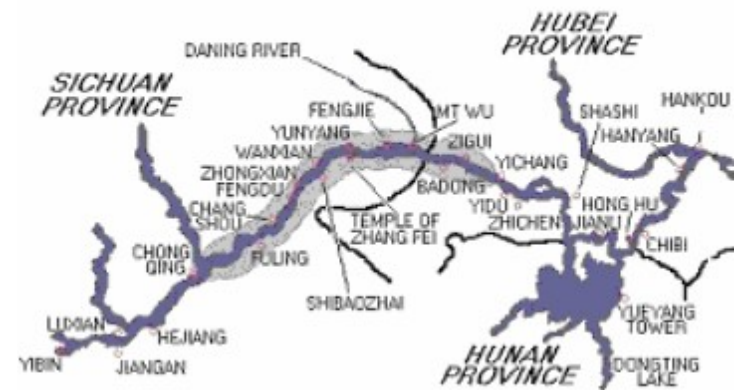
Land usage

- *Land not available for other uses, such as farming, schools, animal habitat, and recreation*

Energy Source	Land Use (m ² /GWh/yr)	Comments
Geothermal	900	Flash plant including wells and pipes
Wind- onshore	1100	Turbine footprint plus access only
Nuclear	1200	Plant site including cooling water
Solar thermal	3200	Desert based - 6 hrs storage
Coal (strip mine)	5700	Including mining site
Solar PV	7500	Solar farm with dedicated land
Hydro reservoir	200,000	100m head, 20m depth
Biomass	460,000	Tree area with 20 yr fuel supply



*Three Gorges Dam, China
22.5 GWe installed capacity
(World's largest power plant)*



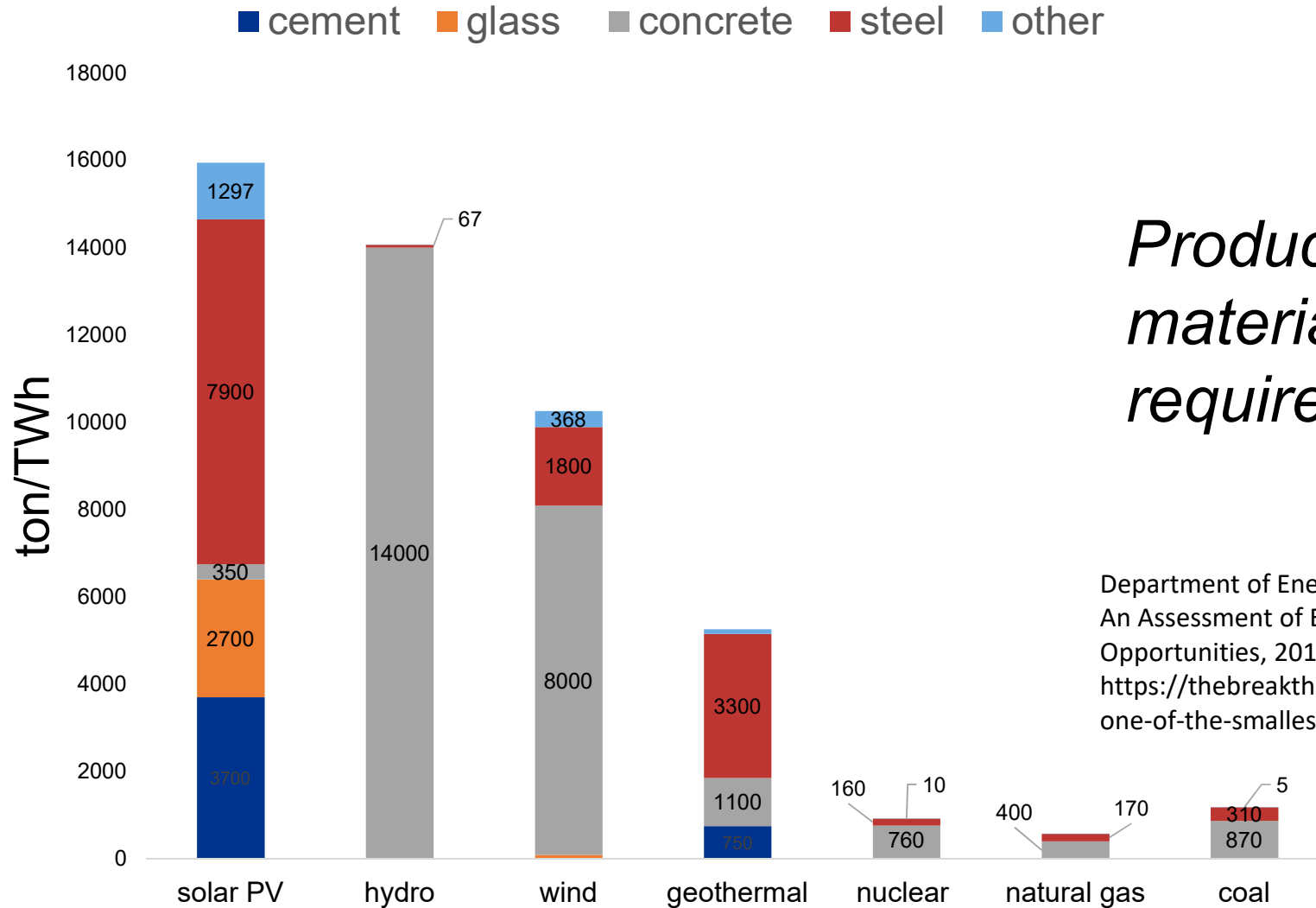
Fuel footprint



- *Inverse energy density*
- *Difficult to plot due to orders of magnitude!*

Fuel	Energy density (MJ/m ³)	Electrical Energy Density (kWh/m ³)	Conversion efficiency
Natural U (Fast)	1.5E+11	1.25E+10	30%
Natural U (LWR)	950000000	80000000	30%
Black coal	24000	2300	35%
Brown coal	15000	1000	25%
Dry wood (biomass)	10000	970	35%
Natural gas (CCGT)	38	5	45%

Material usage



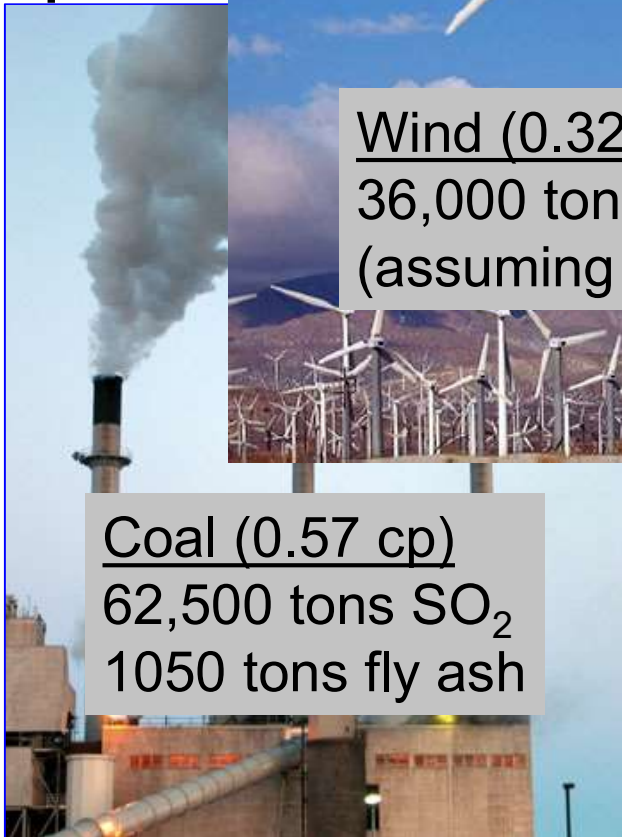
Producing these materials also requires energy

Department of Energy, Quadrennial Technology Review, An Assessment of Energy Technologies and Research Opportunities, 2015; The Breakthrough Institute, <https://thebreakthrough.org/issues/energy/nuclear-has-one-of-the-smallest-footprints>

For a
produ



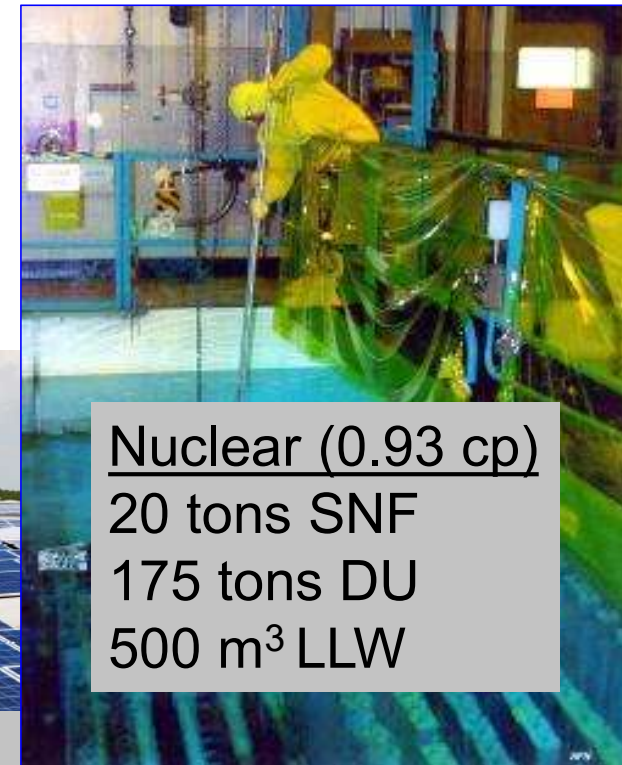
Wind (0.32 cp)
36,000 tons used turbine blades
(assuming other components recycled)



Coal (0.57 cp)
62,500 tons SO₂
1050 tons fly ash



Solar (0.23 cp)
10,700 tons used panels
(leach Cd)



Nuclear (0.93 cp)
20 tons SNF
175 tons DU
500 m³ LLW

https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b

<https://www.energy.gov/maps/map-projected-growth-wind-industry-now-until-2050>

https://sunwatts.com/325-watt-tesla-mono-solar-panel/?gclid=EAlaIqobChMIg6ii8OK56glVtRx9Ch1rQgpDEAYASABEglwvpD_BwE

Are you convinced nuclear is clean?

- Scientists and engineers are convinced by statistics
- The average person is not
 - A scientist or engineer
 - Convinced by statistics
- Tell stories, not statistics, but first **listen** to concerns
 - Stories humanize what you say and help to build trust
 - People must know you care, before they will care what you know

Good example of talking about technical stuff to non-technical audiences



Dr. Anthony Fauci

- USA National Institute of Allergy and Infectious Disease
- <https://www.youtube.com/watch?v=2ItJK8f6LSI>
- Note how he humanizes, and relates to
 - Weather change and associated change in habits
 - Fatigue in taking precautions
 - Sharing holiday celebrations with family
- Also note he doesn't use "big words"

ANS webinar 9 December: Neal Cohen, Nuclear Energy Institute




- It's not what you say, it's what they hear
- Polling results and implications for communications, at least with policy makers
 - Associate wind and solar with carbon-free future
 - Messages that focus on positive connections between nuclear and renewables outperform negative messages
 - Nuclear is stronger as a complement to wind and solar than as a standalone energy source
 - Amplify nuclear's benefits, focusing on its role as a carbon-free energy source
 - Role in helping to create a carbon-free future by serving as the largest 24/7/365 carbon-free energy source
 - Opportunity for innovation

Focus on the benefits

- Clean
- Reliable
- Consider how other “emitters” represent themselves
 - <https://www.youtube.com/watch?v=7FZwCBzd0gQ>
- Here is how we can represent ourselves
 - https://www.youtube.com/watch?v=OEPpljaLIsM&feature=emb_logo

What else can you and I do?

- Make me Ruler of the Universe! 😊
- Help get nuclear in every classroom!
 - **Empower Teachers:** Introduce the Navigating Nuclear curriculum

 **ANS** Center for Nuclear Science
and Technology Information

Introducing

NAVIGATING™ 
NUCLEAR

Energizing Our World



Goals

- **Clarify common misconceptions** surrounding nuclear science and explore its current and future role in technological applications
- **Build understanding** of and create value for nuclear science and technology
- **Inspire future careers** in the nuclear field – and the pursuit of higher education to achieve this goal

Navigating Nuclear Website (navigatingnuclear.com)

- Navigating Nuclear curricular materials for free
 - Virtual field trips
 - Digital lessons
 - STEM project starters
 - Career profiles
 - Next generation science standards
- For students, educators, parents, and the public
- Elementary, middle, and high school resources



Middle School Resources

Guide your students through the world of nuclear energy with digital lesson plans, project starters, career resources, and more to power up the learning in your classroom!

Spark a reaction in your classroom with nuclear science! Start small by exploring an atom as the foundation for nuclear energy. Then, go big and learn how a star releases energy in the form of a nuclear explosion! **Navigating Nuclear** provides educators with standards-aligned resources to connect students to the many fact-based applications of nuclear energy. Students will use nuclear science principles to explore medicine, geology, energy, astronomy, and more!

Resources: [Digital Lesson Plans](#) [STEM Project Starters](#) [Career Profiles](#)



Did You Know?

Nuclear technology keeps you safe and healthy!

Runway lights in the Alaskan outback, heart pacemakers, smoke detectors, criminal investigation, coating non-stick frying pans, luggage and security screening – all use radiation to make our lives easier and more productive.

[Learn more about the program](#) →

About the Partnership
The American Nuclear Society and Discovery Education have partnered to provide the gold standard in nuclear energy education with *Navigating Nuclear: Energizing Our World*.
[Learn more about the program](#)



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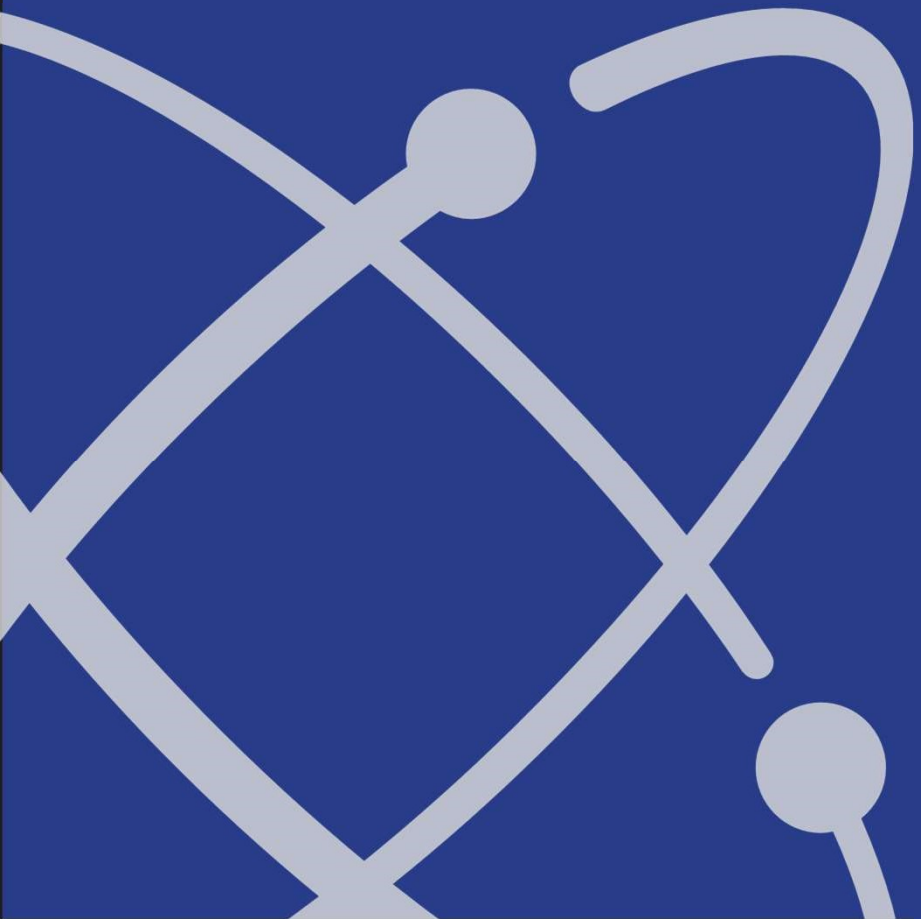
Opportunity!!!

A stylized graphic of an atomic symbol, consisting of two intersecting elliptical orbits and two circular nuclei, rendered in a light blue color against the dark blue background.

Arigatou
Gozaimasu

American Nuclear Society

ans.org



NuclearConnect.org