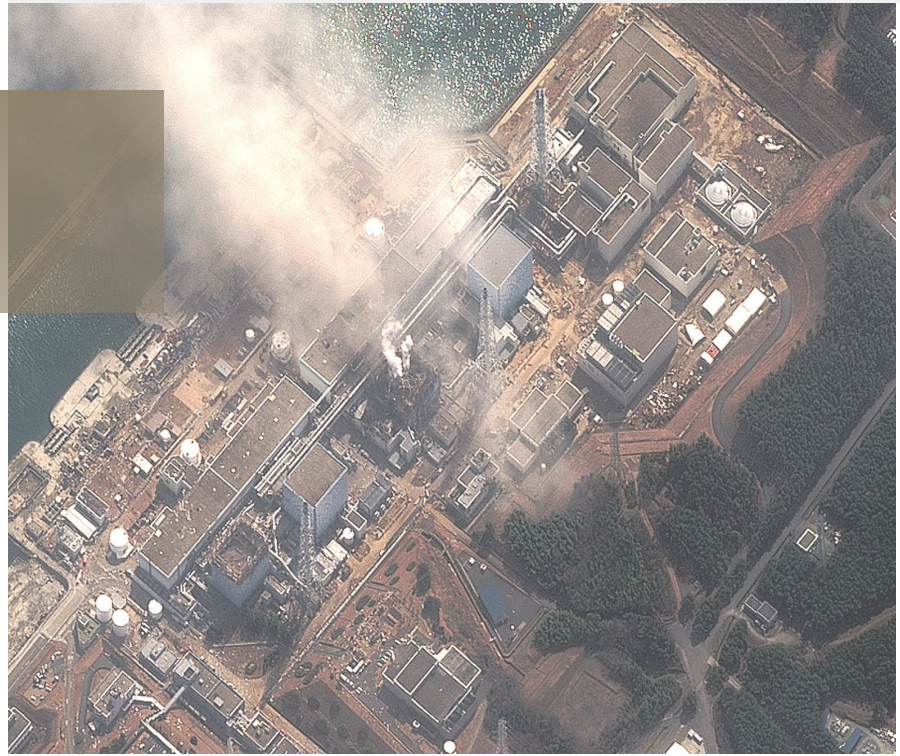
NUCLEAR's POTENTIAL AS TRANSITORY ENERGY SOURCE

ENST 250

Lizzy Gaviria, Ji Won Kim & Christine Zhao

When poll is active, respond at **PollEv.com/christinezha138**

Text **CHRISTINEZHA138** to **22333** once to join



AUDIENCE POLL

How many people died in the aftermath of the Three Mile Island, NJ nuclear meltdown?

How many people died in the Three Mile Island, NJ nuclear meltdown in 1979?


NO TO NUCLEAR POWER
YES TO RENEWABLES GAS
GREENPEACE
Serving Mother Russia since 1971
the Earth
ENVIRONMENTAL DEFENSE FUND®


What technology and policy implementations are needed to make nuclear a viable energy source in the near future?

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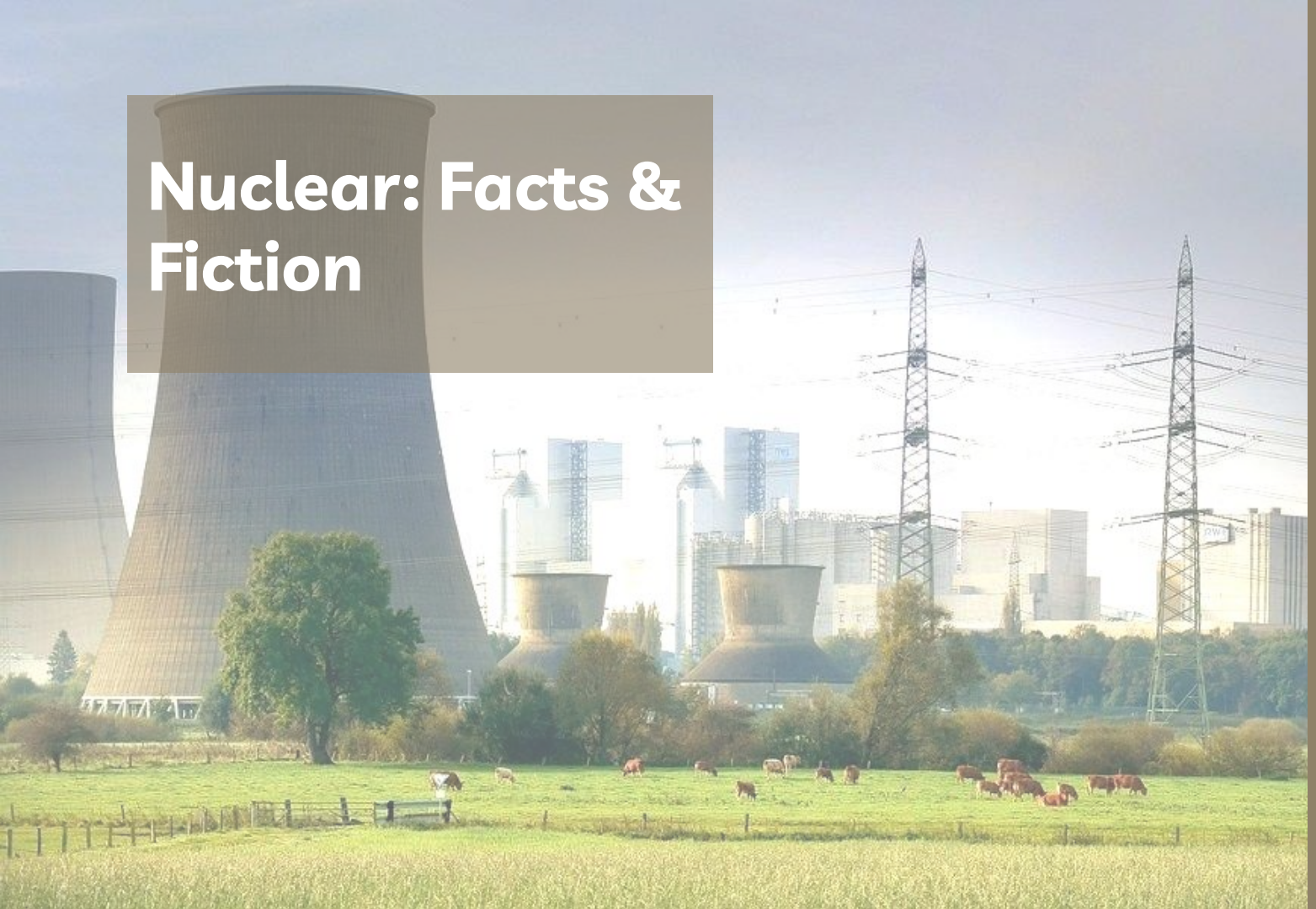
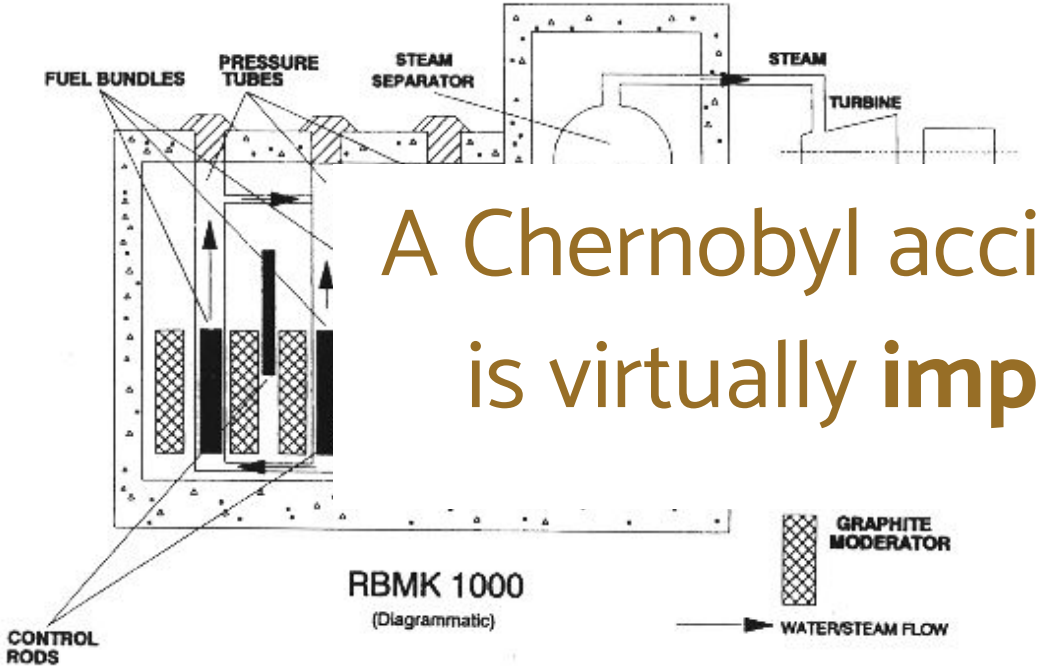


Nuclear: Facts & Fiction

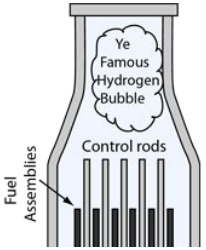
01



nobyl

A Chernobyl accident now is virtually **impossible**

Made into a M
melting thr



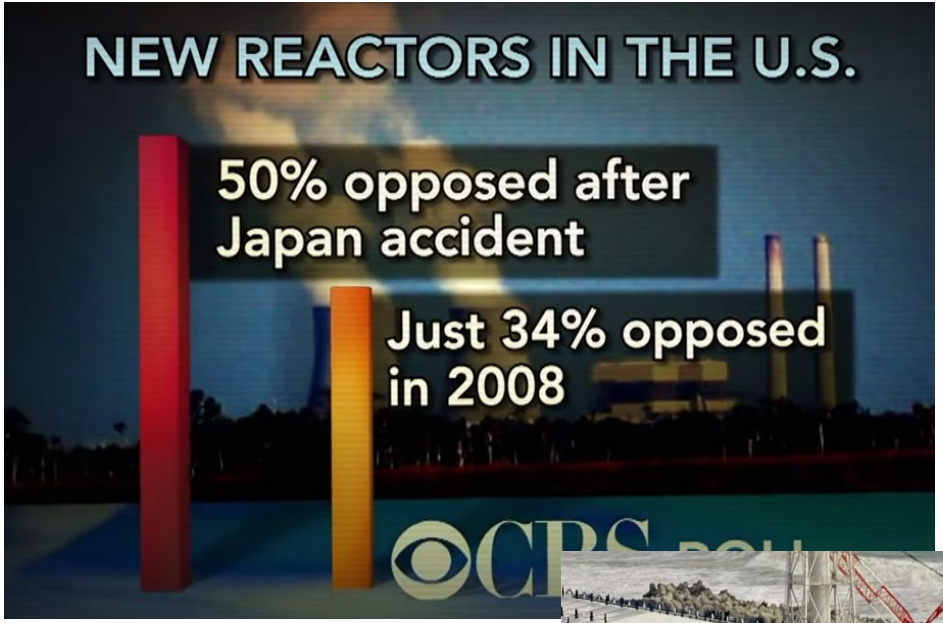
Nuclear Explosion!!
(was not possible)

General panic from disinformation & lack of consistent messaging caused unnecessary exodus

lile
ent
in US.
ortion?

actors
completed since Three
Mile

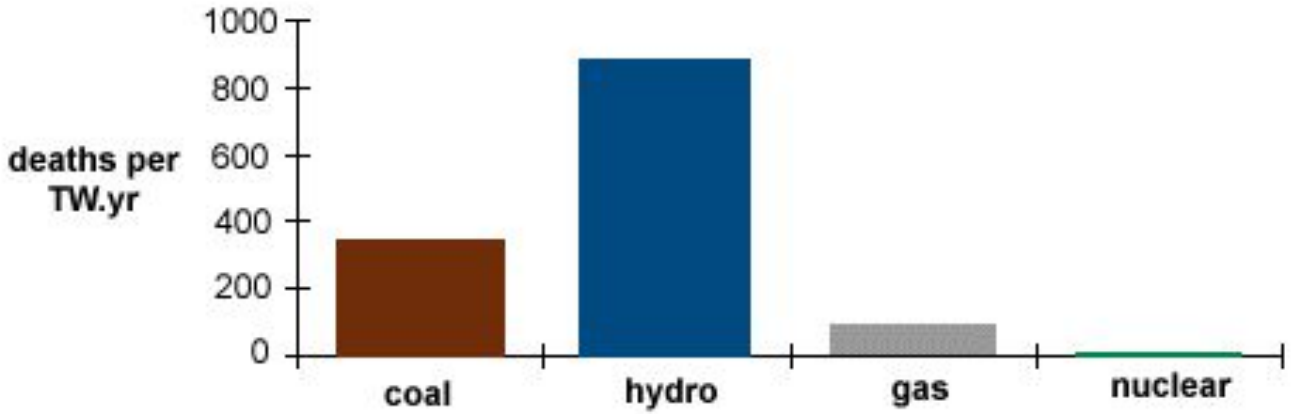
“I don’t know why we need to tell you each and every thing that we do”



Fukushima: Nail in the Coffin

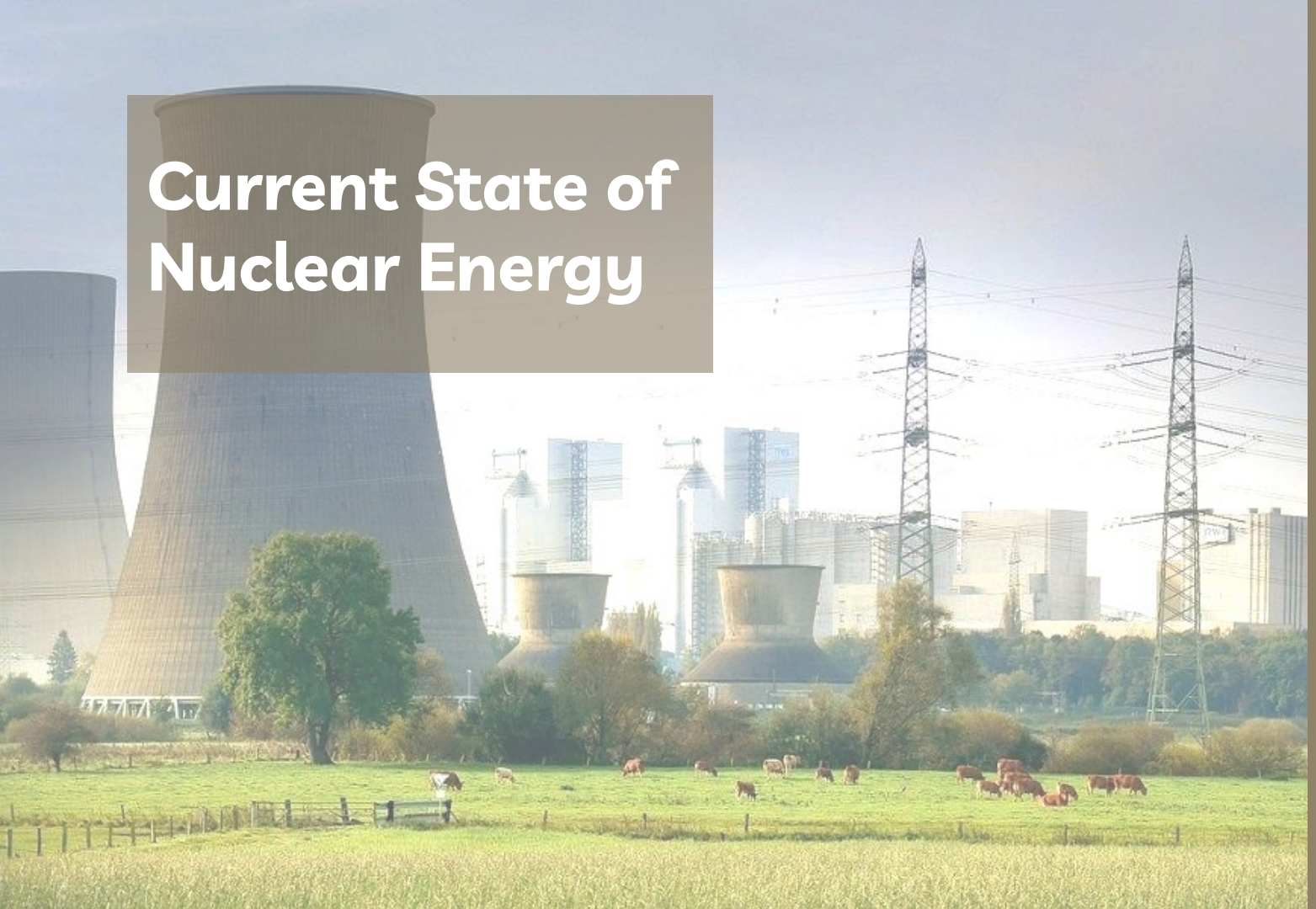
Lower Mortality

Deaths per TW/yr by Energy Sector



Source: Paul Scherrer Institut 1998, considering 1943 accidents with more than five fatalities.

Note: One TW.yr is the amount of electricity used by the world in about five months.

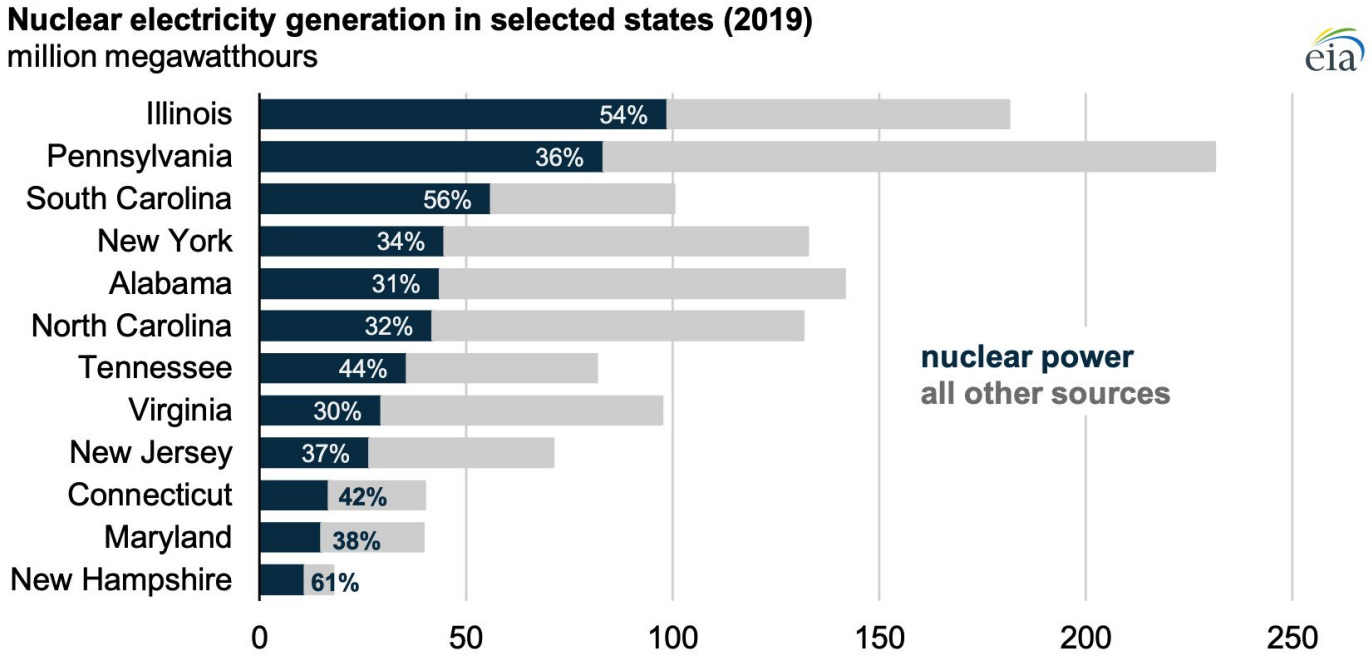


Current State of Nuclear Energy

02

Current State of Nuclear Energy Supply

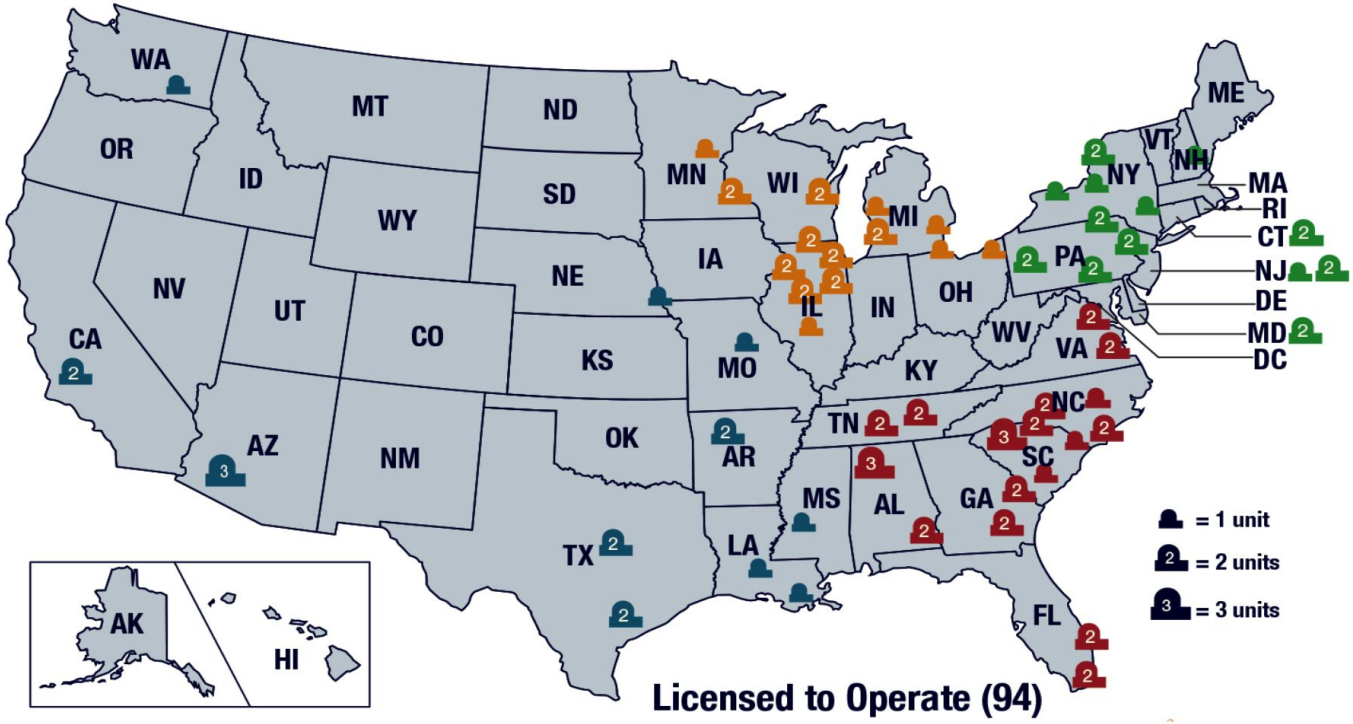
Nuclear supplies 20% of total energy consumed by the US since 1990. 12 states generated more than 30% of their electricity from nuclear power. (2019)



Source: U.S. Energy Information Administration

Current State of Nuclear Power Plants

Nuclear power plants are mainly concentrated in the Eastern parts of the US. There are 96 operating commercial nuclear reactors at 58 nuclear power plants in 29 states (2019).



Source: U.S. Nuclear Regulatory Commission (2018)

Closures of Nuclear Plants

As of 2019, 17 commercial nuclear power plants have been closed; often prematurely to be replaced by natural gas. Additional plants are expected to close in the near future.

Source: U.S. Energy Information Administration

Safety & New Reactor Designs

03

Strict Regulations

Shutdown Features

Extensive shutdown/ safety features to prevent large-scale accidents

Alerting Authorities

Mandatory 15-minute reporting of signals

Regulation

Institute of Nuclear Power Operations (INPO) established, 2.38 in 1985 -> 0.1 in 1997 significant events/reactor

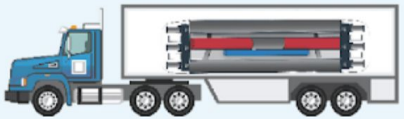
Training

National Academy for Nuclear Training, **simpler yes-no** procedure book

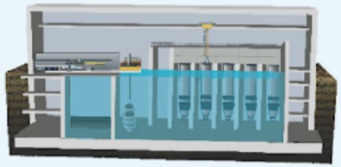
New Technology

The U.S. Dept. of Energy has provided substantial support to develop and diversify the range of advanced reactors that reduce manufacturing and capital costs.

Microreactors
Range: 1 MW to 20 MW
Can fit on a flatbed truck, and are mobile and deployable.

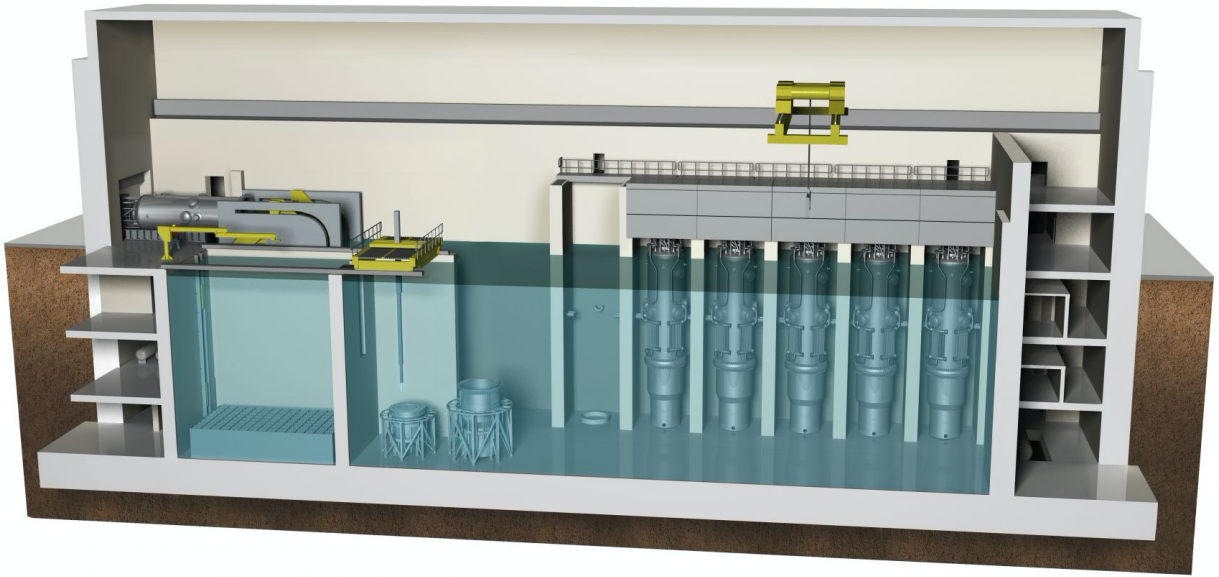


Small Modular Reactors
Range: 20 MW to 300 MW
Can be scaled up or down by adding more units.



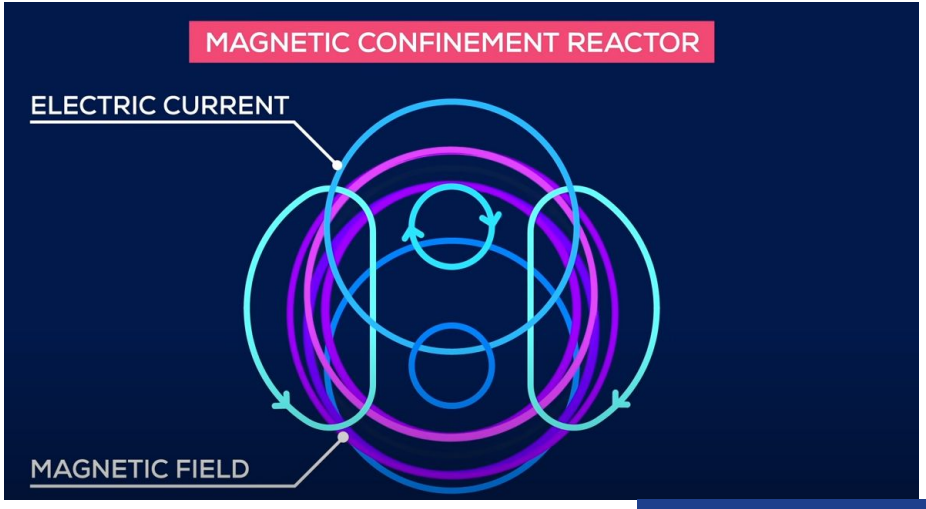
Full-Size Reactors Range:
300 MW to 1,000+MW
Can provide reliable, emissions-free baseload power.

New advanced reactor technologies are being built with features like walk-away safety, spent fuel reuse, and versatility of use in mind.



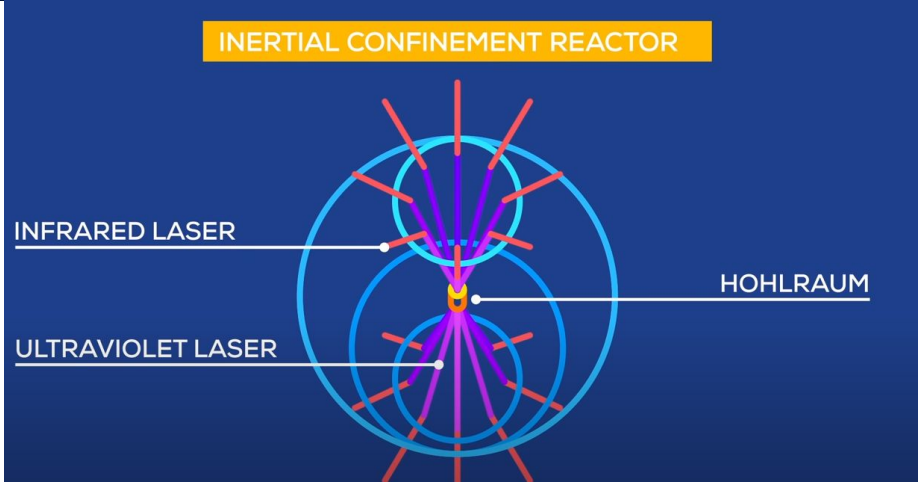
Concept drawing of an Advanced Small Modular Reactor (SMR)

Fusion Reactor



Incredibly safe
No emissions
4g of tritium at a time
Only requires water, moon dust

Con:
COST $$$

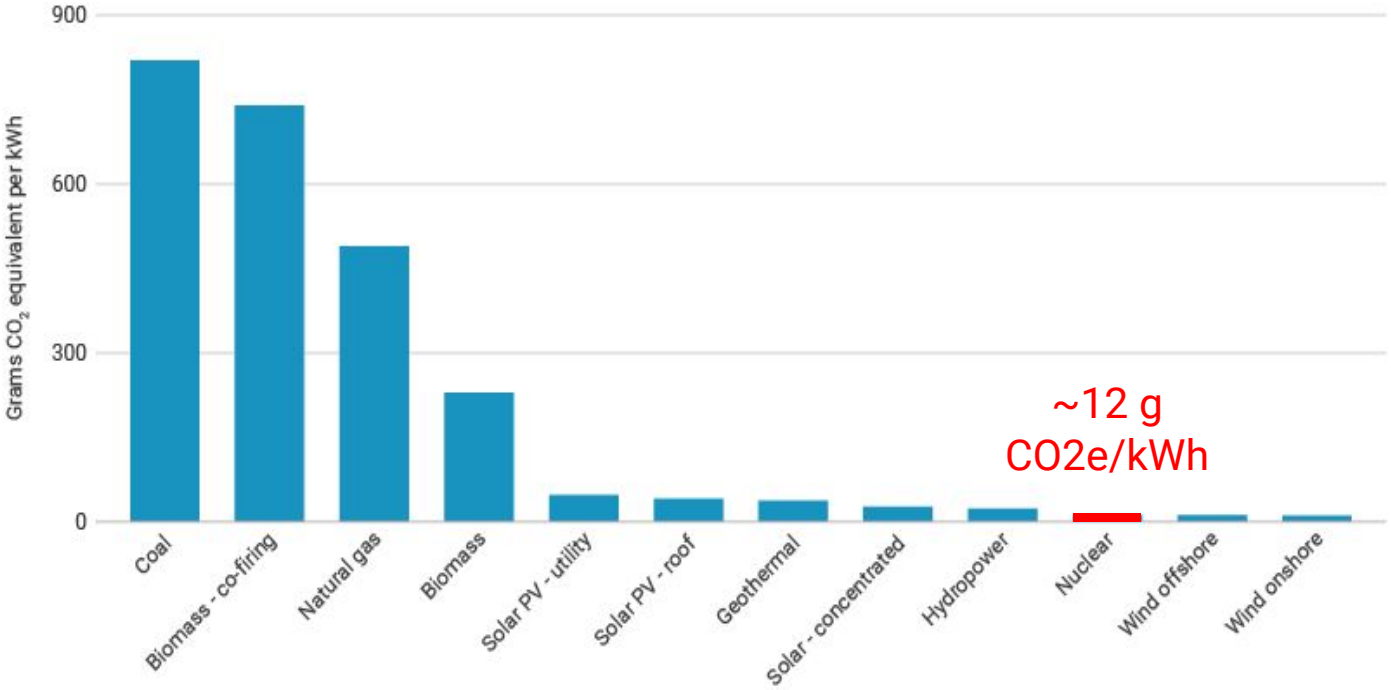


Environmental Impact

04

Low-Carbon Power Source

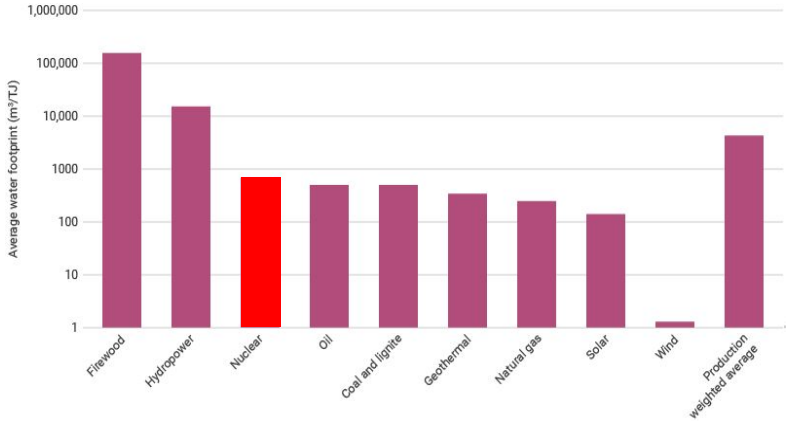
Nuclear power has one of the lowest average life-cycle CO_2 equivalent emissions compared to most other energy sources.



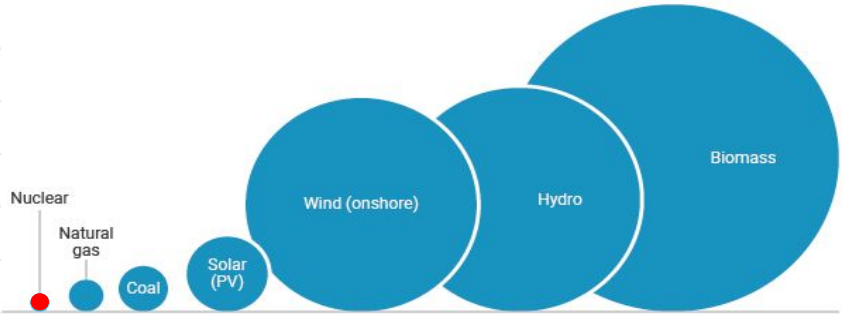
Average life-cycle CO_2 equivalent emissions (source: IPCC)

Water & Land Use

Nuclear power has the smallest relative land use footprint of all power sources, but plants consume significant quantities of water during operational cooling.



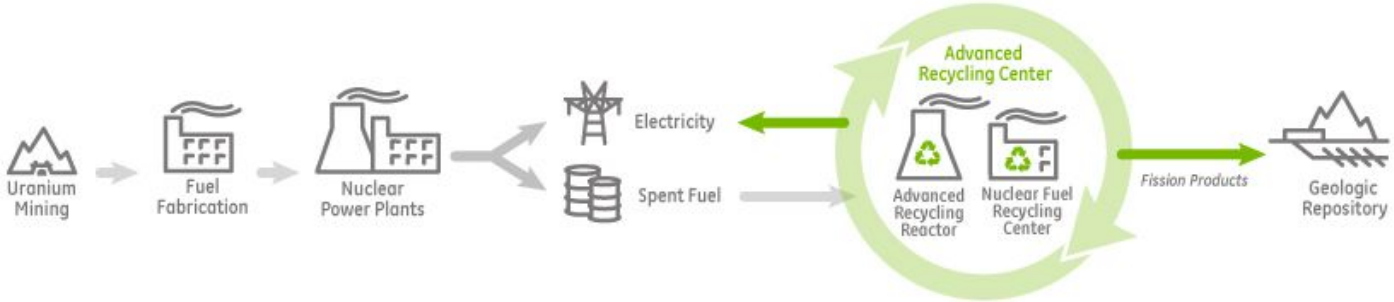
Water consumption per unit of electricity and heat produced 2008-2012 (source: Mekonnen et al., 2015)



Relative land use (fuel mining and generating footprint) of electricity generation options per unit of electricity (source: Brook & Bradshaw, 2015)

Mining & Radioactive Waste

There is no energy technology that is fully without risk to people or the environment. Uranium mining and spent fuel can pose health risks to humans and the environment if not properly managed.



“All of the used nuclear fuel produced by the U.S. nuclear energy industry over the last 60 years could fit on a football field at a depth of less than 10 yards.”

- Nuclear Energy Institute

Policy and Regulation

05

Change in policy and regulations

GOVERNMENT SUBSIDIES

Contracts-for-differences with performance-improvement requirements for specific operating facilities

CONSOLIDATE WASTE STORAGE

Deep geological repositories for nuclear waste like the WIPP in New Mexico

DESIGN AND CONSTRUCTION STANDARDIZATION

Standardization addresses the primary cause of cost overruns in previous projects.

GOVERNMENT LOANS

Loans with performance incentives should aid in the construction of new nuclear plants or uprates

Change in policy and regulations

GOVERNMENT SUBSIDIES

Contracts-for-differences with performance-improvement requirements for specific operating facilities

LONG-TERM WASTE STORAGE

Deep geological repositories for nuclear waste like the WIPP in New Mexico

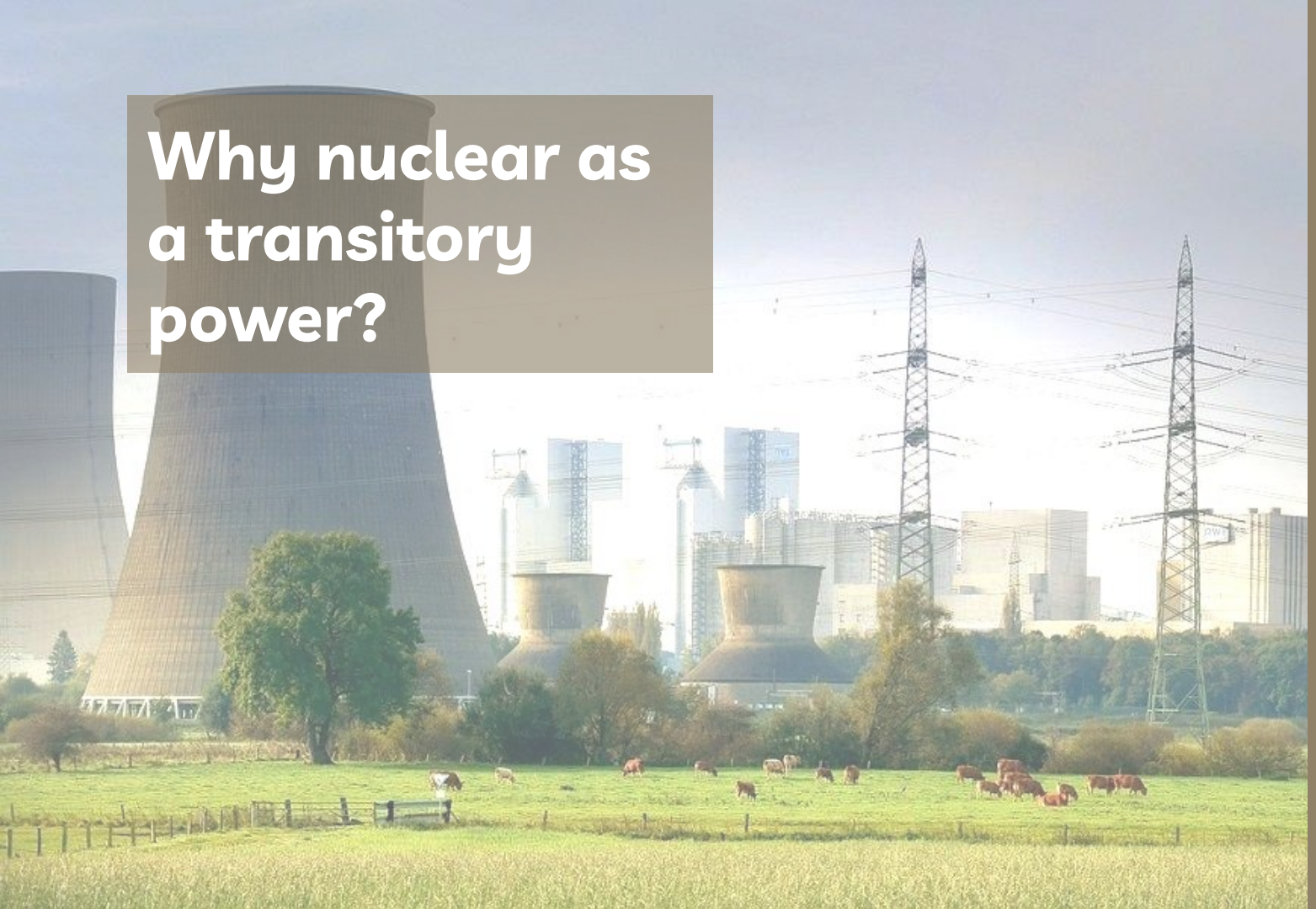
DESIGN AND CONSTRUCTION STANDARDIZATION

Standardization addresses the primary cause of cost overruns in previous projects.

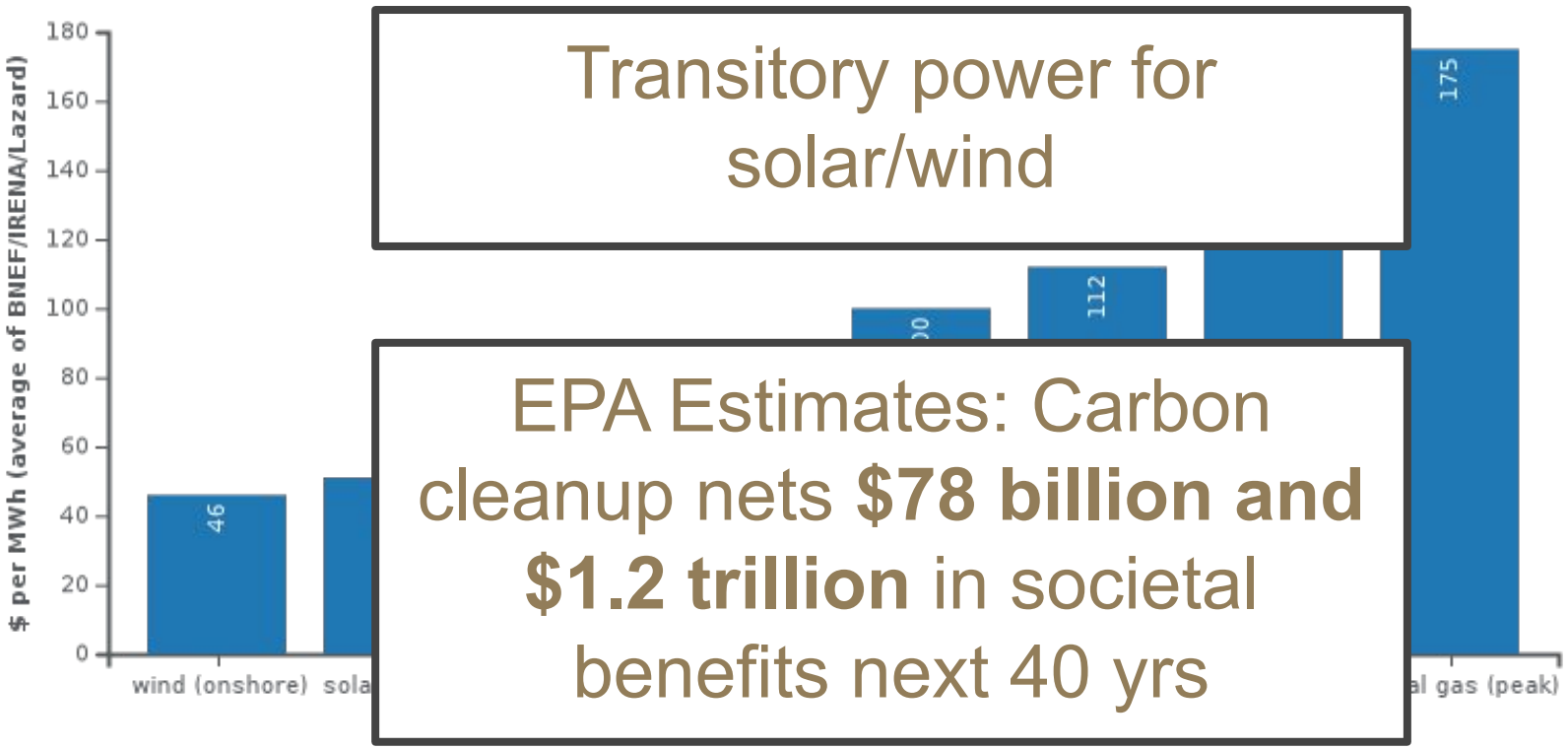
GOVERNMENT LOANS

Loans with performance incentives should aid in the construction of new nuclear plants or uprates

Why nuclear as a transitory power?



Supporting Nucelar



Transitory power for solar/wind

EPA Estimates: Carbon cleanup nets **$78 billion and $1.2 trillion** in societal benefits next 40 yrs

Effectively Communicating Nuclear

Trust & Local Communities

The government needs to disseminate nuclear disaster information but changing opinions needs to come from tight-knit associated groups.

Extensive Knowledge

Proponents must be very knowledgeable on the subject and ready to address numerous arguments

Positive Attitude

Really, it works. Speaking about nuclear using a positive tone impacted the way students viewed nuclear in middle / elementary schools in experiment

THANK YOU FOR LISTENING

Appendix

Who supports nuclear?

"The Intergovernmental Panel on Climate Change, the International Energy Agency, the UN Sustainable Solutions Network and the Global Commission on the Economy and Climate argue for a tripling of nuclear energy, requiring over 1,000 new reactors (10,000 SMRs) to stabilize global carbon emissions."

Does the Green New Deal include nuclear energy?

In 2019, the GND called for the phasing out all nuclear plants and not building any new ones; however, it now defines future energy sources as clean, renewable, and zero-emission, including nuclear.

Would you recommend subsidizing unprofitable, existing nuclear plants?

These subsidies could distort markets and reduce the incentive to innovate; however, subsidizing these plants might be favorable in the short run if it is less costly than replacing plants with renewable energies or constructing a new nuclear plant facility. It is definitely a case-by-case based decision.

Appendix

Figure 1. Nuclear Waste Storage Sites in the United States