

# A Bright New Nuclear Future: and how ANS is helping it happen

**Steven A. Arndt, PhD, PE**  
**President**

**American Nuclear Society**



# Agenda

- American Nuclear Society (ANS)
- Nuclear future
- New technology
- Old challenges / problems
- How can we make it happen

## ANS Vision

*Nuclear technology is embraced for its vital contributions to improving peoples' lives and preserving our planet.*

## ANS Mission

*Advance, foster, and spur the development and application of nuclear science, engineering, and technology to benefit society.*

# New ANS in 2022

- Change plan substantially implemented
- Active Professional Divisions Committee / solving problems
- Local Section Committee
- Net improvement to ANS financial position, despite pandemic
- 2021 budget year ended with a net budget surplus
- Advocacy

# Providing opportunities for publication

- Meetings transactions
- Meetings proceedings
- Technical journals
  - Nuclear Science and Engineering
  - Nuclear Technology
  - Fusion Science and Technology

# Providing webinars on relevant topics

- Web programming up 500% by volume
- Uranium chemistry basics
- ANS K-12 education tool kit
- Resume/CV workshop
- National Laboratory Series
- Nuclear Economics: Future of Nuclear
- Microreactors in the Near Horizon: Innovate Solutions for Clean Energy Systems
- Weekly webinars

# Keeping members informed

- Free access to all journals
- Updated Nuclear News (refresh in July 2022)
- ANS Nuclear Smartbrief
  - Daily email with nuclear news  
([www2.smartbrief.com](http://www2.smartbrief.com))
- ANS Newswire (on ANS website)

# Representing members to non-nuclear communities



- Research and Development Task Force
  - To provide elected officials/government with long term view of research funding needs
- Engagement with new Congress and Presidential administration in 2021
- Crisis Communications/Rapid Response capability
- Nuclear in Every Classroom campaign



# Rapid Response Taskforce

Shaping the narrative; combatting misinformation.

- Prepared for a wide spectrum of nuclear or radiation-related events or emergencies
- 30+ independent technical professionals in diverse nuclear fields
- Online media help center for journalists



THE WALL STREET JOURNAL  
**WSJ**



The  
New York  
Times



## Ukraine efforts



ANS and HPS are collaborating to combat misinformation on radiation and nuclear safety.



*“As before, the most difficult situation is now at the Zaporizhzhya NPP and we are now spending all our efforts on delivering humanitarian supplies there - medicines, as well as on the last delivery of goods for children - baby food and hygiene products*

*We also continue to send medicines and protective equipment to other nuclear power plants.”*

– May 5, Ukrainian Nuclear Society email

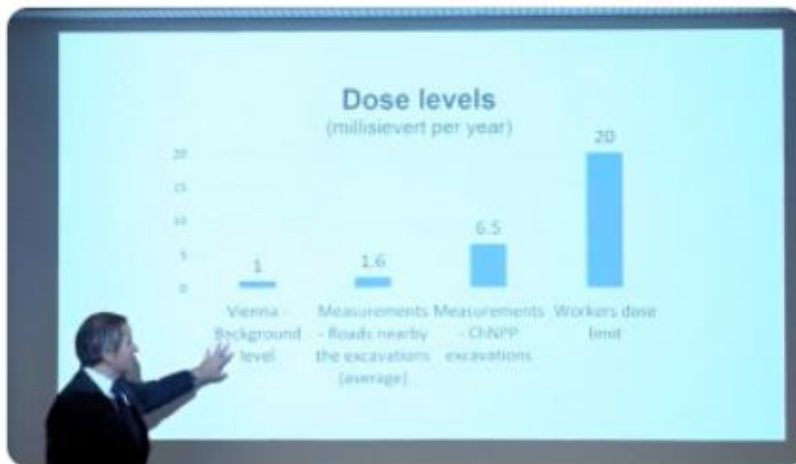
## Ukraine efforts



American Nuclear Society  
@ANS\_org

@iaeaorg Dir. Gen. @rafaelmgrossi says radiation levels higher at Chernobyl trenches dug by  troops but "increase is still significantly below the authorized levels for workers in an environment with this type of radiation" and does not pose great danger.

[youtu.be/DjvLAr5JKOk](https://youtu.be/DjvLAr5JKOk)



9:09 AM · Apr 28, 2022 · Twitter for iPhone

View Tweet analytics


11 Retweets 5 Quote Tweets 24 Likes

Українське Ядерне Товариство  
April 29 at 11:33 AM

- During the INUDECO open online marathon "Challenges of Ukraine's nuclear energy in military time" in a video address to Ukrainian colleagues expressed sincere support to Ukraine and Ukrainian atomic the President of the American Nuclear Society Steve Nesbit t.
- American colleagues strongly condemn the actions of the Russian Federation on the territory of Ukraine, as well as military attacks on Ukrainian nuclear objects. "Russian behavior has no place in the modern civilized world and such actions must be stopped immediately," Mr. Nesbit said.
- Pan Nesbit noted the professionalism of Ukrainian atomnikers who worked at the CAEC and in the exclusion zone during the occupation, expressed words of support for Zaporizhzhya atomnics who work in such difficult conditions so far, and sympathy for the death of people in the Uk to the district.
- Steve Nesbit noted that Ukrainian nuclear power plants for a decade have been operating reliably and safely, and steadily providing Ukraine with a large amount of available electricity. Powerful cooperation with American companies, aimed at building the nuclear industry in Ukraine, improving its security. While these efforts are currently suspended, American colleagues are not leaving plans to resume interaction as soon as possible and assure Ukraine of further active support.
- "American and European nuclear power plants hope for the end of the war in Ukraine as soon as possible and believe that, despite everything, nuclear energy will remain a transparent field of the Ukrainian economy and the basis of the state's energy system," said the Prez id of the American Nuclear Society.

American Nuclear Society  
ВП ГО «УкрЯТ» в Рівненській області  
ВП ГО Українське ядерне товариство у місті Южноукраїнськ  
ВП ГО «УкрЯТ» в м. Непішин  
VP GO "Ukryat" in Vinnytsia region

See original · Rate this translation



0:07 / 6:50

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# K-12 STEM Academy ANS

## Our vision

Nuclear science & technology is taught in every classroom in the nation – with a focus on students from under-served communities.

## Our programs



Educator  
Training &  
Hotline

+



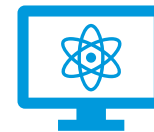
Nuclear  
STEM  
Toolkits

+



Nuclear  
Ambassadors in  
the Classroom

+



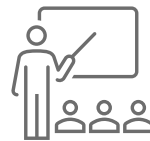
Navigating  
Nuclear™

+



Pathways to  
Nuclear

## By-the-numbers



Engaged over **5,000** teachers  
served

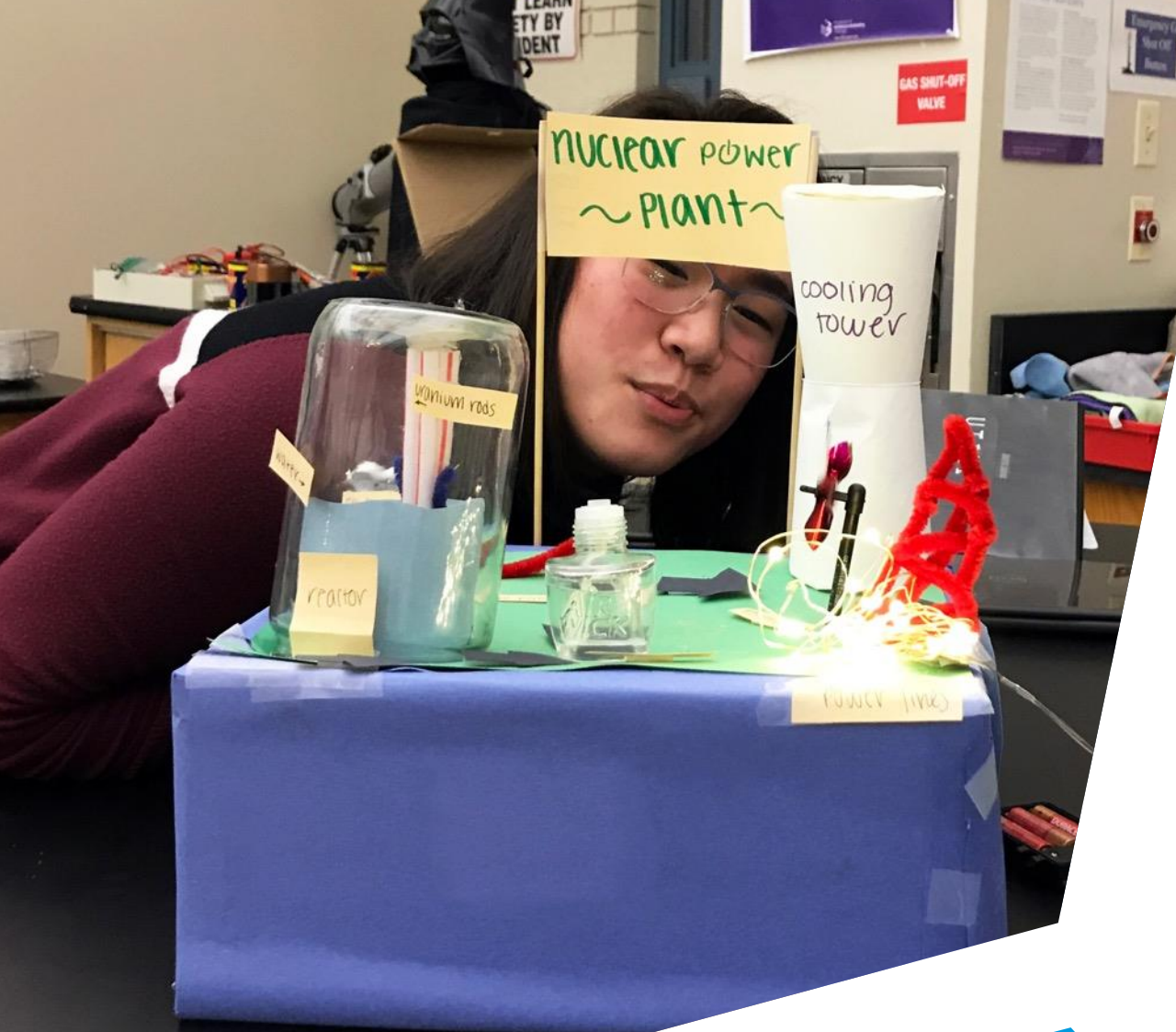


Navigating Nuclear reaches **1.6**  
**million** students & counting



Over **\$2 million** invested  
in K-12

The American Nuclear Society is a 501(c)3 not-for-profit. Program support is tax-deductible as allowed by law.



# NAVIGATING™ NUCLEAR

Energizing Our World



**The latest standard in  
primary and secondary  
nuclear S&T education**

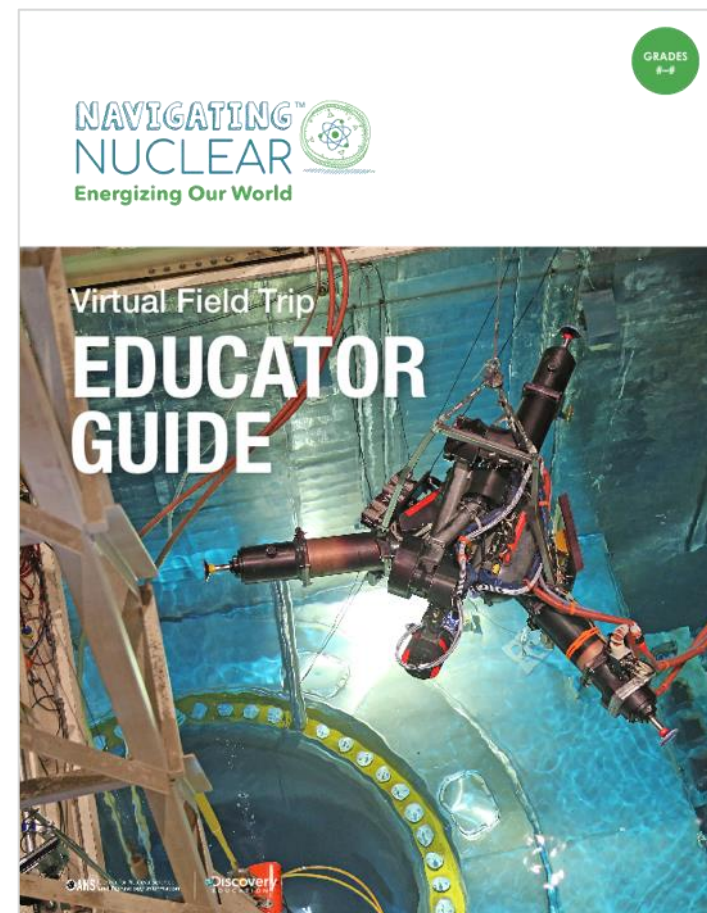


U.S. DEPARTMENT OF  
**ENERGY**

Office of  
NUCLEAR ENERGY

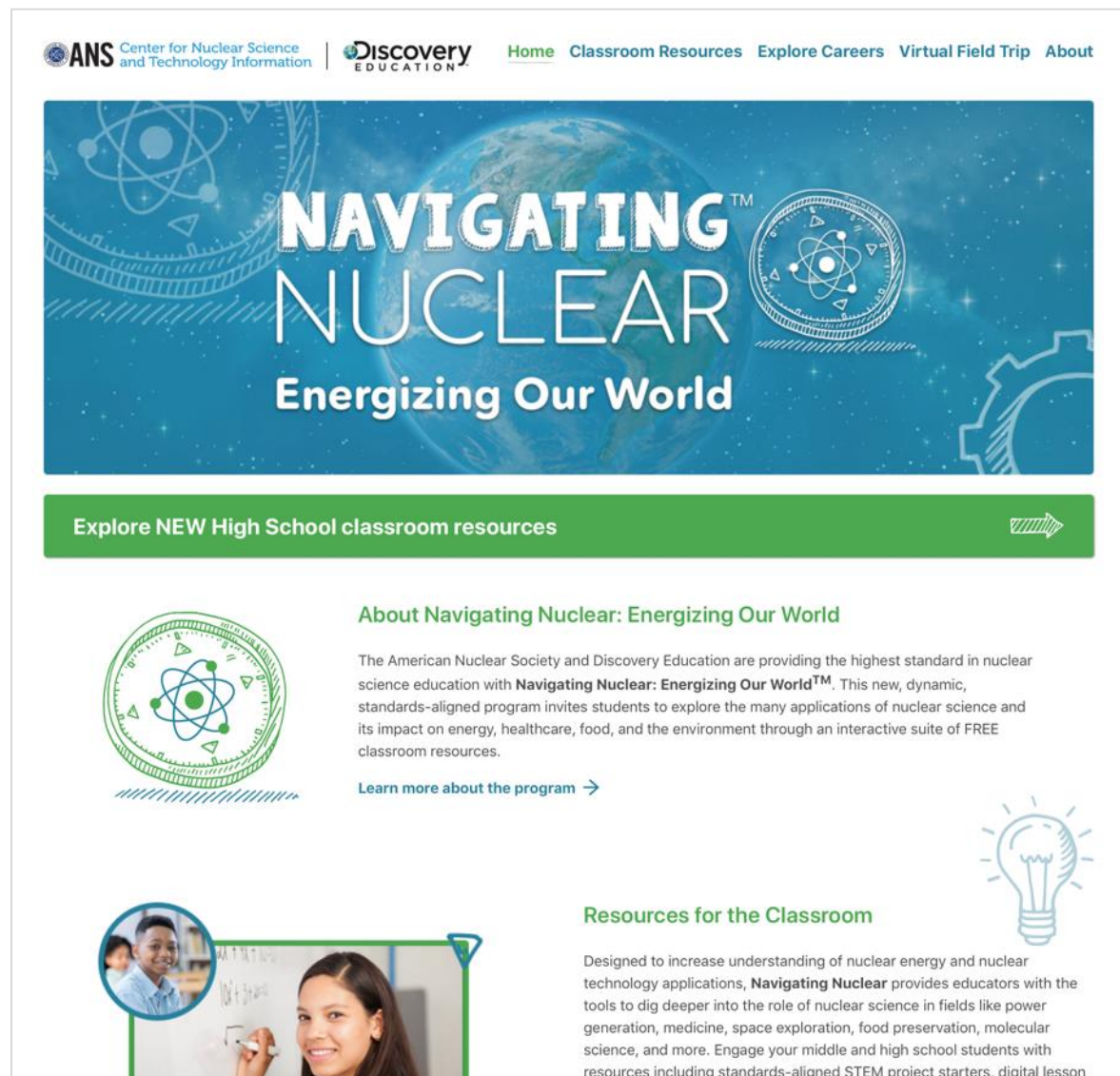
# What is Navigating Nuclear: Energizing Our World

- Primary and secondary (K-12) nuclear energy and science curriculum
- Fact-based
- Lessons, STEM projects, careers
- Virtual Field Trips
- Free, globally available
- [navigatingnuclear.com](http://navigatingnuclear.com)



# Keys to success

- Society commitment
- The right leadership
- The right partners
  - Discovery
  - Department of Energy Office of Nuclear Energy



The screenshot shows the homepage for "Navigating Nuclear: Energizing Our World". At the top, there are logos for ANS (American Nuclear Society) and Discovery Education, along with navigation links: Home, Classroom Resources, Explore Careers, Virtual Field Trip, and About. The main banner features a blue background with a globe, atomic symbols, and the text "NAVIGATING NUCLEAR Energizing Our World". Below the banner is a green button that says "Explore NEW High School classroom resources" with a right-pointing arrow. The page is divided into two main sections. The first section is titled "About Navigating Nuclear: Energizing Our World" and includes a paragraph about the program's goals and a "Learn more about the program" link with a right-pointing arrow. The second section is titled "Resources for the Classroom" and includes a paragraph about the program's resources and a lightbulb icon. At the bottom left, there is a circular inset image of two students in a classroom setting.

# Career Profiles

Feature professionals in the nuclear field and the impacts they have on the world around us

- **Nuclear Researcher**
- **Mechanical Engineer**
- **Radiochemist**
- **Others**



**CAREER PROFILE**

**JOEL DISBRO**  
Lead Racquet Technician / Tour Equipment,  
Wilson Sporting Goods

**Summary**  
You can't play tennis without a racket, and that's where Joel Disbro has focused his career for the past ten years. As a Master Racquet Technician, Joel helps professional tennis players get the most out of their game. He does this by matching athletes with the best racket for their type of play and their particular match. He focuses on every detail from string material, to tension, to make certain their racket is customized and just right.

**How did you choose this career path?**  
Going back to high school, I'd long been interested in the equipment. I tried developing new products, customizing rackets, even grip-wrapping a racket to exactly how I wanted it. That's how I started—I was always a very picky player with my racket! That interest morphed into wanting to improve equipment for other people. I went into professional tennis management at Ferris University. There I got certified on the equipment side. At college, I started teaching tennis. I also managed a pro shop in the DC area. The course director at the time heard about the job here at Wilson, and he recommended me for the interview, and it went from there. I've been at Wilson since 2007.

**What science courses have you taken that most relate to the work you're doing?**  
I took racket technician and USPTA pro courses. I learned about equipment testing with those. There were also the professional tennis management courses as well as what I have learned on my own. I learned a lot once I was on the job. We have a staff that does the design and engineering. I am more of a play tester, providing feedback.

**What exactly does a Lead Racquet Technician do?**  
In Chicago, I work in the Wilson lab. In the pro lab, we take care of our top 150 players that we sponsor. I customize their rackets, the handles, and do pretty much anything you can to a racket. Some players' rackets are relatively easy to customize. For other players, I take anywhere from a day to a few days to do six to ten rackets. When I am not in Chicago, I work with stringing on tour. Wilson is the official stringer of the US Open and the Miami Open tournaments. I travel to those two tournaments every year. This year I was on my tenth US Open to do the stringing. I also do testing for product development. That ranges from coming up with ideas to testing new products on the court. We customize to a lot of parameters, so a racket won't leave my room without being right on. A typical day is checking emails and talking with our tour team, stationed around the world. They take care of players' requests. I meet requests for new rackets, or for test rackets if the player wants to try something different. When we're close to the US Open and Miami tournaments a lot of my day is spent preparing. I make sure we're staffed and have all we need to run those tournaments.

**What's the best part of the job?**  
I don't like to call myself an expert, but I think I'm pretty good at what I do. I like to help players become better and to be more confident in their equipment when they

**Tell me about the connection between the structure and function of the racquet, and what are the benefits of the different types of strings used in racquets?**  
These players have usually been playing with

1 cont. on page 2

**CAREER PROFILE**  
**JOEL DISBRO**



# The results?

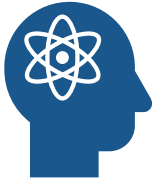
- Upper primary (middle school) curriculum launched in 2018
  - More than 500,000 students in 2018-2019 academic year
- Lower primary (elementary) and secondary (high school) materials now available
- More than 1.5 million students to date
- Virtual field trips most popular
  - More than 50,000 views
  - Viewings rose 3000% from 2019 to 2020
  - Idaho National Lab video 2<sup>nd</sup> most popular of ALL Discovery Education videos
- Top referring domain is Google classroom
  - Teachers are embedding materials in lessons



## Navigating Nuclear (Phase 2)

- ✓ Add earth sciences modules to Navigating Nuclear curriculum examining **nuclear energy's role in a decarbonized future**
- ✓ Offering new **student activities & Experience Studio Boards**
- ✓ Continued Discovery Education **Navigating Nuclear promotion** targeting DE subscriber & educator networks
- ✓ Enhanced focus on marketing in the “non-DE” educational ecosystem





## Nuclear Ambassadors in the Classroom

- ✓ Nuclear professionals in the classroom leading engaging lessons about nuclear S&T and answering student questions.
- ✓ Prioritizing schools serving **students** demographically **under-represented in STEM fields**
- ✓ National expansion, focusing on communities where **nuclear is part of the public discussion**



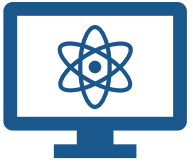
**Natalie Zaczek McIntosh, P.E.**  
Nuclear Fuels Engineer, Exelon Nuclear  
*Featured on a Navigating Nuclear  
Career Profile*



## Nuclear STEM Toolkits

- ✓ **Ready-made “Push-packs”** providing educators and ambassadors with the tools needed to conduct high quality nuclear science & technology lessons and demonstrations.
- ✓ Integrates with **Navigating Nuclear** content





## ANS Training Academy

- ✓ Empowering educators to teach nuclear with confidence
- ✓ Offers a series of **virtual workshops** delivered on our webinar platform to **ANS/DOE-NE educator networks** & others
- ✓ Provides ongoing assistance to teachers and ambassadors through the ANS “**Ask Anything**” support center.
- ✓ Explores **certification opportunities** to validate participation & mastery of the subject





## Pathways to Nuclear: Inspiring a new generation of nuclear professionals

- ✓ Identify “nuclear-interested” students in 6<sup>th</sup>-12<sup>th</sup> grade classrooms
- ✓ Match motivated teens to **nuclear mentors**
- ✓ Explore **extracurricular educational opportunities** with the National Museum of Nuclear Science & History
- ✓ Promote **higher education opportunities in nuclear fields** at local community colleges, trade schools & universities



# Looking ahead...

- Certification Program Business case
- Change Plan → Strategic Vision
- Page Charges
- ANS Code of Ethics

# Nuclear Future



## Small Modular Reactors

- The IAEA defines SMR as
  - Small: under 300 MWe
  - Modular: Built and assembled at a factory, then transported to final location

## Advanced Reactors

- Nuclear Energy Innovation Capabilities Act defines as “nuclear fission reactor with significant improvements over the most recent generation of nuclear fission reactors or a reactor using nuclear fusion”

## High Temperature Reactors

- Core outlet temperatures greater than 700°C

## Micro Reactors

- < 20 MWe



# Nuclear Future



Advanced reactors; Moving towards commercialization and operation

U.S and several other countries are pushing forward with programs to develop, demonstrate, deploy, and commercialize advanced reactors

- Advanced Reactor Demonstration Program
- Risk Reduction Awards
- The Advanced Reactor Concepts Awards
- Project Pele
- Continuing modernization of its nuclear regulatory and licensing frameworks
- Addressing the supply of high-assay low-enriched uranium (HALEU) fuel

# Nuclear Future

## Advanced reactor demonstrations

- TerraPower/GE-Hitachi Sodium sodium fast reactor with a molten salt energy storage system
- X-energy Xe-100 HTGR, with matching investment from industry

## Risk reduction awards

- Kairos Power Hermes reduced-scale test reactor, a precursor of the company's commercial fluoride salt-cooled high temperature reactor
- Westinghouse eVinci, a heat pipe microreactor
- BWXT Advanced Nuclear Reactor, a transportable microreactor
- Holtec SMR-160, a LWR reactor
- Southern Company Services Inc. Molten Chloride Reactor Experiment, a precursor to TerraPower's Molten Chloride Fast Reactor

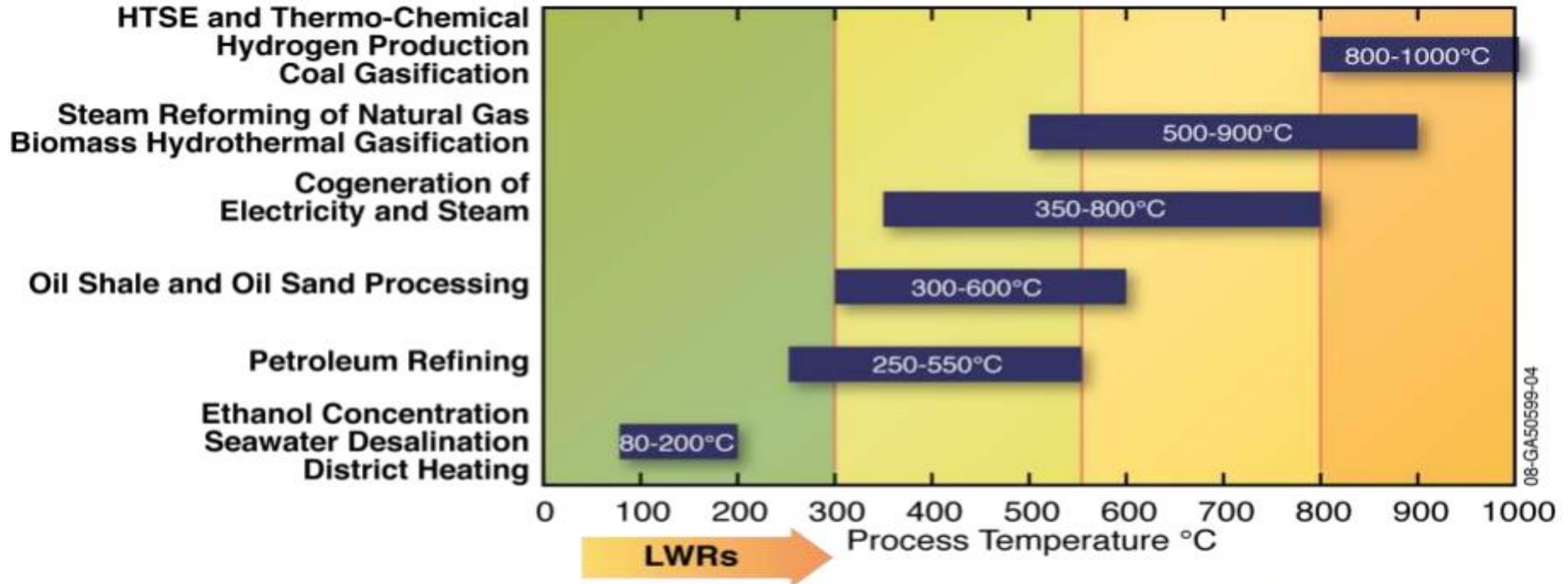
# Nuclear Future

## Advanced Reactor Types, Sizes, and Applications

Technologies	Sizes	Applications
LWRs	Microreactors (1-20 MWe)	Electricity Production
Molten salt reactors		Renewable Integration
High temperature gas reactors	Small modular reactors (20-300 MWe)	Process Heat
Liquid metal reactors		Hydrogen and Ammonia Production
		Off-grid applications
		Desalination
		District Heat

Source: Pillsbury Winthrop Shaw Pittman

# Application of New Technology



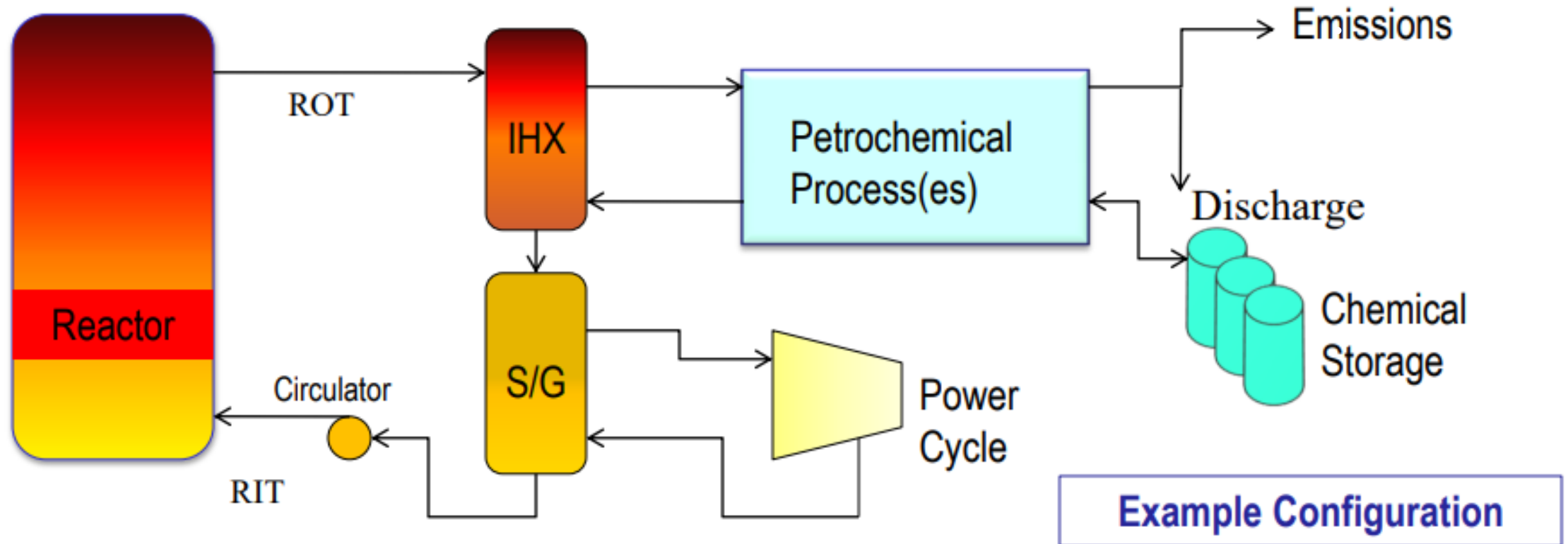
# Applications of New Technology



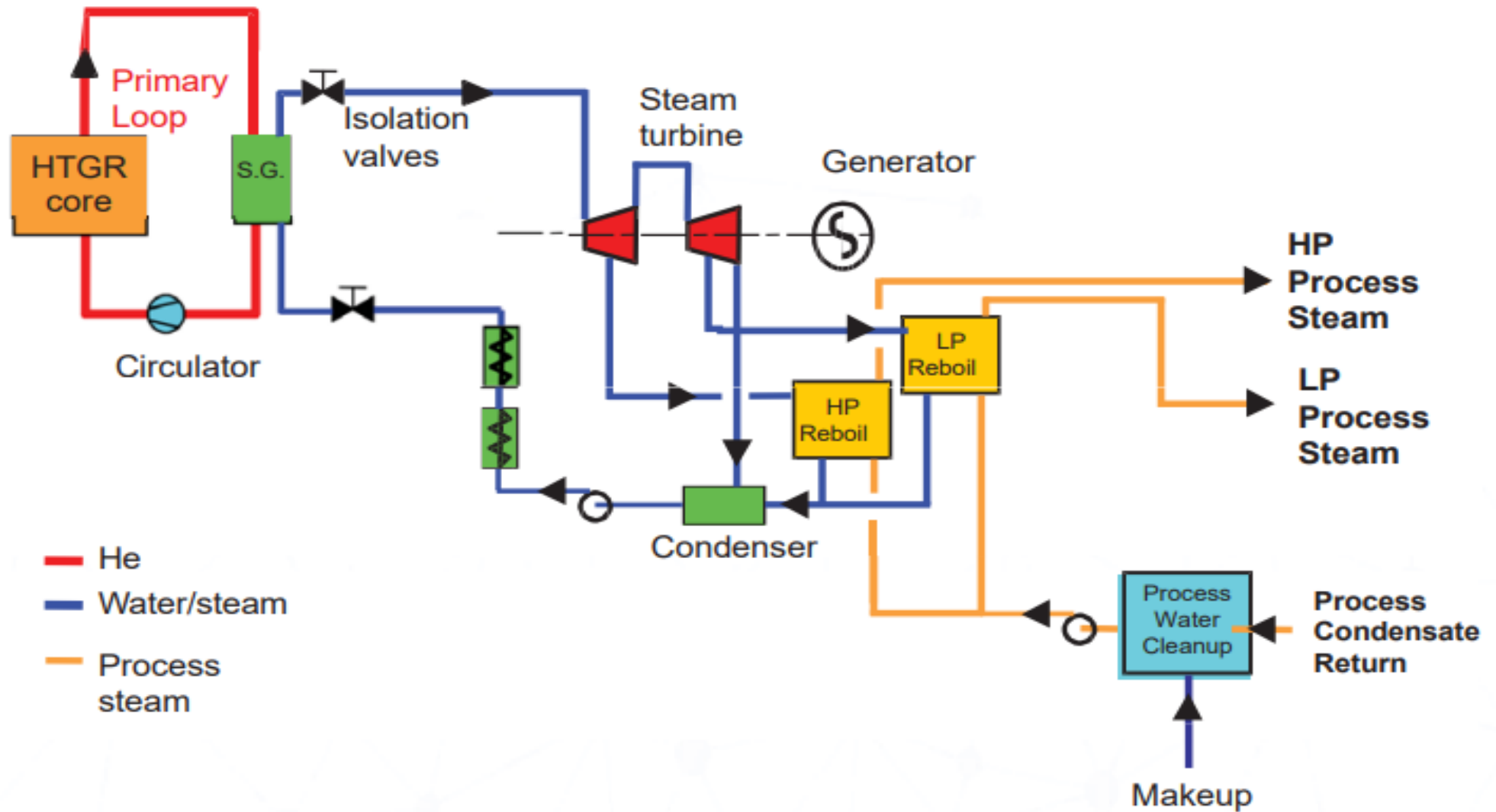
Nuclear power from small modular reactors should be a central part of the chemical industry's drive toward achieving carbon neutrality said Jim Fitterling, chairman and chief executive officer of Dow Inc. at the International Petrochemical Conference in March 2022

Dow is considering adding SMRs at two of its U.S. production sites. "Those would take each site to zero carbon emissions and serve as a baseload for energy needs," Fitterling said. "Coupled with natural gas as another baseload, it seems like a practical way to increase the country's carbon-free energy and provide the constant power needs for industries like ours."

# Nuclear Power Coupling Industrial Applications



# Nuclear Power Coupling Industrial Applications



# New Technology

## New Applications for Reactor Technology

- Desalination
- District Heating
- Hydrogen production
- Energy Storage
- Process heat
- Petro-chem processing

## Development and Construction

- Modular construction
- Digital twins

## Enhanced analytical tools



# Old Problems

- High capital cost
- Infrastructure
  - Lack of research facilities and supplier infrastructure
  - Long construction times and availability of labor
  - Challenges with quality assurance
- Proliferation concerns
- Very high security requirements
- Long time frames for licensing
- Spent nuclear fuel
  - Lack of progress
  - Consent-based siting

# How can we make it happen?

## Policy Level

- Science-based policy
  - What does the science really tell us?
    - Linear-no-threshold model
    - Regulations on top of regulation (MIT study)
    - What are the real security risks?
    - Spent fuel repository / interim storage (how best to frame the debate)
- Level playing field
  - Grid access
  - Life-cycle carbon emissions
  - Reduce the cost to be regulated
  - Safety Goal Policy Statement

# How can we make it happen?

## Regulatory

- Are we making our nuclear power plants “too safe to build”
  - Set the requirements based on the risk, **not perception of risk**
- If we want an outcome, make that the metric
  - Only accept applications that can really be reviewed in two years both because the information is there and the regulatory is ready
- Development of effective international licensing process
- Expect the regulator to be an expert (at all levels, from both perspectives)

## Industry

- Change the relationship with the regulator (and others)
- Develop more realistic development paradigms
- **Become un-ashamed advocates for the technology**

# Questions ?



**American Nuclear Society**

*ans.org*