



# GE HITACHI NUCLEAR ENERGY

Rafael Ledesma

GEH Europe Commercial Regional Executive Director

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# HITACHI

## Rafael Ledesma

Europe Commercial Regional Executive Director

GE Hitachi Nuclear Energy (GEH)

GE Vernova (GEV)

Rafael Ledesma currently is the Europe Commercial Regional Director for GE Hitachi Nuclear Energy (GEH) with over 30+ years of experience in the nuclear sector. He acts as GEH Sales Executive being responsible to integrate all related Services, Fuels, and Advance Nuclear business in the region. Rafael is member of GENUSA Board who is the Global Nuclear Fuels joint venture with ENUSA to supply nuclear fuel in Europe.

Before this role, for 23 years Rafael covered key technical and commercial leadership positions, being responsible for the GEH Operations in Latin America managing complex multidisciplinary international projects, including the Hitachi Nuclear GE (HNGE) first service/product deployment in America; before joint GE, Rafael work for 10 years in the Mexican Nuclear Regulatory Commission (NRC) in Mexico City, including one year in the USA NRC Headquarters in Rockville, MD.

Rafael earned a bachelor's in science, physics and has completed all courses for master's in sciences and for philosophical doctorate in nuclear physic at Mexico National University. Also, Rafael became certified as Senior Reactor Operator Inspector by USNRC (Chattanooga, TN training center).

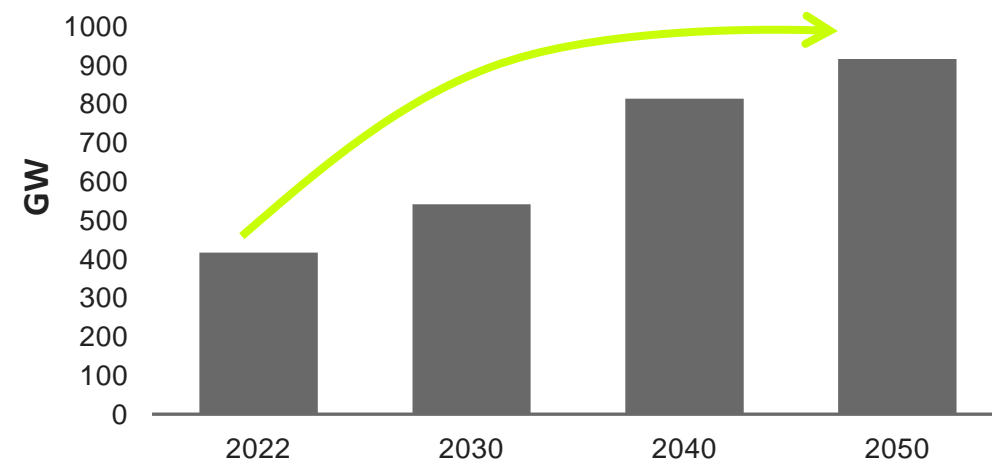
Based in Wilmington, N.C., GE Hitachi Nuclear Energy (GEH) is part of GE VERNOVA, is a world-leading provider of advanced reactors and nuclear services and fuels. Established in June 2007, GEH is a global nuclear alliance created by GE and Hitachi to serve the global nuclear industry.

# NUCLEAR ENERGY

Will play a critical role in the global energy transition

Nuclear energy will need to **more than double in capacity** in order to achieve

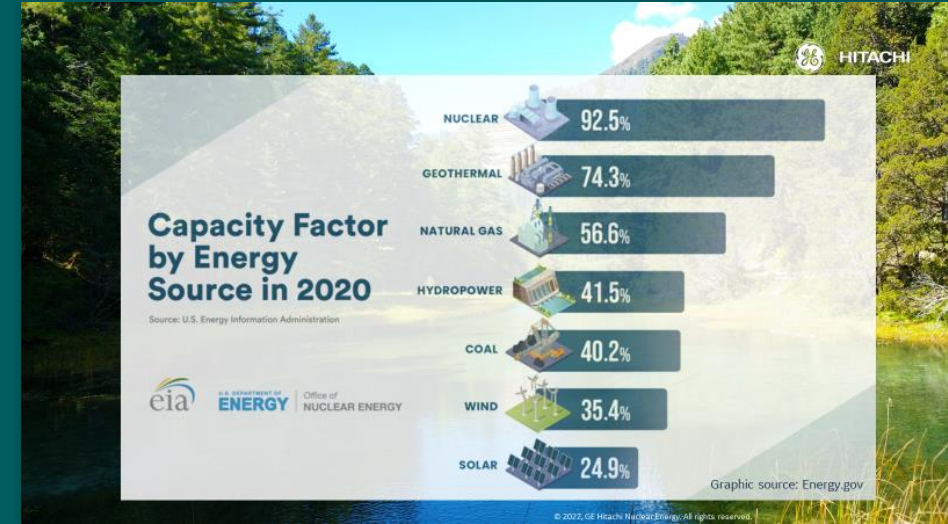
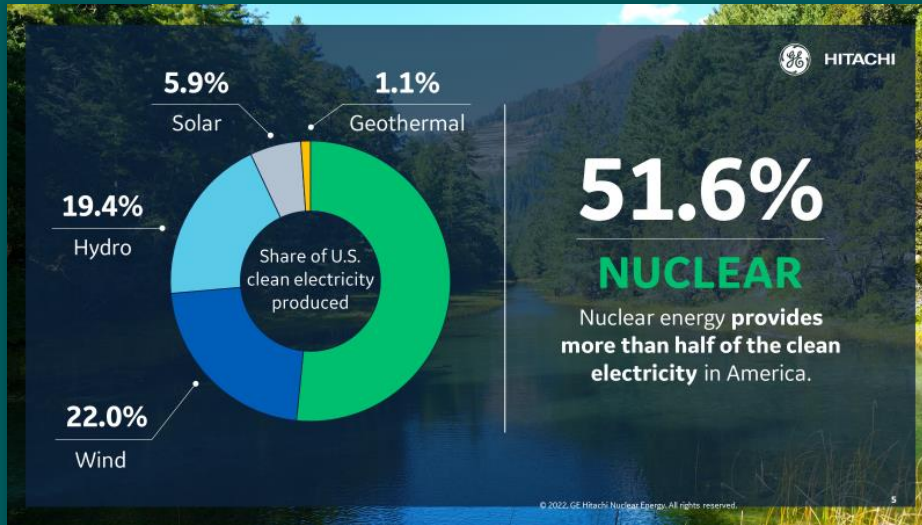
**Net-zero carbon emissions by 2050**



Source: International Energy Agency – World Energy Outlook 2023

# Benefits of Nuclear

Cleaner, more reliable, high power-density: Nuclear contribute to the energy trilemma integral solution



**1 URANIUM FUEL PELLETS**  
The size of a pencil eraser

**1 TON of COAL**

**149 GALLONS of OIL**

**17,000 CUBIC FEET of Natural Gas**

**PROVIDES AS MUCH ENERGY AS**

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**Low land use for plants and used nuclear fuel**

**HOW MUCH LAND DOES IT TAKE TO POWER SIX MILLION HOMES?**

Source	Land Area
WIND	1000 km <sup>2</sup> (386 miles <sup>2</sup> )
SOLAR	600 km <sup>2</sup> (231 miles <sup>2</sup> )
NUCLEAR	6 km <sup>2</sup> (2.3 miles <sup>2</sup> )

**VOLUME OF U.S. SPENT NUCLEAR FUEL**

1310 m (4300 ft) length  
160 FEET width  
24 FEET height

Graphic source: Generation Atomic  
<https://www.generationatomic.org/why-nuclear/>

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## ENERGY LANDSCAPE: TODAY AND TOMORROW



**Wind and solar** grow fastest over next decade driven by **LCOE** (Levelized Cost of Electricity) and **decarbonization goals**



**Gas** will play a vital but changing role, providing **flexible, dispatchable, affordable, reliable and lower CO<sub>2</sub> power**



**Storage and hybrid solutions** emerge, enabling **baseload dispatchability** of renewables



**Nuclear** remains a **key source** of zero-carbon generation (**52% of US Clean Electricity**) with small modular reactors expected to **bring costs down**

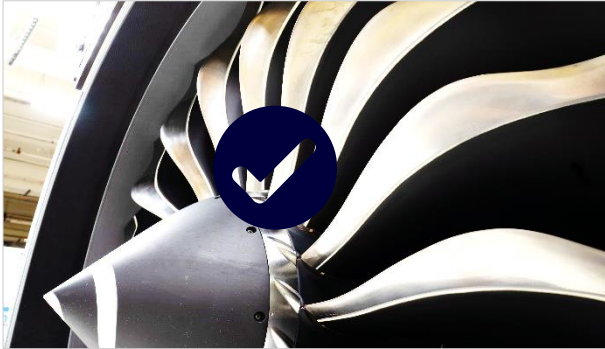


**Grid** will play a critical role in enabling a **diversified energy mix**



**Digital technologies** are the **enablers** tying it all together, **orchestrating** the world's energy through software

# GE companies split:

 **GE Aerospace**

- Global leader in propulsion and systems
- Most competitive and innovative engine value proposition ... efficiency, reliability and lifecycle economics
- Youngest and largest commercial fleet ... most diversified services portfolio

 **GE HealthCare**

- At the nexus of most care pathways
- Leading equipment complemented by high margin services
- Diagnostics, interventional imaging, life care, therapy planning and digital

 **GE VERNOVA**

- Carbon-free power sources, including **nuclear**, hydro and hybrids
- World's most powerful wind turbines and most efficient gas turbines
- Tech to modernize and digitize
- Grid and electrical infrastructure



## SERVICES

### Field Services

- Outage Services
- Inspections
- Plant and Reactor Modifications
- Fuel Inspections
- Decommissioning Services

### Engineered Solutions

- Digital/Software Solutions
- Instrumentation and Controls
- Asset Enhancement Services
- Mechanical Parts
- Electrical/Electronic Parts
- Refurbishment Services



## FUEL

- Advanced BWR fuel
- Natrium™ fuel facility\*
- Accident Tolerant Fuel
- Engineering Services
- Uranium Management

\* To be constructed



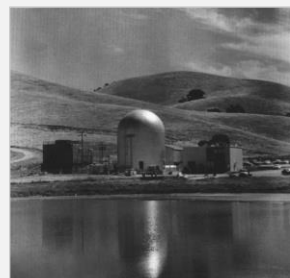
## ADVANCED NUCLEAR

- Small Modular Reactor (BWRX-300)
- Sodium Fast Reactor (jointly developing Natrium™ with TerraPower)

**World leading provider of advanced reactors, services and fuel for >60 years**

# Rich history of nuclear innovation and demonstrate experience deploying nuclear reactors

Proven success turning vision into commercial-scale reality, on time and on budget



## OVER 80 YEARS OF NUCLEAR EXPERIENCE AND INNOVATION

<b>1939</b> First GE involvement in nuclear physics	<b>1955</b> GE Atomic Division established	<b>1957</b> Vallecitos BWR AEC License #1	<b>1962</b> NPD achieves full power – 1st reactor in Canada	<b>1974</b> 25 <sup>th</sup> BWR Peach Bottom 3	<b>1986</b> 50 <sup>th</sup> BWR River Bend	<b>1996</b> 1 <sup>st</sup> Gen III reactor (ABWR) built on time on budget	<b>2014</b> ESBWR U.S. NRC License	<b>2017</b> BWRX-300 launched	<b>2020</b> Natrium™* launched	<b>2022</b> 1 <sup>st</sup> commercial contract for BWRX-300	<b>2023</b> TVA, OPG & SGE invest in BWRX-300 common design
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\*Jointly developed technology with TerraPower

BWR – boiling water reactor  
AEC – Atomic Energy Commission

NPD – Nuclear Power Demonstration  
ESBWR – economic simplified boiling water reactor

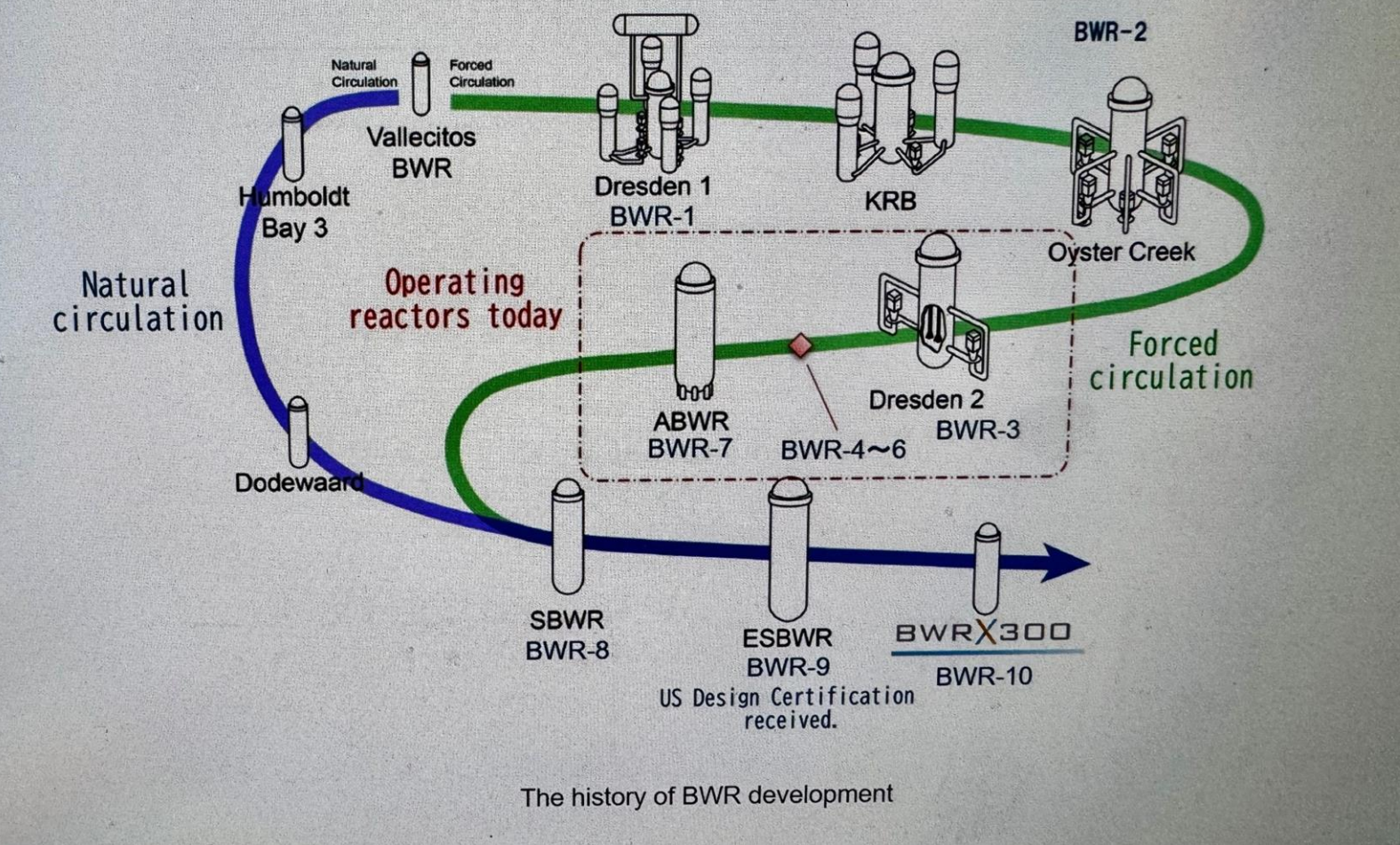
NRC – Nuclear Regulatory Commission  
TVA – Tennessee Valley Authority

OPG – Ontario Power Generation  
SGE – Synthos Green Energy

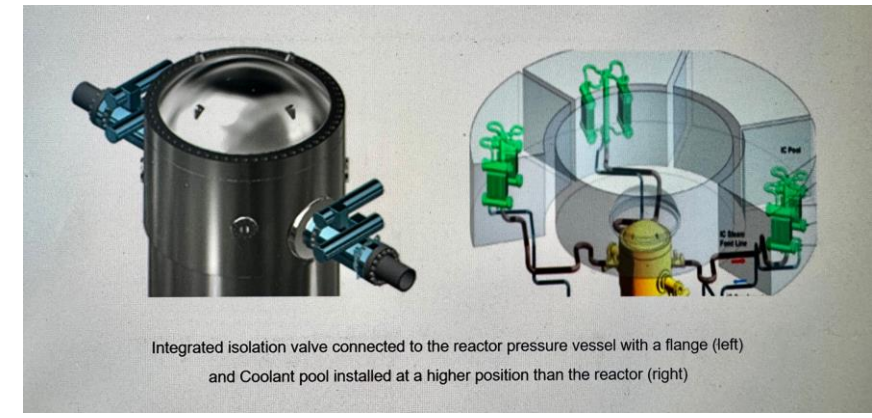
67 Reactors licensed in 10 Countries



# The BWRX-300 combines safety and economic efficiency



## Patented innovation drives further simplicity



Isolation Condenser System  
Integrated Isolation Valve

# Why BWRX-300?

Breakthrough innovation coupled with a proven design reduces cost and risk.



## PROVEN

- 10<sup>th</sup> generation boiling water reactor (BWR)
- Based on a licensed design in the U.S.
- Powered by commercially available fuel with qualified manufacturing facilities in the U.S. and Europe (does not need HALEU)
- Leverages existing supply chain and off-of-the-shelf components

## INNOVATIVE

- Significant capital cost reduction
- Less concrete and steel/MW than competitors
- Small footprint and simple layout
- Underground construction using proven methods from other industries

## SIMPLIFIED

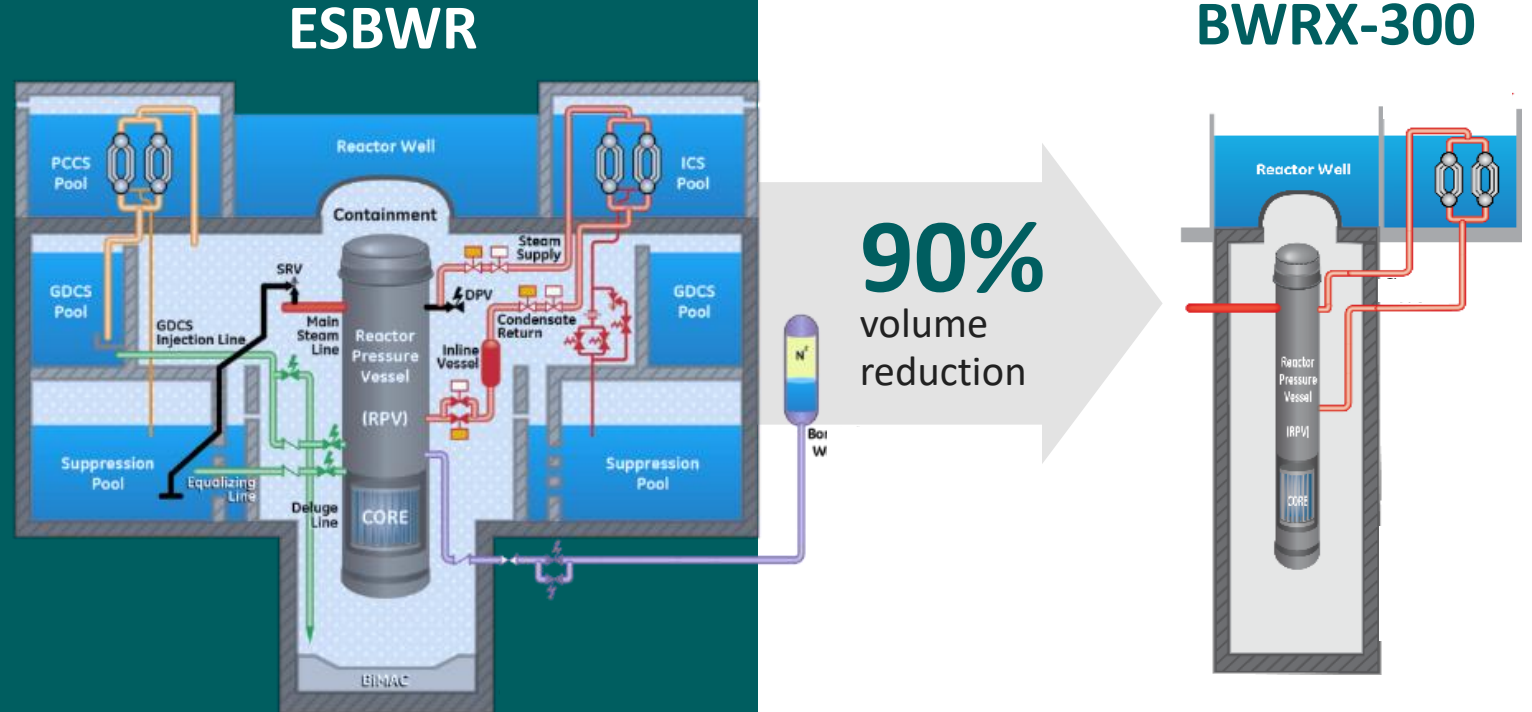
- BWR is inherently simple
- Fewer components than other SMR technologies leading to less capital and operating cost
- Patented innovation drives further simplicity

**Ideal for electricity generation and industrial applications, including hydrogen production, desalination and district heating.**

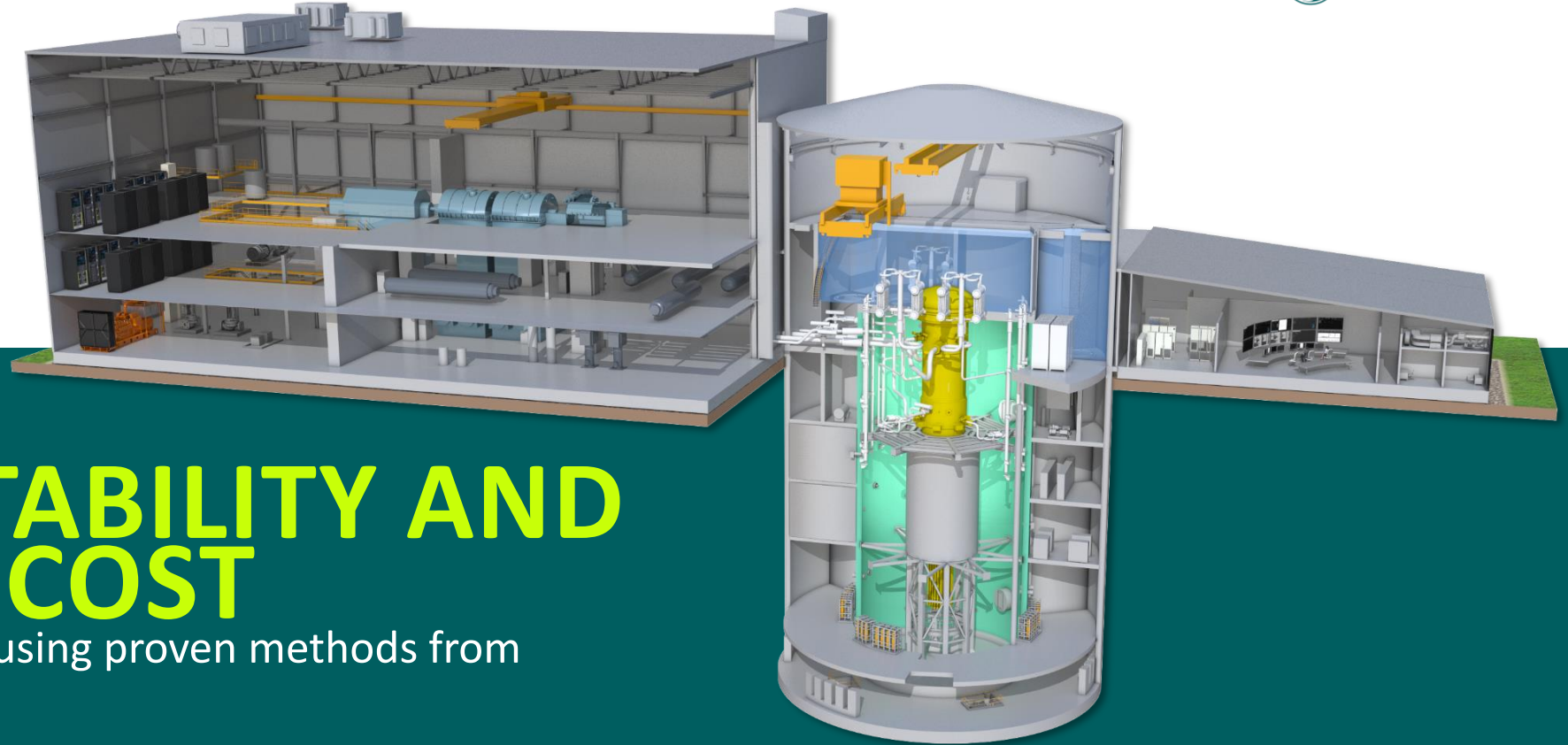
# BWRX-300 small modular reactor

## Breakthrough innovation driving dramatic simplification and cost reduction

- Patented innovation driving simplicity
- Enables dramatic design simplification and elimination of unnecessary systems
- Leads to more than 50% reduction in construction materials per MW
- Game-changing cost reduction – competitive with other generation sources



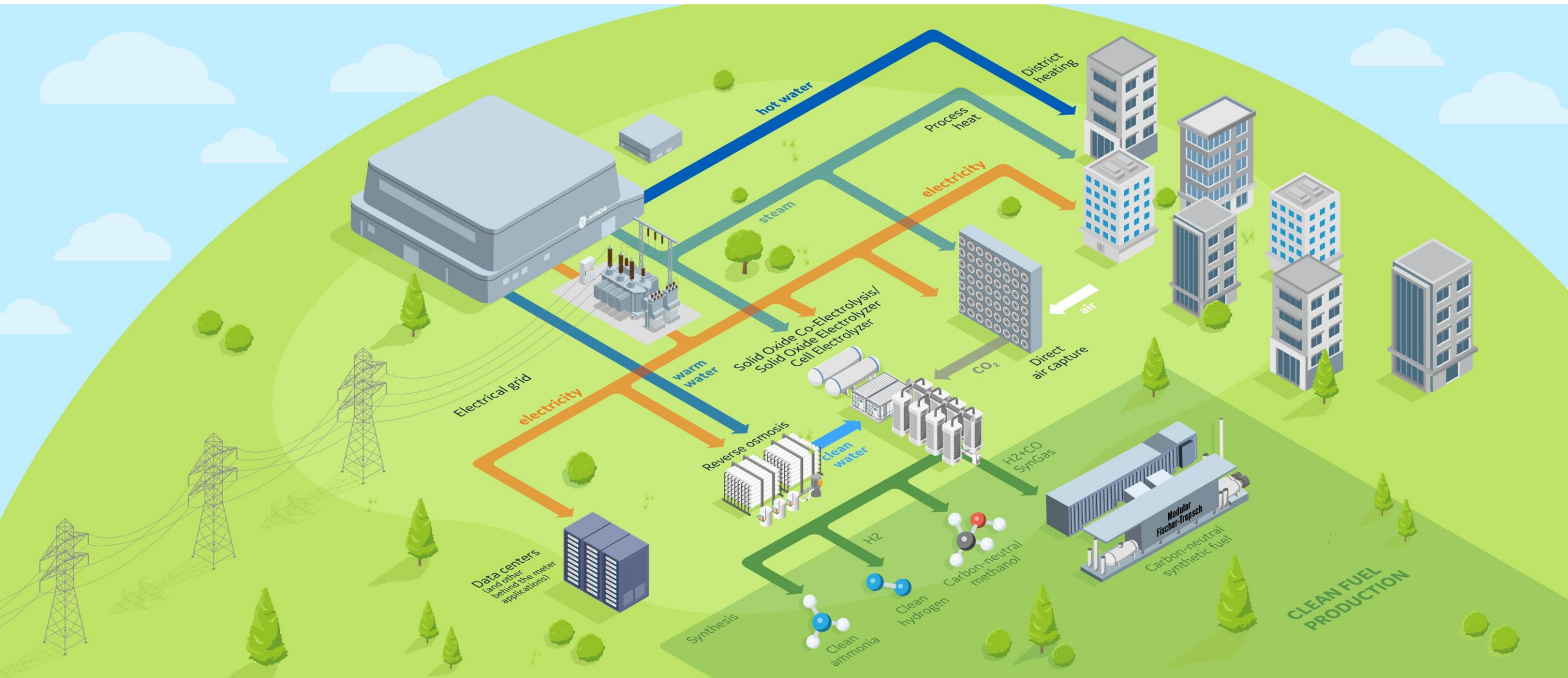
Optimized for cost  
and ease of  
construction



# CONSTRUCTABILITY AND DESIGN-TO-COST

- Underground construction using proven methods from other industries
- Maximum use of catalogue items
- “Off the shelf” turbine/generator
- 90% volume reduction in safety-related concrete

# BWRX-300 applications



# BWRX-300 commercial activity. Positioned for global success

## Focus on regional deployment partnerships and localization



TVA, OPG, Synthos Green Energy and GE Hitachi to share in the investment of approximately

**\$400 MILLION**

to develop the **BWRX-300** standard design

## North America



**Ontario Power Generation (OPG)**, GE Hitachi (GEH), AtkinsRéalis and Aecon signed a contract for the deployment of a BWRX-300 small modular reactor at OPG's Darlington New Nuclear Project site – 3 additional units being planned.



**Tennessee Valley Authority (TVA)** began planning and preliminary licensing for potential deployment of a BWRX-300 at the Clinch River Site near Oak Ridge, Tennessee.



**SaskPower** entered an agreement with GEH to collaborate on project planning and to share expertise for the BWRX-300.

## Europe and Middle East

### Poland

- The government of Poland has reached a decision in principle and approved six locations for the construction of 24 BWRX-300 small modular reactors.
- U.S. Export-Import Bank and U.S. International Development Finance Corporation sign letters of interest to lend up to \$4 billion to support projects.
- Regulator's general opinion concludes BWRX-300 design is compliant with Polish nuclear safety.

### United Kingdom

GEH has been awarded a £33.6 million UK Future Nuclear Enabling Fund grant and entered the Generic Design Assessment process for the BWRX-300.

### Estonia

Fermi Energia selected GEH's BWRX-300 for potential deployment in Estonia.

### United Arab Emirates, Czech Republic and Sweden

GEH has memoranda of understanding or other agreements in place with companies to support global deployment of the BWRX-300.

**BWRX-300 is in deployment ... it is not  
a demonstration project**

# Thank you!

It's an exciting time  
to be “nuclear”

**Rafael Ledesma**

Europe Commercial Regional Director  
GE Hitachi Nuclear Energy (GEH)  
Part of GE Vernova

[rafael.ledesma@ge.com](mailto:rafael.ledesma@ge.com)  
[www.ge.com](http://www.ge.com) | [www.ge.com/pl/](http://www.ge.com/pl/)

Osiris 11-13  
28037, Madrid  
Spain