



AP1000 Technology

Elias Gedeon

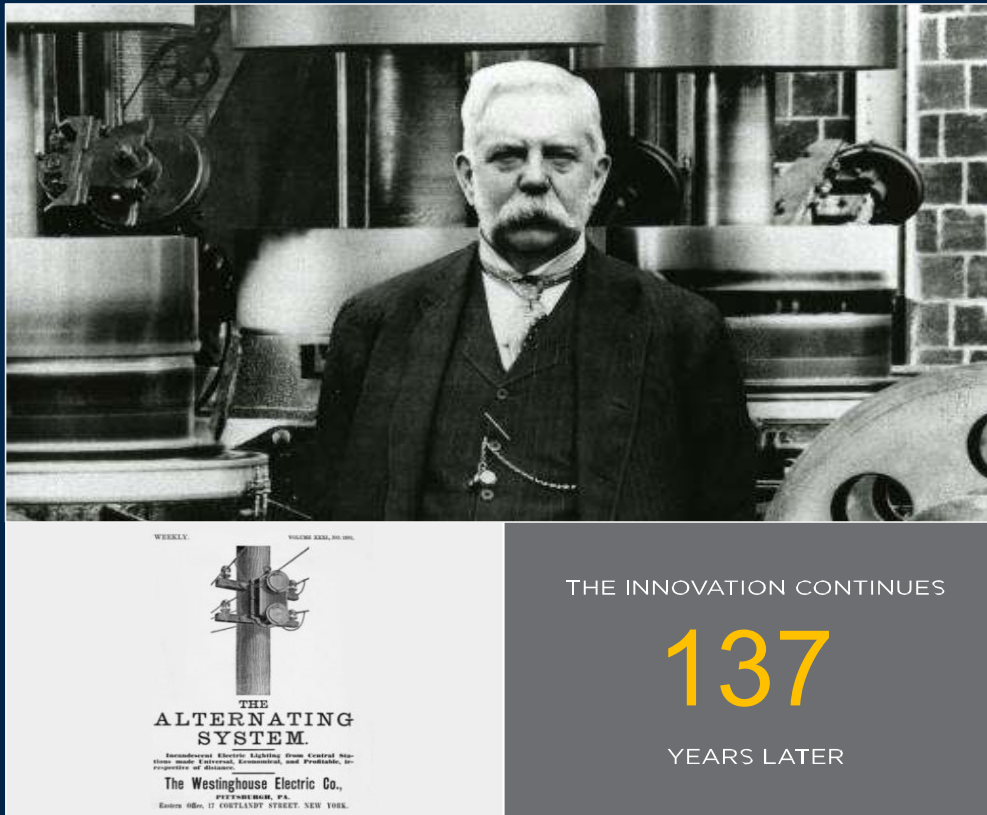
Senior Vice President, Commercial Operations

Westinghouse Electric Company

March 6, 2024

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Westinghouse History



- Founded by George Westinghouse in 1886

Westinghouse established

59

other companies

He received over

360

patents for his work

- Responsible for some of the world's greatest advances in energy technology
- World's first commercial pressurized water reactor (PWR) in 1957 in Shippingport, Pennsylvania, U.S.

Innovation Continues after 137 Years

Designs **first U.S. commercial NPP** in Shippingport, Pennsylvania (USA)



1957

Ukraine's Zaporizhzhia NPP becomes first nuclear reactor loaded exclusively with Westinghouse **VVER-1000 fuel**



2019

Acquires BHI Energy, becoming world's **first end-to-end provider of products and services** for full nuclear plant lifecycle



2022

Announces **AP300™ Small Modular Reactor (SMR)** based on proven AP1000 technology



2023

Announces first Canadian **eVinci™ Microreactor**



2023

1886



Westinghouse founded after **alternating current system** discovered

2018



First of four **AP1000® reactors** begins commercial operation in China

2020



First to install a **3D-printed component** inside of a nuclear reactor

2023



ADOPT™ accident tolerant fuel receives regulatory approval

2023



Vogtle Unit 3 entered commercial operation on July 31, 2023

Westinghouse Advantage

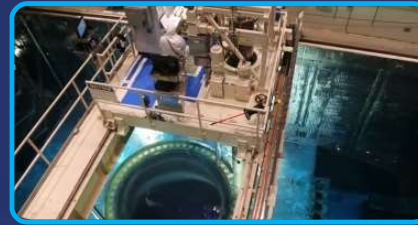
Over **70** years of experience developing & implementing new nuclear technologies that enable reliable, clean, safe and economical sources of energy for generations to come.



9,500 employees located in 21 countries



3 global best-in-class nuclear fuel fabrication facilities



~50% of the world's nuclear power is generated using our technology



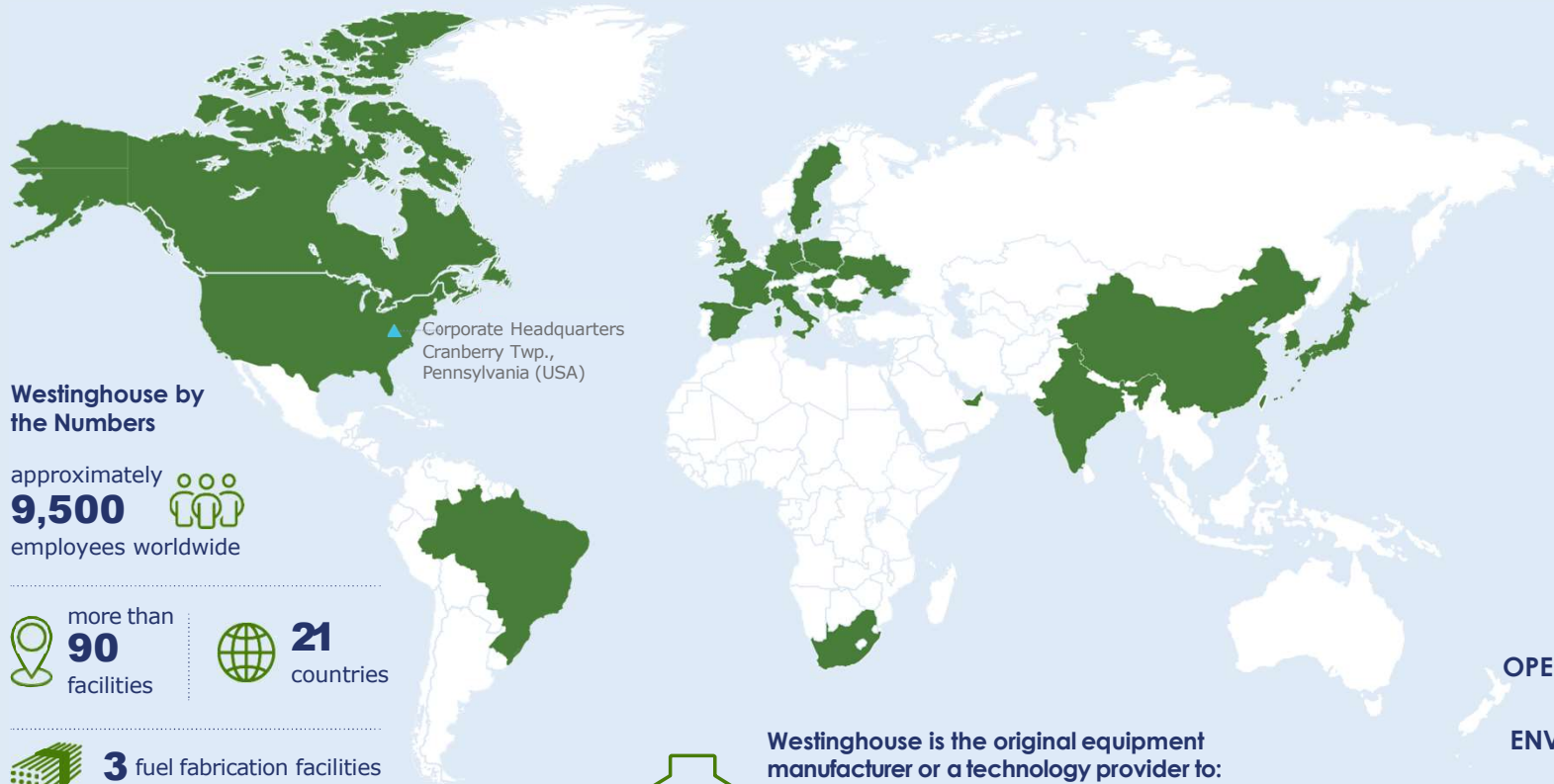
1ST successful deployment of Gen III+ reactor technology



Westinghouse Global Presence

Legend

- ▲ Corporate Headquarters
- Countries with Westinghouse Presence



Westinghouse by the Numbers

approximately
9,500 
employees worldwide

 more than
90
facilities

 **21**
countries

 **3** fuel fabrication facilities

▲ Corporate Headquarters
Cranberry Twp.,
Pennsylvania (USA)



Westinghouse is the original equipment
manufacturer or a technology provider to:
~50% of the global nuclear reactor
fleet, delivering capacity of
~190,000 carbon-free MWe

Comprised of
5
Business Units

ENERGY SYSTEMS

NUCLEAR FUEL

OPERATING PLANT SERVICES

ENVIRONMENTAL SERVICES

eVINCI

Westinghouse

Presence in EMEA

Westinghouse by the Numbers

More Than
4,300 
employees in EMEA

 more than
40
facilities

 **14**
countries

 **2** fuel fabrication facilities

 **Westinghouse is the original equipment
manufacturer or a technology provider to:**
~50% of the global nuclear reactor fleet,
delivering capacity of ~190,000 carbon-free MWe

Legend

-  Countries with Westinghouse Presence
-  Westinghouse Fuel Fabrication Facilities





Westinghouse

Energy Systems

AP1000®
(~1,200 MWe)



AP300™
(300 MW_e)



**Long Duration
Energy Storage**

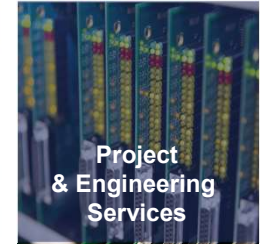


Nuclear Fuel

Operating Plant Services

Environmental Services

eVinci



Today's Energy Landscape

The world is recognizing the need for nuclear & is seeking proven solutions

CUSTOMER CHALLENGES



Emission-free
Energy



Energy
Security



Energy Price
Stability



Grid
Stability

THE SOLUTION

CUSTOMERS CONTINUE TO SELECT WESTINGHOUSE



China has 4 AP1000
reactors in operation & 8
units under construction



Poland contracts for
3 AP1000 reactors



Bulgaria selects 2
AP1000 reactors



U.S. has 1 operating
AP1000 and 1 in final
commissioning



Ukraine contracts for
9 AP1000 reactors



India selects 6
AP1000 reactors



Dr Robert Golob,
Prime Minister

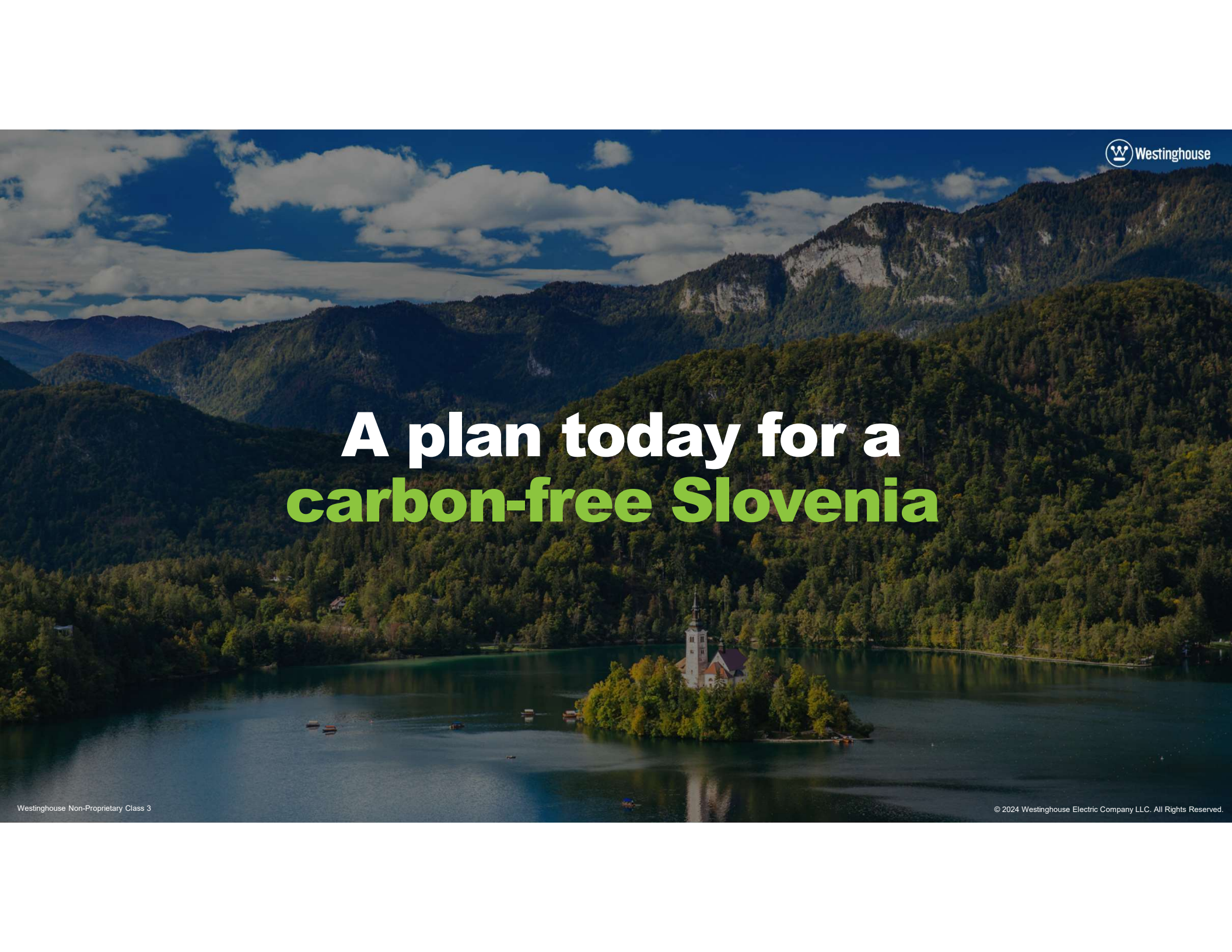


construction of the 2nd nuclear power
plant in Krško is a crucial project for
Slovenia's future

Extract from parliamentary long-term energy
policy meeting, February 1, 2024



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A plan today for a carbon-free Slovenia

Emissions-Free Power

Approximate emissions reduction equivalents*

	 Approximate Emissions Avoided	 Equivalent Vehicles Off the Road	 Homes Powered Annually
AP1000 Power Plant ~1200 MWe	7 million metric tons of CO ₂	1.5 million cars off the road	750,000 homes powered
AP300 SMR ~300 MWe	1.85 million metric tons of CO ₂	400,000 cars off the road	195,000 homes powered
eVinci Microreactor 5 MWe	55,000 metric tons of CO ₂	10,000 cars off the road	5,000 homes powered

Source: data calculated using Westinghouse research and epa.gov emissions comparatives

AP1000 Technology

Record-Setting Operations

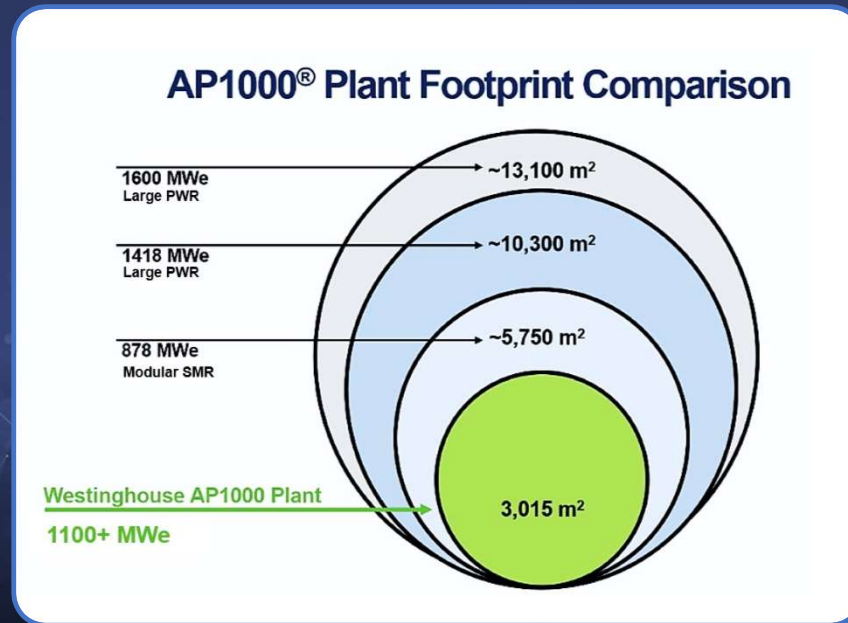


- Superior operating performance – availability and capacity factors >92%
- Dramatically reduced start-up test programs from 10 months to 5 months or less
- Industry performance records set for first cycle refueling outages (28 days) second cycle (19 days)
- Plants used for both baseload and load-follow modes with ramp rates of 1 MW/second
- Sanmen units received a perfect score by the World Association of Nuclear Operators (WANO)

AP1000 Technology

Safe, Simple, Proven

- Generation III+ plant; most advanced in operation today
- Fully passive safety systems and 72+ hour coping after station blackout
- Standardized, optimized design utilizing advanced modular construction
- Licensed by nuclear regulators in Europe, USA, and China
- Record-setting operational performance
- Advanced, load-following capabilities
- Safe, clean, reliable energy



- ✓ Land utilization
- ✓ Infrastructure costs
- ✓ Environmental impact
- ✓ Safety and security
- ✓ Increased efficiency
- ✓ Easier public acceptance
- ✓ Cost-effective decommissioning
- ✓ Potential for modular design
- ✓ Operational efficiency
- ✓ Reduced cooling needs
- ✓ Flexibility in expansion

AP1000 Safety Concept

HIGH LEVEL OVERVIEW

- The AP1000 plant design has a unique capability to respond to extreme, Fukushima-like events due to three fundamental safety advancements:

1. **The AP1000 plant self actuates:** For station blackouts, critical systems, structures and components automatically achieve a fail-safe configuration without the need for operator action or AC/DC power.
2. **The AP1000 plant is self sufficient:** The passive approach to safety eliminates the importance of AC power and cooling supply.
3. **The AP1000 plant is self contained:** Systems, structures and components critical to placing the reactor in a safe shutdown condition are protected within the steel containment vessel which is protected by a robust shield building.

AP1000 introduced a novel safety concept that relies on simplifications to achieve an unparalleled level of protection against extreme and unforeseen events

AP1000 Economic Benefits

The AP1000 pressurized water reactor's (PWR) extensive use of modularization of plant construction mitigates cost of financing during the construction phase and the substantial amount of skilled-craft-labor hours needed on site during construction.

Overnight Construction Cost

The AP1000 plant's modular construction design further reduces the construction schedule and the construction risks.

Simplified Plant Arrangement

The AP1000 plant has a smaller footprint than an existing nuclear power plant with the same generating capacity.

AP1000 Plant Licensing Pedigree

United States / USNRC



- Design Certification under 10CFR52 (2006 & 2011)
- Multiple approvals of utility COL applications (2012)
- Construction inspections (ongoing)

China / NNSA



- PSAR Review / Construction Permits (2009)
- FSAR Review / Fuel Load Permit (2018)

United Kingdom / ONR



- Generic Design Assessment concluded with issuance of Design Acceptance Certificate (2017)

Canada / CNSC



- Pre-project Design Review Phase 2 concluded no fundamental barriers to licensing AP1000 plant design in Canada (2013)



Licensing pedigree of the AP1000 plant design is unmatched by any other technology

AP1000 Plant

Grid Stabilization and Wider Decarbonization

► District Heating

- Heating for up to 100,000 households from 10% of output
- Replacing hundreds of thousands of tons of coal
- Displacing thousands of tons of soot, SO₂ and NO

► Water Production

- Produce up to 1B liters per day of desalinated water using less than 10% of output

► Hydrogen Production

- Produce 50 tons of Hydrogen per day from less than 10% of output using High Temperature Electrolysis process

► Energy Storage

- Use direct thermal transfer for onsite energy storage to save 15% reactor capacity during low demand and release 115% capacity during peak periods

► 1,200 MWe Electricity

- ~10 million metric tons of CO₂ coal emission offset per year
- Fast load-follow capabilities to support variations in demand and provide frequency stabilization



Shaping Tomorrow's Energy Flexible Cogeneration Potential



Plant Vogtle Lights Up With a First Gen III+ AP1000 Reactor

- ▶ Plant Vogtle Unit 3 went online on July 31, 2023
- ▶ The first deployment of AP1000 technology in America
- ▶ Vogtle Unit 3 is the first newly-constructed nuclear unit in the U.S. in over 30 years and can power an estimated 750,000 homes and businesses
- ▶ The Vogtle units will provide clean, reliable electricity for the next 80 to 100 years
- ▶ AP1000 technology boasts a global fleet and Nth-of-a-kind status
- ▶ Vogtle Unit 4 was synchronized on March 1, 2024
- ▶ Upon completion of Units 3 and 4, Plant Vogtle will become the largest nuclear power station in the United States

AP1000 has a global footprint and is nearing Nth-of-a-kind status, reinforcing its establishment and proven capabilities

Building on Krško legacy



- ▶ Westinghouse 2-loop pressurized reactor: 1,994 MWt, 696 MWe
- ▶ Foundation in 1974, commercial operation since 1983
- ▶ First western nuclear plant in eastern Europe
- ▶ Approved operation until 2043 by Slovenia's Environment Ministry

AP1000 Plant Footprint





Slovenia Energy Independence & Security
Shaping Tomorrow's Future. Together

AP1000

Most Advanced, Proven Generation III+ Pressurized Water Reactor with Fully Passive Safety Systems



Innovative

Fully-passive safety systems protect the plant for over 72 hours, even in the event of a station blackout.



Proven

Breaking performance records across the operational fleet.



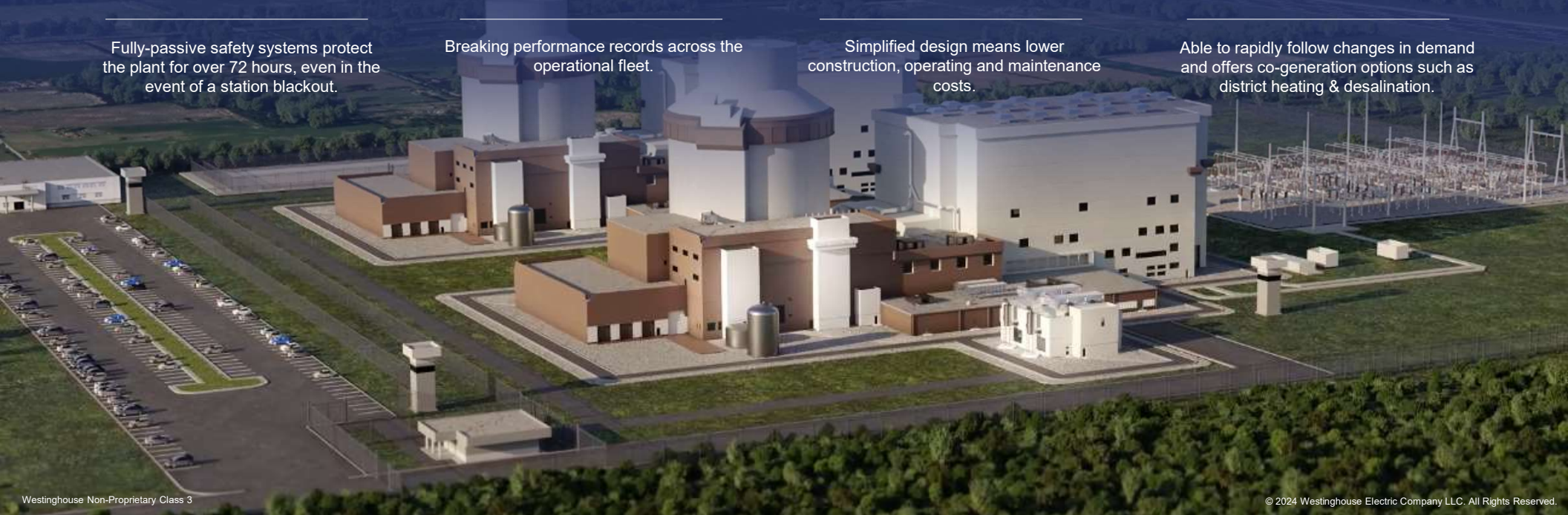
Cost effective

Simplified design means lower construction, operating and maintenance costs.



Flexible

Able to rapidly follow changes in demand and offers co-generation options such as district heating & desalination.





AP300TM SMR

The ONLY SMR based on Nth of a Kind Operating Plants



AP300 SMR

Only SMR based on deployed, operating & advanced reactor technology



Proven Technology

21 AP1000 reactor-years of safe operations

Based on the fully licensed & operating AP1000 technology.



Advanced Safety

More than
30 years licensing advanced passive technologies with global regulators

We pioneered passive safety systems. AP300 utilizes identical passive safety systems used in the AP1000 reactor to maintain safe shutdown condition.



Readily Deployable

Approximately
0.4 acres needed for safety related buildings

Ultra-compact, simplified design reduces construction timeframes. Maximizes use of established supply chain.



Proven Technology

Leveraging AP1000 technology with demonstrated industry leading reliability



300MWe (990MWth) 1-loop PWR
with demonstrated reliability



Westinghouse AP1000 reactor
passive safety technology



Reduces overall components
creating a simpler plant compared
to other SMRs



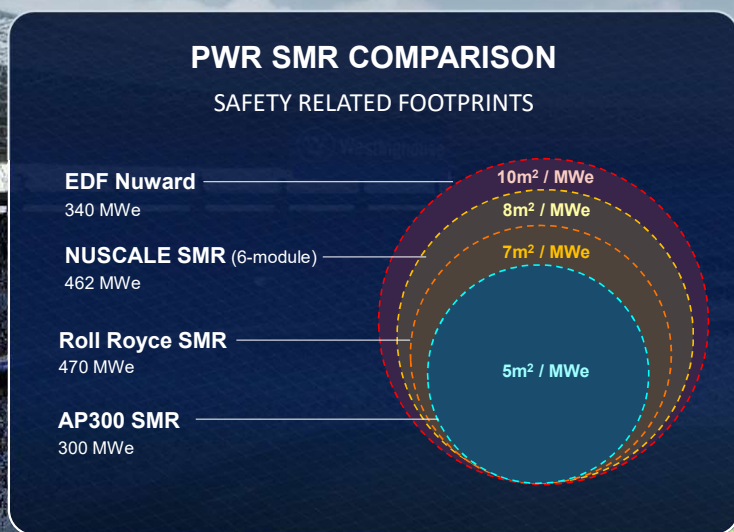
Identical Technology as
AP1000 including:

- | Design & licensing methodologies
- | Major equipment & components
- | Passive safety systems
- | Proven Fuel
- | I&C systems
- | Proven Supply Chain
- | Constructability lessons learned
- | Steel-Composite structural modules
- | O&M procedures & practices

Fast load follow capabilities

Ultra Compact Footprint

AP300 SMR's smaller safety related footprint reduces construction, operating & maintenance costs



Rolls Royce power output and footprint per ONR Project Assessment Report Generic Design Assessment of the Rolls-Royce SMR - Step 1 summary (ONRW-2019369590-1908 Rev 0) | NuScale power output and footprint per NuScale Standard Design Approval Application (www.nrc.gov/docs/ML2300/ML23001A016.pdf) | Nuward power output and footprint per IAEA Advances in Small Modular Reactor Technology Developments (2020 Edition)

Westinghouse Non-Proprietary Class 3

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Passive Safety Pioneers

AP300 SMR uses the identical proven AP1000 fully passive safety systems



Fail Safe

Automatically achieves safe shutdown without the need for operator action



Self Sufficient

Passive approach to safety eliminates the need for backup power & cooling supply



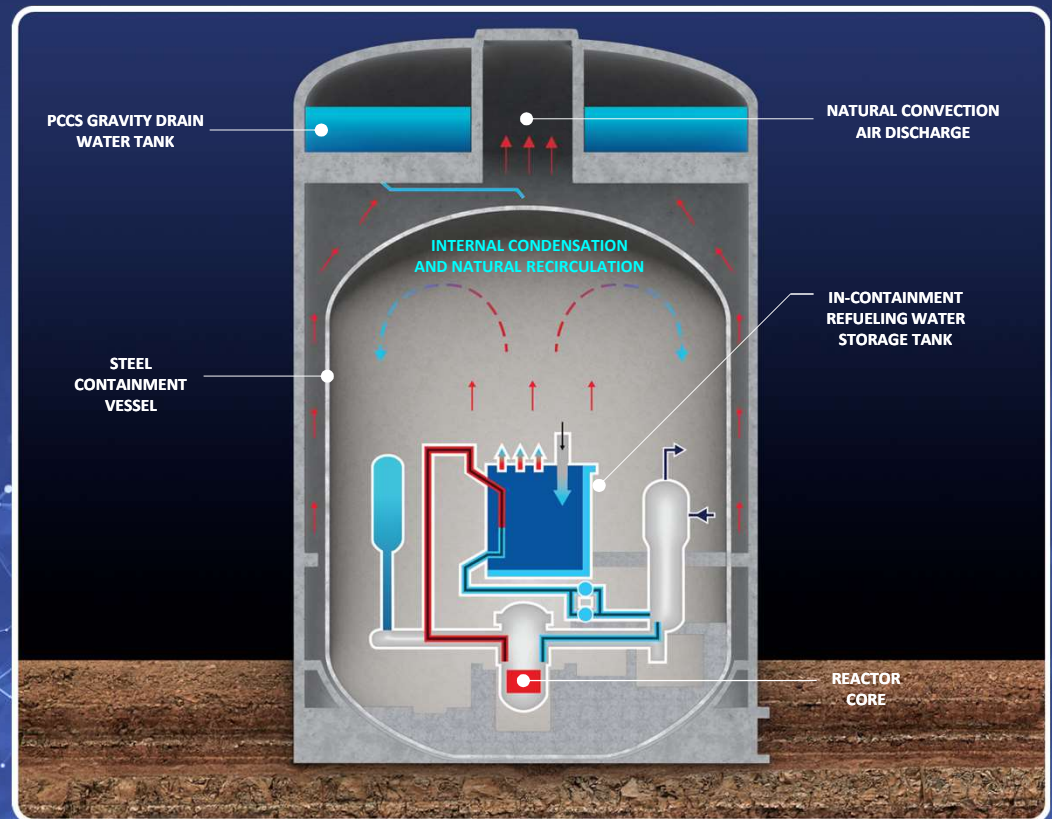
Hazard Proof

Protected by a robust containment designed to withstand extreme external hazards



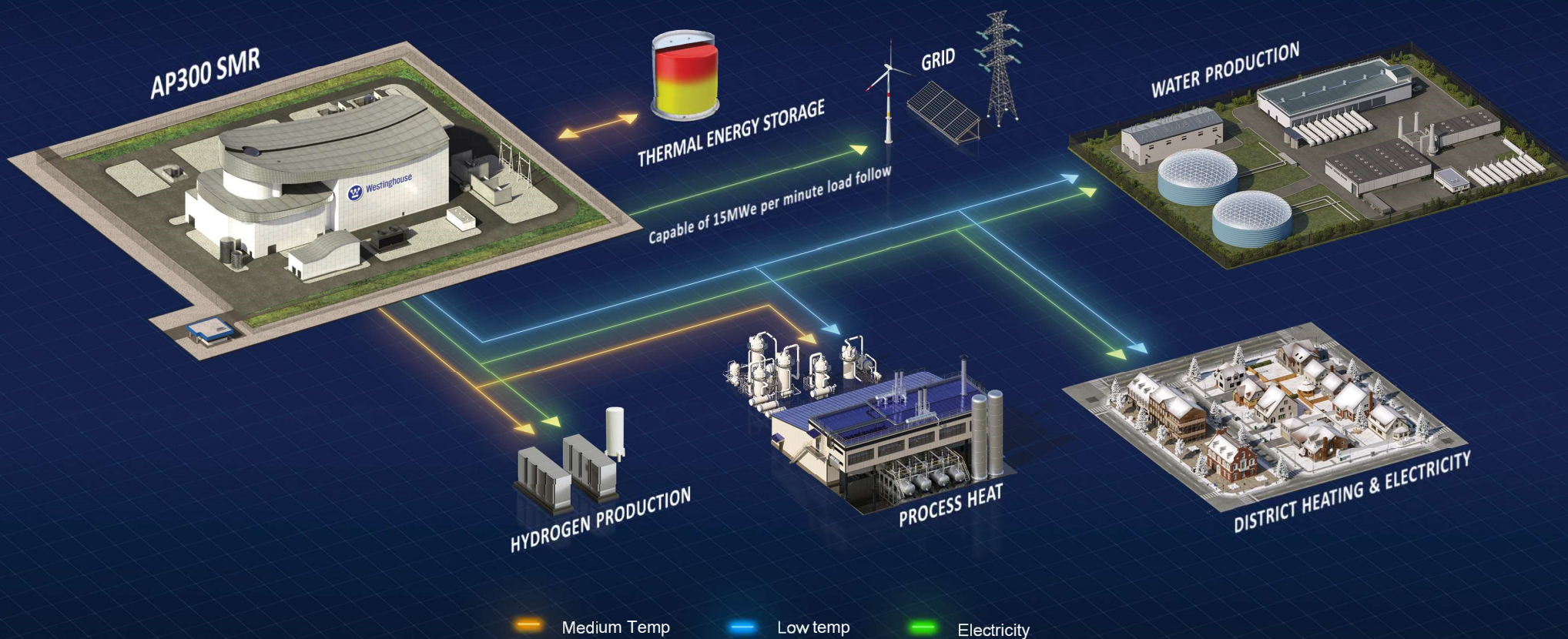
Defense in Depth

Multiple layers of defense for accident mitigation



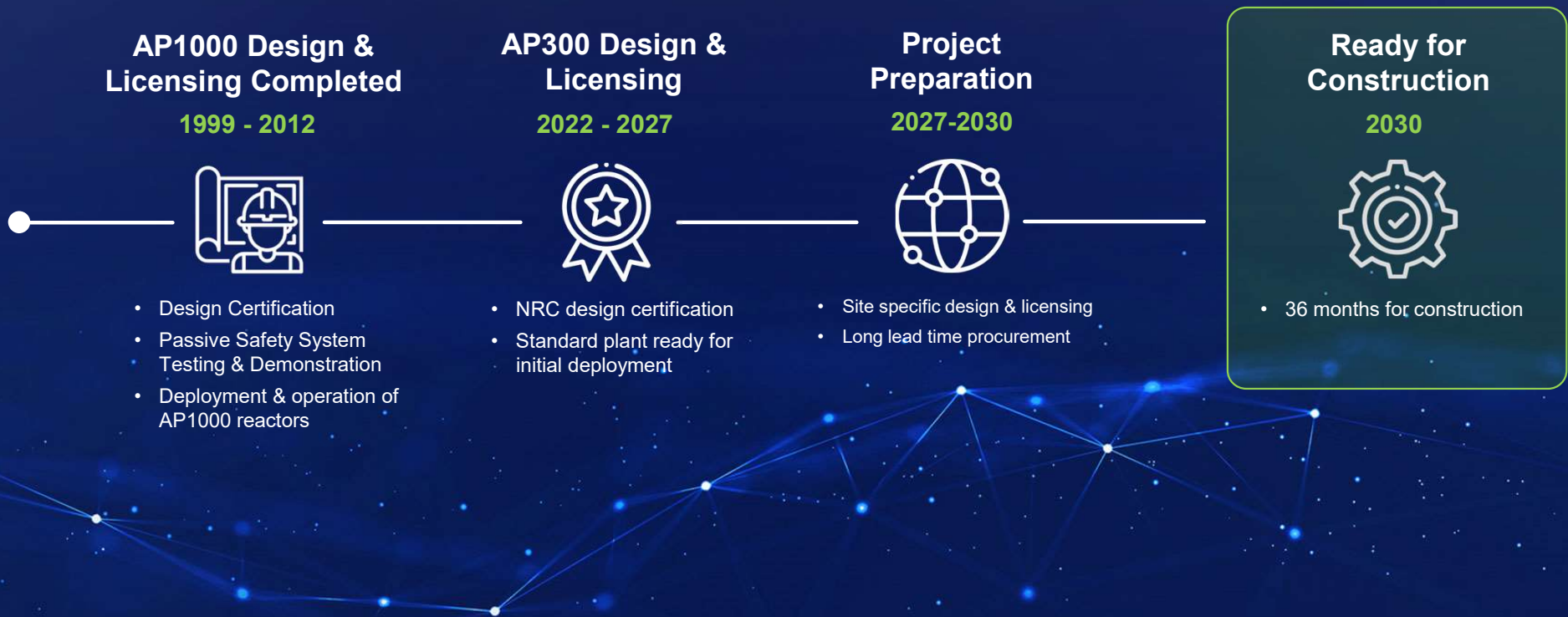
Versatility of Application

AP300 SMR is the backbone of a community clean energy system



AP300 SMR Roadmap

Leverages our AP1000 reactor design and licensing experience to achieve deployment by early 2030's





Readily Deployable by 2030's

Proven pedigree throughout the plant lifecycle ensures deployment & operations success



Technology Readiness

Tens of millions of hours dedicated to AP1000 reactor development

5 AP1000 reactors operating, 1 nearing completion, more pending



Licensing Certainty

Based on licensed & operating AP1000 technology, the only technology to be fully licensed by the U.S NRC



Established Supply Chain

Incumbent AP1000 suppliers can deliver major equipment

Demonstrated capability to localize supply chain



Modular Construction

Simplified, modular, ultra compact nuclear island (costliest portion of any reactor) reduces construction costs/schedule



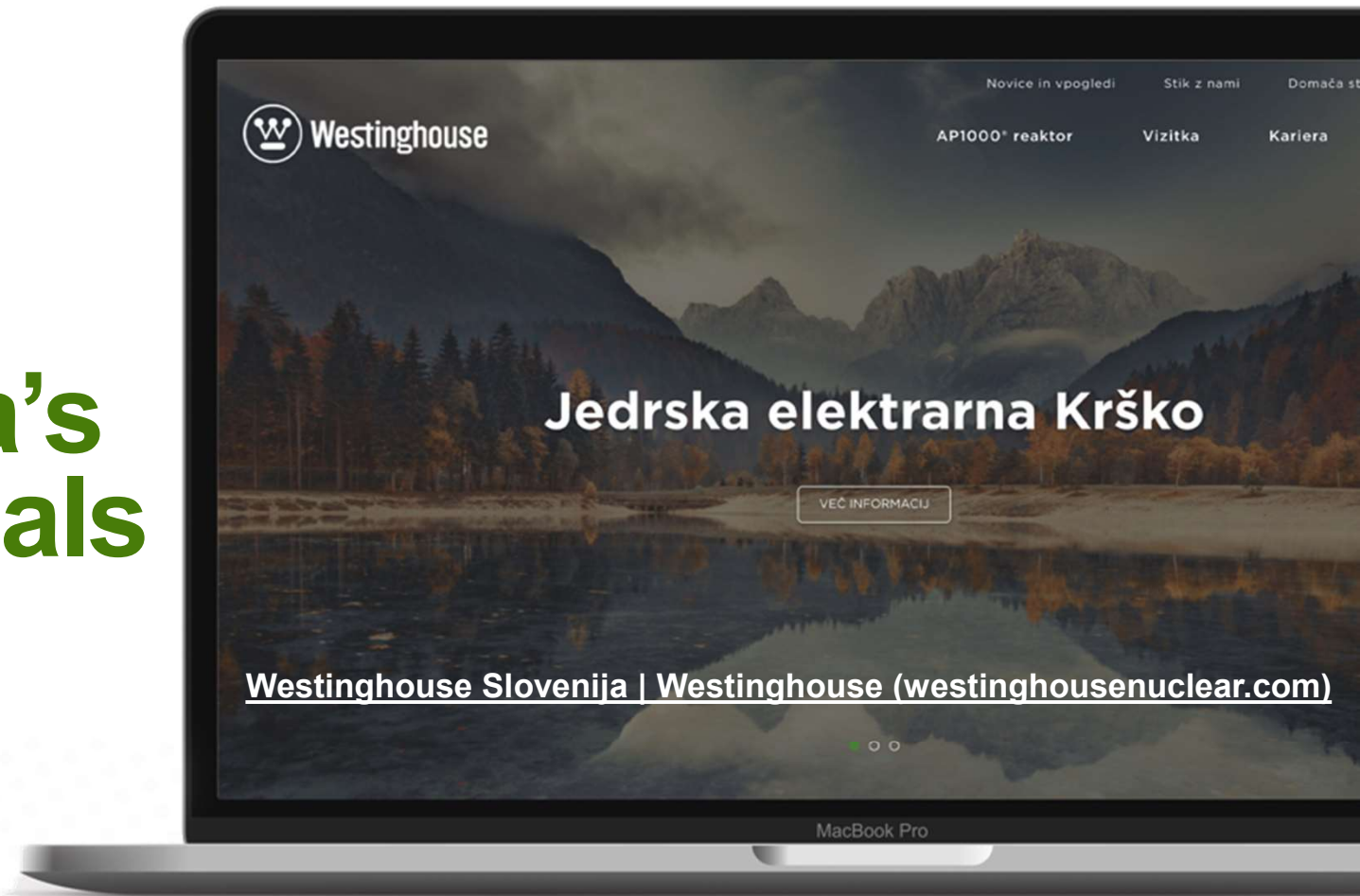
Reliable O&M

Record setting AP1000 operational & outage performance

Targeting **+80-year** life cycle



**We Are
Invested
in Slovenia's
Energy Goals**



Thank You

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Contact US

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