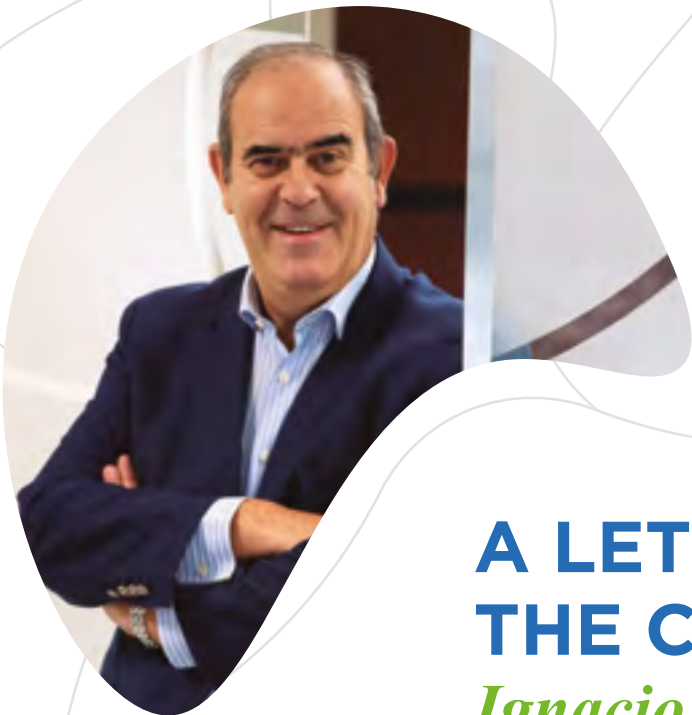




**NUCLEAR RESULTS
IN 2022**
and future perspectives

EXECUTIVE SUMMARY



A LETTER FROM THE CHAIRMAN

Ignacio Araluce

“Spanish reactors had excellent results in 2022 thanks to the work of all their employees and the industry as a whole”

This report discusses **the operating results of Spanish nuclear power plants** as well as the incessant activity both at the national and the international level of the companies that are part of Foro Nuclear, and which I would like to thank for their commitment, support and trust.

The energy crisis the world experienced in 2022 resulted in **many countries expressing their strong commitment to nuclear power through the long-term operation of their reactors and the announce-**

ment of the construction of new units.

The Spanish nuclear industry, which is present in 40+ countries and remains at the forefront of nuclear technology, has raised its international profile by participating in this nuclear development.

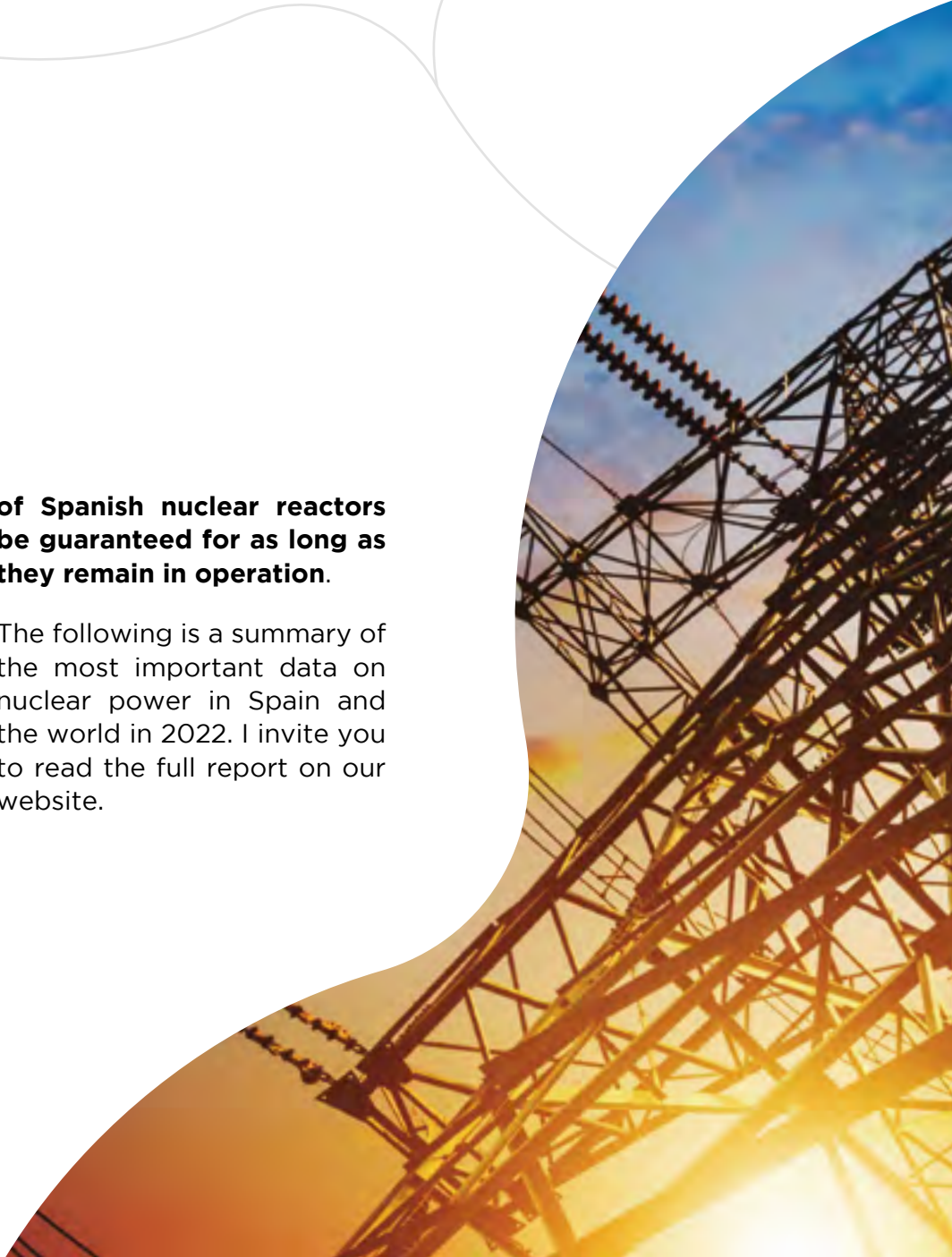
In addition, it has managed to keep Spanish nuclear power plants always up to date with the latest upgrades. Hence, from a technical standpoint we can say that our plants are safe and ready for long-term operation.

“From a technical standpoint, Spanish nuclear power plants are ready for long-term operation”

This is supported by all their performance indicators being above 90 percent. **In 2022, Spanish nuclear power plants** operated for the highest number of equivalent hours at full power and **provided 20.26% of all electricity** in Spain. This constant and reliable base load production brings stability to the power grid and guarantees the supply of electricity while at the same time slowing down global warming thanks to being a CO₂-free source. Nuclear power plays an essential role in the energy transition; for this reason, at Foro Nuclear we insist that **the economic viability**

of Spanish nuclear reactors be guaranteed for as long as they remain in operation.

The following is a summary of the most important data on nuclear power in Spain and the world in 2022. I invite you to read the full report on our website.





NUCLEAR POWER IN SPAIN

PERFORMANCE INDICATORS

90.40%

Load factor

91.98%

Time availability factor

91.32%

Unit capability factor

2.50%

Unplanned capability
loss factor

There are seven operating nuclear reactors in five Spanish sites: Almaraz I and II, Ascó I and II, Cofrentes, Trillo and Vandellós II. **The Spanish nuclear fleet produced 55,983.50 GWh of net electricity, which represented 20.26%** -practically the same percentage as in the previous year- of the country's total net electricity production, which was 276,315 GWh. Gross production stood at 58,589.95 GWh, 3.5% higher than the previous year, as there were 4 refueling outages in 2022 compared to 6 in 2021. **Nuclear production accounted for 31.75% of all emissions-free electricity generated in the country, thus**



consolidating its role as a key source in the energy transition and in curbing polluting emissions.

Nuclear power is the only source that has produced over 20% of all the electricity consumed in Spain for 12 years in a row. It has achieved this with just 5.98% of the total net capacity installed in the country and also with its performance indicators having outstanding results, which is proof of its level of excellence both operation- and safety-wise.

Operating licenses

The operating licenses of Spanish nuclear power plants are renewed once their condition has been assessed by the Spanish Nuclear Safety Council;

said renewal is granted by the Ministry for Ecological Transition and the Demographic Challenge

OPERATING LICENSE DATES

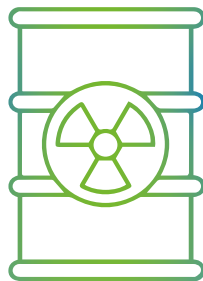
Nuclear power plant	Current license date	Valid until	Next renewal
Almaraz I	07/23/2020	11/01/2027	---
Almaraz II	07/23/2020	10/31/2028	---
Ascó I	09/27/2021	10/02/2030	---
Ascó II	09/27/2021	10/02/2031	October 2031
Cofrentes	03/18/2021	11/30/2030	---
Trillo	11/17/2014	11/17/2024	November 2024
Vandellós II	07/23/2020	07/27/2030	July 2030

Source: Foro Nuclear

In 2022, almost one third of all emission-free electricity in Spain was generated by nuclear power plants, which highlights how crucial they are in the fight against climate change

Photo: CNAT





SPENT FUEL MANAGEMENT

Radioactive waste is not all the same. Radioactive waste is classified according to the nature of the radioactive isotopes it contains. Consequently, it is divided into **two main groups: very low-, low- and intermediate-level radioactive waste** —which is stored permanently at the El Cabril disposal facility— and **high-level radioactive waste, which is mostly irradiated or spent fuel.**

Spanish nuclear power plants store their irradiated fuel inside the pool that was originally built for this specific purpose under wet storage conditions and, once said pool is full, in an Individual Temporary Storage Facility (ATI) under dry

storage conditions; both the pool and the ATI are located at the station's site proper.

The José Cabrera (currently undergoing decommissioning), Almaraz, Ascó, Cofrentes, Trillo and Santa María de Garoña (currently undergoing pre-decommissioning) nuclear power plants all have an ATI that is currently in operation. In particular, Santa María de Garoña's storage facility came into service in June 2022.

Spent fuel from Spanish nuclear power plants is stored at the sites proper inside pools and, when said pools are full, in dry storage facilities known as ATIs

As of December 31, 2022, there were 17,276 irradiated fuel elements temporarily stored at Spanish nuclear power plants, of which 14,635 were kept in spent fuel pools and 2,641 in ATIs.

It is of vital importance that the Spanish Government's **General Radioactive Waste Plan** (Plan General de Residuos Radiactivos or PGRR) —the seventh edition of which is currently undergoing approval— **guarantees the execution of the construction projects for the total capacity ATIs** (ATI-100%) at the sites of the different Spanish nuclear power plants, as they should be commissioned by 2026 at the very latest.

Otherwise, the nuclear power plants would have to be shut down because, as it stands, they do not have enough room to store all their irradiated fuel. Thus, they would not even be able to meet the dates set in the Protocol of Intentions signed —under the auspices of the Ministry for Ecological Transition and the Demographic Challenge— in March 2019 by Enresa and the utilities that own the Spanish nuclear power plants, which established an orderly schedule for the cessation of their activity starting in November 2027 and ending in May 2035.



Photo: Enresa



THE SPANISH NUCLEAR INDUSTRY

In 2022 the Spanish nuclear industry increased its participation in numerous projects both in Spain and abroad and continued to create quality jobs, employing highly qualified candidates with broad capabilities in different disciplines. Yet again, its endeavors have been fundamental for the operation, servicing and upgrading of the country's nuclear reactors.

The contribution of many Spanish companies to the development of the country's nuclear program for over 60 years has resulted **in a solid, competitive industry**. This experience has made it possible for these companies to be present throughout the entire value chain of the Spanish

nuclear business and achieve great national and international renown by exporting products, services and cutting-edge technology to 40+ countries.

The companies in the Spanish nuclear industry are increasingly committed to research, development and innovation, which enables them to take part in development projects for new models of advanced nuclear power plants and small modular reactors (SMRs) and in high energy physics- and nuclear fusion-based programs.

The Spanish nuclear industry continues to expand internationally by exporting cutting-edge technology, services and products to 40+ countries



Photo: ANAV





NUCLEAR POWER AROUND THE WORLD

As of December 31, 2022, **there were 422 reactors in operation in 33 countries around the world, and another 58 new reactors were under construction in 17 different countries.** Over the past few years, nuclear output has amounted to about 2,700 TWh, which represents approximately 10% of all the electricity consumed in the world and almost one third of all the electricity generated without releasing polluting emissions.

Continuity of operation of the world's nuclear fleet

The long-term operation of nuclear power plants to guarantee the supply of electricity and reduce polluting emissions is standard practice. In particular, at the end of 2022 **there were 191 nuclear reactors around the world that had been authorized to operate for more than 40 years by the regulatory bodies of 18 different countries.** All in

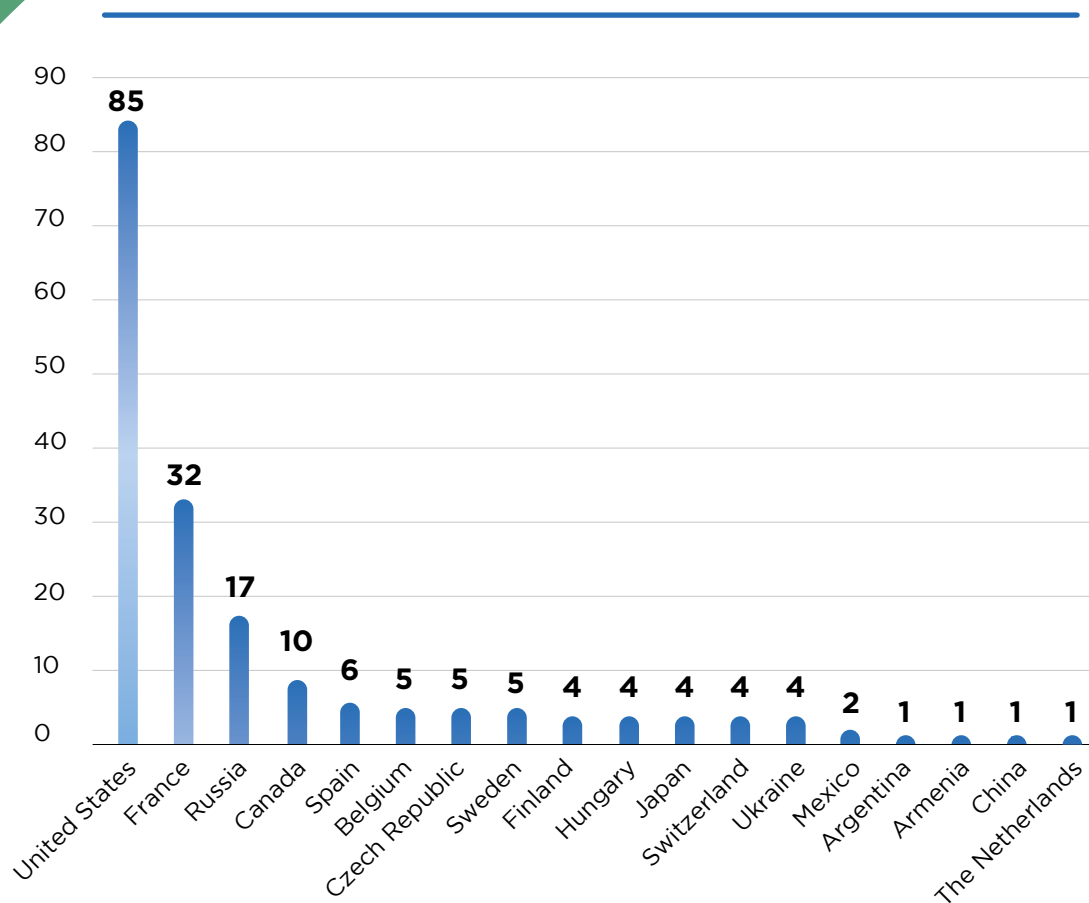
In 2022, construction of 7 reactors began in China, Egypt, and Turkey, and 6 units were connected to the grid in South Korea, China, the U.A.E., Finland and Pakistan. In addition, many countries committed to the construction of new reactors, including Small Modular Reactors (SMRs), and to the long-term continuity of their existing reactors.

all, they represent more than 45% of all existing nuclear reactors. For example, Finland has just granted a 70-year operating license to two of its reactors, and in the U.S., where most reactors have 60-year licenses, 6 of them have been authorized to operate for 80 years.



More than 45% of the world's nuclear reactors are currently licensed for long-term operation

REACTORS IN THE WORLD LICENSED TO OPERATE BEYOND 40 YEARS



Data valid as of December 31, 2022

Source: Foro Nuclear with data from PRIS-OIEA, NRC, ASN, Rostekhnadzor/Rosatom, CNSC, MITECO, FANC, SÚJB, SSM, STUK, HAEA, NRA/Jaif, ENSI, SNRIU, SENER/Gobierno de México, ARN, ANNP, CNNC and ANVS

WHAT IS FORO NUCLEAR?

We are the Association that has represented the interests of the Spanish nuclear industry since 1962. We bring together almost 50 companies and organizations, including electric utilities, nuclear power plants, engineering companies, service companies, nuclear fuel manufacturers, system and large-component suppliers, universities and professional associations.

We increase the value of the industry's activities, products, technology and services and support our members so that they may reach their commercial and business goals. Furthermore, we boost its international presence as a competitive, qualified, technological industry which operates in 40+ countries.

At Foro Nuclear we stand for the continued operation of all Spanish nuclear power plants as stable, constant, reliable and CO₂-free sources of electricity. For us nuclear power is an essential technology in the fight against climate change

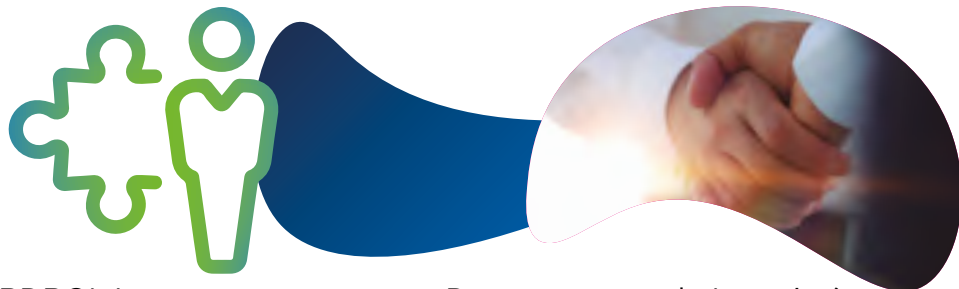
and the energy transition, and so **it is absolutely necessary to guarantee its economic viability** and regulatory stability.

We are able to carry out all our activities thanks to the contributions of our member companies, which are listed on the next page.

We defend the interests of the Spanish nuclear industry and promote its international projection, as well as raising awareness of nuclear power's essential role



OUR MEMBERS



ORDINARY MEMBERS

- AMPHOS 21
- CEN SOLUTIONS
- CENTRAL NUCLEAR DE ALMARAZ
- CENTRAL NUCLEAR DE ASCÓ
- CENTRAL NUCLEAR DE COFRENTES
- CENTRAL NUCLEAR DE TRILLO
- CENTRAL NUCLEAR DE VANDELLÓS II
- COAPSA CONTROL
- DRACE GEOCISA
- EDP
- EMPRESARIOS AGRUPADOS
- ENDESA
- ENSA
- ENUSA INDUSTRIAS AVANZADAS
- ENWESA
- FABE BUSINESS DEVELOPMENT
- GD ENERGY SERVICES
- GE-HITACHI NUCLEAR ENERGY
- GHESA INGENIERÍA Y TECNOLOGÍA
- GRUPO EULEN

- IBERDROLA
- IDOM CONSULTING, ENGINEERING & ARCHITECTURE
- KONECRANES
- NATURGY
- NEWTESOL
- NUCLENOR
- NUSIM
- PROINSA
- RINGO VÁLVULAS
- TECNATOM
- VIRLAB
- WESTINGHOUSE SPAIN

ASSOCIATE MEMBERS

- AEC (Asociación Española para la Calidad)
- AMAC (Asociación de Municipios en Áreas de Centrales Nucleares)
- Aseguradores de Riesgos Nucleares
- CEMA (Club Español del Medio Ambiente)
- Colegio Oficial de Ingenieros de Minas del Centro de España
- Consejo Superior de Colegios de Ingenieros de Minas de España

- Departamento de Ingeniería Química y Nuclear de la Universidad Politécnica de Valencia
- Escuela Superior y Técnica de Ingenieros de Minas de la Universidad de León
- Escuela Técnica Superior de Ingenieros Industriales de Bilbao
- Escuela Técnica Superior de Ingenieros Industriales de Madrid
- Escuela Técnica Superior de Ingenieros Industriales de la UNED
- Escuela Técnica Superior de Ingenieros de Minas y Energía de Madrid
- OFICEMEN (Agrupación de fabricantes de cemento de España)
- SEOPAN (Asociación de Empresas Constructoras y Concesionarias de Infraestructuras)
- SERCOBE (Asociación Nacional de Fabricantes de Bienes de Equipo)



www.foronuclear.org