

BRIEFING PAPER

# THE FRENCH NUCLEAR MODEL AND ITS INTERNATIONAL IMPACT

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Why France chose energy independence  
and built a nuclear empire in the process



# Executive Summary

**France operates one of the world's most comprehensive nuclear energy programs, generating 70% of its electricity from 57 reactors while maintaining strict safety oversight and leveraging nuclear expertise as a major economic asset.**

## Key Highlights

**Energy Independence and Economic Benefits:** [France's nuclear strategy centers](#) on energy security, reducing dependence on foreign energy sources while generating over €3 billion annually through electricity exports. The country produces excess electricity at competitive costs, making it the world's [largest net energy exporter](#).

**Robust Safety Framework:** Two primary organizations ensure nuclear safety: the [ASN \(Autorité de Sûreté Nucléaire\)](#) serves as the independent nuclear safety authority, conducting inspections and licensing, while [IRSN \(French Institute for Radiation Protection and Nuclear Safety\)](#) provides technical expertise and risk assessment. All facilities undergo mandatory 10-year safety reviews.

**Global Leadership Position:** French companies EDF and [Orano](#) are international leaders in nuclear technology, exporting reactors, fuel services, and expertise worldwide. France exclusively exports third-generation reactors with enhanced safety features and follows strict international non-proliferation protocols through organizations like [the Nuclear Suppliers Group](#).

**Policy Foundation:** France's nuclear policy rests on [three pillars established in 1999](#): security of supply, [environmental protection](#) (low-carbon emissions), and responsible radioactive waste management. The country recycles 17% of its electricity from nuclear fuel and operates reactors in [load-following mode](#) to match daily electricity demand.

**Current Challenges and Future Focus:** France addresses emerging threats including nuclear terrorism risks and continues research into advanced reactor technologies like small modular reactors (SMRs). The country emphasizes transparency and public engagement, [recognizing that 70% of citizens](#) previously felt poorly informed about energy policy.

This comprehensive approach positions France as both a [nuclear energy leader](#) and a model for balancing energy security, safety, and economic benefits in nuclear power generation.

## France's Nuclear Energy Program: Structure and Economics

France gets 70% of its electricity from nuclear energy; the main reason is France's energy plan to not be dependent on other countries energy. By using nuclear power, France can produce a lot of electricity on its own, making the country more energy-secure and less vulnerable to energy shortages or price hikes from other countries. This policy of using nuclear energy has been in place for decades and helps ensure that France has a reliable and steady source of electricity. Also, France is the world's largest net energy exporter to the other countries because France produces more electricity than it needs and production costs are low. Reason of low-cost price is cheap electricity because of nuclear power. France can sell the extra electricity to neighboring countries at competitive prices. Based on the electricity exportation, [France makes over €3 billion a year](#).

## Global Nuclear Technology Leadership

France has been very active in developing nuclear technology. French companies, especially [EDF \(Électricité de France\)](#) and [Orano \(formerly Areva\)](#), are global leaders in nuclear energy, supplying reactors, fuel, and related services to countries around the world.

French nuclear reactors are known for their advanced technology and safety features, and France exports these reactors to various countries that want to develop their own nuclear energy programs.

Orano is a key player in providing nuclear fuel products and services, including uranium enrichment and the management of nuclear waste. The company also helps build and operate nuclear plants in other countries. In addition to reactors and fuel, France exports its expertise in nuclear energy [management, safety protocols, and plant operation](#).

## Current Nuclear Infrastructure

Around 17% of France's electricity comes from recycled nuclear fuel. France currently has 57 nuclear reactors, which have a total electrical capacity of around 63,000 MWe (megawatts electrical). France currently has 0 reactors under construction and 14 reactors that have been shut down, with a combined [capacity of about 5,563 MWe](#).

## National Energy Policy Framework

In 1999, a French parliamentary debate reaffirmed the country's energy policy around three main principles:

- Security of supply – Making sure France has a stable, independent, and reliable energy source without relying too [much on foreign imports](#);
- Environmental protection – Especially focusing on reducing greenhouse gas emissions, with nuclear power seen as a key low-carbon [energy source](#).
- Responsible management of radioactive waste – Ensuring that all nuclear waste is handled safely and with [long-term solutions in mind](#).

## Public Engagement and Transparency

In early 2003, France launched its first national energy debate in response to what was described as a "strong demand from the French people." Surveys had shown that about 70% of the population felt poorly informed about energy issues, including where their electricity comes from, the role of nuclear power, and [the challenges](#) of energy policy. The goal of the debate was to educate public opinion. This move marked a shift toward greater transparency and [public involvement](#).

## Nuclear Operations and Load Management

In 2005, France established clear guidelines for national energy policy and security. As the nuclear reactors provide such a large share of the country's electricity, France uses its reactors not just for constant base-load power but also in load-following mode, which means the reactors are adjusted throughout the day to match electricity demand—producing more power during peak hours and less when demand [drops](#) (like at night or on weekends).

## Nuclear Safety Authority (ASN)

The [ASN \(Autorité de Sûreté Nucléaire\)](#) is France's nuclear safety authority, which plays a key role in shaping the country's nuclear regulatory framework. It creates the rules that govern nuclear safety. The ASN submits opinions to the government on draft decrees and ministerial orders related to nuclear activities and also issues its own technical regulations, which provide detailed safety requirements for operators and facilities. The core aim is to ensure that all regulations are easy to understand for both professionals and the public and are publicly available and transparent. ASN ensures individual [license applications](#) for nuclear facilities. However, authority to grant licenses and authorization in the Basic Nuclear Installations (BNIs), like the creation or decommissioning of the nuclear plant, belongs only to the government, though ASN provides expert input. In addition, ASN issues the licenses for small-scale nuclear activities, like in medicine, industry, and research, under the Public Health Code and also issues grants, licenses, or approvals for the transport of radioactive substances to ensure materials are moved safely and securely. The ASN ensures that nuclear facilities and activities in France are in compliance with all rules and regulations. ASN's main tool is inspection to ensure nuclear operators are meeting legal and technical requirements. It has enforcement and penalty powers which can be formal notices or administrative fines, daily fines, and the ability to seize materials or require financial [guarantees to ensure compliance](#).

In accordance with French law, every ten years, nuclear facilities in France undergo a periodic safety review to assess whether they meet safety and operational standards. After each review, ASN is required to issue a position statement regarding the conditions for the continued operation of each nuclear [facility](#).

## Institute for Radiation Protection and Nuclear Safety (IRSN)

In addition to ASN in France, IRSN (the French Institute for Radiation Protection and Nuclear Safety) is also checking nuclear facilities safety. This organization is a public expert on nuclear and radiological [risks](#).

In 2023, IRSN had a discussion about the [small modular reactors \(SMRs\)](#). These are new, smaller types of nuclear reactors. Some of them, like [Nuward](#), are based on the same type of technology as the pressurized water reactors already used in France and other countries. Others are based on new and advanced technologies, which means IRSN had to do a lot of extra work to carefully study and evaluate them.

Besides, IRSN is continuing several research projects, including: PASTIS which studying passive safety systems, these are systems that can work without human action or power), CABRI which focused on how nuclear fuel reacts in accidents where there's a sudden increase in reactor activity (called a reactivity accident), MACUMBA – looking at how well concrete walls can contain radioactive materials and keep them from leaking out.

## Nuclear Non-Proliferation and International Cooperation

France uses technical safety measures to help prevent the spread of nuclear weapons. Because of that, it only exports third-generation nuclear reactors, which are much safer and harder to misuse for making weapons. France works with other countries on nuclear projects very carefully and follows all international rules. It is part of global groups like the Nuclear Suppliers Group (NSG) and the Zangger Committee, which help control who can receive nuclear materials and technology. France also follows European Union laws that manage the export and transfer of items that could be used for both peaceful and military purposes (called dual-use items). As a member of Euratom, France must show all agreements to the European Commission before signing them and publish [agreements once they are approved](#).

## Nuclear and Radiological Security Threats

France takes the threat of nuclear or radiological terrorism very seriously, especially in light of the high level of terrorist threats, like the Paris attacks in 2015. Although the chance of a terrorist group getting a nuclear weapon is currently low, it is still possible, particularly if a nation supports them.

France is supporting the action plan on nuclear safety, which was established in 2011 and includes strengthening transparency, where states should make public reports on their progress, especially on the implementation of the IAEA Action Plan on Nuclear Safety. France's approach is to continue improving nuclear safety and citizens' [interest in and acceptance of nuclear energy production](#).



#### About the Author:

Ani Bigvava 🇨🇭 holds a postgraduate position at Jagiellonian University in Krakow, Poland. She has a Bachelor of Laws from the University of Georgia and brings over two years of experience in academic project management. Her background is complemented by advanced studies and research engagements at prestigious institutions, including the University of Oxford and Universidad Complutense de Madrid, where she explored pressing policy challenges and political issues in Europe and beyond.

Ani's professional expertise spans coordination and university-level project management. She has contributed to policy implementation and stakeholder collaboration across academic and institutional contexts. Her work reflects a strong capacity to navigate complex international frameworks and support institutional governance. With a global perspective and a deep commitment to economic aspects and human rights, Ani is a dedicated and insightful contributor to international relations and policy discussions.

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