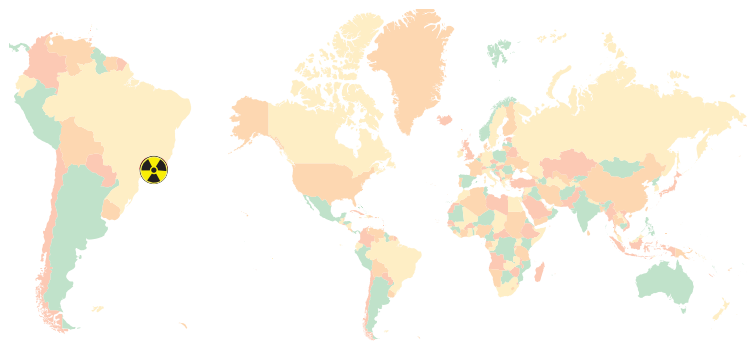


# Case Study

## Angra 3, Brazil



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Angra 3 is a typical example of a nuclear 'hang-over' project, where construction started decades ago has never been finished. It is a second generation reactor designed by Siemens in the early 1970s. Work started in 1984 but was suspended two years later. While 70% of the equipment is reportedly on site, full construction never got underway. The government announced in 2007 that it intends to finish construction and in December 2008 the state-owned utility Eletronuclear signed an agreement with the French company AREVA to complete the power plant. This briefing summarises some of the problematic issues around this nuclear project.

A coalition of environmental and citizen groups has called on European banks and decision makers not to provide their support and participation. Facts about nuclear safety, local approvals, institutional frameworks and project economics, strongly indicate the application of double standards when compared to what is common and required in European countries.

### Basic facts:

- One PWR reactor (1,405 MWe) to be supplied by Areva/Siemens and built for Eletronuclear
- Cost officially put at 4.7 billion dollars (approximately € 3.5 billion)
- Construction to start in 2010 and operational in 2015-2016
- Location 23° 00' S and 44° 28' W (coastline, 130 km West of Rio de Janeiro and 220 km East of Sao Paulo)

<sup>1</sup> Decreto s/n, de 15 de fevereiro (DOU de 18 de fevereiro de 1991, Seção 1, página 3056)

### Nuclear Safety

Being based on a 30-year-old design and with many components already fabricated and stored for decades, Angra 3 is a nuclear power plant that falls far behind current reactor technologies. Upgrades can only partly address these issues and Angra 3 will never reach the same standards as for example, the French Generation III+ European Pressurised Reactor (EPR).

### Illegal and unconstitutional approval

The construction of Angra 3 was originally approved in 1975 by presidential decree number 75870/75. The current government resolved in 2007 to resume construction, based on this 1975 decree. However, this original decree was repealed by a further presidential decree in 1991<sup>1</sup>.

More importantly, the recent decision to build the third reactor at Angra and subsequent governmental approvals, have been found to be in conflict with the Brazilian constitution. Adopted in 1988, the Brazilian federal constitution requires that, in addition to an authorising act of the executive power, any action to construct nuclear facilities in Brazil must be approved by Congress. The construction of Angra 3 was neither discussed nor voted upon in Brazilian Congress. The government is arguing that the reactor was already approved in 1975 before the constitution was adopted, again ignoring the fact that the 1975 decree was nullified by the decree of 1991.

### Weak regulatory environment:

The Brazilian nuclear regulator CNEN is not an independent body and has many conflicting interests, including a direct commercial link to the Angra 3 project. While CNEN, as regulator, has the authority to issue licences to the operator of Angra 3, one of its branches, INB, is simultaneously providing fuel to power Angra's reactors.

The way in which CNEN is organised also poses a conflict of interest. For example, CNEN's institutions are contracted to analyse the impact of accidents occurring in INB factories. CNEN also operates nuclear installations inside research institutes that it licences and regulates. Nuclep, a group that manufactures the equipment for the nuclear industry, is also part of the CNEN infrastructure. So in Brazil, CNEN is an umbrella group with its own supplier, operator, contractor, licensor and regulator.

CNEN has a track record of showing a favourable attitude towards the Angra nuclear power plant. For example, in contradiction to legislation it has repeatedly extended a provisional operational licence to the Angra 2 unit, despite the fact that satisfactory evacuation plans are not in place and that the Federal Public Ministry has required improvements to be made since 2001. Similarly, it allows the operation of two existing units despite the fact that not even an interim repository for its radioactive waste has been licensed.

Since the 70s, some Brazilian organisations have been arguing that the CNEN should become an independent body. The Brazilian Physics Society (SBF) is one of the leading proponents of creating this separate body. In 1985, by presidential decree, the Brazilian nuclear programme evaluation committee was formed. Members of this committee included scientists, engineers, managers and businessmen, whose remit was to produce recommendations to the public administration for the nuclear industry. Its report included a recommendation to create CNEN as an independent regulatory body, but no action has been taken to resolve the innate conflict of interest. A similar recommendation was made in 2007, but to no avail.

The governance structure of CNEN does not reflect the regulatory independence required by the International Convention on Nuclear Safety (CNS) that was adopted 10 years ago by the National Congress in Brazil (Decreto legislativo 4 de 22/01/1997 e decreto 2648 de 01/07/1998).

Similarly, current EU legislation requires that *“Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion, or utilisation of nuclear energy, including electricity production, in order to ensure effective independence from undue influence in its regulatory decision making.”* (EU Directive 2009/71).

## Economic Risks

The cost of € 3.5 billion to build a 1,405 MW reactor seems to be too low. Although it may be argued this is due to some equipment having already been purchased in the 1980s, current reactor projects are nevertheless three to four times more expensive per unit of installed capacity.

Also, securing construction funding in euros increases the financial risk of the project, an aspect that is increasingly challenging to manage in a repayment-of-debt scheme. The Brazilian Real has fluctuated by 37% over a one-year period compared to the euro. This volatility will eventually impact the project's cost.

The large-scale upgrades and adaptations required to integrate new safety requirements into the existing Angra 3 structure, may lead not only to higher construction costs, but also increase the risk of unplanned outages during its operation. For example, the Temelin nuclear power plant in the Czech Republic, which used outdated Russian technologies but was upgraded in 1990s, struggles to achieve a 70% cumulative capacity factor. The first reactor at Angra also demonstrates this problem. Angra has a cumulative load factor as low as 44%, while Angra 2 manages to reach 78%. Angra 1 and 2 took 13 and 25 years respectively to be completed and their total expenses have reached \$10 billion US dollars for a combined capacity of 2,000 MWe.

## Not a Least-Cost Option for CO<sub>2</sub> Emission Reduction

Brazil has great potential for renewable energy sources that can deliver electricity at cheaper rates than new reactors. A peer-review analysis published in the journal *Energy Policy* in 2009<sup>2</sup> shows that power generated at Angra 3 will be more expensive than hydro, biomass and wind energies. Its production has been calculated at \$113 US dollars per MWh, while co-generation with sugarcane bagasse delivers at \$74 per MWh, natural gas at \$79 per MWh and hydroelectric at \$46 per MWh. It concludes that even wind, at \$107 per MWh, can deliver more affordable electricity than Angra 3.

Procel, an energy efficiency programme of the Brazilian government, also identified the potential of energy efficiency measures that can save 7,000 MW of energy by investing just \$560 million in related measures.

## Lack of Transparency

The Brazilian nuclear programme does not appear to make any economic sense or to be driven by energy needs, but instead seems to be driven by geo-political strategic interests. People who were previously involved in a secret programme to build a nuclear weapon (terminated in 1992), continue to be strongly involved. For example, in a December 2006 interview, the former creator and coordinator of the Naval Nuclear Programme between 1979 and 2004, Admiral Othon Luiz Pinheiro da Silva claimed that nuclear submarines are critical if Brazil is to be considered a major power. Admiral Othon is currently chairing Eletronuclear, operator of the Angra reactors.

Brazil joined the Non-Proliferation Treaty only in 1994 and to date has not yet ratified its Additional Protocol to safeguards. On several occasions, it has refused the International Atomic Energy Agency access to its nuclear facilities. This also has implications for the existing lack of transparency and public participation around Angra 3.