José Israel Vargas

From crisis to opportunity

The former minister, an advocate of nuclear energy and critic of corporatism, looks back on his career as a scientist and policy maker

Fabrício Marques

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José Israel Vargas, 83, who was born in Minas Gerais state, is not just a privileged witness to the development of Brazilian science in the twentieth century. As Minister of Science and Technology from 1992 to 1998 – a position he held longer than anyone else has – he became one of the most influential voices in science and technology policy in Brazil. He graduated from the Federal University of Minas Gerais (UFMG) in 1952 with a degree in chemistry but soon became involved with physics. He gained solid experience in physics at the University of São Paulo (USP) and the Aeronautical Institute of Technology (ITA) and received a PhD in nuclear science from the Department of Physics & Chemistry at the University of Cambridge. He was one of the formulators of Brazil's nuclear energy policy at the beginning of the 1960s, an activity that was interrupted by the military coup of 1964, which led to Vargas leaving the country and living in exile in France for six and a half years. While in France, he worked as a researcher at the French Atomic Energy Commission's Center for Nuclear Studies in Grenoble. Vargas returned to his policy-making career in Brazil under Aureliano Chaves, then Governor of Minas Gerais. In the Figueiredo administration, he became the Secretary of Industrial Technology in the Ministry of Industry and Commerce. Itamar Franco's presidency saw him moving to the Ministry of Science and Technology, where he remained through Fernando Henrique Cardoso's first term in office. "Because I'm jinxed, I was always appointed during times of crisis," says Vargas, who, three years ago, compiled a book, *Science at a Time of Crisis*, from some of his writings generated over the last thirty years. A defender of nuclear energy and critic of corporatism in Brazilian science, Vargas talked about his career in this interview with Fabrício Marques.

■ *You have a degree in chemistry, but you embarked on a career in physics. How did that transition happen?*

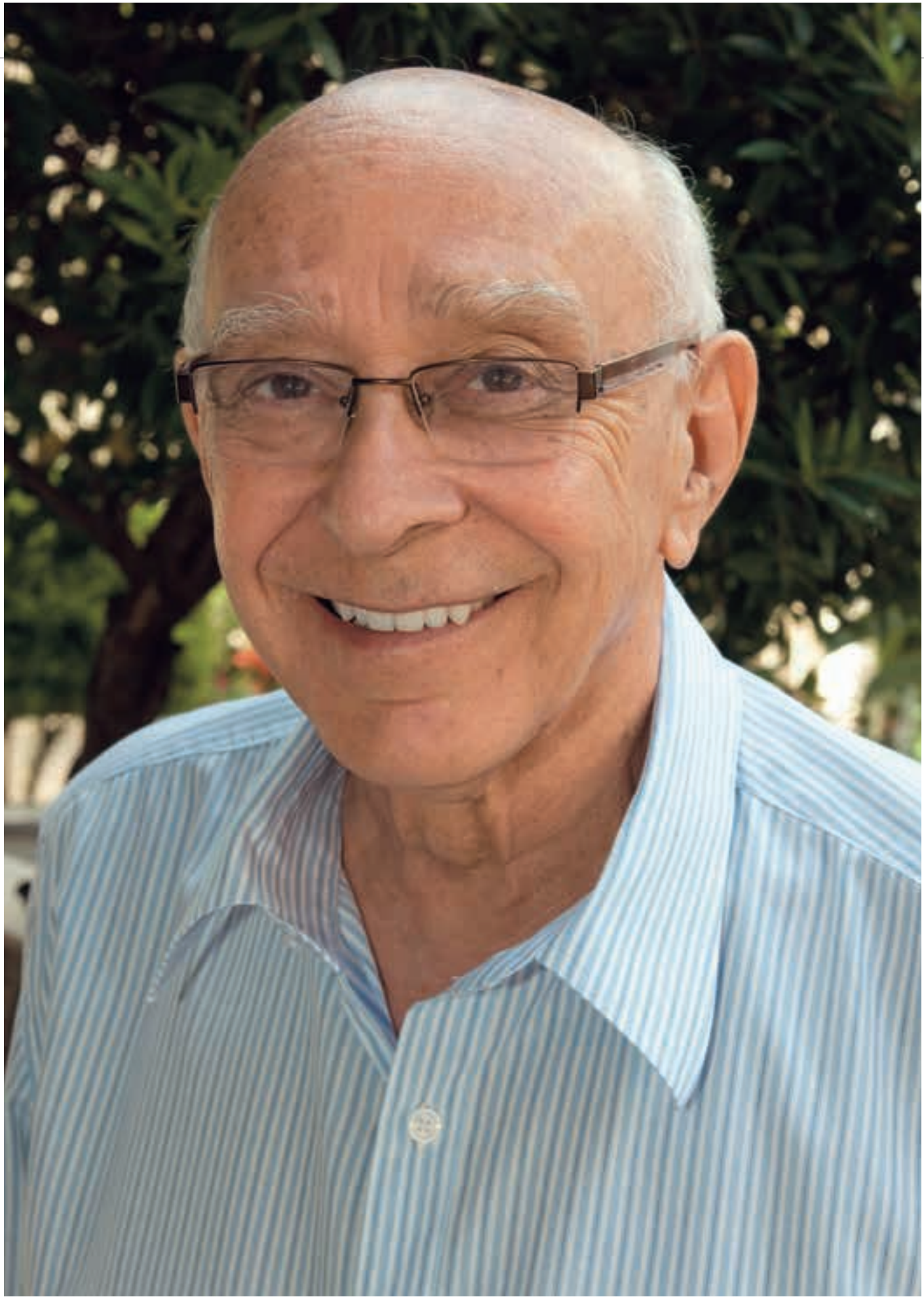
— My friends joke that to physicists, I'm a chemist, and to chemists, I'm a physicist. I think they mean I'm equally ignorant in both areas. The field that most attracted my generation was nuclear physics and nuclear energy, where the biggest technical and scientific advances during and after the Second World War had been made. Brazil had had the good fortune to have a generation that produced a series of great scientists at the USP. This line of scholarship came out of the brilliant Italian school led by Enrico Fermi. At USP, Gleb Wataghin and Giuseppe Occhialini taught Marcelo Damy, Abraão de Moraes, Mário Schönberg, Paulus Aulus Pompeia, César Lattes and Oscar Sala. I came into contact with this generation of scientists when I went to study chemistry at the Federal University of Minas Gerais in 1948. In my second year, I transferred to USP, in Alameda Glete, where I stayed for almost two years. Like every young person at the time, I was a left winger, involved in student protests and the "The oil is ours" campaign, which was led mainly by the Communist youth movement. I made friends with and got to know people there who were to become important scientists.

■ *For example?*

— Ely Silva, Luís Hildebrando Pereira da Silva, Ernst and Amélia Hamburger, Fernando Henrique Cardoso, José Goldemberg, Victor Nussenzweig – with whom, as a matter of fact, I was imprisoned during the oil campaign. I went back to Minas leaning towards physics. Although I continued studying chemistry, I became a high-school physics teacher, and I taught physics in a university-entrance-exam preparatory course in the School of Philosophy at UFMG.

■ *What was your stay at ITA like?*

— At the time, ITA was running a development course for high-school physics teachers. It was an initiative of the CNPq [National Council for Scientific and Technological Development] organized by Paulus Aulus Pompeia, who was one of the most important figures in Occhialini and Wataghin's group. Pompeia had participated in the most remarkable achieve-



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ments in physics in recent times, the discovery of so-called penetrating showers. That discovery was one of the first to demonstrate that the atomic nucleus is much more complex than had previously been imagined. There were some twenty-odd students from all over Brazil in that course. The prospects that nuclear energy offered for the world's economy and for science were tremendous. It was natural that young people with scientific inclinations would want to move into that area. The course was especially interesting because Pompeia brought the leading lights of Brazilian physics to lecture and give conferences. There were also two great American physicists in Brazil at that time, Richard Feynman and David Bohm, the latter of whom was fleeing from McCarthyism. Abraão de Moraes, an important Brazilian physicist, suggested that Pompeia recruit me at ITA. So although I had recently graduated in chemistry, I ended up in the physics department.

■ *What was the environment at ITA like?*
— I was at ITA from 1952 until 1954. It was an extremely interesting period because ITA had recruited the very best people in Brazil: young scientists and engineers in various areas, but especially in mechanical engineering, materials science, aeronautics and, of course, mathematics. It had hired a large number of scientists, including many from the Massachusetts Institute of Technology (MIT). There were some Germans from Von Braun's group, along with Belgian, French, Czech and Swiss researchers, who began working on the project to develop the first Brazilian airplane, the seed of what would one day become Embraer. ITA was a special place, because it offered accommodations, food, a small salary and a minimal work schedule, which allowed people to attend the various courses at ITA. One of those was taught by Walther Baltensperger, from the Zurich Polytechnic, who became a close friend. What's more, I used to go to São Paulo once a week to attend David Bohm's seminar at USP, and I frequently stayed with Fernando Henrique Cardoso. Mário Schönberg lived in the same building, which was reason enough for long conversations late into the night. This experience encouraged me increasingly in the direction of physics. I left ITA because my father was sick and went back to Belo Horizonte. That's when an opportunity arose for me to take the public-service entrance exam to be chair of the physics department at the municipal college. Soon after that, the Institute for Radioactive Research [IPR] was founded in Belo Horizonte, and I was invited by Professor Francisco Magalhães Gomes, its organizer, to do precisely the work I wanted to do, nuclear research.

> The Geisel government appointed me as a member of the board of the National Research Council but wouldn't give me a passport to leave the country

■ *The next step was a PhD from the University of Cambridge.*
— Exactly. At that time, the first Latin American course in nuclear chemistry was being given in Chile, at the University of Concepción, sponsored by the University of Cambridge and by Unesco. I received a grant from the CNPq to attend the course; just two of us taking the course were Brazilian. There I met Alfred Maddock, who suggested I should do a PhD at Cambridge and offered to be my tutor. I started in 1956. Cambridge University had been the main center for the development of nuclear science. There were some five or six Nobel prize winners there at the same time I was. The lead researchers were from the English nuclear-armament program, and many had taken part in the Manhattan Project. A number of scientists were lecturing there at the time, including James Chadwick, who had discovered the neutron, and Otto Frisch, who had developed the first model of nuclear fission.

■ *What did you do when you came back to Brazil?*
— I went back to my old jobs at the Institute for Radioactive Research and at the School of Philosophy [at UFMG], where I was the acting professor of physical-chemistry and advanced chemistry. I later passed the public-service exam and formally became the full professor. I made a lot of efforts to get a hold of the necessary resources for doing scientific work; these efforts were very urgent. I subsequently established a strong relationship with Marcelo Damy and took part in numerous working groups organized by the CNEN [National Nuclear Energy Commission], which he presided over. I was appointed a member of CNEN's board, and, in that capacity, I acted as his deputy on the Board of Governors of the International Atomic Energy Agency [IAEA] in Vienna, where I was on various committees. Two of the more notable ones were the committee that established the rules and safeguards for controlling nuclear activities via inspections and the one that was responsible for formulating the international standards for nuclear data.

■ *Why were you relieved of your duties with the CNEN after the 1964 coup?*
— Naturally, they remembered that I had been a student agitator; the revolution had a long memory; like all revolutions. I was subjected to three police inquiries and my laboratory was invaded by an army detachment. I was relieved of my duties, supposedly at the request of the CNEN board; however, I decided not to leave Brazil until things had been clarified, in order to avoid being tried *in absentia*. In 1964, I received invitations to go to the United States, Argentina, the Netherlands and France. I chose France, specifically Grenoble, but I maintained close relations with the National Institute for Nuclear Science and Technology, which was located in Saclay, near Paris. I went to Grenoble because one of my friends at the International Atomic Energy Agency, Pierre Balligand, who had been the director for power reactors there, became director of the Center for Nuclear Studies in Grenoble, along with Louis Néel, a Nobel prize winner in physics.

■ *What kind of relationship did you maintain with Brazil during that time?*
— In 1969 or 1970, I was asked by the CNEN to come to Brazil to suggest policies, presumably new ones. The chairman of the committee was General Uriel Alvim; he wanted to discuss whether or not to resume the famous thorium project that had been started at the IPR in Belo Horizonte. This project had been initiated at a time when there was no clearly defined Brazilian nuclear policy. In that environment, a group of young engineers, physicists and

chemists from Belo Horizonte had formulated the so-called thorium project, which aimed to build one type of reactor out of the various possible options, the so-called auto-generating or regenerating reactor, which would use a mixture of enriched uranium and thorium. The project lost support, and I became the black sheep of the program. I have never managed to prove it, but, because of something a well-informed friend let slip, I'm certain that our Nuclear Energy Committee was forbidden to have any relationship with me by a secret decree – apparently a common occurrence in the '64 regime.

■ *To what do you attribute this?*

— My cohort [at CNEN], that of the Damy administration, had always advocated an independent nuclear program using natural uranium. But the military government signed an agreement with the United States and acquired a ready-made turnkey reactor fed with enriched uranium, to which the contribution of Brazilian technology would be practically nil. We did not accept that policy. We had our independent position on the Board of Governors of the IAEA. Remember that the certainty of a third world war was then current doctrine in the Brazilian government. In the subsequent Geisel government, there was an agreement with Germany, in which I played an indirect part. The João Pinheiro Foundation in Belo Horizonte, of which I was chairman under the Aureliano Chaves government, formulated the Pronuclear Program to be administered by the CNPq, which aimed to train the personnel who would be needed to implement the nuclear agreement with Germany. Oscar Sala, Goldemberg and I, who were wary about the agreement, were invited to visit the German nuclear facilities. I thought then, and I still think now, that the nuclear program should be an instrument for modernizing Brazil. I considered that agreement to have its positive side. For a long time the nuclear program had been nothing more than an American reactor, Angra 1. We could learn nothing from that reactor about technology – except, to be fair, the technology of safety, management and operations. The first reactor included in the nuclear agreement with Germany was Angra 2, which I supported in the end.

■ *Tell us about your return to Brazil.*

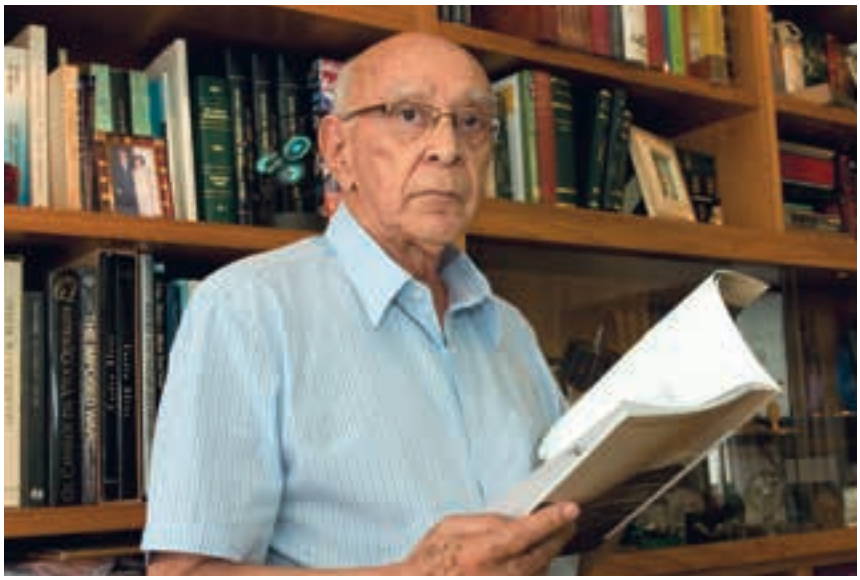
— The time arrived when I had to decide. I had four daughters, the oldest of whom was 12 years old. Remaining in France at that time would have meant staying there permanently because it's likely they would have gotten married there. So I came back in 1972. It was an important moment in Brazilian science. In 1972, Finep [the Research and Projects Financing Agency] was headed by José Pelúcio Ferreira, a leader in promoting an extremely active and smart set of scientific policies here that were supported by ample financial resources coming from the BNDES [the Brazilian Development Bank] and then from Finep itself. I didn't know Pelúcio, but he invited me to talk with him. He wanted me to act as a type of consultant. I told him I was resistant to having any relationship with the military government and said that I was not interested in his invitation. As I was leaving, I asked who had suggested he contact me. He answered, "Celso Furtado." I had become friendly with Celso at Cambridge. I said that this changed the whole picture; if the suggestion came from Celso Furtado, it was because it deserved consideration. "So, what are we going to do?" he asked me. My proposal was to focus on strategic materials, like nickel, zinc and niobium. Niobium is important because we have 90% of the world's reserves of it whereas we don't have nickel; our nonferrous metals are all very altered by tropical storms, so autonomous technology is required. Pelúcio and the Planning minister João Paulo dos Reis Velloso brought about a major reform of the Brazilian science-and-technology system under the Geisel government. To my surprise, I was named a member of the plenary body of the new National Research Council, a presidential commission that coordinated the country's research and development activities. But at the same time, they would not issue me a passport so I could leave the country.

■ *The military government also had a modernizing aspect, as can be seen in the way it courted scientists.*

— The situation at that time was doubtful. Although I had been appointed by Geisel, certain groups and institutions opposed me, perhaps because, with a view to their own careers, they saw me as a competitor. At the same time, Aureliano Chaves had been appointed Governor of Minas Gerais State, and he knew me. He invited me to organize the Department of Science and Technology in the state government. I told him that I couldn't accept because I didn't know the situation in which I would be operating sufficiently well; I had been away for almost seven years. He said to me, "Do you want time to reflect, to think about it, to gather information?" I accepted this suggestion and was appointed chairman of the João Pinheiro Foundation. It was at this time that Embrapa [the Brazilian Agricultural Research Corporation] was created.

■ *What were the discussions like that led to the creation of Embrapa?*

— I was against the project as it was originally drawn up, until the plan for developing human resources was presented. The plan, designed by Alysson Paulinelli, the Minister of Agriculture, was to send 800 young Brazilians to get PhDs at the best foreign universities, particularly Wisconsin, Purdue, Cornell and other centers with international reputations. That's when I said I was in favor of the project. I knew that of those 800, 10% would have the competence to be able to understand the advances that had been made in molecular genetics and would thereby be able to reorient the company's programs in that strategic sector. I remember this issue because it shows that there's no secret to finding the path to progress. The sequence of policies that led to Embraer and Embrapa is an example of such a suc-



cess: recruitment and highly competent training, management flexibility and independence from official bureaucracy. We've somewhat forgotten today that science is the work of individuals. The people who produce good science are good scientists, and the people who produce great science are great scientists. What is the role of the government, politics or management? It is to create conditions under which quality people can produce quality science. The second principle is that, unlike technology, which can be local and linked to particular natural conditions and natural resources, science is universal. There's no such thing as Brazilian science; there's just science.

■ *You were opposed to the creation of the MCT [*Ministry of Science and Technology*]. Why?*
— I was always against it because the Ministry has to compete with other cabinet-level departments that are obviously more important to politicians, who almost always take a short-term view. So the Ministry of Science and Technology is always treated as being a second- or third-level player. In the Reis Velloso shuffle, Pelúcio put science in the view of the President of the Republic, thereby guaranteeing it priority and a budget. That's what matters. Why was the Ministry created? For political reasons, Dr. Ulysses Guimarães wanted Renato Archer to be appointed Minister of Foreign Affairs, but Tancredo had a commitment to Olavo Setúbal. So the Ministry of Science and Technology was created for Archer, who was, in fact, a good minister. That shows how vulnerable and unimportant science and technology are in Brazilian society. They still don't form part of our system of values.

■ *How were you appointed to head the Ministry?*
— President Collor was impeached and Itamar, the new president, invited me to the position. I told him that I'd been a little disillusioned with my position as Secretary of Industrial Technology in the Figueiredo government. Itamar said, "Oh, but I need you to help me carry the burden! I'm trying to form a government of national unity." Because I am jinxed, I arrived in the midst of a crisis, but I was the Minister of Science and Technology, and I lasted longer than anyone in that position. Itamar gave me a lot of support. The things I managed to accomplish in the beginning were largely the result of the privatization of the Companhia Siderúrgica Nacional [National Steel Company]. The proceeds allowed us to continue a large part of the work that had previously been put on hold for lack of funds.

■ *For example?*
— I didn't go there to invent the wheel; I worked from the assumption that my predecessors were neither imbeciles nor malevolent, but that they were people whose choices represented the opportunities – or lack of opportunities – at a given time to carry through on certain projects and initiate certain others. I spent my time finishing work that had already been started. Many of the initiatives, either from the military regime or subsequent administrations, came to absolutely nothing because of a disastrous decision under the Constitution of 1988: the unified-labor-policy regime, which made the salaries of professors at UFRJ, UFMG and Unifesp the same. It also established that the professors at those institutions had the same duties and would receive the same remuneration as the professors at any new universities, such as those the Lula government started founding left, right and center. In addition, there was a provision that, in practice, impeded the hiring of foreign scientists. It took four years of struggle to eliminate that impediment from the Constitution. It took a long time, and even after it had been repealed, the university cliques and the unified-labor-policy regime still kept the country's scholarly communities from being refreshed by people involved in research in interdisciplinary areas.

■ *What is your assessment of the recent changes in legislation on innovation?*
— There are differences of opinion about whether it was Louis XV or Madame Pompadour who was the author of the famous phrase "Après moi, le déluge" ("After me, the flood"). In Brazil, it's the opposite; it's "Before me, the flood." All that had been done before was abandoned. We had two extremely important laws that incentivized the participation of industry in the development of science and technology: Law 8,248, the IT law, and Law 8,661, which allowed companies to deduct up to 8% from their income-tax bill if they invested that money in science and technology. Law 8,248 was very generous; it applied to revenue in the IT sector. Both were altered. One of the reasons for lack of success in building relationships between industry and universities and entities that promote research is that industry wants economically important developments, those that will generate income, to be protected by secrecy. A company that wants to develop a new device will not be persuaded to submit its idea to a decision-making bureaucracy made up of scientists at Finep and the CNPq. Nor will it agree to submit the idea to its peers because they are potential competitors. The solution is to award the incentive afterwards. A company declares that it's going to invest X in science and technology; it invests it, entering into an agreement with a university and doing what it wants with secrecy clauses. When the project is finished, the company shows what it has done to the government, which can either award the incentive or not. It seems trivial, doesn't it? It's essential. But because it runs counter to the desires of the scientific community,

which wants to have the decision-making power, a tension is engendered between the production sector and academia. One of the changes that occurred with this law was to give a greater role to the decision-making bodies. That was a mistake.

■ *What is the future of the Brazilian energy matrix going to look like?*
— First, hydroelectric power. Everybody's talking about megaplants, but when you look at the hydroelectric potential of Brazil, generally speaking, all of the water that has a potential production of less than 20 megawatts is ignored. But miniplants have immense potential. I think we need nuclear energy to replace the generation that today comes from gas, coal and petroleum, which produce greenhouses gases.

■ *Nuclear energy lost a bit of ground in the 1980s because of safety issues, which might be coming to the fore again after the radioactive leaks caused by the earthquake in Japan. Is there a mature technology that will allow us to substitute nuclear power for these other means of generation and truly fulfill all of Brazil's needs?*
— No. There's very little chance of the country resuming activities in that area because the specialists here are now old and because there are no incentives to encourage new people to specialize in it. Over 30 years ago, during the Geisel presidency, a Pronuclear Program was created. When it was active, more than 600 people – engineers, geologists, chemists and physicists – were sent abroad to undertake specialized studies, mainly in Germany. These people have grown old and retired. The only initiative that has survived is the remains of the so-called parallel program, now being directed by Admiral Otto Pinheiro, which is a great success. Thanks to this program, Brazil dominates the technology for the isotopic enrichment of uranium. We have a valuable currency for exchange in this area. So even though we don't have the trained personnel, it would be possible to revive the sector through international cooperation.

■ *And the safety issue?*
— We have to adopt independent and efficient radiation-protection regulatory systems that will guarantee the safety of the existing power stations and of any future ones. What has so far been done in this area doesn't seem sufficient to me. Brazil does not separate licensing from the supervision of nuclear-related activities, so it is not complying with the 2003 recommendations of the International Atomic Energy Agency – which were approved with Brazil's vote. This is also despite the warning issued years ago by the scientific community. An irrefutable example: The accident in Goiânia [1987] led to a bill that would correct this anomaly, but it's still on the back burner in the House of Representatives today. This inertia is the result of corporatist pressure arising from the utilitarian attitudes of the CNEN. I have no doubt that nuclear energy will be fundamental to filling the world's energy needs. Naturally, what happened in Japan will hold up the launch of new projects, perhaps for a long time. There has recently been talk of our alleged wind potential. In France, which generates almost 80% of the energy it consumes with its nuclear power stations, it is estimated that wind power from marine generators is four times more expensive. There's more potential in biomass, particularly sugarcane bagasse, whether it is burned directly or used as raw material in facilities that generate energy through the enzymatic hydrolysis of pulp.

> The science and technology system has been imbued with the official ideological view that Brazil started eight years ago. But in relative terms, the volume of resources has increased very little

■ *Since you left the Ministry, some of the scientific-production indicators have been steadily growing. How would you assess what has happened in these last few years?*
— Unfortunately, the scientific and technological system has been imbued with the official ideological view that Brazil began eight years ago. When I arrived at the Ministry, despite the difficulties I faced, the indispensable participation of the private sector in the science and technology spending was 6%; by the time I left, it had reached 30%. When Sérgio Rezende left the ministry in 2010, it was at 34%. We tripled the number of PhDs from 1,000 to 3,000, and the last administration tripled it again, to 10,000. In relative terms, the volume of funds has increased very little; in absolute terms, it has grown with the GDP. When I left the Ministry, around 1% or 1.1% of the GDP was being spent on science and technology; now it's 1.3%. The GDP has increased, but the relative investment has changed almost not at all. The licensed-patents indicator is still poor; 90% of patents are registered by nonresidents. National scientific production has increased; the number frequently cited is 19,000 annual publications. But there has been a change in the counting method; the current rubric is broader than the previous one used by the ISI.

■ *The number of Brazilian journals in the ISI journal database has gone from a few dozen to more than one hundred.*
— The number naturally increased when the basis for inclusion changed. In other words, there was not really such a significant increase. This question leads me back to the difficulties I faced – and to some of my achievements. One of them was the creation of the CPTEC [the Center for Weather Forecast and Climate Studies at Inpe], thanks to which Brazil has begun to have its first class meteorological forecasts. The José Pelúcio Ferreira National Scientific Computing Laboratory, which previously operated in Praia Vermelha in Rio, has been set up on a new campus in Petrópolis. The National Light Synchrotron Laboratory also began operations under the Fernando Henrique government, financed with funds that partly came from the privatization of the CSN during the Itamar presidency. As to so-called sector funds, in my administration, we created a royalties fund that came from the revenue from oil concessions. It was earmarked for science and technology, thanks to a proposal from then Senator Eliseu Resende, who reestablished the Government's oil monopoly. We created the Brazilian Space Agency, and two satellites were built at Inpe, in addition to two others that were built in collaboration with the Chinese. The sector has benefited from the continuation of the Scientific and Technological Development Program [PADCT] with the World Bank and from the funding of Centers for Excellence, which have become important platforms for Brazil's participation in the world's scientific community. ■