

**Energy Security in Brazil: A Driving Factor for Brazil's Emergence
in our Increasingly Multipolar World**

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A Country in Transition: The Last Phase of Brazil's Metamorphosis

The downfall of the Soviet Union triggered unexpected tremors in the international system, dislodging the United States as one of only two superpowers and propelling less developed countries such as Brazil to global eminence. Ironically, these outcomes were largely the product of U.S. victories in cultivating free societies abroad during the Cold War. No where is this truth more evident than in the ideological underpinnings of Brazilian foreign policy throughout the latter part of the 20th century. The government in Brazil answered pressures to globalize with state capitalism and by financing technological research in state-owned enterprises (SOEs) so as to attract foreign direct investment. Goaded by mushrooming international debt and mounting political dissent in the mid-1970s, Brazilian statesmen embraced the U.S. worldview that democratization endows countries with special virtues that allow them to enhance their political economies and expand mutually beneficial collaboration with neighboring states.¹ In 1984, the military initiated a controlled political opening, or *abertura*, whereby competitive presidential elections established a civilian as the nation's top executive following two decades of military rule. Those early state-led modernization efforts, however, along with the economic downturn unleashed a flurry of centrifugal forces in Brazil's political system.

Ultimately, the pro-military party in Congress disrupted the gradual transition that the military had planned by supporting a progressive alternative candidate. Though this candidate died during the campaign and voters elected a conservative in his place, the tides of change had matured enabling Brazilian foreign policy to evolve independently of the United States.² This opening facilitated the privatization of SOEs such as energy giant Petrobrás and the liberalization of trade through Mercosul, the 'Common Southern Market' Brazil forged with Argentina,

¹ Sean W. Burges, *Brazilian Foreign Policy after the Cold War* (Gainesville: University Press of Florida, 2009): 77.

² Patrick H. O'Neil, Karl Fields, and Done Share, *Cases in Comparative Politics*, 3rd ed. (New York: W. W. Norton & Company, 2010): 458.

Paraguay and Uruguay. In a quintessential display of its new global strategy, Brazil renovated Mercosul in 1994 based on the model set by the European Union in an attempt to offset Mexico's elevated regional standing with the North American Free Trade Agreement (NAFTA). The updated provisions allow participating members to alter the treaty in a manner wholly unattainable under NAFTA, granting them the purview to adopt a common currency and establish free trade agreements with other multilateral entities. The maneuver loudly illustrates Brazil's penchant for consensual leadership. Though reminiscent of the "dependency-inspired worldview"³ Brazil assumed when the United States loomed at the hub of hemispheric affairs, coalition-building now signifies the state's foreign policy strategy for "[hastening] the transition from the dominance of the developed world to a multipolar order in which international power balances and institutions are more favorable to the assertion of Brazil's interests."⁴

Whereas previously Brazil's reliance on global partnerships could be understood in terms of American primacy, its political and economic systems have now progressed to a point whereby Brazil can pursue national concerns instead of conforming to a dominant power's agenda. The country is well on its way towards democratic consolidation, despite relentless episodes of state corruption. Brazil has likewise made considerable strides in developing its economy, though abject income inequalities persist. The 'B' in the BRIC forum, Brazil has gained esteem as a one of the four fastest growing economies alongside Russia, India and China; and its membership in this elite group "embodies the peripheral-state ethos at the heart of Brazilian grand strategy."⁵ Together, these emerging economies accounted for 23% of global gross domestic product (GDP) in 2010. By the end of 2012, growth estimates project that Brazil

³ Burges, *Brazilian Foreign Policy*, 80.

⁴ Hal Brands, "Dilemmas of Brazilian Grand Strategy," *The Strategic Studies Institute Monograph* (2010): 3.

⁵ *Ibid*, 23.

will surpass France in terms of nominal GDP as the fifth largest economy.⁶ Already the fifth largest landmass and fifth most populous country in world, housing over a third of Latin America's inhabitants, Brazil is undoubtedly poised to lead in the 21st century.

While democracy may have provided the stability and transparency needed to accentuate its *grandeza* (national greatness), it will be Brazil's growing clout in the international energy market that solidifies its position as a major power in the coming century. The country wields an abundance of natural resources and stunning energy prowess. An estimated fifty billion barrels of crude oil lie beneath Brazilian waters, its Amazonian river systems provide unparalleled hydroelectric capacity, the country boasts of large uranium deposits and enrichment capabilities, and its annual production of sugarcane ethanol has no overseas rival in supplying the nation with transportation fuels. Such realities inform the warm, nationalistic proverb "God is Brazilian."⁷

Remarkably, oil dependency and international energy crises are what prompted the initial investments in Brazil's energy sector that have engendered the country with such prominence; in the 1970s the government sought to mitigate international debt through energy diversification. By one account, "the country is reaping the benefits from [this] legacy of policies that were intended to advance its self-sufficiency and autonomy from international markets but are now paradoxically conferring important advantages for engaging with the world economy..."⁸ Today the market value of its leading energy corporation Petrobrás exceeds that of Microsoft, and its 46% renewable energy matrix makes Brazil the least carbon intensive of all major economies.⁹

⁶ Samuel W. Bodman, James D. Wolfensohn, and Julia E. Sweig, "Global Brazil and U.S.-Brazil Relations," *Council on Foreign Relations Independent Task Force Report*, no. 66 (2011): 14.

⁷ Larry Rohther, *Brazil on the Rise: The Story of a Country Transformed* (New York: Palgrave MacMillian, 2010):171.

⁸ Lael Brainard and Leonardo Martinez-Diaz, ed, *Brazil as an Economic Superpower? Understanding Brazil's Changing Role in the Global Economy* (Washington DC: Brookings Institution Press, 2009): 5.

⁹ Rohther, *Brazil on the Rise*, 187.

Not surprisingly, energy already constitutes the most politicized sector of the Brazilian economy. Nonetheless, it will receive increased attention from policymakers in coming decades, as conventional models for responding to fluctuations in the market transform. Brazil is set to benefit from the “new energy paradigm” that emerges from these changes in market conditions and new global approaches to energy.¹⁰ Analysts point to two trends driving these policy-related structural developments: world dependence on commodities and burgeoning resolve to preserve the environment. As for the former, heightened demand for energy will fuel tensions among states that only can swell as their dependence on energy increases. Supply shortages and disruptions are already breeding geopolitical rivalries, as energy markets can no longer generate the excesses in supply consumers saw in the 1980s and 1990s when private ownership and the elimination of trade restrictions represented viable solutions for offsetting climbing oil prices.¹¹

In order to understand Brazil’s impending role in the international community, it is imperative that we understand the circumstances compelling these paradigm shifts. With competition dictating the sale and distribution of commodities, cost minimization became the chief concern. Accordingly, states neglected to allocate sufficient funds to infrastructure creation and fully commit to resource exploration and production (E&P). International oil prices climbed in 1999, reaching a high of \$70 barrel in 2006 and thereby revealing the West and Far East’s deep-seated vulnerability to price hikes. Given the political unrest in the Middle East and widespread dependency on the Organization of Petroleum Exporting Countries (OPEC), particularly Saudi Arabia, Iran and Iraq which hold the three largest known oil reserves in the world, it is increasingly evident that states must augment their investments in efficiency and innovation if they hope to compensate for inevitable growth in their populations and economies.

¹⁰ Dieter Helm, ed, *The New Energy Paradigm* (New York: Oxford University Press, 2007):4-5.

¹¹ *Ibid*, 10.

Though sensitivity to prices has long qualified as a key consideration in the formation of energy policy, the surges in consumption projected by the International Energy Agency (IEA) have demonstrated why energy policy will undergo a structural shift in the next decades.¹² From 2010 to 2030 the IEA expects to see at least a 27% increase in world demand for primary oil, with developing countries experiencing over 73% of that expansion.¹³ In light of its green growth and recent sub-salt discoveries, Brazil will command superior stature in coming years.

Still, the country is not guaranteed this fate. To complete its metamorphosis, Brazil must adapt to these imminent changes in international energy markets. Just as the United States' success in thawing its icy confrontation with the U.S.S.R. did not produce hegemony, Brazil should not expect to see its power amplified without first having taken a proactive energy approach. The remaining analysis will provide an energy profile of Brazil that draws attention to policy shortcomings and areas for growth; the next section will examine case studies and Brazilian institutions primed to respond to shifting market conditions through interest articulation and policy demands. The paper will conclude by highlighting probable partnerships and environmental considerations within this new paradigm, namely how energy will function a springboard for Brazil to implement its foreign policy strategy. The only pitfall that stands to ensnare Brazil in quest for greatness is a failure to address power cuts and damage to the environment. It is only from negligence and mismanagement that Brazil may not rebound.

¹² Helm, ed, *The New Energy Paradigm*, 30.

¹³ International Energy Agency and Organization for Economic Co-Operation and Development, *World Energy Outlook 2006* (Paris: OECD/IEA, 2006): 86.

Energy Profile of Brazil: Policies and Projections

Fossil Fuels: Crude Oil, Natural Gas and Coal

Fossil fuels account for approximately 47% of the total energy supply in Brazil.¹⁴ For over half a century Petrobrás has stood at the helm of oil and natural gas exploration. Established in 1953 under the tenure of General Getúlio Vargas, the organization enjoyed exclusive rights to drill in Brazil until 1997 when the state disbanded its monopoly. Though now forced to sell at market prices, the multinational corporation faces no challenges to its industrial supremacy from the forty domestic and international companies that are too engaged in the production of fossil fuels in Brazil. In fact, Petrobrás' competitors place its expertise in such high regard that the company exports its off-shore drilling technology to other countries, sends personnel to direct organizations on its industrial know-how and even trains outside technicians at its teaching institution Petrobrás University. When Brazil reached energy self-sufficiency in 2006, Petrobrás alone was generating over two million barrels of oil each day.¹⁵

Since achieving energy independence, Petrobrás has allocated over US\$87.1 billion to capital expenditures and the acquisition of assets, US\$75 billion of which it devoted to outlays in Brazil. Moreover, the company's 2007-2011 investment plan has appropriated US\$49.3 billion to domestic E&P and US\$12.1 billion to projects overseas.¹⁶ Despite its proficiency in oil production, Brazil has few known coal reserves and consequently assigns less than 2% of its energy matrix to coal. Likewise, natural gas makes up only 9% of Brazil's energy consumption, as the country imports 25% of its natural gas through GASPOL, the Bolivia-Brazil pipeline

¹⁴ Benjamin S. Allen, "Deforestation's Challenge to Green Growth in Brazil," *Berkeley Roundtable on the International Economy* Green Growth Economies Paper (2009): 16.

¹⁵ Rohther, *Brazil on the Rise*, 175.

¹⁶ Sidney Weintraub, Annette Hester, and Veronica R. Prado, *Energy Cooperation in the Western Hemisphere: Benefits and Impediments* (Washington DC: Center for Strategic and International Studies Press, 2007): 246-247.

financed by Brazil in 1999. Spanning 3,150 kilometers, it constitutes the longest natural gas pipeline in Latin America. Though its demand for gas affords it notable sway over Bolivia, Brazil received added incentive to decrease its dependence on Bolivian natural gas in 2006 following President Evo Morales' decision to nationalize oil and gas markets.¹⁷

With prices of petroleum hovering around \$100 per barrel, Brazil's already-bright forecast for fossil fuels improved exponentially in 2007 when Petrobrás announced its discovery of sub-salt deposits in the Santos Basin two hundred miles off the coast of São Paulo. An estimated five to eight billion barrels of crude oil and natural gas were detected twenty thousand feet below sea level in a single field called Tupi. Lodged between a thick layer of salt and the sea floor, those deposits marked the largest find in over a decade. Two other critical fields have been found in this sub-salt area, Iara in the Santos Basin and Parque das Baleias in the Campos Basin off the coast of Rio de Janeiro, each of which is predicted to yield an additional six billion barrels.¹⁸ While the rest of the continental shelf awaits exploration, the Agência Nacional do Petróleo has released preliminary figures on the total deposits in the 100,000 square kilometer Campos Basin and the 149,000 square kilometer Santos sub-salt strata stretching from Espírito Santo state to São Paulo. The agency's projections put the deposits of hydrocarbons at fifty billion – a sixfold increase from the thirteen billion barrels of known reserves in Brazil. These estimates, if proven, would place Brazil among the ten largest oil reserve holders in the world, on par with Russia and Venezuela. Further, they would permit Brazil to increase fossil fuels' 9%

¹⁷ Bodman, Wolfensohn, and Sweig, "Global Brazil," 35.

¹⁸ Rohther, *Brazil on the Rise*, 175.

share in electricity generation.¹⁹ Granted, Brazil needs tens of billions of dollars in investment and thousands more workers if it hopes to extract those crude oil and natural gas reserves.

Though Petrobrás increased investment plans by 50% upon receiving news of its discoveries, Brazil will require immense technological advancements to penetrate the massive salt stratum and successfully transport the reserves back to the mainland. First, it must install a number of high-sea platforms from which engineers will drill wells. These wells must then traverse thousands of feet of water and a dense layer of sediment before reaching an opaque block of corrosive salt, which has potential to clog the well and eat holes in its lining.²⁰ In light of the April 2010 ‘Deepwater Horizon’ oil spill in the Gulf of Mexico, this high-risk process of deep-sea drilling has evoked understandable opposition from environmental groups. A self-proclaimed accomplishment, in 2009 Petrobrás drilled thirty five thousand feet in the Tiber-1 field off the coast of Houston in what it celebrated as the deepest oil well ever drilled. Just months later, however, the international community rebuked those drillings as a fiasco when the British Petroleum oil spill erupted in the same area.²¹ That incident illustrates how broaching the limits of drilling technology may in actuality create foreboding consequences for Brazil instead of generating progress and prestige. Nevertheless, Brazil represents the only other country in the Western hemisphere besides Canada that is in a position to become a new major oil exporter. While such harvests may enable Brazil to evolve into a net natural gas exporter, its imports of Bolivian natural gas will only expand until those reserves are online.

¹⁹ Bodman, Wolfensohn, and Sweig, “Global Brazil,” 32.

²⁰ Rohther, *Brazil on the Rise*, 178.

²¹ *Ibid*, 174.

Alternative Energies: Hydropower, Ethanol and Nuclear Energy

Created in Petrobrás' likeness by the Brazilian government in 1962, Electrobrás has born less success for Brazil than its counterpart. Droughts and power shortages gripped the country from 2001 to 2002, and Brazil only narrowly escaped rationing in 2008 despite having projected its shortcomings in electricity generation for 2009. Equally unsettling, former president Lula da Silva's recent "Lights for Everyone" initiative failed in its objective to bring electrical power to all Brazilians, particularly the rural poor in the Northeast. With such a lackluster history, the expected 50% increase in electricity demand for the next decade appears ominous.²² Though Lula subsidized solar power and wind turbine endeavors during his administration, these sources have only marginally assisted in the country. Hydropower, by contrast, has produced a consistent 80% of electricity since the state developed its first hydroelectric dams in the 1980s, as Brazil possesses three key river systems encompassing a majority of the Amazon basin, which bears the largest volume of water in the world.²³ Due to its successes, Brazil has already tapped into 75% of its hydroelectric capacity with dam installations, and the country generates well above the world average hydropower contribution to overall electricity production at 16%.²⁴

Yet, hydropower has not proven a wholly reliable energy source, fickle to disturbances in rainfall patterns and climate change. The country must therefore invest in water storage technologies in order to avoid power outages, especially considering that hydroelectricity in Brazil comprises a fourth of total energy supply.²⁵ Trends in Brazilian hydropower, though, may undermine such innovation, as energy companies are increasing pursuing smaller reservoirs so as

²² Bodman, Wolfensohn, and Sweig, "Global Brazil," 35.

²³ Rohther, *Brazil on the Rise*, 171.

²⁴ Susana Moreira, "Brazil: Keeping the Lights On," *The Whitehead Journal of Diplomacy and International Relations* (2008): 115.

²⁵ Allen, "Deforestation's Challenge," 16.

to leave a smaller footprint on the environment. Those small- and medium-scale projects will burden the state if it hopes to capitalize on water storages during times of scarcity.²⁶ Most early hydropower ventures in Brazil, in contrast, were massive; when it began in 1984 the state's first hydroelectric project Itaipu marked the biggest initiative of its kind at a cost of over US\$19.6 billion. With twenty turbines in all, Itaipu is located on the Paraná River near the border Brazil shares with Paraguay, and overall the damn generates 20% of Brazil's electricity at a whopping 14,000 megawatts, rendering it one of the five largest sources of electricity in the world, surpassed in scope only by China's Three Gorges Dam on the Yangtze River.²⁷

As was true then, though, the most attractive areas for hydroelectricity conductance lie in heart of the Amazon, in regions budding with environmental and indigenous activism. Since the government transitioned to democracy in 1985, securing clearance and funding for hydropower construction projects in the Amazon has become increasingly difficult. Brazil's historic Turcuruí project, the first hydropower site constructed away from a major population center, sheds light on the reasons for such institutional obstacles. In its eagerness to generate electricity, the military squashed all opposition to the project's location on the Araguaia River and failed to clear trees from the 11,000 square mile stretch of land used to build the artificial lake that buttresses the dam. Though capable of generated 8,300 megawatts, the dam qualifies as a bigger source of green house gas (GHG) emissions than Sao Paulo due to the neglect of governmental officials and mass decomposition of vegetation, which has resulted in the release of carbon dioxide and methane.²⁸ With most new hydroelectric construction sites still far from demand

²⁶ Bodman, Wolfensohn, and Sweig, "Global Brazil," 35.

²⁷ Rohther, *Brazil on the Rise*, 191.

²⁸ *Ibid*, 194.

centers. Brazil must enhance its long distance transmission lines to expand the scope of services.

Fortunately, dry seasons coincide with sugarcane harvest season allowing sugar ethanol to supplement shortages in hydropower with its 4% stake in the nation's electricity matrix²⁹ and its over 18% contribution to total energy supply in Brazil.³⁰ Unlike hydropower, sugarcane crops do not produce energy efficient yields in the Amazon due to the region's heavy rains and consistent heat. An acre of sugarcane in grown in the Amazon yields 25% less sugarcane than an acre reared in São Paulo, and a ton of sugarcane from the Amazon excretes 50% less raw cane than a comparable ton from São Paulo would. Over two thirds of ethanol production consequently occurs in São Paulo under the auspices of the state's Center for Sugarcane Technology.³¹ An unparalleled patron of bio-fuels, Brazil currently makes 430,000 barrels of sugar ethanol each day, 80% of which fuel domestic needs, such as the mandate that all gasoline sold in Brazil contain 25% ethanol. The country intends to double its bio-fuel production in the next ten years with a 2020 target of exporting 180,000 barrels/day.³²

As for innovation within the industry, the Brazilian government has sponsored considerable research on alternative sources of bio-fuel, including but not limited to: soybeans, palm oil, sunflowers, cotton, and algae. The material that has gained the most traction has been the *mamona*, or castor bean, plant which grows natively in northeast Brazil. When he was in office, Lula lobbied for *mamona*-based ethanol production due to the economic advantages it offered his native northeastern region, yet the bio-fuel manufacturers have not implemented the proposal. Though many critics argue ethanol is an inefficient fuel, differentiation between

²⁹ Moreira, "Brazil: Keeping the Lights On," 125.

³⁰ Allen, "Deforestation's Challenge," 16.

³¹ Rohther, *Brazil on the Rise*, 190.

³² Bodman, Wolfensohn, and Sweig, "Global Brazil," 37.

biomass derivatives is crucial. A large body of government-sponsored research demonstrates the relative efficiency of sugar ethanol to its corn-based counterpart; in Brazil, each unit of energy expended to adapt sugar into ethanol generates eight new units of energy whereas energy used to convert corn generates less than two new units. Technological improvements to long-held production techniques may also be on the horizon. In a recent bout of genius, ethanol producers managed to increase energy yields from bio-fuel per harvest; whereas previously agencies discarded stalks after compressing their sugar, many companies are now saving those same stalks and using the residue to generate the electricity needed to convert ethanol to sugarcane. Another freshly discovered technique for increasing energy production stems from the genetic modification of sugarcane. For years Brazilian researchers have had the ability to manipulate the plant's genes to make it sweeter and yield more bio-fuel per plant unit, but the genetically modified food debate has prevented such methods from reaching the market.³³

Though less widely discussed than its hydropower and ethanol capabilities, Brazil possesses over 278,000 tonnes of uranium deposits and has developed enrichment technology in accordance with the Nuclear Non-Proliferation Treaty (NPT). After a failed collaborative effort between the Western German firm Kraftwerk Union (KWU) and Brazilian SOE Nuclebrás, in 2000 the country fine-tuned its two uranium enrichment reactors, *Angra I* and *Angra II*, having mastered the enrichment process in 1986. These reactors generate approximately 3% of electricity in Brazil. Having resumed construction on its third nuclear power plant and with

³³ Rohther, *Brazil on the Rise*, 191-192.

plans to build four more, Brazil will likely see inflated importance of nuclear power in its energy matrix in coming years.³⁴ Given the devastating 2011 Japan earthquake and nuclear spills that occurred in its aftermath, it will have to proceed with caution to avoid international censure.

Brazilian Political Institutions: Treading in High Waters

Rising Challenges for Energy Capabilities

Given the obstacles to electricity generation exposed in its energy profile, Brazilian public and private sector interests ought to assign increased importance to past episodes in the nation's history, during which Brazil has defied barriers to energy production. One such trial may be found its quest to attain technological independence pertaining to the enrichment of uranium from the United States and Germany. Ever since Brazil first encountered its vast uranium deposits in the 1940s, its nuclear aspirations have generated controversy due to the reality that enrichment plants qualify as dual-process technologies that may serve peaceful purposes and lend themselves to weapons development.³⁵ An ardent opponent of expanding military nuclear know-how, the United States refused to exchange technology with Brazil for its uranium, instead introducing a global initiative through the International Atomic Energy Association (IAEA) granting it jurisdiction over deposits of uranium worldwide. The Soviet Union naturally rejected the plan, yet surprisingly Brazil marked the only other objector. After thwarting a German shipment of nuclear technology destined for Brazil with its supreme navy in 1954, the United States agreed to sponsor two nuclear research reactors in Brazil despite overt

³⁴ Daniel Fledes, "Brazil's Nuclear Policy from Technological Dependence to Civil Nuclear Power," *German Institute of Global and Area Studies Working Paper for the Dynamics of Violence and Security Cooperation Research Program*, no. 23 (2006): 15.

³⁵ *Ibid.*, 6.

military nuclear aspirations. Having received news that the Argentinean power plant *Atucha I* was in operation, Brazil contracted a U.S. subsidiary of General Electric to construct its first nuclear power station *Angra I* in 1972. Just three years later, Brazilian leaders forged an accord with the German Foreign Minister espousing their plans to erect eight nuclear plants in Brazil.³⁶

When it became clear that the West German company KWU had effectively reneged on promises to provide enrichment technology through its dogged pursuit of the elusive jet nozzle method, the Brazilian Autonomous Program of Nuclear Technology (PATN) formed. Disillusioned by their exclusion from the official effort, Brazilian physicists and engineers joined the Army, Air Force and Navy in creating this parallel program. Financed with undesignated funds from the defense budget, PATN benefited from the assistance of the electrical company *Siemens* and the Institute for Energy and Nuclear Research (IPEN) at the University of São Paulo, the latter of which appealed to the military due to its exemption from IAEA safeguard-related inspections. To accrue support for the program, the military cultivated relationship with liberal economic policy makers and pro-hydroelectric interests undercut by Nuclebrás and the official program. The parallel program consisted of four decentralized research projects that eventually succeeded in developing ultracentrifuge enrichment capabilities. Once PATN gleaned a solid footing, the government stepped in but eventually handed authority back to the Navy, the first branch that sought nuclear faculties as a means of powering submarines.³⁷

This victory showcases how an indigenous Brazilian effort was able surmount severe challenges to energy growth. The government and major Brazilian companies dependent on electricity should heed this case study when approaching the problem of electrical security. The National Interconnected System (SIN) in Brazil harnesses the bulk of production with only 3.4%

³⁶ Fletes, "Brazil's Nuclear Policy," 9-12.

³⁷ Michael Barletta, "The Military Nuclear Program in Brazil," *Center for International Security and Arms Control* (1997): 4.

of Brazil's electrical capacity falling outside of SIN. Since 1998 SIN has expanded by over 36%, rendering it one of the largest interconnected grids in the world. Yet, lines running from the North to the South are inadequate and leave the north-northeast region. The Southeast enjoys the more comprehensive grids, as the country's most industrial and wealthy region. While the center-west region has better infrastructure than the Northeast, it still suffers from a lack of balance that favors the federal district. Moreover, the Amazon has not yet seen SIN installments and instead must rely on isolated systems for its electricity. Though the state has assumed an active role in ensuring electricity, intervening during the 2008 shortage to diversify electricity sources with 25 new natural gas plants and 6 oil-based thermoelectric facilities, the public and private sectors alike could do more to guarantee the availability of energy to Brazilians.³⁸

Specifically, Brazil's US\$11 billion Proinfa initiative (Program to Promote Alternative Sources of Electricity) merits praise and attention. Since 2002, Proinfa has enhanced bioelectric capacity in the South-Center-West by over 80% and 20% in the North-Northeast.³⁹ Because it is 65% more expensive than hydropower to generate, thermoelectricity has not gained traction in most energy matrices in Brazil. Nonetheless, over 75 thermoelectric plants exist, the majority of which are fueled by natural gas. Although electricity consumption constitutes the most efficient use of energy, Brazil has witnessed only a 13% average growth rate in efficiency whereas it has seen a 27% average growth rate in overall electricity consumption. Brazil hopes to close this gap with its "Strategic Plan for Energy Efficiency" (PNEf) which it initiated in 2007 through its Ministry of Mines and Energy. PNEf recommendations from efficient growth include: instating

³⁸ Moreira, "Brazil: Keeping the Lights On," 116-117.

³⁹ Ibid, 125.

building regulations to encourage energy efficiency, initiating a public awareness campaign, and setting targets for reductions in demand from the South-Southeast.⁴⁰

Elite Mobilization for Development

Equally important to energy security in Brazil, elite involvement will be necessary in the future to better facilitate development. No historical circumstance illustrates the power of elite mobilization better than Brazil's turn towards ethanol in the mid-1970s. Sparked by the 1973 Yom Kippur War and OPEC's decision to suspend production, both of which sent prices soaring, a coalition of elite technocrats, energy analysts and business entrepreneurs lobbied the government to decrease oil imports and devise alternative energies in their stead. The alliance originated in 1975 within the Department of Ministry and Commerce specializing in technological development. This group coalesced with the Energy Group at the University of São Paulo, which informed them of the feasibility of sugarcane ethanol.⁴¹ The Arab oil embargo tripled the cost of oil imports, and the price of sugar in international markets reached a low in 1974. These developments, along with the colossal debt Brazil had amassed from decades of borrowing to finance its oil dependency, led to the creation of the Programa Nacional do Álcool, or Pró-Álcool, in 1975. The program provided tax incentives to the sugar industry to increase production, required Petrobras to purchase and distribute sugarcane ethanol, initiated a nationalistic marketing campaign to rouse support for ethanol, imposed taxes on gasoline higher, and mandated that all distributors blend fuel with a minimum of 20% ethanol.⁴²

⁴⁰ Ibid, 119-120.

⁴¹ Jose Goldemberg, "Energy Policies in Brazil," *Economic and Political Weekly* 18, no. 9 (1983): 311.

⁴² Marc D. Weidenmier, Joseph H. Davis, and Roger Aliaga-Diaz, "Is Sugar Sweeter at the Pump? The Macroeconomic Impact of Brazil's Alternative Energy Program," *National Bureau of Economic Research Working Paper* 14362 (2008): 4.

Between 1975 and 1979, ethanol production saw a 500% increase. Brazil expanded Pró-Álcool even further in 1979 by forging a deal with major car companies whereby they manufactured vehicles that ran on pure ethanol. Though the government has since inflated the required ethanol content of gasoline to 24% and slashed subsidies on sugarcane ethanol, its production is still taxed at a lower rate.⁴³ In 2002 Ford introduced flex-fuel cars to the market with Volkswagen following suit in 2003. These flex-fuel cars operate on gasoline, ethanol and combinations of the two fuels. Today, approximately 90% of all new cars manufactured in Brazil are of the flex-fuel variety. According to one estimate, the combined macroeconomic impact of the decline in oil imports and creation of the sugarcane ethanol industry was a 35% growth in GDP.⁴⁴ Whereas total oil imports towered at 70% during 1970s, current levels of imported oil are less than 10%.⁴⁵ Such energy independence indicates a wild success for elites in mobilizing to protect their interests and, in turn, the prosperity of the country.

The Brazilian government appears to have recognized the essentialness of elite participation in policy-making. In 2003 the Lula administration created the Council for Economic and Social Development (CDES), an innovative body that fosters dialogue between political and economic elites with the aim of improving democratic governance. With 82 members in all, each serving five-year terms, CDES consists of the President of the Republic, 10 governmental representatives, and 71 individuals chosen to reflect the nation's geographic and sectoral diversity.⁴⁶ By exposing members to the government's policy agenda, CDES seeks to generate consensus and secure feedback regarding national strategies and programs. The forum

⁴³ Ibid, 6.

⁴⁴ Ibid, 17.

⁴⁵ Ibid, 3.

⁴⁶ Mahrukh Doctor, "Lula's Development Council: Neo-Corporatism and Policy Reform in Brazil," *Latin American Perspectives* 34, no. 6 (2007): 138.

meets once each month and “builds on Brazil’s own corporatist traditions and institutions, updating and adapting them to make them more capable of responding to the demands of democratization, economic liberalization, and globalization.”⁴⁷ Thus, CDES signifies a system of interest representation that the government has modified to match the new realities of Brazilian politics, in which clientelistic practices coexist alongside transparent lobbying.

Independent and nonpartisan, CDES reports directly to the executive in Brazil. Emphasis on the executive over the legislature represents an understandable decision, given the fragmentation and multiplicity of parties within the Brazilian National Congress – a sure result of the country’s open-list proportional representation system and electoral laws which neglect to designate a minimum threshold of votes needed by a party to receive representation in Congress.⁴⁸ Though perhaps preferable to collaboration with the legislature, close CDES ties to the president have caused many to question the integrity of the institution as a voice of civil society. Early classes of CDES members defined themselves as a “pressure group” to the public, a role created largely by CDES’ first head – the president of USIMINAS, a massive steel company in Brazil.⁴⁹ With business interests overrepresented on the commission, the group has already provided input in areas, such as education and the economy, and has the propensity to take on a leading role in discussing and informing the state’s energy agenda and policies.

External and Environmental Dimensions: Poised for Leadership

Clearly, the evolution of the Brazilian political system has ushered in a host of changes

⁴⁷ Ibid, 137.

⁴⁸ O’Neil, Fields, and Share, *Cases in Comparative Politics*, 457.

⁴⁹ Doctor, “Lula’s Development Council,” 142.

regarding the country's posture and ability to address growing concerns about energy security and the environment. Just as its shift from heavy state corporatism to a more mild neo-corporatist system has allowed for the creation of bodies such as CDES, the transition of Brazil from a patrimonial society to a bureaucratic and managerial state has opened previously closed avenues for nongovernmental groups to articulate their interests to Brazilian policy-makers.⁵⁰ No longer solely a government of elites, modern democracy in Brazil has facilitated the development of environmental resistance in the Amazon. Groups such as Greenpeace, for instance, have started policing illegal logging operations by splattering paint on the logs so that they are identifiable in ports.⁵¹ With over 50% of Brazilians citing environmental concerns as the single most important issue of the coming decade, at least 90% of Brazilians identified the climate change as a serious concern.⁵² The nation plainly values its lush environment.

Despite the fact that 46% of its total energy consumption is renewable, well above the world average of 12.9%, deforestation stands to undermine the green growth Brazil has achieved. Though a declining phenomenon, deforestation accounts for the most prominent source of greenhouse gas (GHG) emissions in Brazil at 55%, with cattle ranching and agribusiness each compromising another 25% of emissions and contributing to deforestation in their own right. Surprisingly, industrial processes and energy use produce only 20% of Brazilian emissions when they generate the bulk of GHGs in most other countries. Home to endless flora and fauna and over 60% of the Amazon rainforest along with the Cerrado Plains and Pantana Wetlands, Brazil must regulate its contributions to global climate change before time expires. Rising volumes of

⁵⁰ Ignacy Sachs, Jorge Wilhelm, and Paulo Sérgio Pinheiro, *Brazil: A Century of Change* (Chapel Hill: University of North Carolina Press, 2009): 168.

⁵¹ Kathryn Hochstetler and Margaret E. Keck, *Greening Brazil: Environmental Activism in State and Society* (Durham: Duke University Press, 2007): 175.

⁵² Bodman, Wolfensohn, and Sweig, "Global Brazil," 39.

rain, periodic droughts and moderate inflations in temperature have left Brazil exposed to increasingly erratic seasons. The international community could benefit from some resounding leadership from Brazil in the realm of climate change, resembling the country's bold performance in 2003 at the Cancun summit of the Doha Round of World Trade Organization talks. Responding to pressures from the United States and EU to sign the 'Singapore Package,' Brazil rallied and organized third-world countries in resisting the provisions of that package until those parties agreed to eliminate their crippling agricultural subsidies.⁵³ Given Brazil's stake in promoting a multipolar world, such activity will likely become more commonplace.

Having pledged to reduce its emissions by 30% in 2010 through its National Policy on Climate Change, Brazil must pursue innovation if it hopes to emerge from current energy and environmental predicaments unscathed. According to projections, the world's dependence on oil will balloon into the 2030s, at which time OPEC will still control approximately 51% of global oil supply.⁵⁴ Though China and India alike have invested extensively in Brazilian E&P and its sub-salt deposits will undoubtedly generate immense profits, the government ought to continue to invest in energy diversification and begin decentralizing its electricity grids so to increase efficiency, enhance reliability and protect against possible attacks. The past successes of state-led development policies illustrate the renewed importance of technological research. When the state departed from its inward-oriented, import-substitution industrialization policies in the 1960s, it financed CENPES, the 'in-house' research institute of Petrobrás. The personnel exchanges, linkages and collaboration between the two institutions allowed Petrobras and

⁵³ Brands, "Dilemmas of Brazilian Grand Strategy," 22.

⁵⁴ Jan H. Kalicki and David L. Goldwyn, *Energy & Security: Toward a New Foreign Policy Strategy* (Baltimore: John Hopkins University Press, 2005): 28.

CENPES to construct PROCAP (Deepwater Exploration Systems) instruments. More than any factor besides its natural resource endowments, these state-of-the-art structures propelled Petrobras to greatness, functioning as its “springboard for internationalization.”⁵⁵

In light of its abounding energy reserves and impressive track record in surmounting difficulties in energy development – first with Pró-Álcool, and then with its parallel enrichment program – Brazil should have no trouble traversing into decentralized energy environment, especially considering the state grants for infrastructure research available through the Banco Nacional de Desenvolvimento Econômico e Social (BNDES, National Economic and Social Development Bank), Financiadora de Estudos e Projetos (FINEP, Research and Projects Financing), and the Financiamento de Máquinas e Equipamentos (FINAME, Machine and Equipment Financing).⁵⁶ Though decentralizing electrical plants has not yet been deemed a pressing national security concern by Brazilian authorities, the prospect of terrorism directed towards a state’s energy infrastructure remains on the horizon. Graphite explosives, or ‘blackout bombs’ as they are known, excrete fine carbon filaments that obstruct electrical currents, thereby wielding the power to totally disable an enemy’s power grid.⁵⁷ By increasing the amounts of localized electricity nationwide, decentralized energy would also cut costs associated with transporting electricity in Brazil. Regardless of how soon Brazil makes this switch, the rising importance of energy security has conferred Brazil with unmatched prominence in the global system, permitting the country to exert extensive influence in our increasingly multi-polar world.

⁵⁵ Brainard and Martinez-Diaz, ed, *Brazil as an Economic Superpower?*, 209.

⁵⁶ Ibid, 199.

⁵⁷ Gal Luft and Annie Korin, ed., *Energy Security Challenges for the 21st Century: A Reference Handbook* (Santa Barbara: Praeger Security International, 2009): 314.

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