

# **Creating Sustainable Digital Infrastructure: How to Secure a Green Future for LATAM Data Centers**

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## I. Introduction

The increasing demand for digital services, driven by the proliferation of AI tools and cloud computing, has focused attention and investment on the physical infrastructure supporting these technologies. Data centers, which host computer infrastructure such as servers, storage systems, and networking equipment, are the backbone of these digital services. The expansion of data centers has emerged as a key driver of economic growth and technological innovation worldwide. Latin America (LATAM) is an increasingly attractive region for green data center investments due to its abundant renewable energy resources and strategic placement in relation to North American markets. LATAM's geographical proximity to the U.S. allows for improved latency and speed of digital services near major demand centers. The region also has relatively cheap land and labor, making it attractive for potential developers.<sup>1</sup> Given the strength of the region's renewable energy, LATAM has the potential to be a hub for green data centers that utilize clean energy and energy-efficient technologies to minimize their environmental impact.<sup>2</sup>

To sustainably and successfully manage green tech infrastructure, Latin American countries must address their regulatory and load uncertainties, including grid stress and limited market incentives. They can do so by adopting policies that align digital growth with environmental progress.<sup>3</sup> This paper maps the energy landscape and current state of green data center investments in Brazil, Uruguay, and Paraguay. The analysis also identifies regulatory and infrastructure barriers to long-term sustainable growth and provides policy recommendations aimed at aligning digital transformation with careful environmental considerations.

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<sup>1</sup><https://socialgeek.co/tecnologia/las-gigantes-tecnologicas-expanden-sus-centros-de-datos-por-america-latina/>

<sup>2</sup><https://www.ibm.com/think/topics/green-data-center>

<sup>3</sup><https://bcb27500.delivery.rocketcdn.me/wp-content/uploads/2024/12/Data-Centers-no-Brasil-%E2%80%93-Perspectivas-Oportunidades-e-Desafios.pdf>

Strengthening the region's capacity to host green data centers will be essential not only for national economic and technological development but also for positioning Latin America as a competitive player in the global digital economy while maintaining each country's digital sovereignty.

Brazil, Uruguay, and Paraguay are key players in green data center investment in Latin America due to their ample renewable energy resources, particularly hydropower. Brazil, as LATAM's largest economy, combines a highly renewable energy mix on its electric grid with significant existing data center infrastructure investments. Meanwhile, Uruguay offers near-complete renewable electricity and strong sociopolitical stability, providing ideal conditions for green data centers. Similarly, Paraguay possesses untapped hydropower capacity and has extremely low electricity prices, which makes digital investment in the country very attractive.

## **II. Background**

### **A. Expansion of Data Centers**

Global energy infrastructure has seen substantial expansion in the digital age. Data centers have become significant for this expansion, allowing technological processing at a higher functionality. Beyond the provision of cloud services, data centers also provide storage and management capabilities that enable business systems like e-commerce, social media platforms, and other digital services, such as tax filings and document management.<sup>4</sup> To provide continuous service, data centers require access to robust and reliable energy supplies.

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<sup>4</sup><https://www.ufinet.com/en/the-role-of-a-data-center-in-the-modern-world/>

## **B. Data Center Carbon Footprint**

The rapid expansion of digital infrastructure creates extensive environmental impacts. Data centers are large consumers of energy and water, and thoughtfully managing the implications of their resource intensity is a critical consideration. The growth in electricity demand is directly tied to sustainability: without careful planning, rising loads risk driving higher greenhouse gas emissions and water usage, but they also present an opportunity to anchor new renewable energy investment. The United States hosts the world's highest concentration of data centers and illustrates the challenges of managing large electric load growth. A U.S. Department of Energy report found that data centers consumed about 4.4% of total U.S. electricity in 2023 and are expected to consume 6.7–12% by 2028.<sup>5</sup> Additionally, Goldman Sachs Research forecasts global power demand from data centers will increase 50% by 2027 and by as much as 165% by the end of the decade (compared with 2023).<sup>6</sup>

As the demand for artificial intelligence applications powered by data centers continues to accelerate, the need to find ways to sustainably power their operations is an increasingly urgent need.<sup>7</sup> Data center operations require immense amounts of cooling energy and electricity, both for processing the data and cooling facilities, but data centers have the potential to vastly increase greenhouse gas emissions if they are not powered by renewable energy.<sup>8</sup> Currently, data centers account for 2.5–3.7% of global greenhouse gas emissions.<sup>9</sup> While ESG goals and public sector emissions targets shape long-term direction, they can often be outweighed by the immediate drive for business growth and system performance. This makes strategic siting

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<sup>5</sup><https://www.energy.gov/articles/doe-releases-new-report-evaluating-increase-electricity-demand-data-centers>

<sup>6</sup><https://www.goldmansachs.com/insights/articles/ai-to-drive-165-increase-in-data-center-power-demand-by-2030>

<sup>7</sup>[https://odatacolocation.com/en/blog/green-data-centers/?utm\\_source=chatgpt.com](https://odatacolocation.com/en/blog/green-data-centers/?utm_source=chatgpt.com)

<sup>8</sup><https://pmc.ncbi.nlm.nih.gov/articles/PMC11773490/>

<sup>9</sup><https://us.anteagroup.com/news-events/blog/esg-considerations-for-data-centers>

decisions, such as locating data centers in regions with predominantly renewable energy, among the most crucial for minimizing environmental impact.

Battery energy storage systems (BESS) are emerging as an important tool for data center sustainability, allowing operators to replace existing diesel generator backup systems with non-polluting alternatives.<sup>10</sup> One of the main applications of BESS is integrating the battery system with colocated renewable energy sources to power the data centers. Batteries enable operators to store power generated by intermittent renewable energy sources such as wind and solar power that do not generate electricity at all hours.<sup>11</sup> By reducing variability in renewable outputs, battery storage reliably reduces stress on the grid and offers more efficient operations for high-load facilities like data centers. Utilities can also leverage BESS as a source of dispatchable power, allowing for greater grid flexibility and supporting demand response strategies. By supporting both renewable integration and utility system stability, batteries are positioned as a cornerstone technology for meeting the rising energy needs of digital infrastructure without sacrificing sustainability.

### **C. Digital Infrastructure Sovereignty**

While foreign investment in green data centers can bring significant technological and economic advantages, it also raises questions about digital infrastructure sovereignty, which is a country's ability to govern and control the hardware, software, and data flows within its borders<sup>12</sup>. A very important consideration within the sovereignty conversation includes avoiding resource exploitation with little to no material benefit to the communities bearing the impacts of digital

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<sup>10</sup><https://corporate.enelx.com/en/question-and-answers/what-is-battery-energy-storage>

<sup>11</sup>ibid

<sup>12</sup><https://www.weforum.org/stories/2025/01/europe-digital-sovereignty/>

infrastructure development. Since much of the green data center investment in LATAM is driven by foreign multinational companies, there are serious concerns about maintaining digital sovereignty in the region. Meaningful government regulation over data center activities can help to alleviate some of these concerns. For example, requiring certain sensitive data to be stored locally or establishing clear rules around environmental reporting and cybersecurity standards to ensure that multinational operators contribute to national development goals while complying with domestic laws.

These approaches direct governments to avoid data colonialism, which is described as the “process by which governments, non-governmental organizations and corporations claim ownership of and privatize the data that is produced by their users and citizens.”<sup>13</sup> Digital infrastructure should therefore function to serve national and local interests just as much as global corporate ones. Even with foreign-led investments, these tools and considerations can provide a higher level of digital sovereignty. By embedding sovereignty considerations into investment agreements, LATAM can avoid losing control of its digital infrastructure to foreign companies while ensuring local communities are benefiting from hosting their innovation and expertise. This balance is critical not only for safeguarding national interests but also for LATAM citizens to be meaningfully consulted and considered before prioritizing the interests of the multinational corporations.

#### **D. The Case for Green Data Centers**

Locating data centers in geographies whose electricity grids have a high penetration of renewable resources aligns with the sustainability goals of many major tech companies, such as

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<sup>13</sup><https://harvardlawreview.org/blog/2023/06/data-colonialism-and-data-sets/>

Google and Meta. Countries with low-cost renewable resources can attract investment from multinational technology companies seeking to expand their infrastructure while meeting their sustainability and emissions commitments.

On one hand, this provides some digital sovereignty for the country itself, so that the nation can control the hardware, software, and data.<sup>14</sup> Large foreign investment in data centers could undermine digital sovereignty unless strong regulatory frameworks are established to enable host governments to shape how infrastructure operates within their borders. Thus, by setting rules for data storage, environmental impact, and energy use, Latin American countries can preserve a degree of digital sovereignty even amid growing foreign corporate investment. Additionally, such investments can stimulate the economy (local construction, grid upgrades, revenue) while supporting corporate sustainability goals.<sup>15</sup> Investing in green data centers maintains or creates a system of sustainable business operations for the corporation.<sup>16</sup>

## **E. Latin America's Emerging Market**

Latin America is emerging as a locus of green data center investment. Countries in the region are leading in the green data center market, with a valuation of US\$891 million in 2022 and a projection of US\$1.65 billion by 2028.<sup>17</sup> Brazil currently holds the largest share of investments in the region, sitting at around 40% in 2023.<sup>18</sup> However, smaller countries like Uruguay and Paraguay offer copious green energy alternatives for the data center market in Latin America. With major U.S. and Asian tech companies seeking green digital infrastructure to meet their

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<sup>14</sup>ibid

<sup>15</sup><https://www.cbre.com/insights/briefs/data-center-growth-has-economic-ripple-effects>

<sup>16</sup>ibid

<sup>17</sup><https://www.arizton.com/market-reports/latin-america-green-data-center-market>

<sup>18</sup><https://www.credenceresearch.com/report/latin-america-mega-data-centers-market>

sustainability goals, Latin America’s highly decarbonized electric grid is attractive. Boston Consulting Group describes this dynamic when they write that “clean energy that meets both cost and reliability standards for data center operators is further incentivizing development in regions outside the U.S., especially for players seeking to align their energy needs with sustainability goals.”<sup>19</sup>

Despite their comparatively green electricity supply, Latin American countries face challenges to investment, with issues of load uncertainty and concerns that new load will stress the grid as potential obstacles to data center expansion. One challenge stems from the unpredictability of energy supply from renewable sources such as hydropower. Additionally, operating data centers in a country that relies predominantly on one kind of energy can negatively impact the energy grid if issues emerge with that source, such as water scarcity, reducing hydroelectric output. Diversifying sources of energy is an important strategy to ensure the stability of the grid, and overreliance on a single technology increases system vulnerabilities.

While existing analyses highlight global data center growth and its environmental implications, limited research has explored the regulatory and infrastructural conditions shaping Latin America’s ability to attract green data center investments. The following section examines Brazil, Uruguay, and Paraguay as case studies to assess these opportunities and challenges in depth.

## **F. Ethical Implications: Avoiding “Green Colonialism”**

In encouraging the expansion of data center investments from foreign multinationals in LATAM, there must be careful consideration of power and fiscal dynamics. With LATAM’s history of

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<sup>19</sup><https://www.bcg.com/publications/2025/breaking-barriers-data-center-growth>



European colonialism and its historical resource advantages, it is difficult to understand what is fair to use and take from previously exploited countries and their peoples. The rapid push for green data center investment in Latin America risks reproducing this familiar pattern, which may be seen as a form of “green/data colonialism” where wealthy nations and corporations exploit the region’s renewable resources for their own sustainability goals without contributing proportional benefits to local communities. While data centers may bring some tax revenue and short-term jobs, they create relatively few permanent positions and can consume significant amounts of energy and water, competing with local needs and interfering with the host country’s own environmental progress.

While this paper identifies Latin America as a region rich in opportunities for green data center investment, it also emphasizes that expansion must be pursued within an ethical framework that safeguards environmental integrity and local community well-being. The rapid growth of digital infrastructure cannot come at the expense of the very resources (land, water, and renewable energy) that make the region attractive in the first place. The recommendations outlined in this paper are designed to be implemented with this ethical lens in mind. Doing so will ensure that green data center development strengthens the region’s resilience, supports LATAM economic growth, and protects natural resources for future generations.

### **III. Data Center Case Studies: Brazil, Uruguay, and Paraguay**

#### **A. Brazil**

##### **Brazil’s Electric Grid**

Brazil's electric grid is 85–90% renewable energy and consists of 55% hydro, 14–15 % wind, 8–9 % biomass, with a growing share of solar power. With a clean grid being attractive to large technology companies seeking renewable energy to power their operations, Brazil is in a good position for green data center investments.<sup>20</sup> Brazil has a dynamic business environment, and the country currently hosts over 130 data centers, with plans to expand further nationally.<sup>21</sup> There are existing policy initiatives in Brazil to attract further investment in data centers powered entirely by renewable energy. The current administration is proposing tax breaks on green energy data center infrastructure, which is forecast to attract around R\$2 trillion (~US\$352 billion) in investment over the next decade.<sup>22</sup> As Brazil continues to diversify its renewable energy grid, the demand for battery storage has increased due to intermittency issues of resources like solar and wind.<sup>23</sup> Complementing those energy sources with battery backup and storage will allow more certainty for investors seeking to build high-load digital infrastructure in Brazil.

## **Investment**

Companies like Ascenty, Grupo FS, Equinix, ODATA, Tecto, and Elea are already heavily investing in the development of data centers in the strategic hubs of São Paulo and Rio de Janeiro.<sup>24</sup> These organizations are all seeking to operate their businesses in an efficient yet emission-free manner, and Brazil stands as an ideal location for the creation of green data centers. Thymos Energia, a business consultancy specializing in the energy sector, projects that

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<sup>20</sup><https://www.reuters.com/sustainability/climate-energy/brazil-offer-tax-breaks-lure-data-center-investments-sources-say-2025-04-28/>

<sup>21</sup><https://bcb27500.delivery.rocketcdn.me/wp-content/uploads/2024/12/Data-Centers-no-Brasil-%E2%80%93-Perspectivas-Oportunidades-e-Desafios.pdf>

<sup>22</sup><https://www.techpolicy.press/brazil-is-handing-out-generous-incentives-for-data-centers-but-what-it-stands-to-gain-from-it-is-still-unclear/>

<sup>23</sup><https://www.bnamericas.com/en/features/why-battery-storage-will-be-key-for-brazils-booming-datacenter-sector>

<sup>24</sup><https://odatacolocation.com/en/blog/green-data-centers/>

these investments in data center infrastructure in Brazil will expand to reach R\$60 billion by 2030.<sup>25</sup>

### **Regulatory backdrop & challenges**

The Brazilian Congress passed a Low Carbon Energy Law in September 2024 to offer incentives for clean energy.<sup>26</sup> The law offers tax incentives for wind, solar, and biomass energy projects, including energy efficiency measures for industry and transportation. The law works to address concerns with Brazil's high reliance on hydropower as its main renewable energy source. These concerns are particularly acute due to climate impacts reducing water levels while demand for hydropower steadily increases, thus stressing Brazil's energy grid.<sup>27</sup> Incentivizing other renewable energy sources will drive demand up another energy alley and lessen pressure on water.

A policy prioritized by the government to address overreliance issues is to support new renewable energy projects for new data centers. Formal funding for this has been launched through the US\$4 billion AI plan.<sup>28</sup> For one, TikTok's parent company, ByteDance, has been in partnership negotiations with Brazilian wind power companies to establish a data center powered by new offshore wind on the northeast coast of Brazil.<sup>29</sup>

## **B. Uruguay**

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<sup>25</sup>ibid

<sup>26</sup><https://www.gtlaw.com/en/insights/2024/12/latin-america-energy-updates-september-and-october-2024>

<sup>27</sup><https://time.com/7282222/brazil-clean-energy-ai/>

<sup>28</sup><https://www.reuters.com/technology/artificial-intelligence/brazil-proposes-4-billion-ai-investment-plan-2024-07-30/>

<sup>29</sup><https://www.reuters.com/sustainability/climate-energy/tiktok-owner-weighs-data-center-project-brazil-sources-say-2025-04-25/>

## Electric Grid

Uruguay's electricity grid has one of the cleanest electricity supplies in the world, with around 98% renewable energy sources.<sup>30</sup> Unlike Brazil's hyperfocus on hydropower, wind energy is becoming increasingly important as a power source in Uruguay, driven in part by the country's experience with decreased river water levels reducing hydro energy output.<sup>31</sup> Wind turbines' low cost and high capacity have enabled Uruguay to produce over 40% of its energy from wind.<sup>32</sup> The remaining percentage of their renewable energy sources stems from expanded solar and biomass power.

Nonetheless, Uruguay's high penetration of wind energy, while an advantage, suggests potential instability under constant, variable data center loads. Integrating battery energy storage in Uruguay would also allow the country to smooth fluctuations in some renewable energy generation and store surplus during off-peak periods. The country has high investment potential for battery storage solutions due to current modernization projects like the deployment of electricity meters funded by the Inter-American Development Bank.<sup>33</sup>

Uruguay is in a unique position based on its geopolitical setting as a small country (175,000 square kilometers) with large rivers, plentiful grasslands, and a largely urban population.<sup>34</sup> With this mix of resources, there is potential to build new wind and solar farms and hydroelectric dams throughout the nation. Uruguay also has no large fossil fuel reserves of its own to take

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<sup>30</sup><https://earth.org/the-uruguay-way-achieving-energy-sovereignty-in-the-developing-world/>

<sup>31</sup>ibid

<sup>32</sup>[https://www.researchgate.net/publication/357094980\\_The\\_evolution\\_consolidation\\_and\\_future\\_challenges\\_of\\_wind\\_energy\\_in\\_Uruguay](https://www.researchgate.net/publication/357094980_The_evolution_consolidation_and_future_challenges_of_wind_energy_in_Uruguay)

<sup>33</sup><https://www.trade.gov/market-intelligence/uruguay-battery-storage-and-smart-grids-0>

<sup>34</sup>ibid

advantage of, making renewable resources even more attractive since they don't have to compete with incumbent fossil fuel producers.

## **Investment**

With a well-developed and renewably powered electric grid, Uruguay has attracted large investments in the green data center landscape, especially with increasing demand for digital services.<sup>35</sup> Large corporations like Google have already been taking advantage of Uruguay's favorable conditions for green data center development. In 2024, Google constructed a US\$850 million data center in Canelones, Uruguay, to help expand their data and computing processing.<sup>36</sup>

## **Regulatory backdrop & challenges**

"The Uruguay Way" is a framework named by Ramón Méndez Galain describing a combination of regulations, institutional support, and consensus building.<sup>37</sup> Uruguay has had a lot of success in the regulations of its energy transition due to this approach. Additionally, support from external stakeholders has helped strengthen Uruguay's grid. For example, in 2022, the Development Bank of Latin America approved a loan of US\$300 million to Uruguay to create more sustainable energy in the country, further strengthening its grid.<sup>38</sup>

The Uruguayan government launched a program in May 2025 called Uruguay Innova to streamline regulatory processes for innovation in the information and communications technology operations occurring in the country.<sup>39</sup> Uruguay's Free Trade Zones also offer tax exemptions, making those zones opportunistic places to build data centers, like the Google

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<sup>35</sup><https://www.trade.gov/market-intelligence/uruguay-data-centers>

<sup>36</sup>ibid

<sup>37</sup>ibid

<sup>38</sup><https://www.arizton.com/market-reports/latin-america-green-data-center-market>

<sup>39</sup><https://latamfdi.com/uruguay-innova/>

investment in Parque de las Ciencias, a major free trade zone.<sup>40</sup> Free Trade Zones (FTZs) are specially designated areas within a country where businesses benefit from reduced or eliminated taxes, customs duties, and regulatory requirements. These zones are designed to attract foreign investment and promote economic activity, often by offering companies favorable conditions for importing equipment, operating with fewer trade barriers, and exporting services or goods.

## **C. Paraguay**

### **Electricity Grid**

Paraguay has a remarkable, nearly 100% renewable energy-powered grid, with hydropower the primary source for generating electricity.<sup>41</sup> The Itaipu and Yacyretá dams are responsible for the abundant energy supply for the nation's hydroelectricity, although both border and share power with Argentina and Brazil.<sup>42</sup> Battery energy storage systems help manage fluctuations in hydroelectric output and reduce the need to divert energy exports during high domestic demand. Deploying storage near Itaipu and Yacyretá would allow Paraguay to bank excess generation during low demand and dispatch it during peak load.

Itaipu Binacional cleared the debt of the construction of the hydroelectric dam in February 2023, but under the original 1973 treaty, Paraguay was obliged to sell much of its unused share of the dam's electricity to Brazil at below-market rates until the debt was repaid.<sup>43</sup> This repayment

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<sup>40</sup><https://www.trade.gov/market-intelligence/uruguay-free-trade-zones#:~:text=There%20are%20eleven%20FTZs%20around,main%20benefits%20are%20as%20follows:&text=Tax%20Incentives:%20Companies%20operating%20within,%2C%20VAT%2C%20and%20import%20duties.>

<sup>41</sup><https://www.arizton.com/market-reports/paraguay-data-center-market>

<sup>42</sup><https://www.newsweek.com/cheap-clean-energy-transforming-paraguay-silicon-valley-south-america-opinion-1985926>

<sup>43</sup><https://itaipu.energy/news/itaipu-binacional-clears-historical-debt-for-construction-of-the-plant/#:~:text=Itaipu%20Binacional%20paid%20off%20on,begin%20in%20August%20this%20year.>

concluded and thus freed Paraguay from its financial obligations and opening the door for renegotiated energy sales, greater control over its surplus electricity, and new opportunities to channel that energy into domestic industries such as large-scale data centers. Although much of the energy produced is exported, the capabilities of these hydroelectric dams have attracted major foreign investors for the construction of massive data centers.<sup>44</sup>

Nonetheless, Itaipu's status as a binational dam creates competition between the neighboring countries of Paraguay and Brazil. Paraguay inherently holds the advantage with its ample amount of energy available for the smaller amount needed within the nation. In the latest iteration of the power sharing agreement deal between both countries established in 2025, Paraguay gained the ability to sell its excess energy production to the Brazilian market, which had previously been heavily restricted.<sup>45</sup>

## **Investment**

Investment in Paraguay as a data center market is still developing. One of the biggest limitations is that Paraguay offers little physical infrastructure and scalability needed by large data centers, offering insufficient megawatts (MW) capacity to hold operations.<sup>46</sup> Paraguayan companies mainly utilize data centers in Brazil and Argentina instead, limiting digital sovereignty.<sup>47</sup>

However, Hive Digital Technologies has taken the initiative in constructing their hydro-powered crypto-mining data center complex at the Itaipu dam.<sup>48</sup> According to a report by Aritzon

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<sup>44</sup>ibid

<sup>45</sup><https://www.riotimesonline.com/brazil-and-paraguay-redefine-itaipu-energy-deal-ending-decades-of-disputes/#:~:text=Brazil%20and%20Paraguay%20have%20finalized,month%2C%20reflecting%20only%20operational%20costs.>

<sup>46</sup><https://www.elinmobiliario.com.py/en/post/paraguay-an-emerging-market-for-data-centers-with-regional-strategic-potential>

<sup>47</sup>ibid

<sup>48</sup><https://www.datacenterdynamics.com/en/news/hive-to-build-100mw-hydroelectric-cryptomine-data-center-in-paraguay/>

Advisory and Intelligence, Paraguay's data center market size is projected to reach US\$88.5 million by 2027.<sup>49</sup> To reach this projected market size, Paraguay will need to expand its available capacity by developing new facilities and upgrading existing infrastructure, especially near energy generation hubs like Itaipu.

### **Regulatory backdrop & challenges**

With the deregulation in Paraguay's energy industry since the end of the Itaipu debt repayment plan, there is potential for the Paraguayan government to expand its renewable energy grid to better provide for the infrastructure needs of large data centers. The government has the opportunity to incentivize investment and thus generate a stronger, more independent electrical infrastructure in the nation.<sup>50</sup> A study by the Energy Systems Research Group (GISE) found that data center growth in Paraguay could help to finance around 39% of investments in electricity and 17% of investments in transmission between 2024 and 2027, which would greatly add to the current revenue the nation receives from its energy exports.<sup>51</sup> This would generate an estimated US\$1.087 billion by modernizing the energy market with more data center investment, according to the report.<sup>52</sup>

In February 2024, the International Monetary Fund (IMF) backed a “non-conventional renewables” regulatory decree, which introduces grid interconnection rules, tariffs, and tax incentives for solar and wind.<sup>53</sup> Concurrently, the government launched an independent audit of ANDE (Paraguay's national electricity company) and a cost-efficiency study to inform future

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<sup>49</sup>ibid

<sup>50</sup><https://www.americaeconomia.com/en/node/290896>

<sup>51</sup>ibid

<sup>52</sup>ibid

<sup>53</sup><https://www.elibrary.imf.org/view/journals/002/2024/200/article-A001-en.xml>



electricity rate adjustments, aiming for greater transparency.<sup>54</sup> Additional measures to modernize electricity infrastructure in the country include adopting energy efficiency standards for major appliances, deploying smart meters to enable dynamic pricing, and governance reforms across generation, transmission, and distribution. Together, these reforms strengthen Paraguay's energy sector governance and create an environment for large-scale sustainable energy data center investments.

## **IV. Policy Recommendations: LATAM Green Data Center Infrastructure**

### **A. Integrate Digital Infrastructure into National Energy Plans**

Brazil, Uruguay, and Paraguay's governmental energy ministries should integrate data centers' load forecasts into their national energy planning models. Brazil's Ten-Year Energy Expansion Plan (PDE, acronym in Portuguese) discusses several goals surrounding energy for the coming decade.<sup>55</sup> Although the report considers solutions surrounding hydroelectric power and decreasing Brazilian energy systems' water usage, there is no explicit mention of data centers and their energy load projections. Incorporating accurate load forecasts into planning would help avoid grid congestion, align demand with generation, and encourage proactive investments. The PDE could also explicitly include BESS deployment targets alongside renewable expansion to ensure a stable supply for high-load facilities.

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<sup>54</sup>ibid

<sup>55</sup>[https://www.gov.br/mme/pt-br/assuntos/secretarias/sntep/publicacoes/plano-decenal-de-expansao-de-energia/pde-2031/english-version/relatorio\\_pde2031\\_introducao\\_eus.pdf](https://www.gov.br/mme/pt-br/assuntos/secretarias/sntep/publicacoes/plano-decenal-de-expansao-de-energia/pde-2031/english-version/relatorio_pde2031_introducao_eus.pdf)

A major challenge in integrating such forecasts is the uncertainty of both electricity and water consumption from data centers. Currently, most operators are not required to publicly disclose this information, limiting governments' ability to forecast effectively. Implementing standardized reporting requirements for large-scale digital infrastructure, including annual projections of energy and water usage, would support this integration. While such disclosure could deter some companies from investing in regions with more stringent transparency rules, it would more importantly avoid costly grid instability and ensure infrastructure is developed sustainably. If a regional consensus on transparency is reached, then it would also not become an issue of driving companies away from investing in data centers there, especially given the ample market. Still, to balance public and private interests, partially confidential disclosure of consumption could be a good option if managed with appropriate safeguards.

Uruguay's Ministry of Industry, Energy, and Mining has outlined the country's power decarbonization plan, but it lacks integration of considerations pertaining to data center expansion.<sup>56</sup> With the rapid expansion of Uruguay's data centers, it is crucial to include forecasts of data center energy usage in the discussion of the renewable energy grid's diversification.

Paraguay's 2021 Renewable Readiness Assessment (RRA), in collaboration with the International Renewable Energy Agency (IRENA), aligns renewable potential with long-term energy planning.<sup>57</sup> The assessment developed roadmaps and institutional coordination for integrating solar, wind, and biomass into Paraguay's energy matrix. The RRA's framework illustrates Paraguay's willingness and capacity to conduct high-level integrated planning, which

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<sup>56</sup><https://www.cleanenergyministerial.org/content/uploads/2024/11/uruguay-action-plan-21cpp.pdf>

<sup>57</sup>[https://www.irena.org/-/media/files/irena/agency/publication/2021/sep/irena\\_rra\\_paraguay\\_2021.pdf](https://www.irena.org/-/media/files/irena/agency/publication/2021/sep/irena_rra_paraguay_2021.pdf)

can be expanded to include digital infrastructure, like data centers, given their energy demands and strategic importance.

## **B. Reducing Hydropower Dependency: Renewable Energy Auctions**

Out of the three case study LATAM countries, Uruguay has the most diverse energy grid due to early recognition of hydroelectric dependency issues. As previously mentioned, Uruguay has unique conditions that have facilitated its utilization of a diverse mix of renewable energy resources. It is difficult to implement this diversified resource mix in other nations that do not have the same sociopolitical stability, geography, and urban dynamics as Uruguay. Brazil and Paraguay remain heavily reliant on hydropower despite ongoing efforts to diversify their grids. Chile's energy auctioning system offers an applicable and innovative solution for the two hydro-heavy nations. Chile runs technology-neutral auctions for long-term power-purchase agreements (PPAs), which have been key drivers for the country's large-scale solar and wind projects.<sup>58</sup>

To ensure long-term grid resilience and sustainable digital infrastructure, Brazil and Paraguay can leverage their existing frameworks (e.g., Brazil's Low Carbon Energy Law) to regionalize incentives and expand power auctions for wind and solar, particularly in areas targeted for data center development like the Northeast coast. Hybrid energy projects that integrate solar, wind, and battery storage should also be prioritized to reduce stress on hydro resources. For Paraguay, the newly enacted Decree 1168/2024 offers an opportunity to launch renewable energy auctions as well, securing power purchase agreements (PPAs) that attract private investment in solar and wind. Drawing from Chile's successful diversification, Brazil and Paraguay can enhance energy sovereignty, sustainability, and resilience while utilizing its clean energy surplus to serve

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<sup>58</sup><https://www.ica.org/policies/6550-chile-energy-auctions>

growing digital demand. Uruguay’s energy supply, although already quite diversified, can leverage similar policy initiatives to enhance grid reliability.

### **C. Expand Green Tech Investment Zones**

Organización Latinoamericana de Energía (OLADE) recommends developing private participation in renewables.<sup>59</sup> By concentrating incentives for green energy infrastructure in certain places, firms can be anchored in each community. Thus, expanding “Green Tech Investment Zones” in the case study countries would align data center investment and infrastructure with environmental and energy goals. This area would include fiscal incentives, such as a “no tax zone” or tariff advantages and streamlined permits. Uruguay’s Innova can be adapted to fit this structure by adding centralized licensing and clearances.

Similar location-specific strategies have proven successful in other countries and regions, like Singapore’s Data Centre Park (DCP).<sup>60</sup> In 2024, Singapore’s Infocomm Media Development Authority (IMDA) also launched the Green Data Centre Roadmap for the country.<sup>61</sup> This analysis details specific sustainability criteria for the DCP and enhancements for existing government resource efficiency and emission reduction grants.<sup>62</sup> Creating these criteria within a data center area, or “Green Tech Investment Zone” in LATAM, could learn from Singapore’s model.

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<sup>59</sup><https://www.olade.org/en/publicaciones/strategy-for-a-more-renewable-latin-america-and-the-caribbean/>

<sup>60</sup><https://www.imda.gov.sg/how-we-can-help/establishment-of-a-data-centre-park-dcp>

<sup>61</sup><https://www.mayerbrown.com/en/insights/publications/2024/08/singapores-green-data-centre-roadmap-representing-a-necessary-intersection-between-digital-infrastructure-and-sustainability>

<sup>62</sup>ibid

In Brazil, the zones could be created with incentives like the green tax credit system already in place for low-carbon hydrogen production.<sup>63</sup> The zones could be established in the country's Northeast coast, where there is already investment and strong wind potential, while also implementing these strategic government incentives. Uruguay can do the same in its preestablished free trade zones, where data centers already exist, such as Parque de las Ciencias.<sup>64</sup> The incentive and permitting framework here can also be drawn from a preexisting system like Uruguay Innova, which fosters multi-sector alignment and collaboration. Paraguay's zoning proves more difficult to regulate due to its less flexible grid. However, the government can begin with establishing zones for the data centers in the Itaipu and Yacyretá dams, where hydroelectricity is already being used. Once the grid is expanded to a diverse mix of resources, zoning can also be amended.

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<sup>63</sup><https://www.ibanet.org/Brazil-path-to-decarbonisation-tax-incentives-and-policies-on-hydrogen-and-biofuels>

<sup>64</sup>ibid