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GREEN ENERGY LEADERS

Latin America's Top Countries In Renewable Energy



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PREFACE

The Latin American and Caribbean has one of the richest sources of natural renewable energy in the world. It boasts enormous potential for non-conventional renewable energy. In fact, it is estimated that if the region exploited just a tiny fraction of its non-hydro renewable capability, it could meet the energy demands of the region's growing economies.

So why has the region's uptake of non-traditional clean energy technologies been so slow? False perceptions have blocked what otherwise would be the most obvious way forward.

The myth that renewable energy is highly expensive compared to fossil fuels remains, but it is a myth. Between 2009 and 2014 the generation costs for solar energy have fallen by 80 per cent; wind energy generation costs have declined about 60 per cent. Both technologies are highly cost competitive with fossil fuels in many markets. Besides, they provide numerous non-market benefits, especially those associated with climate change and reducing health risks.

Another mistaken perception: that traditional energy technologies and an expanding grid are the best approach for delivering energy to the rural poor. The opposite is true. Renewable energy technologies are far more amenable to reaching rural populations, precisely because they are not dependent upon investment in a grid.

But this scenario is rapidly changing. The myths surrounding renewable energy are being dispelled, particularly the myth that it is too expensive. In just a couple of decades, Latin America and the Caribbean has become a hub for clean energy technologies. In 2013, US\$16 billion was allocated to invest in renewable energy in the region, accounting for seven per cent of global clean energy investments.

The Latin America and the Caribbean region is experiencing a silent and complex renewables revolution, but progress is slow. The region is still dependent on fossil fuels and hydropower. Alongside renewable energy, its countries continue to explore non-renewable techniques such as fracking to access new oil and gas reserves. New hydroelectric complexes are being developed. It is estimated that more than US\$40 billion is currently used to subsidise fossil fuels in the region. Traditional energy sources will not disappear any time soon in the region or elsewhere in the world.

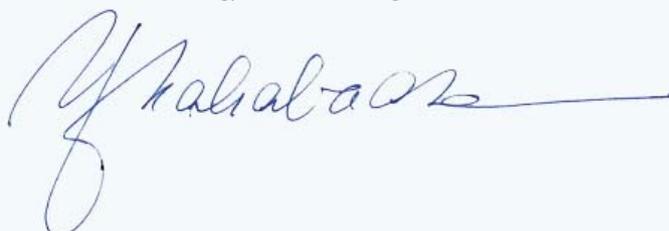
But the modern renewable energy market is growing quickly. There are many examples across the region of the development of clean energy projects. This report shows that Latin America and the Caribbean have significant potential to show what a clean energy future could look like.

Costa Rica, Uruguay, Brazil, Chile and Mexico epitomise the work the region is doing to accelerate the necessary paradigm shift. Currently, only six per cent of energy in the region comes from modern energy sources like solar, wind, biomass or geothermal power. However, it is expected that by 2050 this will grow to 20 per cent.

Clearly, there is a strong economic and financial case for investment in renewable energy, alongside an enormous global imperative to move away from the burning of dirty fossil fuels which cause global warming.

The Latin American and Caribbean region has the opportunity to develop in a different and better way. It can move away from fossil fuels and become a global renewable energy leader. The region has all the renewable natural resources it needs to become a paragon for clean energy projects. It offers both an opportunity and a responsibility to future generations. It has all that it is needed to shape a green economy future.

Let the clean energy revolution begin!



Yolanda Kakabadse
President, WWF International



INTRODUCTION

7%
THE TOTAL GLOBAL
AMOUNT OF
ELECTRICITY LATIN
AMERICA GENERATES

Latin America is the new frontier for clean and sustainable energy, the new hot spot for renewable energy.

In 2013, Latin America attracted about US\$16 billion of investment in the clean energy sector, representing over seven per cent of total global investments in renewable energy [1]. Decreasing technology costs and increasingly supportive policies in the clean energy field have allowed the region to become an exciting market for renewable energy.

Today Latin America generates about seven percent of total global electricity, and almost 65 per cent of that comes from renewable sources [2]. The largest share comes from hydropower: more than 725 terawatt-hours (TWh)¹. Non-traditional renewable electricity sources (such as solar, wind, geothermal, etc.) account for only six percent of the power mix in the continent.

It is expected that by 2050 over 20 per cent of the electricity generated in the region will come from non-hydro renewables [4].

From the northern Sonora Dessert in Mexico to southern Argentinian Patagonia, the region is loaded with vast renewable energy resources. They alone could supply over 20 times the electricity demand expected by 2050, which will nearly triple to about 3,500 TWh [5]. The region's estimated onshore wind energy potential, about 1,600 TWh, would alone be enough to fully power the continent's current electricity demand [6].

Electricity consumption is expected to increase annually by three per cent. By 2030, this rate of growth will require the region to almost double its installed power, to about 600,000 MW [5]. Taking into account these massive power infrastructure requirements, renewable energy could be established as leading source of power. It could shift the region's energy model towards a more sustainable one.

In the period between 2006 and 2013, total renewable energy capacity in Latin America and the Caribbean grew more than 270 per cent². In the same period, more than 3,000 MW of new additional renewable capacity were brought on line [2]. There is no reason why the region's success in renewable energy could not continue to be extended over the coming decades. There are several renewable energy success stories offering exciting examples of the potential for a clean energy revolution in the region. Five of the 26 countries of Latin America distinguish themselves for renewable energy performance. They shine thanks to the enabling environment created by their energy and industrial policies, the growing renewable energy investment attractiveness they have created, and the high speed in which clean technologies have penetrated into their energy markets. Latin America is booming for renewable energy, but these five countries are particularly raising the bar for clean energy transformation.

This report is WWF's compilation of renewable energy success stories in Latin America. Based upon different indicators such as the Bloomberg New Energy Finance (BNEF)'s Climate Scope Score 2014, 2013 & 2012 [2][7][8]; the Ernst and Young (E&Y)'s Renewable Energy Country Attractiveness Index 2014 & 2013 [9][10]; and the World Energy Council (WEC)'s Sustainability Index 2013 [11], this report ranks the five countries with the most exciting development in clean energy. This compilation promotes their achievements in reshaping the energy paradigm of the continent. They are making renewable energy Latin America's new normal.

¹ terawatt-hour (TWh) is equal to 1,000,000 gigawatts-hour (GWh). For reference, the electricity consumption of the USA (2011) was around 4,100 TWh [3].

² From 11.3 GW in 2006 to 30.6 GW in 2013 [2][7].



#1 COSTA RICA

[Best positioned Latin American country in WEC's Sustainability Index 2013]

Key Figures

| | | | |
|---|--------|--|-------|
| Population (millions) (2013): | 4.9 | Installed power capacity (GW) (2013) | 3 |
| GDP (billion USD) (2013): | 49.6 | Non-hydro renewable share (%) (2013) | 31 |
| Five-year GDP growth (%) (2009-2013) | 11 | RES Non-hydro power generation (GWh) (2013) | 3,952 |
| GDP per cap (USD/cap) (2013): | 10,122 | RES Non-hydro energy investments (billion USD) (2006-2013) | 1.7 |
| Growth rate of power demand (%) (2012-2013) | -0.013 | Electrification rate (%) (2013): | 99.4 |

Source: [2]

COSTA RICA

**COSTA RICA
HAS DECIDED TO GO
FOR A TARGET OF
100 %
RENEWABLE
ENERGY BY
2021**

Over a century ago, San Jose became the third city in the world and the first in Latin America to light up its streets with electric power [54]. In 1984, 25 lamps powered by a small hydroelectric plant were the first steps towards a bright and clean future for Costa Rica [55].

Today, the country is close to achieving another milestone in the country's energy history: to become the first 100 per cent renewable energy-powered country in Latin America.

As for many countries in Latin America, climate change is the biggest threat to its power system. Among the many dangers climate change poses to the region, it is likely to have significant impacts by reducing rainfall [56][57]. Shifts in rainfall patterns could particularly imperil generation of electricity by hydropower [58], Costa Rica's main source of electric generation.

Aware of the risks of a single major source of power generation, the government has decided to go for a target of 100 per cent renewable energy by 2021. Ultimately, the target aims to boost the penetration of non-hydropower technologies and diversify options for electricity supply, but also to pursue a carbon neutral economy [59]. Costa Rica is perhaps the greatest renewable energy paradise in the whole Central American region.

The country is privileged by its 223,000 GWh a year of potential hydroelectricity, out of which at least 10 per cent are already economically exploitable [60]. It is also among other countries in the region with the largest geothermal potential: up to 2,900 MW are available for its' exploitation [61]. Finally, due to its geographical location, Costa Rica enjoys excellent potential for generating wind energy, with speeds between 4.8 and 5.6 m/s [60].

Today, Costa Rica is taking every opportunity to exploit its renewables. One decade ago, total installed capacity of geothermal and wind power was 145 MW and 62 MW respectively. By 2012, total installed capacity of geothermal and wind power grew to 217 MW and 148 MW respectively. An additional 210 MW for geothermal power and 215 MW of wind power are expected to be in operation throughout the next decade [58]. By 2013, total clean energy installed capacity (excluding large hydroelectricity) reached over 900 MW [2].

In 2013, Costa Rica generated some 10,100 MWh of electricity out of which 87 per cent were from renewable energy sources. Although the majority came from hydropower generation, around 20 per cent of the total renewable electricity was generated from non-hydropower renewables [62]. With these figures, Costa Rica establishes itself among the leader countries in Latin America for non-hydro renewable power generation¹⁴.

Costa Rica is a regional leader in implementing policies that favour renewables. The country has established at least two key mechanisms that have facilitated the penetration of renewables to the power mix. Firstly, a specific technology auction system, which by 2012 allowed 138 MW of additional clean energy capacity to be contracted (38 MW small hydro; 100 MW wind power) [7]. Secondly, a programme to promote local generation by consumers, who can sell surplus energy back to the grid. Under this program, a total of 5 MW of additional capacity was made available by small producers who connected their solar, wind, biomass, and small hydropower or cogeneration systems to the grid. By early 2012, 225 kW of additional clean electrical capacity were achieved (mostly from solar sources) [61].

Thanks to its great potential and its favourable policies, Costa Rica has created an attractive environment for renewable energy financing. During the period from 2006 to 2013, its US\$50 billion economy attracted over US\$1.7 billion funding for renewable energy projects [51]. In 2013 a record US\$600 million were committed to renewables. Around 40 per cent of that went straight to non-hydro renewables [2].

¹⁴ In 2012, El Salvador and Nicaragua were the largest producers of non-hydro renewable electricity relative to total electricity production: 24 per cent and 21 per cent respectively [63].

Given its high proportion of renewables in the energy mix, Costa Rica's energy performance is outstanding in terms of environmental sustainability. Costa Rica boasts achievements in energy efficiency as well as renewable energy and other low-carbon developments, making it one of the cleanest countries on earth in terms of electricity generation [11].

In the Latin American region, it is the cleanest country in terms of a range of factors: energy consumption per unit of GDP; carbon intensity in energy conversion processes; impacts over air and water pollution related to energy production; and amount of emissions for electricity produced [11].

Moreover, consistent with its commitments towards carbon neutrality by 2021, Costa Rica is also moving forward on its greening agenda for the transport sector [59]. Aiming at reducing its dependence on oil for transportation, Costa Rica started developing the electrification of its transport system. By 2030, Costa Rica plans to have nine per cent of vehicles in country's transport sector running on electricity [59].

Despite its small size, Costa Rica is taking giant leaps and leading by example: a 100 per cent sustainable one. It is an inspiring example for other countries in the region.



#2 URUGUAY

[Latin American country with the highest share GDP invested in renewable energy in 2012]

Key Figures

| | | | |
|---|--------|--|------|
| Population (millions) (2013): | 3.4 | Installed power capacity (GW) (2013) | 3 |
| GDP (billion USD) (2013): | 55.7 | Non-hydro renewable share (%) (2013) | 10 |
| Five-year GDP growth (%) (2009-2013) | 13 | RES Non-hydro power generation (GWh) (2013) | 745 |
| GDP per cap (USD/cap) (2013): | 16,382 | RES Non-hydro energy investments (billion USD) (2006-2013) | 22 |
| Growth rate of power demand (%) (2012-2013) | 10.1 | Electrification rate (%) (2013): | 98.6 |

Source: [2]

URUGUAY

Uruguay is a country that, other than in football, often goes unnoticed. With less than 180,000 km² in surface area this tiny country ranks second as the smallest in South America [42]. Uruguay is neither one of the most populated (3.4 million [43]) nor the richest in the region. In 2013, its GDP was 55.7 billion US\$ [30]⁸. However, thanks to its accomplishments in the policy arena, it is considered as one of the most ‘talented’ nations on Earth. The Economist elected it as the country of the year 2013 [44].

What makes Uruguay so special in the policy field? Uruguay is a country that has put in place path-breaking reforms that have served to improve local wellbeing, setting a precedent for other nations across the globe. During the last 10 years, Uruguay has pursued good governance, and achieved real transformational changes in education, energy, environment and inland security [45]. It has sought long-term economic stability, social inclusion and environmental sustainability for all Uruguayans.

In 2008, in line with country’s development aspirations, Uruguay’s administration approved its national 2005-2030 Energy Policy strategy [46][47]⁹. The energy policy constituted a long-term vehicle to enhance productivity and social development, while improving and fostering industrial competitiveness, energy independence, economic and environmental sustainability, and social integration [47]. Embedded on four main strategic axes¹⁰, the energy policy defined the guidelines, timescales and various lines of action to achieve a central objective: to satisfy all national energy needs cost-effectively.

Two of the priorities of Uruguay’s energy policy are to promote energy supply diversification; and to provide adequate energy access to all social sectors.

The priorities reflect Uruguay’s determination to achieve a 100 per cent country electrification rate by 2015 and renewable energy supply optimality by 2020¹¹. And it is in this context that Uruguay’s government has sought to provide universal access to energy through supporting energy generation like photovoltaic electricity and solar water heating.

Through its 2005-2030 Energy Policy strategy, Uruguay took leaps towards a long lasting clean future. Perhaps, in Latin America, there is no country that will achieve what Uruguay is aiming for: 100 per cent electrification; 50 per cent share of renewables in the primary energy supply; and 15 per cent power generation from modern renewables by 2015 [47]¹². It has meant Uruguay is now one of countries with the highest electrification rate of the whole continent: 98.6 per cent [48].

The country is defining global trends in renewable energy investment [1]. In 2012, it ranked first in the global top five countries with highest share of GDP invested in renewable energy [49]¹³. In 2013, it ranked fourth as the country that attracted the largest absolute amount of investment in Latin America, about US\$1.1 billion [1]. In 2014, it ranked first in Latin America with the fastest growth rate of clean energy investment [51].

Uruguay is indeed achieving a renewable energy transformation. The country will soon reach 40% cent of its primary energy matrix from renewables. Given the great availability of renewable resources, Uruguay is already able to cover over 80 per cent of its electricity needs from renewables [50].

HIGHEST
SHARE
OF GDP
INVESTED IN

RENEWABLE
ENERGY

⁸ For comparison, in 2013, Argentina and Brazil’s GDP was US\$612 billion and US\$2,246 billion respectively [30].

⁹ The policy was then ratified by Uruguay’s Parliament multi-parties Energy Commission in 2010

¹⁰ Viz. institutional frameworks, energy supply diversification, energy demand management and social integration.

¹¹ “Optimality” is the accepted level of balance, based on stability and sustainability concerns, that the energy system can achieve when considering renewable and natural gas supply and energy demand management measures.

¹² That is, excluding large hydros.

¹³ About three per cent[50]

Inside Uruguay's 2030 energy vision, solar plays a fundamental role in promoting universal access. Photovoltaic electricity and solar water heating systems are at the heart of its energy supply strategy. Uruguay's regulatory framework for solar technologies is perhaps one of the most complete in the region. It includes at least 17 legal instruments that enable solar technologies to expand [52]. In particular, solar water heating has become a priority for Uruguay. In 2009 the government enacted the "Solar Thermal Energy Law" which declares research, development and capacity building on this technology a matter of national interest for the country [53].

Uruguay's 2005-2030 vision makes the country a one-of-a-kind leader for renewables in Latin America.



#3 BRAZIL

[Best positioned Latin American country in BNEF Climate Scope Score 2014 &]
in Ernst & Young's RES Country Attractiveness Index 2014]

Key Figures

| | | | |
|---|--------|--|--------|
| Population (millions) (2013): | 200 | Installed power capacity (GW) (2013) | 126 |
| GDP (billion USD) (2013): | 2,250 | Non-hydro renewable share (%) (2013) | 15 |
| Five-year GDP growth (%) (2009-2013) | 7 | RES Non-hydro power generation (GWh) (2013) | 45,815 |
| GDP per cap (USD/cap) (2013): | 11,250 | RES Non-hydro energy investments (billion USD) (2006-2013) | 96.3 |
| Growth rate of power demand (%) (2012-2013) | 8.6 | Electrification rate (%) (2013): | 99 |

Source: [2]

BRAZIL

From wherever you are standing, Brazil is Latin America's giant. Not only it is the wealthiest country on the continent, accounting for more than 30 per cent of region's GDP, it is also one of the energy cleanest [30]. In 2013, renewables supplied almost 80 per cent of total electricity generation in the country. Hydropower was the largest source of electricity provision: more than 390,000 GWh of reliable power for Brazilians [31].

Hydroelectricity generation in Brazil is already massive, but only reflects a fraction of its hydropower potential: which is estimated at more than 243 GW. Currently, only about 30 per cent of it is exploited [32]. But it is growing. Under current trends, current hydropower installed capacity will almost double by 2035, covering more than 60 per cent of the total estimated potential [33].

As a source of clean electricity, hydropower has been great for Brazil's growth. But it has also been a good backdrop for the growth of other renewables too. Hydropower is exceptional in filling the power supply gaps of more variably-reliable renewables [34]. For instance, as wind and hydropower co-habit well in power systems, the combination of these two sources have formed an excellent basis for exploiting the probable 300 GW of wind energy potential available in this Amazonian country [35].

More than 2,200 MW of total installed capacity made Brazil the largest wind energy producer on the Latin American continent in 2013 [31]. Today, there is over 7000 MW of additional wind power capacity in the pipeline, due to come on stream by 2016. It is estimated that the Brazilian wind market is growing at a rate of 2,000 MW per year [36].

This is not so surprising if one sees that the 5-year growth of wind power installed capacity from 2009 to 2013 was 38 per cent annually [31].

In 2012, wind energy powered over four million households, providing two per cent of total national electricity consumption [37]. The wind sector in Brazil employs more than 30,000 people and half of those jobs were created in 2012 [26].

Total clean energy investments over the period of 2006 to 2013 were US\$96 billion, representing almost 75 per cent of all investments committed to Latin America during this period [2]. Around 70 per cent of this went into wind [7]. Brazil is comfortably the most attractive country for wind energy investments in the region [10].

Brazil's wind energy sector has benefited from two key factors: the development of a local value chain for the sector, and a facilitating energy policy that has been able to provide certainty to investors over the long term.

Given its rapid market expansion, more and more wind technology manufacturers are choosing Brazil as their manufacturing hub. Multinational companies involved in the business already have production sites there and are further expanding their turbine construction activities [38]. This expansion is bringing with it knock-on business and manufacturing sectors: production and provision of services; manufacturers of gearboxes, generators, blades and turbines; project development, construction and installation services; operation and maintenance providers and power generation [7]. It is expected that by 2016, Brazil will become a manufacturing venue for 100 per cent Brazilian-made turbines, and a major assembler for the much of the Latin America region [38]. Brazilian's wind sector supply chain is already the continent's market leader.

To a large extent, industrial policy has driven the development of this wind value chain. That's particularly down to rules being introduced whereby, in order for project developers to access Brazilian Development Bank (BNDES) financing, projects must use domestically made equipment [8].

> 7000 MW
OF ADDITIONAL
WIND POWER
CAPACITY
IN THE PIPELINE

Part of wind energy's success in Brazil has been due to the establishment of mechanisms to support renewables, such as the early 2000's Brazilian National Program PROINFRA. Under this program, a total capacity of 3,300 MW was equally assigned to non-conventional electricity generation sources: wind, biomass and small hydropower. It guaranteed a fixed tariff for electricity generated, as well as access to the grid, for 20 years [36]⁵. Although the program suffered from various bottlenecks, by 2005 PROINFRA has facilitated the addition of 1300 MW of wind power capacity to the grid [36] [39].

Some years later, a new mechanism came into place: technology specific electricity auctions. The auctioning scheme (competitive bidding system) aimed to efficiently and cost-effectively increase the energy security of the country [36]. Through this policy vehicle, which remains valid today, producers and utilities enter long-term wind power purchasing agreements for 20 years⁶.

The agreements provided certainty to investors (therefore easing project financing), fostered competition, and committed players to deliver results as only serious tenderers were allowed to participate in the auctioning [40][36]. Since 2005, these auctions have resulted in the contracting of more than 6,000 MW of wind power additional capacity [39]⁷.

The PROINFRA program, as well as the specific technology tendering system, has demonstrated the effectiveness of encouraging participation of private companies in the renewable energy market. These initiatives are the main reason that Brazil is the today's regional leader for wind energy generation and development. And the story isn't over yet. Projections foresee 16,000 MW of installed wind energy capacity by 2021 [14].

The development of the Brazilian renewable energy sector is without a doubt a remarkable success in Latin America.

Electricity generation from renewables has almost doubled in ten years. These supporting mechanisms have led to Brazil becoming the renewable energy giant of Latin America.

⁵ The PROINFRA program was conceived with two phases. Whereas the first one assigned 3300 MW of total capacity to renewable energy generation, the second established a 10 per cent renewable electricity target (excluding large hydro) within 20 years. So far, second phase has not been implemented [36].

⁶ The tendering system is not exclusive to wind power purchasing, but for all renewable power purchasing. For instance, for biomass electricity generation long-term agreements have lifespans of 15 years.

⁷ Overall, auctions have resulted in 31 GW of contracting new capacity, 40 per cent of which is conventional hydro, 20 per cent of which is non-conventional renewables, and 40 per cent of which is conventional fossil fuels, mostly gas [41].



#4 CHILE

[2nd best positioned Latin American country in BNEF Climate Scope Score 2014 & 2013]

Key Figures

| | | | |
|---|--------|--|-------|
| Population (millions) (2013): | 17.6 | Installed power capacity (GW) (2013) | 17.8 |
| GDP (billion USD) (2013): | 277.2 | Non-hydro renewable share (%) (2013) | 8 |
| Five-year GDP growth (%) (2009-2013) | 10 | RES Non-hydro power generation (GWh) (2013) | 6,509 |
| GDP per cap (USD/cap) (2013): | 15,750 | RES Non-hydro energy investments (billion USD) (2006-2013) | 7.1 |
| Growth rate of power demand (%) (2012-2013) | 3.8 | Electrification rate (%) (2013): | 98.5 |

Source: [2]

CHILE

More than 64,000 tons of steel - in the form of wind farms and turbines - help to power the largest global producer of copper.⁴ By 2013, Chile had about 360 MW of wind energy capacity, capable of generating two per cent of country's total renewable electricity [20]. But by 2030, it is estimated Chile will generate at least 10 times the wind power it generates today [21].

Wind has been a major breakthrough technology in the Chilean electricity mix, but it is far the only one. Chile currently supplies around 33 per cent of its total electricity with reliable renewable energy: hydroelectricity supplies about 87 per cent, biomass, over 10 per cent [20].

Chile's abundant renewable energy resources could satisfy the country's current energy consumption 25 times over [22]. Chile is getting there little by little. For example, compared to 2009, non-hydro renewable energy power generation in Chile almost tripled [20].

The increasing penetration of renewable energy in Chile is not coincidence. The country has established itself as a leader in Latin America's clean energy landscape by adopting a 20 per cent renewable electricity target by 2025 [23]. It has become one of the region's hot spots for green investments.

The penetration of renewables in Chile's grid has been fostered by the establishment of a robust energy policy framework. In recent years, the government has focused on increasing energy availability and security; promoting competition in the energy sector and sustainable investments; enhancing regulations to provide better access to clean energy; promoting research programs in the energy field; formulating energy efficiency and energy savings policies; promoting and engaging with renewable energy projects; and enhancing cross-cutting policies in the residential and transport sectors [24]. Since the year 2000, at least 11 policy vehicles have been introduced encouraging Chile's renewable energy sector, including regulatory instruments, economic instruments, direct investment, research and development support schemes, and financial incentives, and obligations [25].

Perhaps the most encouraging policy vehicle has been the Law for Fostering Non-Conventional Renewable Energy. The "20/25 Law", as it is commonly known, requires that by 2025, 20 per cent of electricity that providers supply to the grid must be from renewable sources [23]. Chile's Energy Ministry is obliged to demonstrate how their own actions, such as awarding contracts, are in line with the 2025 objective.

Thanks to "20/25", Chile not only portrays itself as a green powered economy, but has established its place in Latin America as one of the few countries with ambitious renewable electricity targets [26]. It is a renewables-friendly institutional framework that has allowed successful implementation of Chile's renewable energy policies. For instance, the Center for Renewable Energies (CER) established in 2009 an official body, under the Ministry of Energy, to promote and foster renewable energy projects. It provides up-to-date information on latest technologies in the sector, enhances capacity building, and fosters cooperation among renewable energy advocates and interested stakeholders [27].

For some time, Chile has been a target for clean energy investments. In 2012, Chile was nominated as South America's second most attractive market for clean energy, just after Brazil [10]. Over the period from 2006 to 2013, more than US\$7 billion were committed to renewable energy projects [2]. In 2012 alone, over US\$2 billion were invested in clean energy; 67 per cent of that was allocated to wind energy [7].

Around 270 MW of additional renewable energy capacity are currently under construction, and another 6,721 MW have been approved. A further 3,607 MW are being evaluated [28].

CHILE
ESTABLISHED THE
CENTER FOR
RENEWABLE ENERGIES
(CER)
IN
2009

⁴ Onshore wind turbines require an average of 180 tonnes of steel per MW [19].

All this additional capacity reflects the excellent business environment for clean energy in Chile. During 2012, international investors put over US\$280 million into a 115 MW wind farm in the central region, US\$140 million into a 90 MW wind farm in the North, and some US\$200 million into a 65 MW solar power plant [7]. In 2013, about US\$960 million went to solar projects and another \$580 million went to wind farms [2].

While local mechanisms for financing renewable energy have been limited in the past, Chilean sources of funding become increasingly present [29]. In the 2012/13 financial year, local banks contributed to the renewable energy sector to the tune of more than US\$700 million [7][2].

Due to its solid renewable energy policy set-up, and the highly attractive investment environment it provides, Chile is an example of a renewable energy success story in Latin America.



#5 MEXICO

[3rd best positioned Latin American country in Ernst & Young's RES Country Attractiveness Index 2014]

Key Figures

| | | | |
|---|--------|--|--------|
| Population (millions) (2013): | 122.3 | Installed power capacity (GW) (2013) | 64 |
| GDP (billion USD) (2013): | 1,261 | Non-hydro renewable share (%) (2013) | 5 |
| Five-year GDP growth (%) (2009-2013) | 7 | RES Non-hydro power generation (GWh) (2013) | 13,469 |
| GDP per cap (USD/cap) (2013): | 10,310 | RES Non-hydro energy investments (billion USD) (2006-2013) | 11.3 |
| Growth rate of power demand (%) (2011-2012)[12] | 2.1 | Electrification rate (%) (2013): | 97.6 |

Source: [2]

MEXICO

Mexico has an outstanding wind power potential: 50 GW or more [13]. With high load factors of over 20 per cent, and mean annual wind speeds that can be as high as 11 m/s in some locations, Mexico seems to have its energy future blowing in the wind [14].

It is no surprise then that current installed wind energy capacity is above 1,900 MW, and that wind supplies over three per cent of renewable electricity produced in the country [12]. More than 1,500 MW of additional clean wind power capacity is already under construction or is soon to begin [13].

At first glance, wind energy in Mexico seems to play a minor role. The renewable energy sector is dominated by hydropower and geothermal generation, offering more than 80 per cent and 14 per cent of the share of total clean electricity supply respectively [6]. When looking at the evolution of the Mexican wind energy sector, wind power has been the fastest growing and most penetrating technology in recent years. In 2012, wind power grew almost 400 per cent compared to the year before [15]. Wind power capacity in Mexico could be 10 to 20 times larger by 2020 [13].

Mexico and wind power certainly offers a renewable energy success story. Since the 1990s, Mexico has been laying the foundations for continuous wind energy deployment, by putting wind energy friendly policies in place. This is what explains the success wind power has enjoyed in the country: the systematic building up and establishing of a constructive policy framework that provides confidence to investors, and which attracts investments from local and international players [16].

Annual investment growth in clean energy has been relatively steady in Mexico's since 2008, about 13 per cent on average [17]. Much of that growth is attributed to wind power, Mexico's flagship green electricity. Back in 2001, there were 3 MW capacity of wind power. Just over a decade later, it boasts over 1500 MW [6]. Currently, Mexico is the most attractive country for wind investments in Latin America, followed by Brazil and Chile [9]. 2012 brought investments of US\$2.3 billion in the wind sector, almost eight times more than in 2011 [7][8]. In the same year, two of the top three clean energy asset finance deals were wind related: a 396 MW wind farm worth US\$960 million, and another wind farm of 102 MW, worth US\$165 million [7].

Over the last two decades, it has involved relevant stakeholders (particularly private sector and international funding agencies) in creating, developing and growing a wind sector through the provision of policy certainty. The policies have been rolled out through various means: contracts to connect variable energy sources to the national grid; expanding transmission infrastructure; developing a national strategy to promote renewables; issuing new regulations to strengthen the self-supply modality of electricity provision; issuing tenders for additional installed capacity development; and providing finance for self-supply modality wind energy projects [16].

In short, the Mexican government has built a more supportive regulatory and financial environment that offers confidence to investors. In 2003, there was less than 1 MW of wind power installed capacity operated by private companies. By 2013, it surpassed 1,900 MW [2].

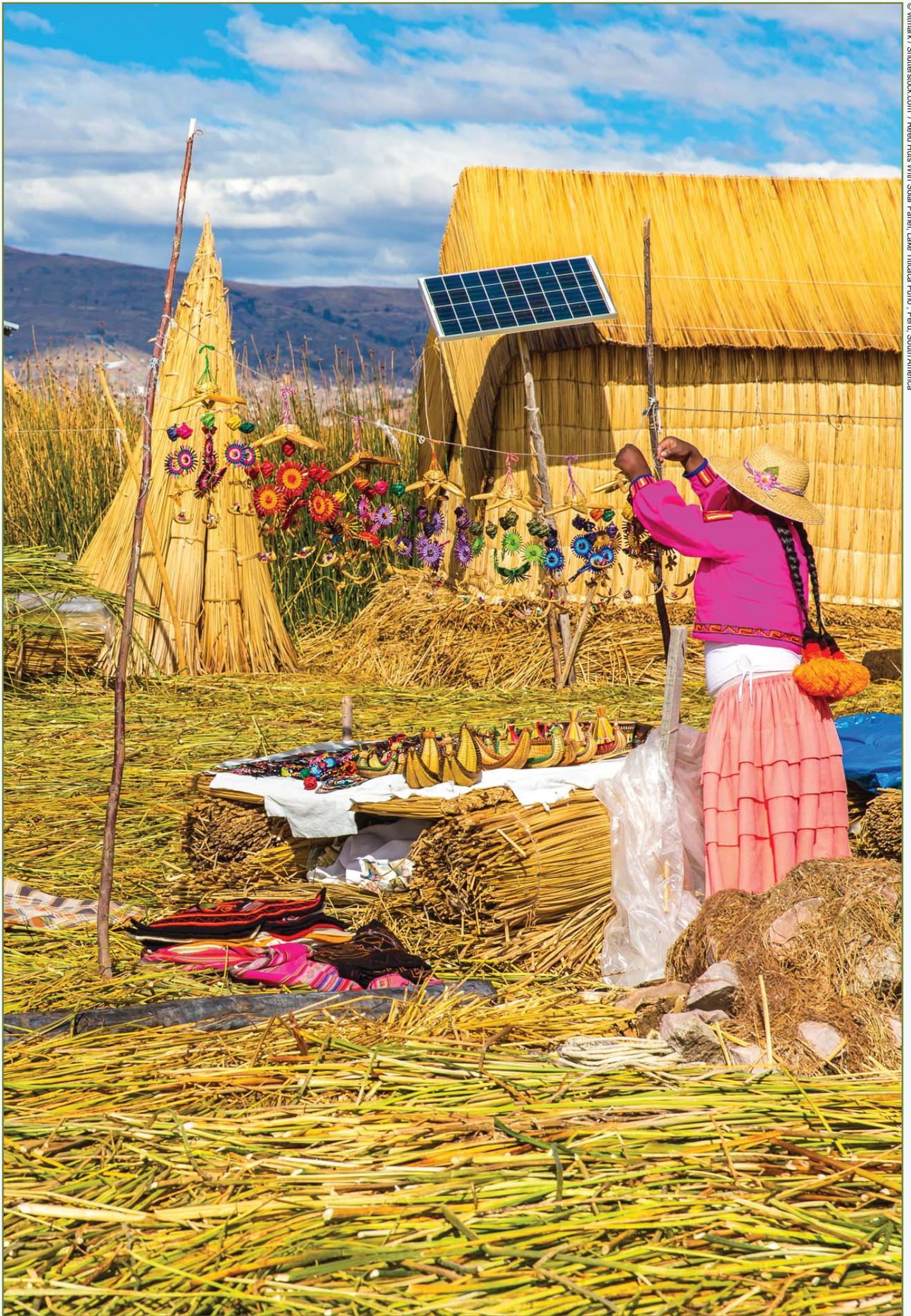
Over the last two decades, the Mexican government's commitment towards wind energy has only increased. Nonetheless, and despite of the outstanding growth in wind power capacity and the increasingly attractive investment environment, Mexico is still far from seizing its own full potential. At least 12 GW of installed capacity can be economically feasible and yet to develop by 2020[14]. However, current expectations of achieving 33 per cent clean energy by 2018 [18] will probably lead Mexico towards exploiting this available and huge wind resource potential³.

WIND POWER
CAPACITY IN MEXICO
COULD BE
20 X
LARGER BY
2020

³ In the context of this target, Mexico aims to generate 33 per cent of its electricity with "clean energy" which includes renewables but also hydroelectricity, cogeneration and biofuels.

In future, further strengthening the legal and regulatory framework, and increasing engagement from the private sector will be essential to scale up investments to match the country's wind energy potential. Given the achievements already made and projects now coming on stream, this is unlikely to be an issue for Mexico.

An enabling and evolving policy framework has allowed Mexico to become a centre of excellence for wind energy projects.



SPECIAL MENTION:

PERU

[1st Place in the Global Microfinance Microscope 2013]

Key Figures

| | | | |
|---|-------|--|-------|
| Population (millions) (2013): | 30.4 | Installed power capacity (GW) (2013) | 10 |
| GDP (billion USD) (2013): | 202.3 | Non-hydro renewable share (%) (2013) | 78 |
| Five-year GDP growth (%) (2009-2013) | 11 | RES Non-hydro power generation (GWh) (2013) | 4,532 |
| GDP per cap (USD/cap) (2013): | 6,655 | RES Non-hydro energy investments (billion USD) (2006-2013) | 3.4 |
| Growth rate of power demand (%) (2012-2013) | 5.373 | Electrification rate (%) (2013): | 90 |

Source: [2]

SPECIAL MENTION

PERU

PERU
PLANS TO USE
SOLAR
TO PROVIDE
ELECTRICITY
TO
500,000
POOR
HOUSEHOLDS

The future of Latin America's renewable energy potential is solar. The region has sunshine that many other regions in the world would envy. Latin America's current energy demand could be met about 40 times over using solar energy¹⁵. A full 70 per cent of its' renewable energy potential comes from the sun [5].

In 2013, only 0.4 percent of Latin America's total non-hydro renewable power consumption was solar [6]. That seems too little for a region that generates about 60 per cent of its power from renewables (including hydro). But on current trends, the picture might soon look quite different.

By the end of 2012, the region's solar power installed capacity was about 90 MW [7]. By mid-2014, it is estimated that capacity has already grown to over six times as much [58][59]. During the first half of 2014, two solar mega plants came on stream: the Aura Solar I Plant in Mexico (30 MW) and the Amanecer Solar Cap Plant in Chile (100 MW) [69][70]. According to power project developers, there are at least an additional 836 MW of solar projects under construction; more than 1,000 MW of solar power will come online in the region before 2015 [67].

Declining system costs, alongside increasing policy support throughout the continent, have driven growth in solar capacity. Combined with resource availability, business opportunities have increasingly encouraged solar-focused investment in the region. In 2012, investments in solar reached US\$1.4 billion and accounted for about seven per cent of region's total investments in renewable energy. Peru, Mexico and Chile together accounted for about 70 per cent of the figure [7].

In 2012, Costa Rica attracted almost US\$10 million to its solar sector, while Ecuador saw US\$4.4 million in solar financing [7]. As part of its aspiration to double renewable power generation by 2018, Mexico has set a target of additional 574 MW of solar capacity [71]. Given their win-win market condition for up scaling, Brazil, Chile, Panama and Dominican Republic are other Latin American countries where the future of solar shines brightly [72][73].

As energy demand grows on the Latin American continent, opportunities are ripe for countries to exploit solar resources to provide power for to their citizens.

Peru in particular is using solar power to pursue energy security, independence and diversification.

The Andean country plans to use solar to provide electricity to 500,000 poor households [74]. In 2010, solar systems in remote rural areas, where extension of grid infrastructure is expensive, was estimated to exist only in 0.8 per cent of the more than 2.2 million Peruvian rural homes [75]¹⁶. Through this program, Peru intends to increase this capacity 30 times over, while ensuring a quarter of all rural homes in the country have access to electricity.

Peru already has a good track record of fighting energy poverty with solar power. In 2006, the Peruvian Ministry of Energy and Mines (MEM), in partnership with the United Nations Development Programme (UNDP), implemented the programme "Photovoltaic Rural Electrification in Peru". It led to the installation of 4,200 solar systems in Amazonian Peru by 2011. The "Energy, Development and Life" project, conducted by the German Cooperation Agency (GIZ), has allowed over 33,000 people to benefit from solar technologies [77].

The future of solar in Peru is promising beyond international funded initiatives. Local microfinance has also played a role in bringing solar access to Peruvian families.

¹⁵ Considering both, solar photovoltaic electricity (PV) [estimated 37 PWh], and concentrated solar power (CSP) [estimated 17 PWh] potentials[5].

¹⁶ More recent figures estimate there are 19,586 households with solar systems, that is, about 0.9 per cent of all households [76].

Microfinance in Peru is well established. In 2013, the country was nominated (for the sixth consecutive year) as the place with the best regulatory framework, competitive and innovative business environment and highest level of client protection for microfinance [78]. In fact, out of the 63 Latin American microfinance institutions that offer products that support clean energy, 10 are based on Peru. In 2012, three of these funded a huge 12,590 borrowers with green microloans [7].

The Peruvian decision to go for solar is paying off. It is estimated that between 2010 and 2011, the solar market has generated about US\$5.4 million [76]. In a Peruvian market, where renewables could provide energy to over 2.5 million people, the opportunities for solar are worth seizing.



SPECIAL MENTION: NICARAGUA

[2nd best positioned Latin American country in BNEF Climate Scope Score 2012]

Key Figures

| | | | |
|---|-------|--|-------|
| Population (millions) (2013): | 6 | Installed power capacity (GW) (2013) | 1 |
| GDP (billion USD) (2013): | 11.3 | Non-hydro renewable share (%) (2013) | 31 |
| Five-year GDP growth (%) (2009-2013) | 6 | RES Non-hydro power generation (GWh) (2013) | 1,442 |
| GDP per cap (USD/cap) (2013): | 1,883 | RES Non-hydro energy investments (billion USD) (2006-2013) | 1.6 |
| Growth rate of power demand (%) (2012-2013) | 1.7 | Electrification rate (%) (2013): | 76.2 |

Source: [2]

SPECIAL MENTION

NICARAGUA

IN 2013,
16 %
OF TOTAL
ELECTRICITY
IN NICARAGUA
WAS
SUPPLIED BY
GEOHERMAL

Nicaragua is a renewable energy paradise in Central America. Its abundant resources allow this small country to boast great potential for hydropower, geothermal electricity and wind power [79]. And it is already being exploited. In 2013, over 50 per cent of total power supply was supplied by renewables. Together, geothermal and wind power accounted for more than 30 per cent of all generation [62]. Over the period between 2008 and 2012, Nicaragua had the highest annual growth in Latin America for non-hydro renewable power generation: almost 30 per cent [63].

Despite Nicaragua being one of the smallest countries on the continent, in 2012 it occupied the 20th position (out of 32) based on GDP [30], today it boasts one of the highest levels of clean energy investment per unit of GDP. In 2012, US\$292 million were invested in clean energy in Nicaragua, equivalent to 2.8 per cent of the country's GDP. In the same year, Nicaragua increased its renewable energy installed capacity by more than 40 per cent compared to 2011 [7]. Despite 2013 bringing a significant decline in investments, this US\$11 billion economy has been able to attract US\$1.6 billion to its renewable energy sector since 2006. That's more than many other countries in Latin America [51].

The great success story of Nicaragua has been the increasing market penetration of geothermal energy. Twenty years ago, there was no geothermal generated power in Nicaragua. By 2013, there were over 150 MW of installed capacity supplying around 16 per cent of the total electricity consumed in the country [62].

Nicaragua is not one of the major consumers of renewable electricity in Latin America. In fact, it is still a highly dependent fossil fuel economy. Around 50 per cent of total electricity generation comes from burning oil and diesel. It also has a low electrification rate: over 22 per cent of the population does not have access to electricity [6].

Nonetheless, Nicaragua deserves recognition for overcoming such drawbacks. In 2003, electricity generation from renewables and the electrification rate were 12 and 10 percentage points lower than they were in 2012 [80]. Thanks to renewables, Nicaragua is slowly catching up.

Nicaragua has been able to attract investments in the clean power sector despite its size and modest economy. In 2010, an historical US\$430 million was attracted to the sector [7]. Around half of it to geothermal generation, and half to wind power. Subsequent years were less exciting, but since 2011 about US\$690 million have been brought to Nicaragua, the equivalent to six per cent of the country's 2013 GDP. The Nicaraguan market is expected to rise a further twice over again in the coming years [81].

In particular, micro financing institutions are playing a key role in Nicaragua's clean energy future. Today, micro financing in Nicaragua is responsible for more than US\$1.2 million of investment in renewables [7].

Nicaragua has great geothermal resource potential. It is estimated that its geothermal generation could worth up to 5,500 MW, over four times current total installed capacity [80]. Over the coming decade, geothermal power could grow at least a further 250 to 400 MW [80]. In the last five years, its capacity grew twice over [62].

From north to south, geothermal generation is widespread in Nicaragua's territory. Nicaragua's Ministry of Energy and Mining is confident that at least 1,500 MW of geothermal potential are economically exploitable already; enough to power the whole country's energy consumption three times over [82]. However, to make it happen, more investment is needed. Based on recent trends, that is unlikely to present a major barrier to Nicaragua's clean energy ambitions.



CONCLUSION

Latin American and the Caribbean is already an example of renewable energy success. Little by little, the continent, home to more than 600 million people, is paving the way for the provision of clean and reliable energy to every one of its nations [64]. Costa Rica, Uruguay, Brazil, Chile and Mexico are heading up the move towards a sustainable energy future. But they are not the only ones. Peru, Nicaragua, Panama, Argentina and Colombia are increasing their efforts to catch up with the leaders.

Latin American countries are moving towards 100 per cent renewable energy. There is, of course, still a long way to go. Today, Latin America emits more than 1,500 million tonnes of CO₂ by burning coal, oil and gas to supply the energy it needs [65]. Many regions in the continent are still dependent on fossil sources to power their economy. Perverse consumer subsidies to fossil fuels are still encouraging a carbon-intensive and unsustainable energy system over one based on renewables. In 2013, more than US\$40 billion were allocated to subsidise fossil energy in Latin America, compared to twice the amount of money invested in renewables.[51] [66]. Latin America can and should be powered by nature. Its countries need to invest more in sustainable wind, solar, geothermal, biomass, hydro and ocean energy, as well as phasing out support to unsustainable fossil energy.

Supplying power from renewables can bring great benefits to Latin America's economy and society. It offers long-term energy security, lower energy system costs, industrial development, job creation, improved local health and environmental conditions, greater energy access and climate change mitigation.

Five countries can already talk about these rewards. Hopefully, many more will join them soon.

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WWF's mission is to stop the degradation of the earth's natural environment and to build a future in which humans live in harmony with nature. The Global Climate & Energy Initiative is WWF's global programme addressing climate change through promoting renewable and sustainable energy, scaling up green finance, engaging the private sector and working nationally and internationally on implementing low carbon, climate resilient development.

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GREEN ENERGY LEADERS: Latin America's Top Countries In Renewable Energy

Special Mention

Both **Peru** and **Nicaragua** have special mention in this report

1st

Costa Rica is in first position

2nd

Uruguay is in second position

3rd

Brazil is in third position

4th

Chile is in fourth position

5th

Mexico is in fifth position



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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