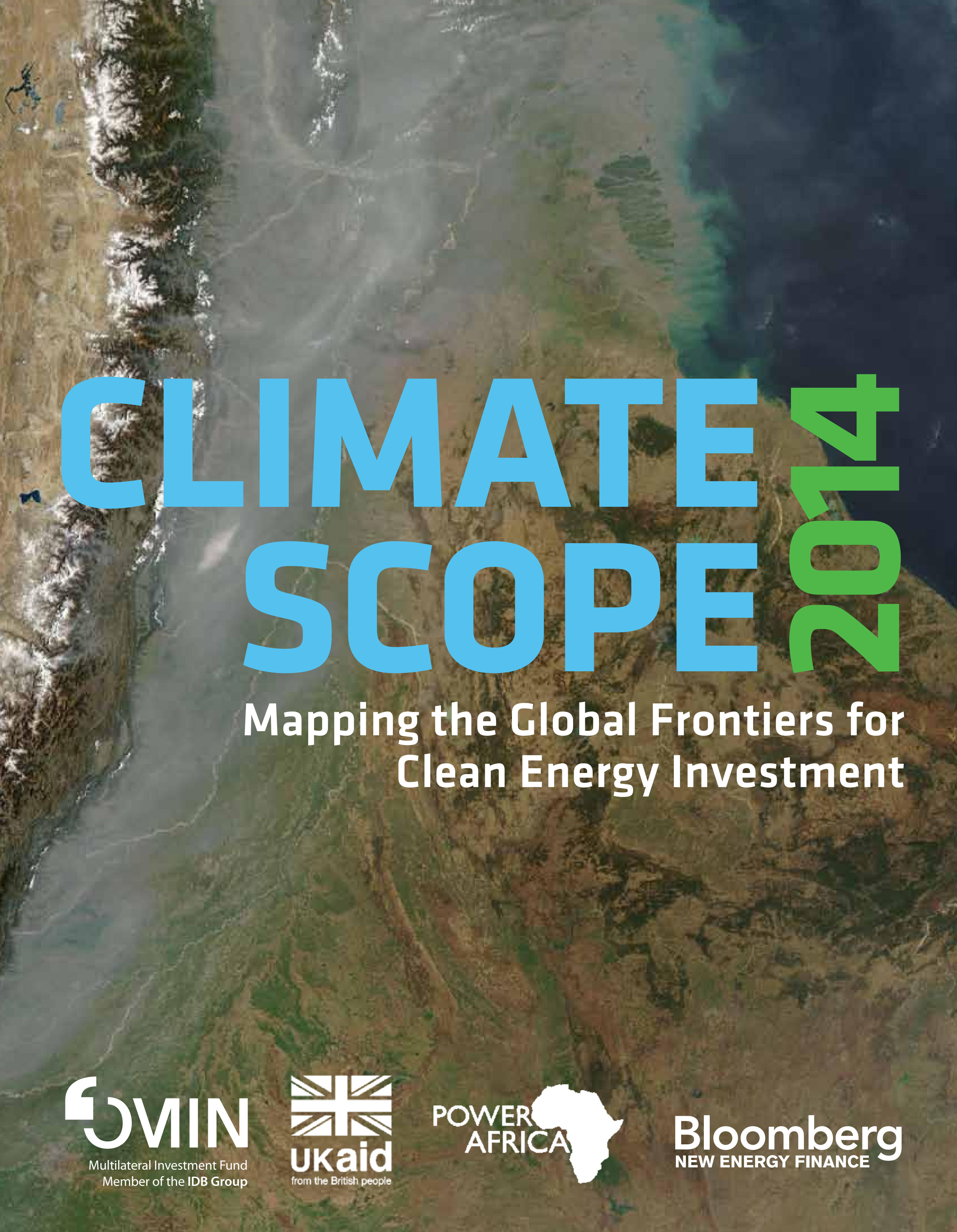

CLIMATESCOPE 2014

Mapping the Global Frontiers for Clean Energy Investment

MIN
Multilateral Investment Fund
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UKaid
from the British people

POWER AFRICA

Bloomberg
NEW ENERGY FINANCE

EXECUTIVE SUMMARY

For years, it has been widely accepted that only the world's wealthiest nations have the means to enjoy the benefits of zero-carbon emitting sources of energy. Developing nations, it was assumed, could afford only fossil generation. This belief guided numerous investment decisions and policies. It has even shaped the dynamics of international climate talks.

But green technologies have come a long way, and clean energy technologies are no longer out of reach for developing countries, which are home to some of the most extraordinary wind, solar, geothermal, biomass, large and small hydro, and other natural resources. In many cases, insufficient energy access has meant high reliance on accessible but dirty fossil fuels. Reliance on diesel generation in many developing countries results in some of the poorest nations having some of the most expensive electricity in the world, making the economic case for alternative sources of power often quite compelling. And in the least developed nations, where hundreds of millions of people have little or no access to electricity, cleaner energy as a distributed source of power is often the obvious choice over extending traditional hub-and-spoke transmission networks or local diesel generators.

Do global investors or policy-makers in the developing world yet recognize this? And what steps have they taken to facilitate clean energy development and deployment?

These are the fundamental questions that this project – *Climatescope* – asks and seeks to answer. *Climatescope* surveyed and analyzed 55 important developing nations to understand market conditions for accommodating the growth of the most innovative clean energy technologies, such as solar (photovoltaics and concentrating), wind, biomass, geothermal, and small hydro (projects smaller than 50MW). The report focused particularly on India and China where 10 states and 15 provinces were examined in greater detail. The goal was to produce snapshots of these jurisdictions potentially useful in strategic decision-making for investors, manufacturers, project developers, policy-makers, and researchers, among others.

While a number of *Climatescope* nations has historically embraced large hydro generation to meet local power needs, the study focused exclusively on newer sources of low-carbon generation, both because they are often technologically cutting edge and because they can generally be deployed far faster than large hydro projects, which can take years or even decades to commission. By comparison, wind projects can be sited and erected in as little as two to three years. Utility-scale photovoltaic solar projects can be constructed in as few as six months and distributed photovoltaic systems can be added to rooftops in a day or less. In short, these technologies are poised to make an immediate impact on energy supply and access in the developing world. *Climatescope* sought to assess how ready these countries are to embrace them.

THE CLIMATESCOPE METHODOLOGY

Climatescope seeks to bring quantitative rigor to complex questions. At its core is a data-driven model that takes into account 54 distinct inputs or "indicators" to produce overall scores for individual nations on a zero-to-five basis. These countries are then ranked to highlight those most attractive for clean energy investment and capacity build-out. These scores and rankings are published in this report and at www.global-climatescope.org where users are encouraged to delve more deeply into the data. For the sake of simplicity and order, each of these indicators falls under one of four umbrella "parameters." Each of these has a default weighting in the final *Climatescope* score used to produce a country's overall score. The parameters (and their default weightings, which can be adjusted at Global-Climatescope.org) are:

Enabling Framework (40 %) Parameter I

An assessment of a country's fundamental market conditions. This includes the regulatory and power market structures, local power prices, and expectations for electricity demand overall. Countries with more liberalized electricity markets, higher electricity prices, and higher expectations for demand tended to score higher as they were deemed more appealing for clean energy development. In all, 22 indicators were taken into account in this parameter.

Clean Energy Investment and Climate Financing (30 %) Parameter II

An examination of financings that have taken place to date, along with the availability of capital for further development. This included a look at microfinance loans in support of green development with an eye toward micro entrepreneurs and individuals looking for low-carbon solutions to improve their businesses or living standards. Countries where more capital has been deployed or more capital is viewed as available tended to score better on this parameter, which included 14 indicators.

Low-Carbon Business and Clean Energy Value Chains (15 %) Parameter III

A look at the financial, manufacturing and service industries which typically support clean energy development. This includes detailed examinations of segments of the clean energy manufacturing chains. For the least developed nations, the parameter more closely analyzes the companies needed to facilitate distributed, "off-grid" energy deployment. Countries with more value chain players present locally scored higher in this parameter, which comprises five indicators.

Greenhouse Gas Management Activities (15 %) Parameter IV

An assessment of public and private sector efforts to mitigate greenhouse gas emissions in three spheres: carbon offset projects, policy and corporate initiatives. Countries deemed to be doing more to specifically address CO2 emissions scored higher on this parameter, which encompasses 13 indicators.

Climatescope examined a highly heterogeneous set of nations. This review included the world's two largest by population (India and China, each with over 1 billion citizens) and three of the smallest (Bahamas, Barbados, and Belize with fewer than 1 million citizens each). As a result, some indicators in the study were "levelized" to account for a country's gross domestic product (GDP). For instance, countries were not judged in Parameter II based just on the total volume of clean energy investment attracted but rather on how that investment compared to the size of the country's overall economy.

Climatescope also assessed nations across a wide income range, from those at the very bottom of the development pyramid to others firmly considered "middle income." For the least developed nations, a modified, "off-grid" methodology was used to magnify the importance of addressing energy access issues. All African nations with the exception of South Africa were scored using the off-grid methodology, along with four countries in Asia and one in Latin America and the Caribbean.

GLOBAL FINDINGS

The *Climatescope* nations represent over half the world's population and approximately a quarter of its GDP.
Among the key findings:

- Demand for electricity overall is growing swiftly in the *Climatescope* nations. From 2008 through 2013, these countries added 603 gigawatts (GW) of new capacity (roughly three times Russia's current capacity), growing their grids by nearly a third to 2,013GW. By comparison, over the same period OECD nations added 258GW and grew by 9.6 percent to 2,887GW.

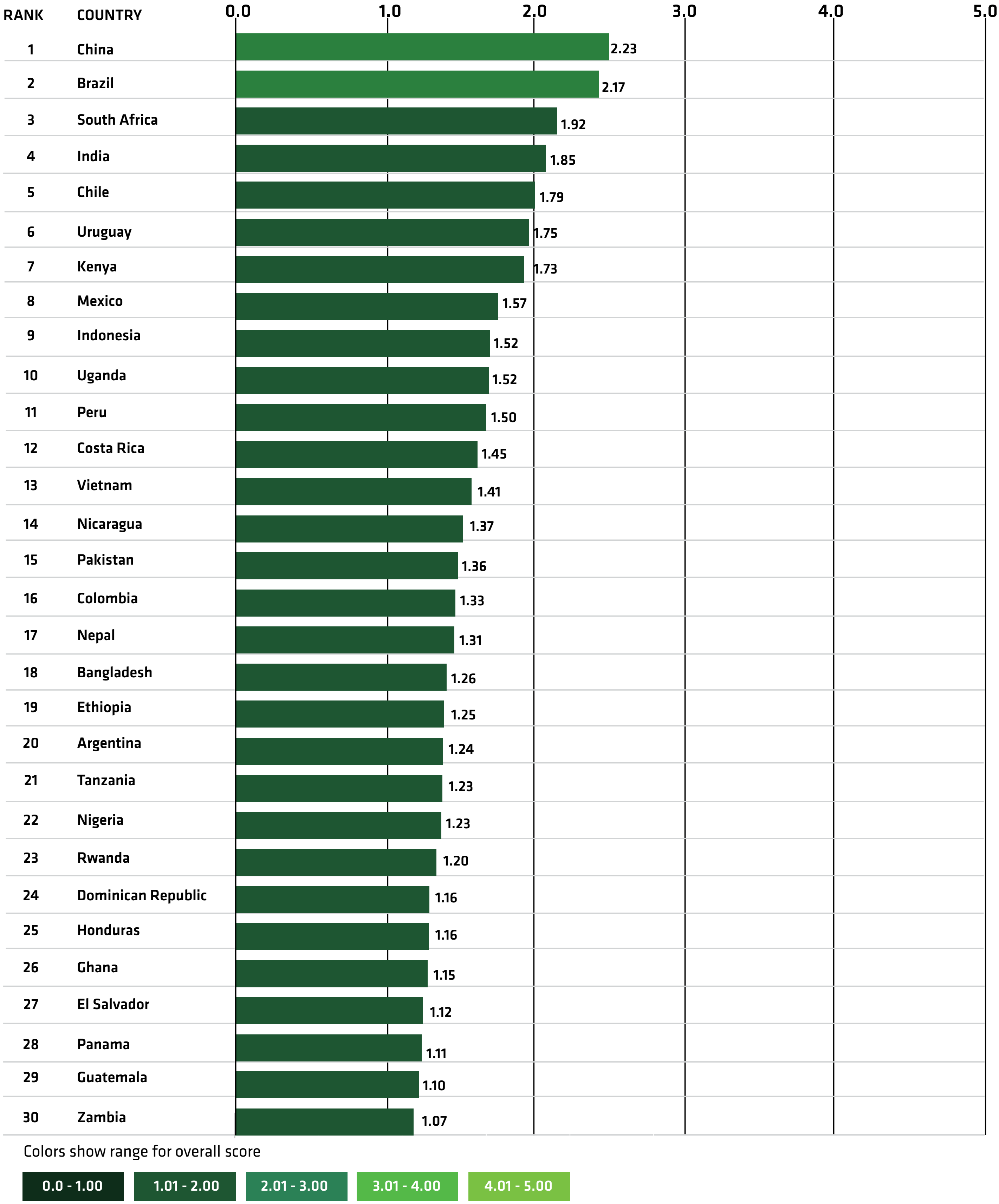
- Demand for clean energy is growing even faster in these countries than in the most developed nations. From 2008 through 2013, *Climatescope* nations added 142GW (more than France's current total capacity) of new, non-large hydro renewables capacity, representing a 143 percent growth rate. OECD nations also saw strong growth, adding 213GW over those five years or 84 percent more non-large hydro clean energy than in 2008. On a percentage basis, new non-large hydro clean energy has been growing at a quicker clip in *Climatescope* countries (18.8 percent per year, on average, since 2008) than in OECD countries (12.8 percent). In fact, in 2013 on a volume basis, Climatescope countries added nearly as much capacity (37GW) as OECD nations (43GW). Counting large hydro as an additional source of zero-carbon energy, *Climatescope* nations now have 666GW installed capacity compared to 806GW in OECD countries. Moreover, in *Climatescope* nations, renewables (including large hydro) actually represent a larger percentage of total capacity than they do in OECD countries.

- Large-scale clean energy project development makes basic economic sense in many *Climatescope* countries, given local conditions. Virtually all nations have energy security concerns, and the *Climatescope* countries are no exception. Moreover, in these countries electricity prices paid by industrial players such as manufacturers averaged $147.90 per megawatt-hour in 2013. This falls well above Bloomberg New Energy Finance's (BNEF) estimate for the average price at which wind power needs to be sold for a typical wind project owner to earn an acceptable financial return. In fact, the mid-point for the BNEF "levelized cost of electricity" (LCOE) for wind globally is $82, suggesting that industrial customers in these nations could potentially enjoy a substantial saving by purchasing wind-generated power rather than what they currently receive from the grid. In the case of photovoltaics, the BNEF LCOE is $142, suggesting a potentially even match between this newer source of generation and existing generation. Twenty-three of the Climatescope jurisdictions (42 percent of the countries, states and provinces) had average industrial power prices that topped $142 in 2013 and 32 (58 percent) had such prices topping $82. Doing business in these regions is typically more expensive than in more developed countries. Still, these high prices suggest major opportunities – particularly given the outstanding local natural resources.

- Distributed clean energy has major potential in *Climatescope* nations. Across the *Climatescope* countries, the price residents paid for electricity (the "retail" price) averaged 14.7 cents per kilowatt-hour in 2013. However, prices topped 15 cents per kilowatt-hour in 20 *Climatescope* countries and 22 cents in 16 countries. Bloomberg New Energy Finance estimates the levelized cost of residential electricity for solar power at approximately 15 cents per kWh with the LCOE potentially much lower in the sunniest parts of the world. That is, when power is priced at 15 cents or higher it can often make more financial sense for a homeowner to have a solar system installed rather than continue to pay monthly bills. Moreover, in countries where less than half the population has access to a grid of any sort, distributed

2014 Global Climatescope scores

Overall ranking top 30



Climatescope 2014 Report by Bloomberg New Energy Finance
Multilateral Investment Fund part of the Inter-American Development Bank,
UK Department for International Development, Power Africa

sources of clean generation represent a logical and less costly alternative solution to diesel generation.

• Policy-makers in these nations are moving rapidly to improve their policy frameworks to attract more clean energy investment. In all, there are at least 359 clean energy-supportive policies on the books in the 55 *Climatescope* nations. Nearly half went into effect in 2012 and 2013. The most popular policy tools involve energy market mechanisms, which seek to harness the power of market competition among project developers to spur development. Often, this has meant "reverse auctions" held by regulators in which developers must bid to supply power at lowest possible cost. No less than 228 policies currently in effect in these nations involve some form of energy market mechanism. (All of these policies are reviewable via the *Climatescope* website.)

• Countries with policy frameworks viewed as more stable and ambitious tended to attract higher levels of clean energy investment. Policies in each of the *Climatescope* nations were judged by a global panel of outside experts on the basis of their ambition and potential for success. Those nations that received higher policy scores on *Climatescope* also tended to be those that attracted higher levels of investment.

• Microfinance (MFI) is playing a key role in bringing initial capital to far-flung communities. *Climatescope* found at least 114 organizations that self-identified as providing "green" microfinance. Still, the survey suggested that a number of MFI organizations are just beginning to address these issues. Of 70 organizations that responded to the *Climatescope* survey from Africa, only 30 said they offer any type of green microfinance assistance.

COUNTRY RESULTS

The *Climatescope* model was intentionally designed to be flexible. While it produces overall scores and rankings for all the nations, users can also go online to "drill down" on specific parameters and indicators. Aggregated data can also be downloaded. No quantitative model can fully portray the many characteristics of a specific energy market. Still, the *Climatescope* model yields interesting insights about the state of clean energy development in the 55 nations. Among the key findings:

• No nation scored higher than 2.23 and the average score was just 1.1. Given the continuum of zero-to-five, this suggests room for significant improvement in these countries in many respects. Policy frameworks can be strengthened, local value chain segments can be fulfilled, and more local capital can be made available, among many areas for potential improvement.

• China achieved the highest overall *Climatescope* score. China is the largest manufacturer of wind and solar equipment in the world, has the largest demand market for wind and solar equipment, and has taken major strides to improve its domestic policy framework.

• Brazil finished 2nd with a score of 2.17. The country has moved aggressively to facilitate greater clean energy development through a series of state-organized tenders for power contracts. Its manufacturing value chain is expanding and the country makes considerable volumes of lower-cost capital available through its national development bank.

• South Africa achieved 3rd place with a score of 1.92. The country attracted $10 billion in new clean energy investment in 2012 and 2013 after holding a series of reverse auctions for clean power contracts. Its overall score was boosted by an explosive clean energy investment growth rate.

• Among 10 nations with the highest overall scores in *Climatescope*, there was relative geographic diversity. Four are in Latin America: Brazil; Chile; Uruguay; and Mexico. Three are in Asia: China; India; and Indonesia. Three are in Africa: South Africa; Kenya; and Uganda.

• Among the three continents, the 10 Asian nations surveyed had the highest average score of 1.31. While China is a major part of the global clean energy story, Asia more broadly is becoming a clean energy equipment manufacturing hub. Seven of 10 Asian nations surveyed finished in Climatescope's top 20. Pakistan, India, Indonesia, and Vietnam, among others, are all rapidly scaling their clean energy economies.

• Latin American and Caribbean nations, which scored a collective 1.07, were buoyed by the performance not just of traditional powerhouse Brazil, but relative newcomers Peru, Costa Rica, Colombia, and Nicaragua. Clean energy activity across the region has become substantially more diversified in recent years with Brazil no longer accounting for the large majority of activity or investment. Thanks to policy reforms and a surge in outside investment, other countries are making important strides while others in the region with ample local fossil reserves are doing less.

• The 19 African nations surveyed for *Climatescope* collectively scored 1.06 and were helped by strong performances from South Africa, Kenya, and Uganda. South Africa and Kenya have had significant clean energy projects either kick off or completed in the past few years while Uganda fared well because of the abundance of players there providing off-grid energy services. Energy poverty issues are paramount in many of these countries and those that have found ways to pair the goals of expanding energy access with growing clean energy tended to score highest.

• On Enabling Framework Parameter I, the overall average score was a 1.09 suggesting substantial room for improvement across nearly all *Climatescope* countries. Brazil scored highest on this parameter due to its policy regime and its relatively high electricity prices. Rwanda also scored well under the *Climatescope* "off-grid" methodology, in part because of its level of clean energy capacity installed on a per-capita basis and because its current distributed sources of energy – kerosene and diesel – could be cost effectively replaced with alternative generation.

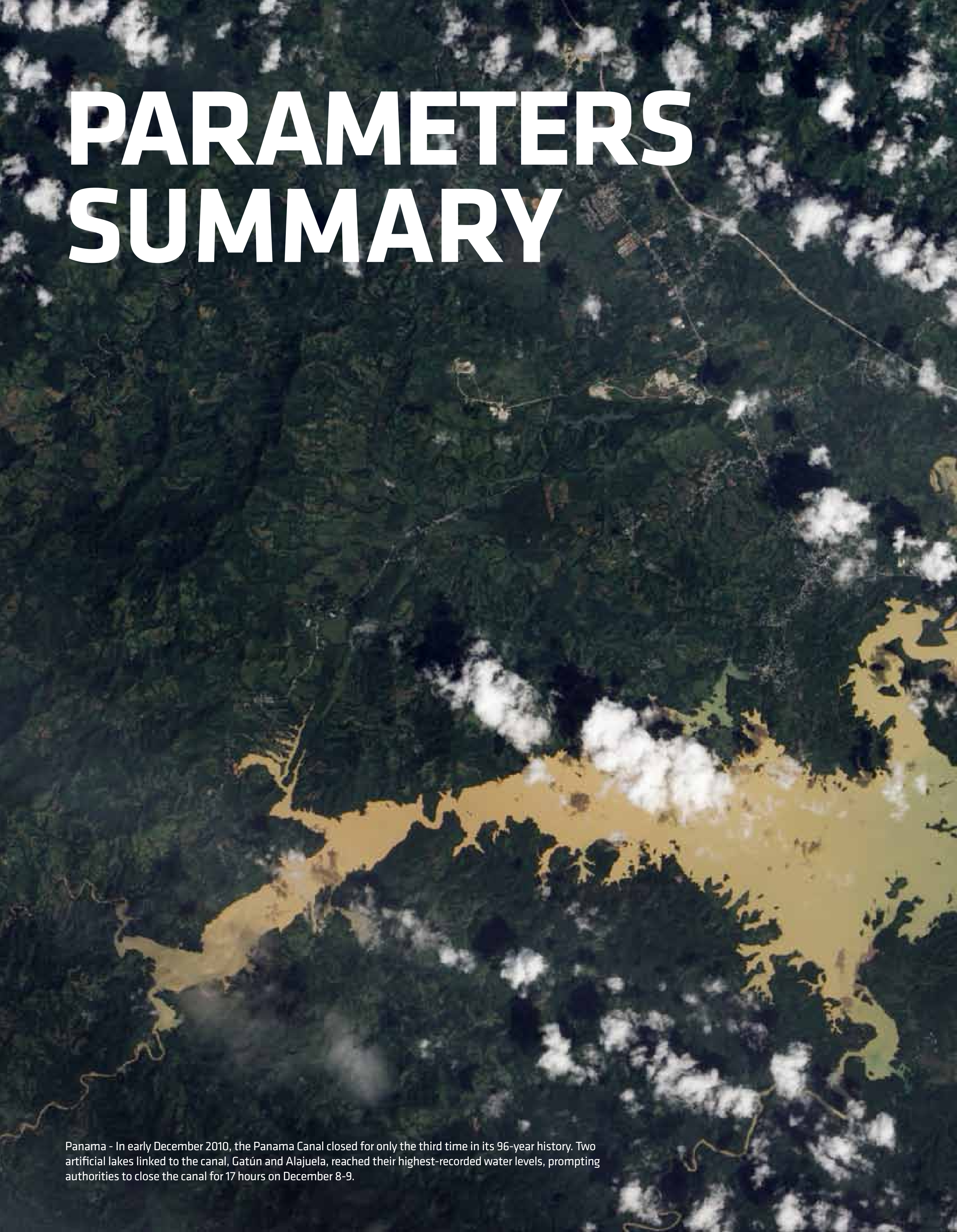
• On Clean Energy Investment & Climate Financing Parameter II, the *Climatescope* countries overall averaged a score of just 0.62 indicating that more capital must be deployed into these nations if clean energy is to truly advance. Uruguay was the high scorer on this parameter after attracting $2.2 billion in new clean energy investment in 2013 and posting a massive 142 percent investment growth rate from the prior year. South Africa finished second on this parameter, also due to a surge of investment in 2013.

• On Low-Carbon Value Chain Parameter III, the *Climatescope* nations had their best performance with a 1.93. The overall result was helped by China, which had a “perfect” 5.0 score since it has in place every segment of the clean energy value chains surveyed for *Climatescope*. Unsurprisingly, several of the other largest countries in the survey also scored well, including Brazil, South Africa, and India.

• On Greenhouse Gas Management Activities Parameter IV, the *Climatescope* nations collectively scored 1.34 with a wide range of performances among countries. Chile scored best on this parameter thanks to a comparably high level of offset activity. A total of 14 nations have some form of CO2 reduction enshrined in law.

This year’s report builds upon two *Climatescopes* produced in 2012 and 2013 that focused exclusively on 26 Latin American and Caribbean nations. The *Climatescope* was conceived and produced in partnership with the Multilateral Investment Fund (MIF) of the Inter-American Development Bank Group. The MIF is once again a supporter of *Climatescope* in 2014 and is joined by the UK Department for International Development (DFID) and the Power Africa. BNEF would like to thank all three organizations for supporting this important project.

PARAMETERS SUMMARY



Panama - In early December 2010, the Panama Canal closed for only the third time in its 96-year history. Two artificial lakes linked to the canal, Gatún and Alajuela, reached their highest-recorded water levels, prompting authorities to close the canal for 17 hours on December 8-9.

PARAMETER OVERVIEW

HIGH LEVEL FINDINGS

From the start, the primary goals of *Climatescope* were to gather, collate, and publish the most comprehensive data sets ever collected on clean energy development for a large swathe of the developing world. That meant sending researchers to over 50 national, state, and provincial capitals around the globe. It meant compiling a major data file that users of www.global-climatescope.org can download freely from the web. Finally, it meant scoring each of the 55 nations that were assessed and ranking them to highlight those most attractive for private clean energy investment and development.

In short, this project did not set out to draw sweeping conclusions, but rather to empower readers and users of Global-Climatescope.org to use the data to draw conclusions of their own. That said, through this research, some inevitable lessons were learned about clean energy activity in these 55 nations. These, in turn, offer potentially useful insights about the state of play of renewables in the developing world as a whole.

Rising demand for power

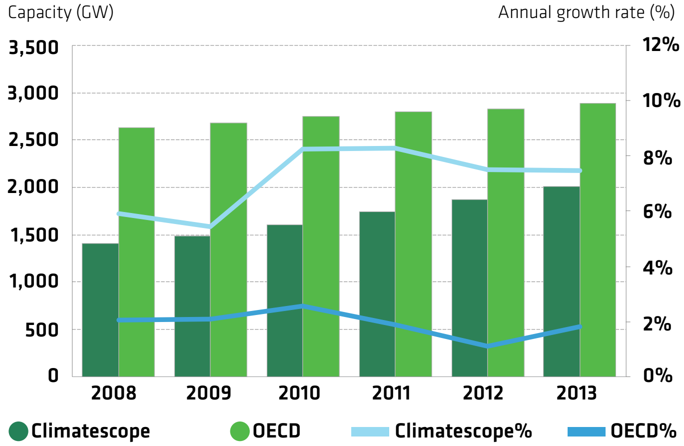
From 2008 through 2013, the 55 countries surveyed for *Climatescope* added 603GW of new capacity – including both new clean energy and fossil fuel capacity – to grow their grids by nearly a third to 2,013GW. To put that in context, that new capacity represents approximately three times what Russia has on line today.

By comparison, over the same period OECD nations[1] added 258GW and grew by 9.6% to 2,887GW. In a sense, this is hardly surprising as economic growth rates in these developing nations have often exceeded those found in more developed countries, particularly as a deep economic recession took hold in Europe and the United States in 2008-2009.

Most notable of all, of course, has been the astonishing rate of capacity growth in China, now the world's 2nd largest economy. From 2008 to 2013, China added 416GW, growing its capacity 51.4% to 1,225GW to become the largest (and highest emitting) in the world. By contrast, the world's largest economy – the United States – grew power generating capacity by just 73.6GW, or 6.8% to 1,152GW as of year-end 2013. The growth rate in India was not far behind China's; power generating capacity there grew by 84.7GW or 56.2% to 235GW over those same five years.

It has not just been large nations that have posted high growth rates, however. In percentage terms, capacity growth in smaller Nicaragua (44.7%) was about comparable to China as the Central American nation added 399MW since 2008 and grew its capacity to 1.3GW.

Total cumulative power generating capacity (GW) and annual growth rate (%) in Climatescope countries vs OECD Nations, 2008 - 2013



Source: Bloomberg New Energy Finance

Finally, the growth has not been confined merely to wealthy or even middle income nations. Myanmar, for instance, saw its installed capacity grow 2.2GW or 130% though still has just 30% of its population connected to the grid.

Prior to the major global recession of 2008-2009, *Climatescope* nations were adding capacity at a somewhat faster pace than OECD nations in percentage terms. Post-2009, however, new capacity added in more developed nations slowed to an average annual rate of just 1.8% while it jumped to 7.9% in *Climatescope* countries. It would appear that just as conditions for power generation growth were weakening in OECD countries they were strengthening in developing nations.

Rising demand for clean power

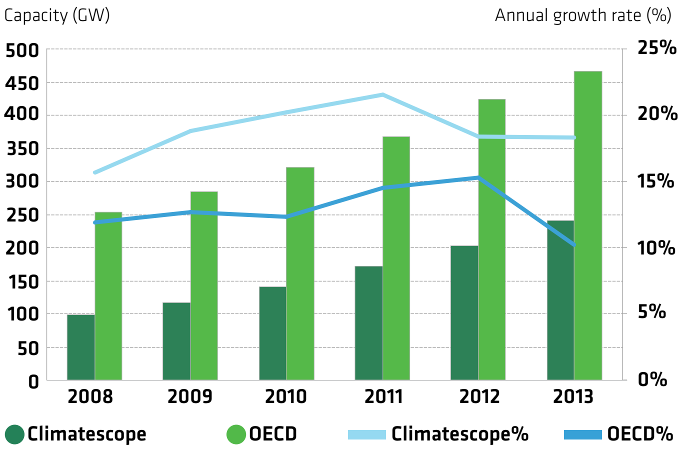
Meanwhile, the rate at which clean energy (not including large hydro) has grown in *Climatescope* nations has been significantly faster as measured on a percentage basis. Percentage growth rates in these 55 countries were ahead of those in OECD nations even prior to the recession. However, the gap widened substantially from 2009-2011 then narrowed somewhat.

From 2008-2013, *Climatescope* nations added 142GW of new clean energy capacity (more than France's current total capacity). During that same time, OECD countries added 213GW. On a percentage basis, Climatescope nations saw a growth rate over those five years of 143%, compared with 84% in OECD countries.

1. Mexico and Chile are OECD nations and *Climatescope* countries

Part of this can simply be explained by scale; collectively, *Climatescope* countries have a smaller GDP than OECD nations. Thus adding similar amounts of capacity in *Climatescope* countries will inevitably appear larger on a percentage basis. However, the gap between the two regions on a volume basis was its narrowest ever in 2013 when *Climatescope* countries added 37.3GW and OECD countries added 43.3GW. Much of this has to do with China, which was the largest demand market for renewables in 2013. With China on track to set another annual record for solar installs, it is entirely possible that total clean energy capacity installed in *Climatescope* nations will surpass that installed in OECD countries in 2014. It is even more likely that all non-OECD countries (the 55 Climatescope nations, minus Mexico and Chile who are part of the OECD, plus other developing countries) will surpass OECD countries in terms of new capacity added in 2014.

Non-large hydro clean energy cumulative capacity (GW) and annual growth rate (%) in Climatescope countries vs OECD nations, 2008 - 2013

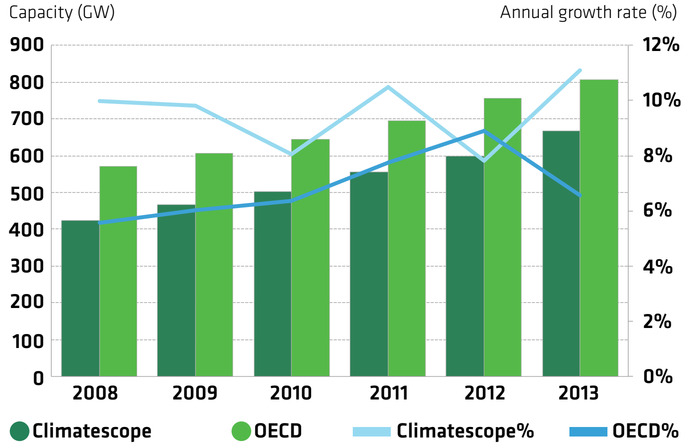


Source: Bloomberg New Energy Finance

Still, the gap remains quite wide between total clean energy capacity installed in the OECD and what is in place in *Climatescope* countries. As of year-end 2013, Climatescope nations had 241GW total non-large hydro renewable capacity installed compared with 467GW in OECD countries. Furthermore, clean energy has represented a smaller percentage of new capacity additions in Climatescope countries than in wealthier nations. Renewables represented just over a quarter of all new installations in *Climatescope* countries from 2008-2013. By comparison, they accounted for over 80% of new capacity added in the OECD.

Climatescope looks primarily at activity in non-large hydro clean energy development, mainly because these technologies are newer and have the ability to make a more immediate impact in developing countries. However, it is intriguing to compare the role of all renewable sources in these nations – including large hydro.

Clean energy (including large hydro) cumulative capacity (GW) and annual growth rate (%) in Climatescope countries vs OECD Nations, 2008 - 2013



Source: Bloomberg New Energy Finance

On that basis, total capacity in *Climatescope* countries as of year-end 2013 was 666GW compared with 806GW in OECD nations. Moreover, as a percentage of total capacity, *Climatescope* countries are actually more reliant on these clean energy technologies than OECD countries. One third of all capacity in *Climatescope* countries is accounted for by large hydro-inclusive clean energy. In OECD countries, that total is 27.9%. Large hydro as a technology has been well established in a number of developing nations for decades. Today, it accounts for 57% of capacity in Brazil, for instance, and 71% of the country's capacity is accounted for by non-CO2 emitting sources.

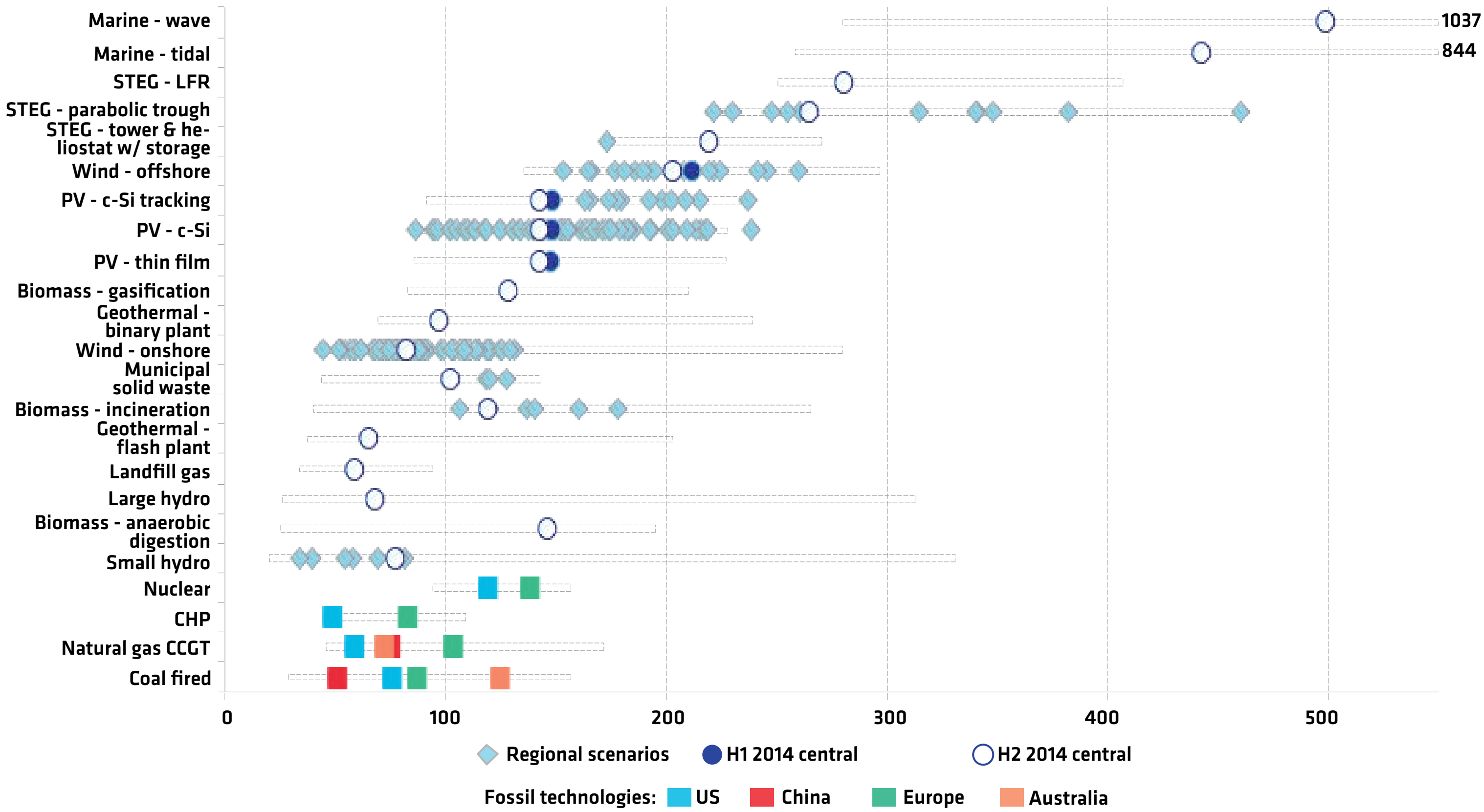
The economic competitiveness of renewables

New non-large hydro clean capacity added in *Climatescope* nations suggest that these non-CO2 emitting technologies are gaining traction in the developing world and the investment increases tell a similar story. But even more fundamentally, a strong case can be made that renewables make economic sense in many of these countries based simply on the high local electricity prices.

Put simply, renewable energy stands the best chance of getting built in countries where: (a) natural resource conditions are conducive; (b) incumbent sources of electricity are priced high; or (c) where both are the case. In the case of many Climatescope countries, the resources are unquestionably outstanding and, for the most part, unexploited. The question then turns to the cost of incumbent generation and how well renewables can compete.

Bloomberg New Energy Finance semi-annually conducts a global survey on the "levelized cost of electricity" (LCOE) for various sources of power generation. Essentially, this derives the prices at which a typical project developer would have to sell his or her power in order to earn a simple 10% return on investment on the project. Obviously, conditions can vary substantially across the globe with the three primary drivers of a technology's LCOE be-

BNEF levelized cost of electricity, H2 2014



Source: BNEF H2 2014 Levelized Cost of Electricity Update

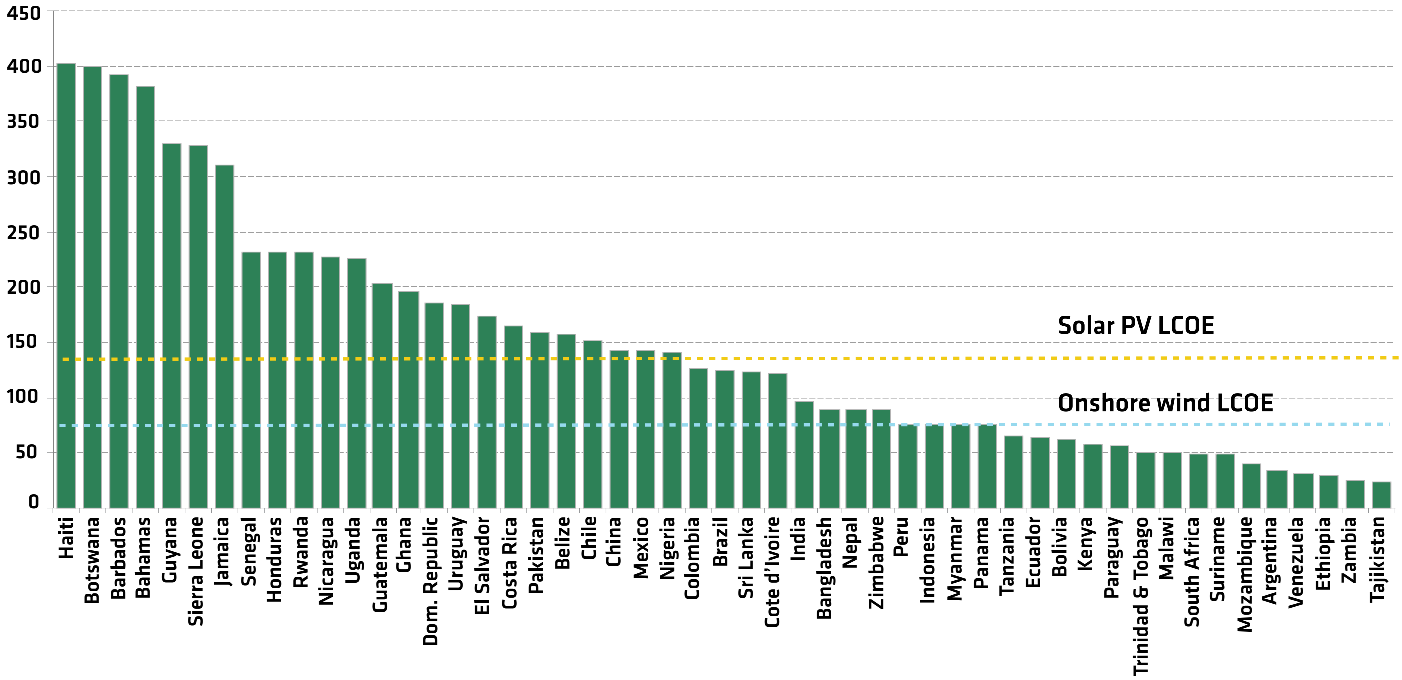
ing the cost of available capital to build a clean energy project, the local cost of the necessary equipment (wind turbines, solar modules, etc.) and the quality of the local natural resource.

Among the data points collected by *Climatescope* was the average price paid for electricity by industrial users such as manufacturers in these countries. The survey found average industrial electricity prices across all countries of $147.90 per megawatt-hour. This falls well above the average BNEF LCOE[2] for wind at approximately $82. While this represents the most simplistic comparison, it does suggest that industrial customers in these nations could potentially enjoy substantial savings by purchasing wind-generated power rather paying for what they currently receive from the grid.

In the case of photovoltaics, the BNEF LCOE is $142, suggesting a potentially even match between this newer source of generation and existing generation. Twenty-three *Climatescope* nations had industrial power prices that topped $142 in 2013; 32 had such prices topping $82. Doing business and financing costs in these nations are typically more expensive than in more developed countries. Still, these high prices suggest major opportunities ahead.

2. Costs of capital assumed per technology are based on local conditions and availability of local capital

Industrial power prices vs onshore wind and solar photovoltaic LCOE, 2013 ($/MWh)



Source: Bloomberg New Energy Finance

In reality, conditions vary substantially among countries and, as discussed above, the LCOE for a technology is driven every bit as much by the cost of capital and the availability of equipment locally as it is by natural resource availability. This is particularly relevant in the context of developing countries where sufficiently low-cost capital can at times be extremely challenging to source and tariffs or other barriers can make the importation of goods challenging.

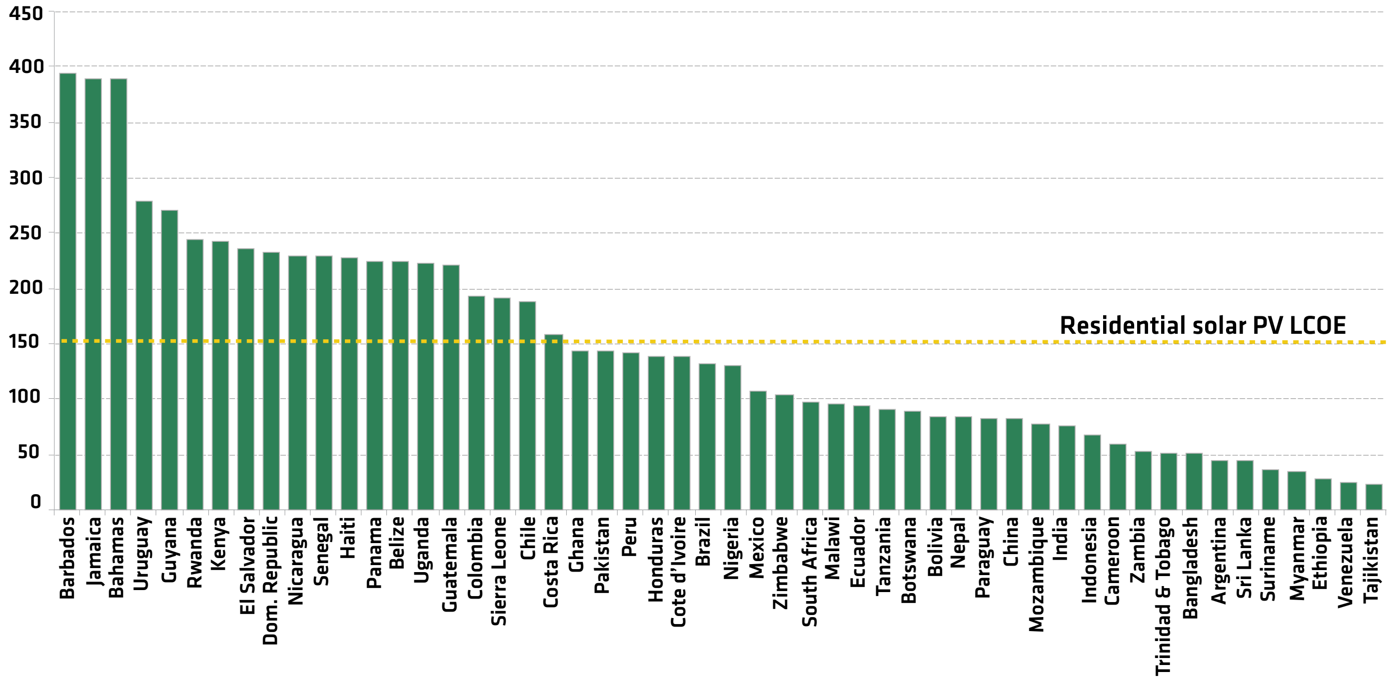
On the flip side, for policy-makers, and providers of concessionary finance this should offer some assurance that clean energy, when financed effectively, can truly be the cost-competitive option in many parts of the globe for industrial customers.

The opportunity for distributed generation

The economics of renewables are even more appealing when it comes to the question of distributed generation in developing countries. *Climatescope* researched prices available to residential customers in the 55 nations and found they averaged 14.7 cents per kilowatt-hour in 2013[3]. However, prices were above 15 cents per kilowatt-hour in 20 *Climatescope* countries and 22 cents in 16 countries. Bloomberg New Energy Finance estimates the levelized cost of residential electricity for solar power at approximately 15 cents per kWh with the LCOE potentially much lower in the sunniest parts of the world. That is, when power is priced at 15 cents or higher it can often make more financial sense for a homeowner to install a solar system rather than to continue to pay monthly bills. Moreover, in countries where millions lack access to a grid of any sort, distributed sources of clean generation can represent a logical and less costly solution to diesel generation. However, the right conditions must be present for this type of development to flourish. This includes not just the correct regulatory structures and supports, but the necessary market players on the ground to build out capacity.

3. Three countries did not have available data and were not included in the overall average

Residential power prices vs residential solar photovoltaic LCOE, 2013 ($/MWh)



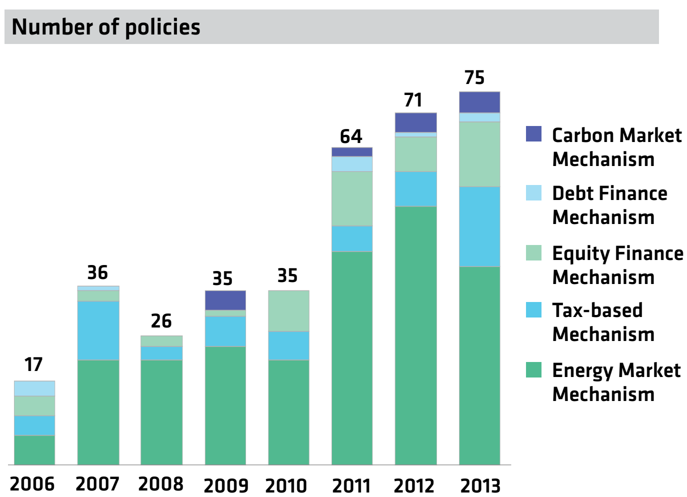
Source: Bloomberg New Energy Finance

Progress on policy

Climatescope surveyed 55 developing nations to get a better understanding of what policy frameworks have been established to date and which may be most effective. Data collection included the creation of policy records now accessible at www.global-climatescope.org.

In all, the survey found at least 359 clean energy-supportive policies on the books in these countries today dating back to 2006. Moreover, it found that the number of policies that have gone into force has picked up steam in recent years. Of the total policies on the books today, 306 were established since the start 2008 and 210 since the start of 2011. Clearly, activity has accelerated in the last three years, perhaps because the economics of clean energy have become more appealing, particularly as the price of solar equipment has dropped. This was perhaps because developing nations have become more engaged in fostering low-emission sources of energy and diversifying their power matrices.

Policies in force by type and year of establishment



Source: Bloomberg New Energy Finance

A large number of different clean energy policy ideas is being trialled in these nations, including many that have been implemented in more developed nations, such as feed-in tariffs (FiTs) that allow clean power generators to sell their electricity at above-market rates that take into account the benefit of zero-carbon production or accelerated depreciation tax treatment for clean energy assets.

The most popular types, however, appear to involve energy market mechanisms, which are generally measures affecting the structure of energy markets, often through the provision of incentives for certain types of generation. These kinds of policies have become more in vogue in recent years as policy-makers have sought to keep pace with the market trend down in equipment prices and not “over-pay” for clean energy. In some cases, policy-makers in developing nations have clearly taken to heart some of the hard lessons learned in OECD countries about the potentially costly nature of FiTs. In others, using energy market mechanisms simply represents how they have added capacity for decades. The only difference is they are now adapting them explicitly with the goal of adding clean capacity.

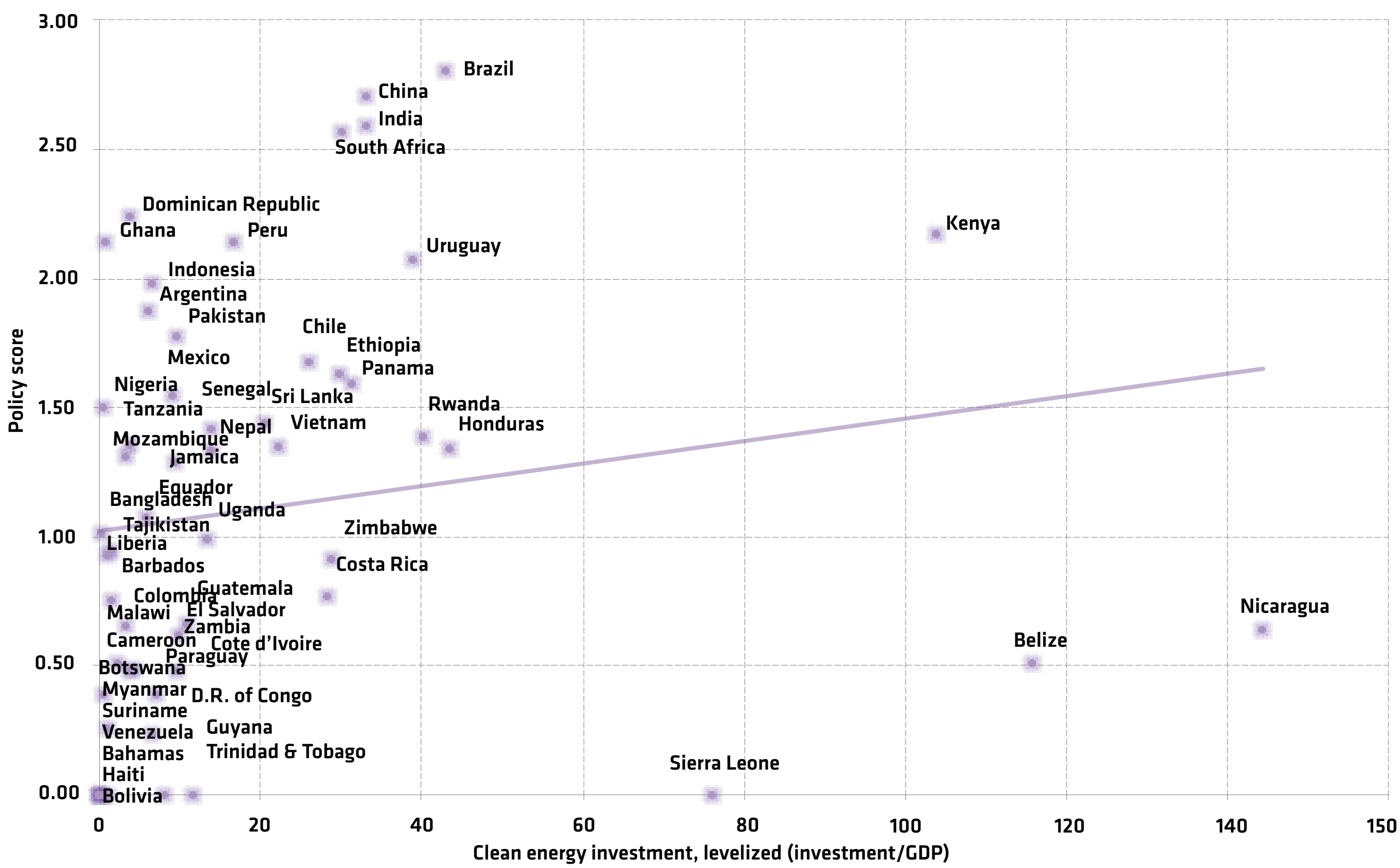
To leverage market forces best, countries such as Brazil, Peru, South Africa, and others have held “reverse auctions” in which project developers must bid to supply power at the lowest possible cost. No fewer than 228 policies currently in effect in these nations involve some form of energy market mechanism. Over half of the 75 new policies that went into effect in these countries in 2013 involved a market mechanism policy.

The total number of policies in place in a given country or region tells less than half the story, however. Inevitably, some nations are far more ambitious and effective in implementation than others. For this reason, Climatescope sought input from 32 external experts. Each was asked to complete a survey on individual policies in multiple countries. The end result was the country’s policy score. (For more details, please see the Methodology section of the report).

What *Climatescope* found was that countries with stronger policy frameworks tended to attract higher levels of proportional clean energy investment (the amount of investment they receive compared with their overall GDP). There was hardly a one-to-one relationship, however. This may be attributable to inevitable time lags between when a strong policy regime is established and when private investors react through new investment.

There were some clear outliers though this was somewhat to be expected, given the *Climatescope* methodology, in part because it accounts for investment by “levelizing” it against a country’s GDP. This explains why smaller nations Nicaragua, Belize, and Sierra Leone registered such high levels of investment on the

Climatescope country policy scores compared with total clean energy investment



Source: Bloomberg New Energy Finance

above chart. As for Kenya, it scored particularly well on the policy indicators, partly because it too was being graded using an "off-grid focus" methodology for policy.

Overall, countries where policy scores are high but investment levels have thus far been low may be worth watching carefully in coming years. Inevitably, private investment tends to come not long after strong policy regimes are implemented.

Structural improvements needed for more off-grid development
Climatescope 2014 examined the underlying conditions for clean energy capacity growth in some of the world's least developed nations. Specifically, the study's off-grid focus methodology was tailored for countries with the lowest rates of energy access. The methodology included asking very specific questions about the regulatory structures and policies in place to facilitate distributed generation build-out.

While the survey found some notable success stories, there were clearly areas for improvement. Broadly speaking, the countries surveyed appear to be making proactive efforts to put in place policies specifically intended to facilitate distributed clean energy growth. This has included creating dedicated government agencies, setting national targets for improving energy access, and reducing taxes and duties on clean energy equipment. Across the 23 countries surveyed under the off-grid focus methodology, the average score on the energy access policies indicator within Enabling Framework Parameter I was a 3.19 (out of a maximum of 5).

On the other hand, *Climatescope* revealed clear signs that in many countries, fundamental market structures are not yet conducive to small-scale capacity build-outs. This became particularly apparent in the distributed energy regulatory framework indicator, also in Parameter I. That indicator involved *Climatescope* researchers asking a series of questions about the fundamental conditions for off-grid development in specific nations. On some of these, countries scored quite well. For instance, the overwhelming majority do allow mini-grids to be built. A majority also allow small-scale developers to charge tariffs reflective of the cost of their own generation, or have dedicated regulators to oversee this kind of activity.

But all too often, these nations appear to fail to give developers sufficient autonomy or clarity on the rules for developing capacity that is either entirely off the grid or at the far edges of it. For instance, the survey found that well below half the countries surveyed offer standardized power purchase agreements (PPAs). Only about half offer clear rules on connecting mini-grids or small power projects to the main grid. Ultimately, on the off-grid power structure indicator, the 23 nations scored a fairly average 2.31 out of a potential 5.

In short, while efforts are clearly under way to develop programs that proactively support small-scale development, considerable work remains to be done on establishing market structure rules for distributed clean energy growth to scale up to the point that it has a major impact on increasing energy access rates.

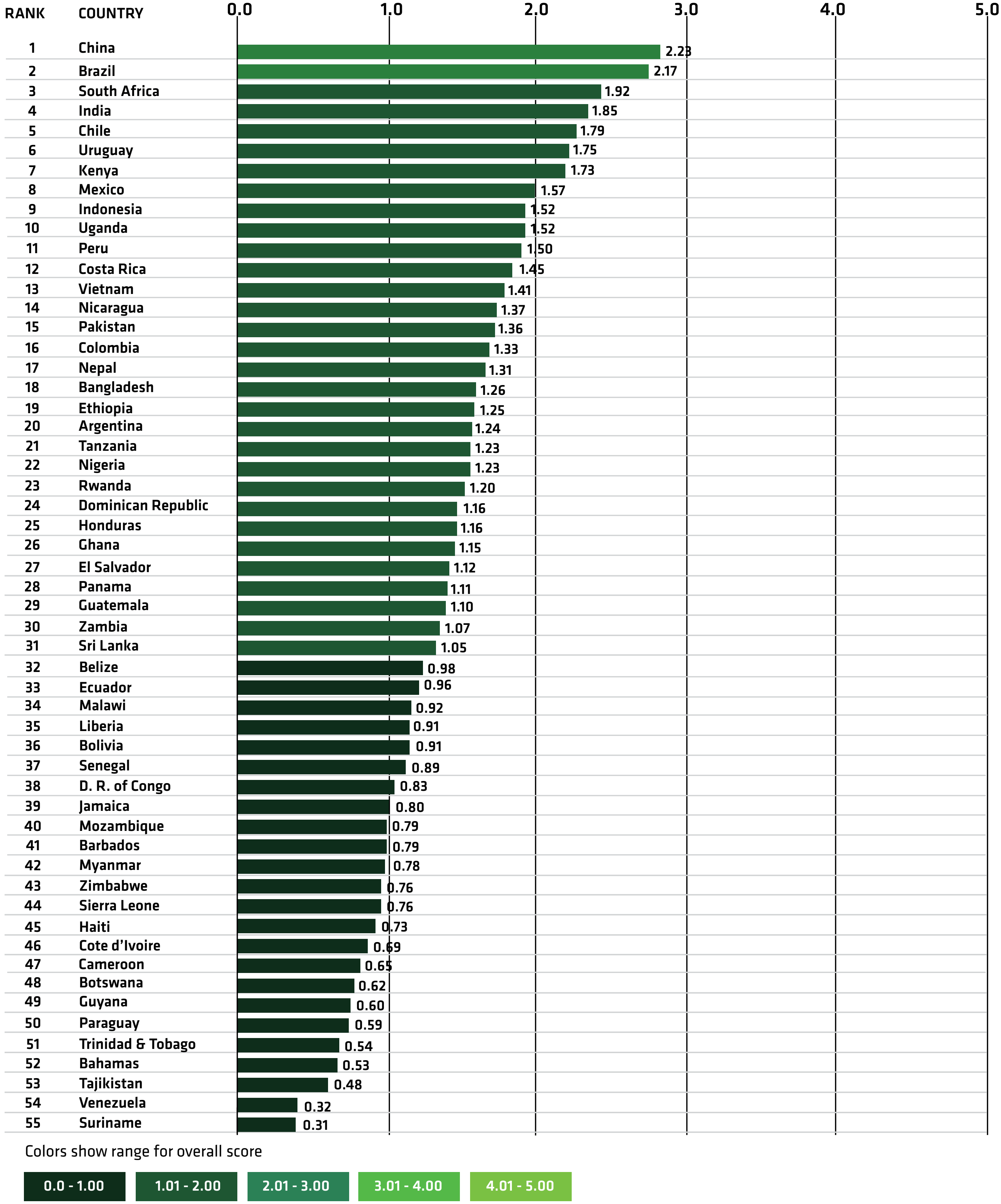
Off-grid power structure survey responses

Characteristic	% yes
Mini-grids: requirements & license	89%
Cost-reflective tariffs	63%
Dedicated regulator	63%
Mini-grids: threshold	63%
PPAs of sufficient duration	54%
Duration of tariffs	50%
Tariff deregulation	50%
Clear rules on interconnection	48%
Purchase obligation	39%
Light-handed regulatory framework	37%
Quality of service standards	35%
Small Power Plants can deliver financial services	33%
Standardized PPAs	28%
Dedicated team within utility	24%
Clear rules on arrival of the main grid	22%

Source: Bloomberg New Energy Finance
Note: for more details on the nature of these questions, please see the Methodology section

2014 Global Climatescope scores

Overall ranking top 55



THE CLIMATESCOPE SCORES

The overall *Climatescope* results portray a series of nations rapidly advancing along the path toward embracing clean energy development – but with considerable further distance yet to travel. The survey scored nations, Chinese provinces and Indian states on a 0-5 basis, taking into account 54 underlying indicators. Ultimately, the average across the countries came to just 1.11, indicating just how much additional work remains to be done.

Among those nations that scored in the top 10, there was relative diversity, underlining that *Climatescope's* 54-indicator methodology offered a myriad of avenues to achieving a strong score. The top 10 featured geographic diversity with four Latin American, three Asian, and three African countries.

China achieved the highest overall *Climatescope* score, at 2.23. Despite being the world's largest emitter of CO2, China is also the largest manufacturer of wind and solar equipment, has the largest demand market for wind and solar capacity, and has taken major strides to improve its domestic policy framework. Brazil finished 2nd with a score of 2.17. It has moved aggressively to facilitate greater clean energy development through a series of state-organized tenders for power contracts. Its manufacturing value chain is expanding and the country makes considerable volumes of lower-cost capital available through its national development bank.

South Africa achieved 3rd place with a score of 1.92. The country attracted $10 billion in new clean energy investment in 2012 and 2013 after holding a series of reverse auctions for clean power contracts. Its overall score was boosted by an explosive clean energy investment growth rate.

Not all the top scoring countries were large, however. Uruguay, with its population of just 3.4m, landed sixth on the list after attracting more clean energy investment in 2013 than in all previous seven years combined.

Top 10 Climatescope countries

Rank	Country	Score	Strongest parameter	Weakest parameter	Comment
1	China	2.23	III: Value Chains	II: Investment	World leader by volume in clean energy capacity installed, manufacturing and capital attracted in 2013
2	Brazil	2.17	I: Enabling Framework	II: Investment	Scored well thanks to policies and despite sharp recent investment drop
3	South Africa	1.92	II: Investment	I: Enabling Framework	2013 investment surge in response to tenders for clean power contracts
4	India	1.85	III: Value Chains	II: Value Chains	Considerable manufacturing capacity in place, despite recent dip in financing activity
5	Chile	1.79	IV: GHG Management	I/IV: Enabling Framework / GHG Management	Boosted by national CO2 reduction target and strong clean energy 2013 investment flows
6	Uruguay	1.75	II: Investment	I/IV: Enabling Framework / GHG Management	Smaller nation saw more 2013 clean energy investment than any other nation as a percentage of national GDP
7	Kenya	1.73	I: Enabling Framework	IV: GHG Management	Scored highest among nations assessed with the off-grid focus methodology
8	Mexico	1.57	IV: GHG Management	I: Enabling Framework	Local commitments to CO2 reductions; energy reforms should boost Enabling Framework score for 2015
9	Indonesia	1.52	III: Value Chains	I: Enabling Framework	Strong value chains for wind, geothermal, and small hydropower, plus substantial numbers of service providers
10	Uganda	1.52	III: Value Chains	II: Investment	2nd highest "off-grid" finisher; has main off-grid value chain players operating in-country

Source: Bloomberg New Energy Finance

Kenya landed 7th on the list, particularly due to the efforts it has made on its regulatory and market structures to attract investment and partly due to the significant capital that has actually been deployed there in support of geothermal and other projects. The country did also benefit somewhat from being scored on key indicators under the off-grid focused methodology.

In terms of nations that landed near the bottom of the *Climatescope* ranking, there appeared to be two primary reasons for the poor performances. First, there were countries with plentiful local conventional energy resources, either in the form of fossil fuels or large hydro generation. This was the case for Paraguay, Trinidad & Tobago, Suriname and Venezuela. Second, there were countries that clearly have the potential for clean energy, but have simply made relatively little effort to build support frameworks to welcome its development.

Regional comparison

In terms of comparing the three regions assessed in *Climatescope* – Africa, Asia, and Latin America and the Caribbean (LAC) – Asian nations scored highest with an average of 1.33. This was at least partly due to the fact that there were just 10 Asian nations surveyed, compared with 19 for Africa and 26 for LAC. Thus, China's rank had a strong impact on Asia's overall score. Still, Asia beyond China is increasingly becoming a clean energy equipment manufacturing hub and this was reflected in seven of the 10 Asian nations surveyed finishing in *Climatescope's* top 20. Pakistan, India, Indonesia, and Vietnam, among others, are all rapidly scaling their clean energy economies.

Latin American and Caribbean nations, which scored a collective 1.07, were buoyed by the performance not just of traditional powerhouse Brazil, but relative newcomers Peru, Costa Rica, Nicaragua and Colombia. Clean energy activity across the region has become substantially more diversified in recent years with Brazil no longer accounting for the large majority of activity or investment. Thanks to policy reforms and a surge in outside investment, other countries are making important strides.

The 19 African nations surveyed for *Climatescope* collectively scored 1.06 and were helped by strong performances from South Africa, Kenya, and Uganda. South Africa and Kenya have had significant clean energy projects either kick off or completed in the past few years while Uganda fared well because of the abundance of players there providing off-grid energy services. Energy poverty issues are paramount in many of these countries and those that have found ways to pair the goals of expanding energy access with growing clean energy tended to score highest.

Lesser developed nations

Due to the sheer diversity of nations in *Climatescope*, the survey's methodology was intentionally flexible to take into account the somewhat different conditions required to facilitate clean energy growth in the world's least developed countries. This involved the use of an "off-grid focus" system for scoring 23 countries in the survey where energy access issues are most critical (see the Methodology section for further explanation of how these countries were selected and the scoring criteria). While the overall *Climatescope* methodology is maintained for these nations, certain indicators were added to evaluate them under Enabling Framework Parameter I and Low-Carbon and Clean Energy Business Value Chains Parameter III.

Among these nations, Kenya scored highest. The country fared well, in particular, on the indicator's measuring policies that proactively support energy access and for its distributed energy regulatory framework. The country also scored highly on two indicators that specifically measure the level of providers offering distributed generation services in country. (Implications of the specific indicators related to the off-grid focus methodology are explored further in the Parameter I and Parameter III discussions.)

ENABLING FRAMEWORK PARAMETER I

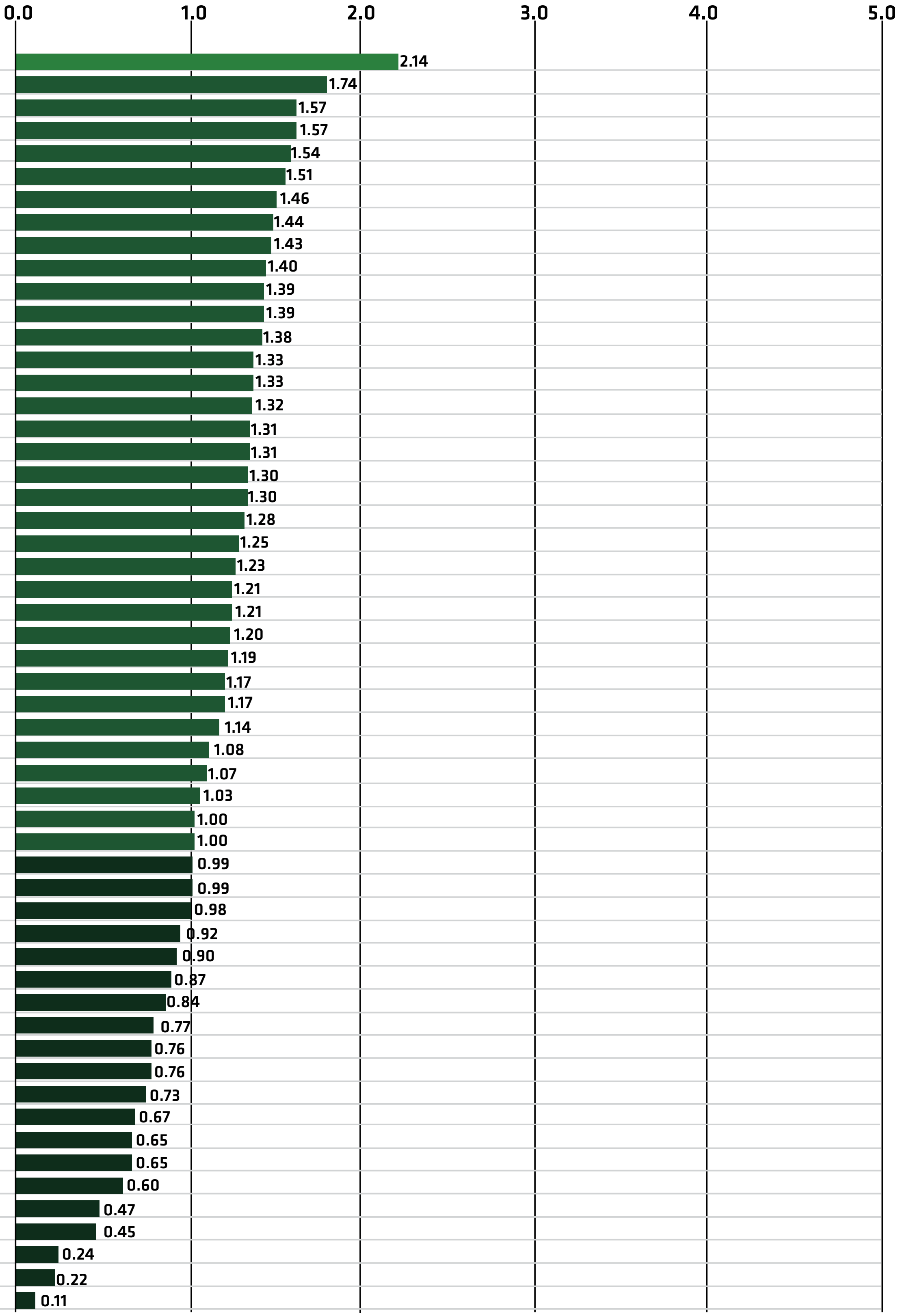
The Enabling Framework Parameter I includes a total of 22 indicators, which assess a country's policy and power sector structure, levels of clean energy penetration, level of price attractiveness for clean energy deployment, and the expectations for how large the market for clean energy can become.

Parameter I took into account a wide variety of indicators to compile a final score. This ranged from the macro in the form of overall policy scores for a country's clean energy policy regime, to the micro in the form of kerosene or diesel prices for lesser developed nations.

Given this variety, it should perhaps come as little surprise the diversity of nations that scored well on Parameter I. Top five finishers included not only the world's second and seventh largest economies (China and Brazil, respectively) but also its 72nd (Dominican Republic), 87th (Kenya), and 144th (Rwanda). The diversity was also boosted by the *Climatescope* methodology which specifically sought to take into account the somewhat different conditions required to facilitate clean energy growth in the world's least developed countries.

2014 Global Climatescope scores

Parameter I ranking



RANK	COUNTRY	SCORE
1	Brazil	2.14
2	Rwanda	1.74
3	China	1.57
4	Kenya	1.57
5	Dominican Republic	1.54
6	Nicaragua	1.51
7	India	1.46
8	Liberia	1.44
9	Uruguay	1.43
10	Peru	1.40
11	Panama	1.39
12	Nepal	1.39
13	Chile	1.38
14	El Salvador	1.33
15	Vietnam	1.33
16	Uganda	1.32
17	Tanzania	1.31
18	Belize	1.31
19	Ethiopia	1.30
20	Honduras	1.30
21	Guatemala	1.28
22	Costa Rica	1.25
23	Bangladesh	1.23
24	Malawi	1.21
25	Pakistan	1.21
26	Indonesia	1.20
27	Nigeria	1.19
28	Argentina	1.17
29	Ghana	1.17
30	Senegal	1.14
31	Sri Lanka	1.08
32	Cote d'Ivoire	1.07
33	Sierra Leone	1.03
34	Ecuador	1.00
35	Jamaica	1.00
36	South Africa	0.99
37	Zambia	0.99
38	Colombia	0.98
39	Haiti	0.92
40	Mexico	0.90
41	Zimbabwe	0.87
42	Mozambique	0.84
43	Botswana	0.77
44	Barbados	0.76
45	D.R. of Congo	0.76
46	Cameroon	0.73
47	Paraguay	0.67
48	Bolivia	0.65
49	Myanmar	0.65
50	Guyana	0.60
51	Bahamas	0.47
52	Tajikistan	0.45
53	Trinidad & Tobago	0.24
54	Suriname	0.22
55	Venezuela	0.11

Colors show range for overall score

0.0 - 1.00 | 1.01 - 2.00 | 2.01 - 3.00 | 3.01 - 4.00 | 4.01 - 5.00

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UK Department for International Development, Power Africa

Parameter I, top 5 countries

Rank	Country	Score	Reason
1	Brazil	2.14	Supportive local policy framework, growth of installed renewables capacity, rising biofuel production and high spot power prices
2	Rwanda	1.74	High relative level of clean energy penetration compared to a smaller economy, supportive energy access policies and high local energy prices
3	China	1.57	Strong local clean energy policy structures, rapidly rising overall demand for generation
4	Kenya	1.57	Positive efforts on energy access policies, including a rural electrification program; very high local energy prices
5	Dominican Republic	1.54	Strong clean energy policy regime, including net metering, feed-in tariffs and tax incentives.

Source: Bloomberg New Energy Finance

Brazil finished top of the list, despite the economic slowdown there that has deflated recent clean energy investment. The country has moved actively to hold reverse auctions for power delivery contracts from wind projects and make low-cost capital readily available through its national development bank (provided developers comply with certain “local content” rules).

The smaller country of Rwanda, with just 10GW of installed capacity, also scored well on this parameter, a reflection both of efforts it has made in recent years to support greater energy access through policy-making, but also of the oppressively high local kerosene and diesel prices, plus a very high rate of its population using solid fuels for cooking. All offer promise for small-scale renewables as an affordable, alternative energy source.

Those nations that finished near the bottom of the Parameter I table tended to fall into three categories. First, there were those that have bountiful local energy supplies that manifest themselves in low-priced electricity for consumers. Such low prices make it challenging for clean energy developers to compete. These nations included in 47th place Paraguay, which has such substantial large hydro supplies, it is a net electricity exporter. It also includes Bolivia (48th), Tajikistan (52nd), Suriname (54th), and Venezuela (55th), all of which have local supplies of natural gas or crude oil.

Second, there were nations where energy actually is quite pricey but have seen virtually no clean energy uptake to date. These tended to be lesser developed nations such as Cameroon (46th) and Guyana (50th).

Finally, there were nations where particularly low scores on the policy indicator due to a lack of incentives hindered their Parameter I score overall. This included Myanmar (49th) and the Bahamas (51st).

CLEAN ENERGY INVESTMENT & CLIMATE FINANCING PARAMETER II

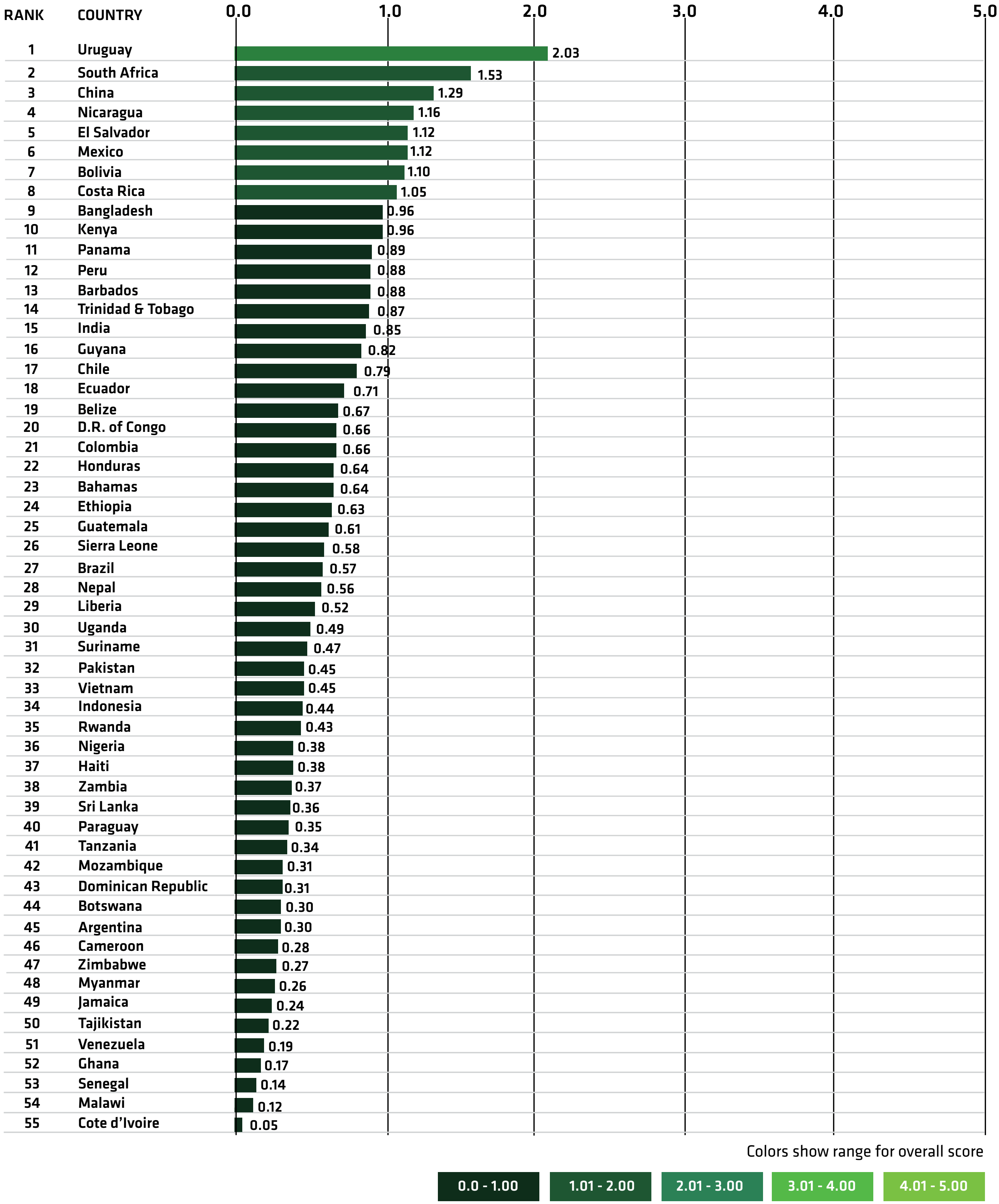
Clean Energy Investment & Climate Financing Parameter II looks at 14 indicators and accounts for the amount of clean energy investment a country attracts, the availability of local funds, the local cost of debt and green microfinance activity.

Uruguay finished at the top of the Parameter I table after a remarkable year for new project financings in the nation of over three million people. In the wake of an energy crisis last decade, Uruguay successfully held reverse auctions for clean power contracts. These spurred renewable project development and resulted in $1.3bn in new financings for renewables projects in 2013. Most of the funds were made available by multilateral and export-import finance institutions.

The story was somewhat similar in South Africa which has moved aggressively in recent years to diversify away from a reliance on coal through a series of tenders for power contracts. Other top scorers included China, which secured the most new funds for clean energy of any nation in 2013. (The *Climatescope* methodology “levelized” the clean energy investment indicator against each country’s GDP to ensure larger countries were not simply rewarded for being bigger.)

2014 Global Climatescope scores

Parameter II ranking



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UK Department for International Development, Power Africa

Parameter II, top 5 countries

Rank	Country	Score	Reason
1	Uruguay	2.03	$1.3bn in new funds secured, a huge haul compared to its $56bn GDP economy
2	South Africa	1.53	$10.5bn 2006-2013 cumulative investment; scored highly for its clean energy investment growth rate, and for the volume secured locally
3	China	1.29	The global leader in clean energy investment on a dollar volume basis
4	Nicaragua	1.16	Since 2006, a Climatescope leader with $1.6bn secured cumulatively; high number of local green microfinance institutions
5	El Salvador	1.12	Attracted $51m for its first large-scale PV plant in 2013; significant green microfinance network

Source: Bloomberg New Energy Finance

Parameter II sought to take into account not just activity in 2013 but rates of clean energy investment growth over the past seven years and cumulative investment. As a result, those countries that have either experienced activity only recently or have experienced no activity at all tended to fall to the bottom of the Parameter II rankings. Among these nations were Argentina (45th), Myanmar (48th), Senegal (53rd), and Cote d'Ivoire (55th).

LOW-CARBON BUSINESS AND CLEAN ENERGY VALUE CHAINS PARAMETER III

Low-Carbon Business and Clean Energy Value Chains Parameter III assessed through three indicators the availability of local manufacturing and other similar types of capacity to spur clean energy deployment. These seek to take into account the availability of: local manufacturers to provide the equipment needed to construct projects, local financial firms to provide capital, and local service firms to provide assistance such as legal or other services. For lesser developed nations, this parameter used the augmented off-grid focus methodology to take into account the availability of technical assistance and service providers in value chains specifically related to distributed clean energy. In all, *Climatescope* sought to account for no less than 63 segments of these value chains. In the case of the least developed nations, a total of 78 value chain segments were assessed.

It is important to note that countries that score higher than others on Parameter III do not necessarily have more actual manufacturing capacity than others (though that is certainly possible). Rather, this parameter simply conducts a binary count of how many value chain segments are fulfilled in each country based whether there is at least one company active in each segment. As this marks the first year *Climatescope* has been conducted on a global basis, it is not possible to compare the rate of growth within these value chains from prior years. Still, a snapshot of what aspects of these value chain segments are filled and which are empty today does offer some intriguing insights.

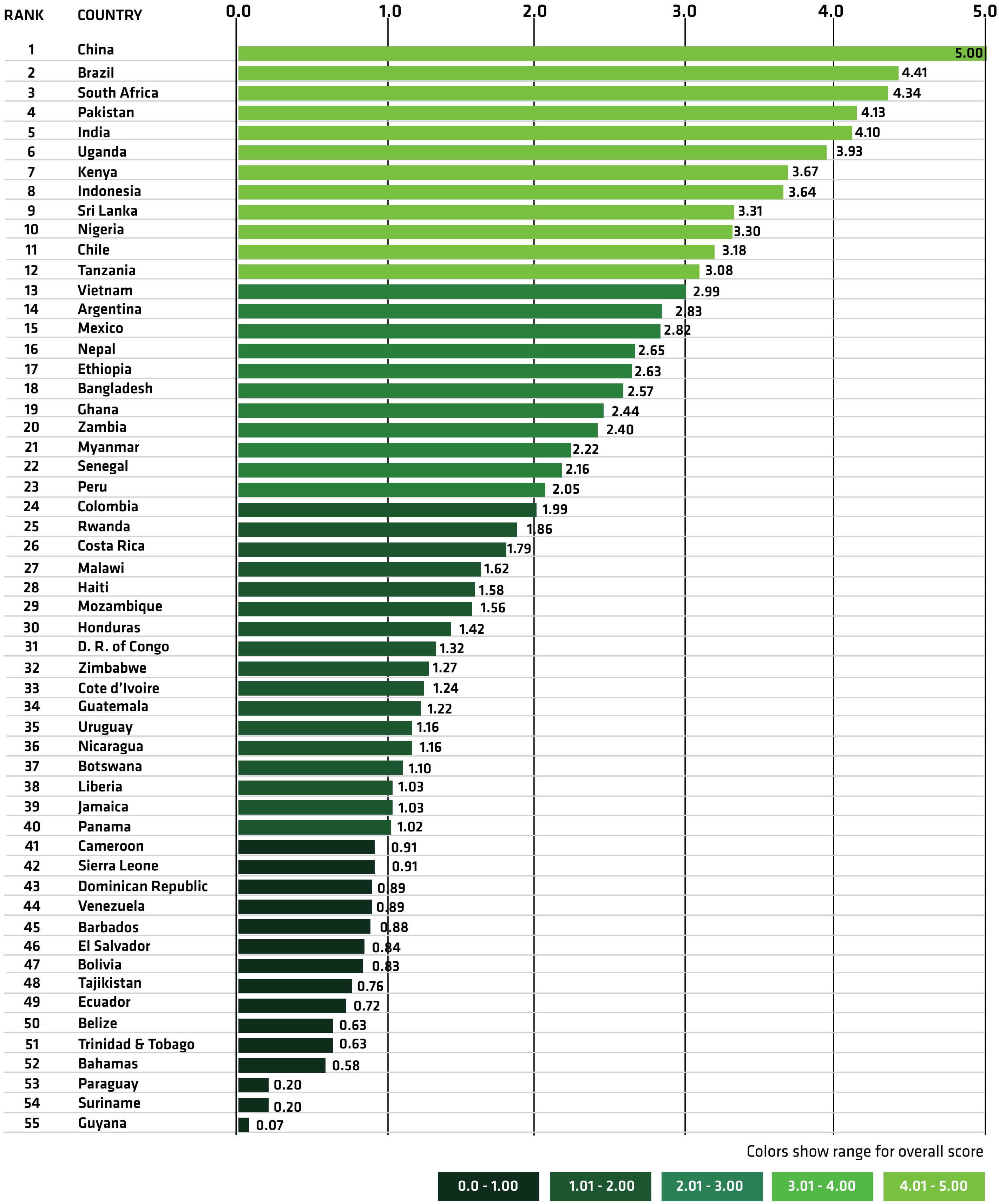
More than any other, scores on Parameter III do to a large extent correlate with country size as the largest nations with the biggest economies have the most manufacturing and clean energy capacity in place overall. Thus it is unsurprising that the largest nation assessed by *Climatescope*, China, also had the highest (and maximum) score. However, China's ranking is also justified by the fact that the country today is, on a volume basis, unquestionably the top manufacturer of clean energy equipment worldwide.

Brazil, the largest LAC country, is also home to more manufacturing value chain segments in that region than any other and ranks 2nd worldwide. The country has implemented explicit local-content rules in recent years mandating that clean energy projects must use certain amounts of equipment manufactured within Brazil to qualify for low-rate financing from the country's development bank. South Africa (3rd on Parameter III) and India (5th) have seen growth in their value chains for somewhat similar reasons. Policy-makers in both nations view clean energy as an economic development opportunity that they do not want to cede to other nations.

Pakistan scored highly on this parameter in no small part because it was being graded with the off-grid focus methodology. As a result, the country's score is largely a reflection of players present there to facilitate distributed-scale clean energy development.

2014 Global Climatescope scores

Parameter III ranking



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Parameter III, top finishers

Rank	Country	Score	Reason
1	China	5.00	World's largest clean energy equipment maker has players in every value chain segment surveyed
2	Brazil	4.41	Local content rules tied to Brazil development bank financing have accelerated a local clean energy value chain build-out
3	South Africa	4.34	Traditionally strong presence of local financial firms plus concerted effort to expand manufacturing though local content rules
4	Pakistan	4.13	Strong presence of players facilitating off-grid renewables development
5	India	4.10	Substantial wind manufacturing capacity and ample service and financial providers; expanding photovoltaic manufacturing capacity

Source: Bloomberg New Energy Finance

GREENHOUSE GAS MANAGEMENT ACTIVITIES PARAMETER IV

Greenhouse Gas Management Activities Parameter IV takes into account carbon offset project activity, level of policy support for carbon emissions reduction, and local corporate awareness of carbon issues through a total of 13 indicators.

This parameter encompassed a wide range of scores as some nations have been active in various aspects of contemplating their CO2 footprints through the establishment of registries or other activities or by actually rolling out national or local policies with an eye toward explicitly addressing the issue. Many nations are hosting some type of CO2 reduction project registered internationally. The top five finishers tended to be nations that to date have been more active in getting projects registered internationally, but most have also been active in some way in developing actual CO2 reduction policies. Chile, which topped the list for Parameter II, has now approved South America's first carbon tax. China, 3rd on the parameter despite being the world's largest CO2 emitter, has now launched several local pilot cap-and-trade schemes. Mexico (4th) saw its carbon tax come into force in January 2014..

At the other end of the spectrum, quite a few nations have done very little to date on these issues. Slightly less than half of nations surveyed scored below a 1.0 on this Parameter. In a number of cases, this was unsurprising given the level of economic development of many of these countries. I. There were some exceptions, however. Venezuela finished 44th on the list, Suriname 51st and Sri Lanka 54th. The lowest overall scorer on this parameter was Haiti.

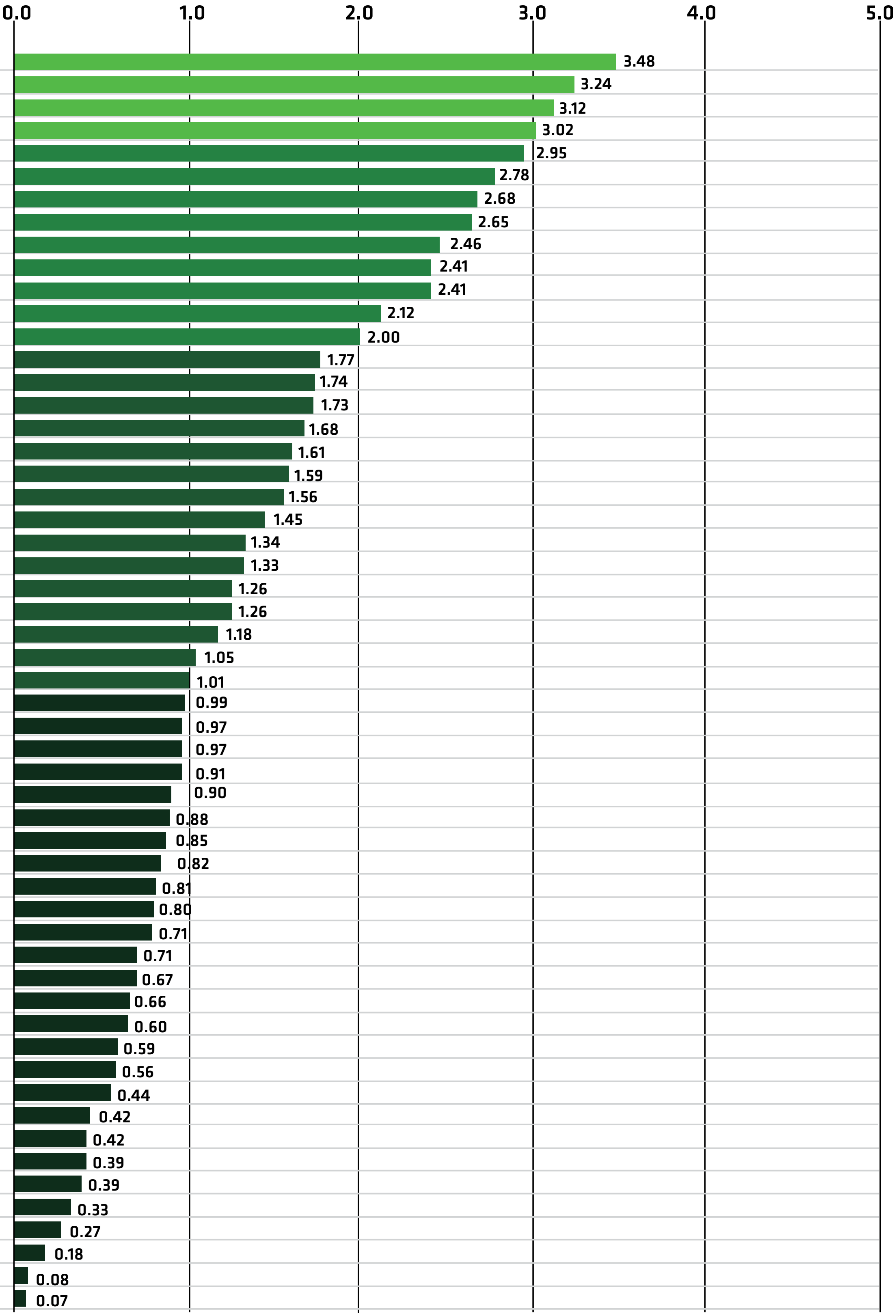
Parameter IV, top finishers

Rank	Country	Score	Reason
1	Chile	3.48	Has 120 GHG offset projects registered internationally with more on the way. Has approved South America's first carbon tax
2	Brazil	3.24	409 GHG offset projects registered internationally and 86 corporates who report GHG activity
3	China	3.12	Despite being world's largest emitter scored highly thanks to wide-reaching CO2 registries and targets set to cut emissions, plus local cap-and-trade programs
4	Mexico	3.02	Target set of 30% reduction in emissions by 2020, developing a tracking tool for NAMAs, has 194 GHG offset projects registered. Carbon tax rolled out earlier this year
5	Colombia	2.95	Member of Partnership for Market Readiness initiative to reduce GHG, has 69 GHG offset projects across a wide spectrum of sectors

Source: Bloomberg New Energy Finance

2014 Global Climatescope scores

Parameter IV ranking



RANK	COUNTRY	SCORE
1	Chile	3.48
2	Brazil	3.24
3	China	3.12
4	Mexico	3.02
5	Colombia	2.95
6	South Africa	2.78
7	India	2.68
8	Uruguay	2.65
9	Peru	2.46
10	Costa Rica	2.41
11	Indonesia	2.41
12	Dominican Republic	2.12
13	Vietnam	2.00
14	Ghana	1.77
15	Kenya	1.74
16	Argentina	1.73
17	Uganda	1.68
18	Nicaragua	1.61
19	Ecuador	1.59
20	Honduras	1.56
21	Guatemala	1.45
22	Zambia	1.34
23	Bolivia	1.33
24	Nepal	1.26
25	Paraguay	1.26
26	Jamaica	1.18
27	Belize	1.05
28	Malawi	1.01
29	Nigeria	0.99
30	Tanzania	0.97
31	Zimbabwe	0.97
32	Ethiopia	0.91
33	Panama	0.90
34	D. R. of Congo	0.88
35	Cameroon	0.85
36	El Salvador	0.82
37	Mozambique	0.81
38	Pakistan	0.80
39	Tajikistan	0.71
40	Myanmar	0.71
41	Guyana	0.67
42	Rwanda	0.66
43	Bangladesh	0.60
44	Venezuela	0.59
45	Trinidad & Tobago	0.56
46	Barbados	0.44
47	Senegal	0.42
48	Cote d'Ivoire	0.42
49	Bahamas	0.39
50	Botswana	0.39
51	Suriname	0.33
52	Sierra Leone	0.27
53	Liberia	0.18
54	Sri Lanka	0.08
55	Haiti	0.07

Colors show range for overall score

0.0 - 1.00 | 1.01 - 2.00 | 2.01 - 3.00 | 3.01 - 4.00 | 4.01 - 5.00

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