Precise Solutions

Increasing the Share of RE through STi in LATAM

rubendario.cruz@cidet.org.co | @rdcruzr

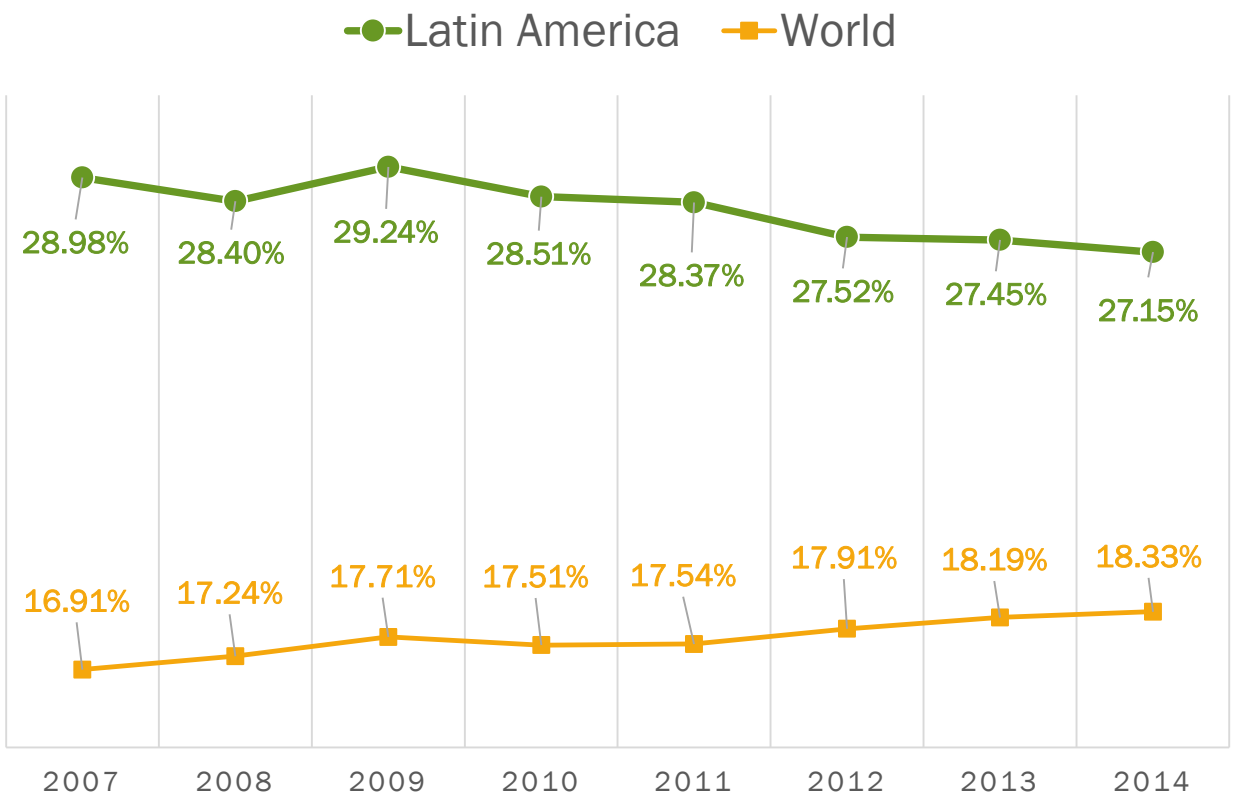
2017-2018 Intersessional Panel of the UN CSTD

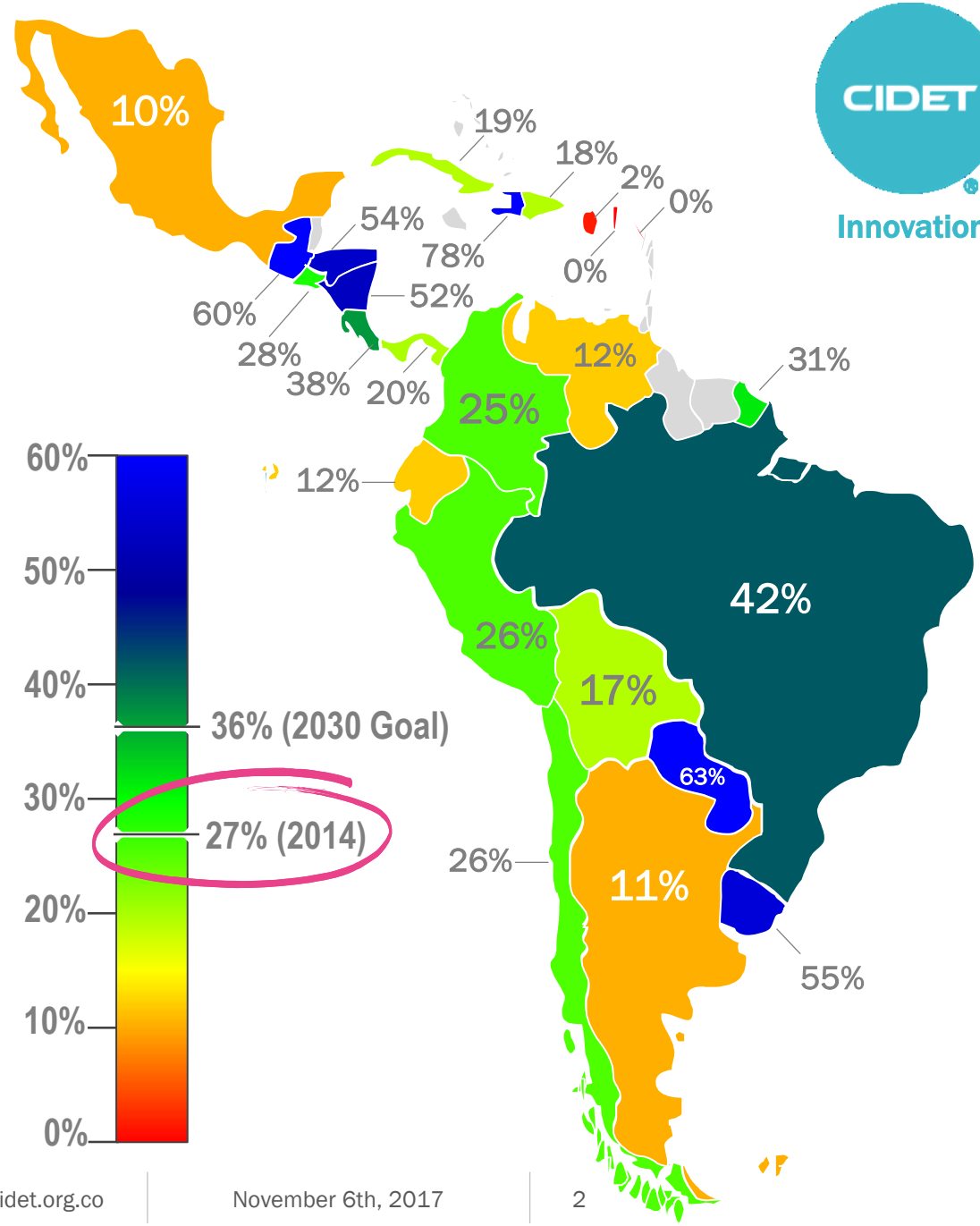
The role of STi to increase the share of renewable energy by 2030

United Nations Conference on Trade and Development (UNCTAD)

Palais des Nations, Room XXI, Geneva, SWITZERLAND | November 6th, 2017

Renewable share in Total Final Energy Consumption (TFEC)†

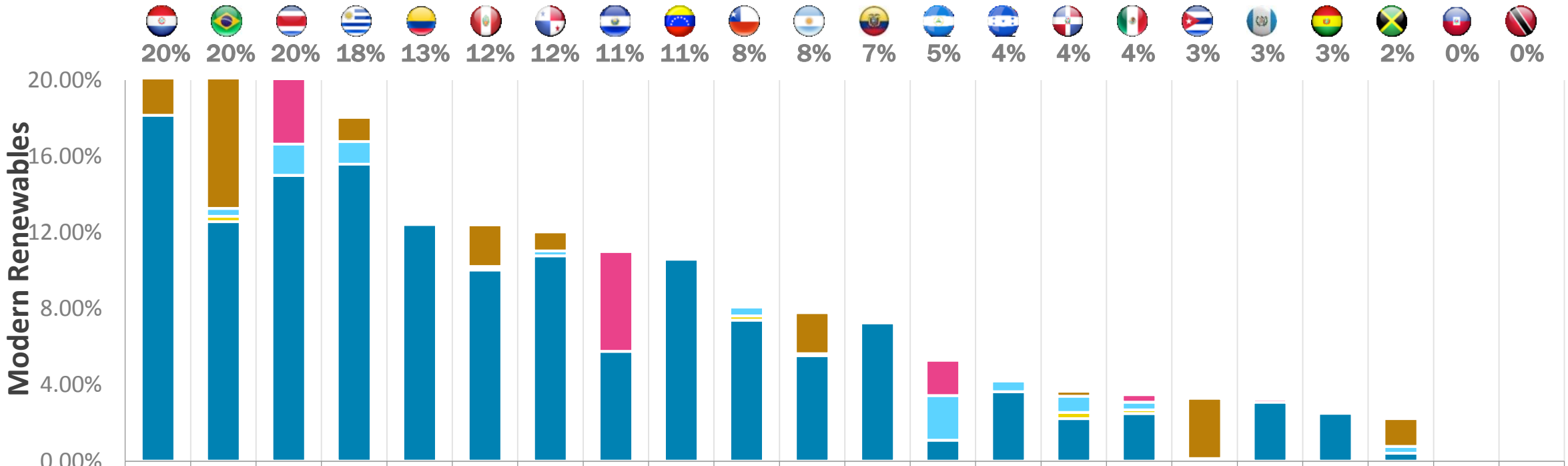




† Global Tracking Framework (2014): http://gtf.esmap.org

*The boundaries, colors, denominations and any other information shown on this map do not imply, on the part CIDET nor UN, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Renewable share (%) in TFEC from... (2/2) Latin America



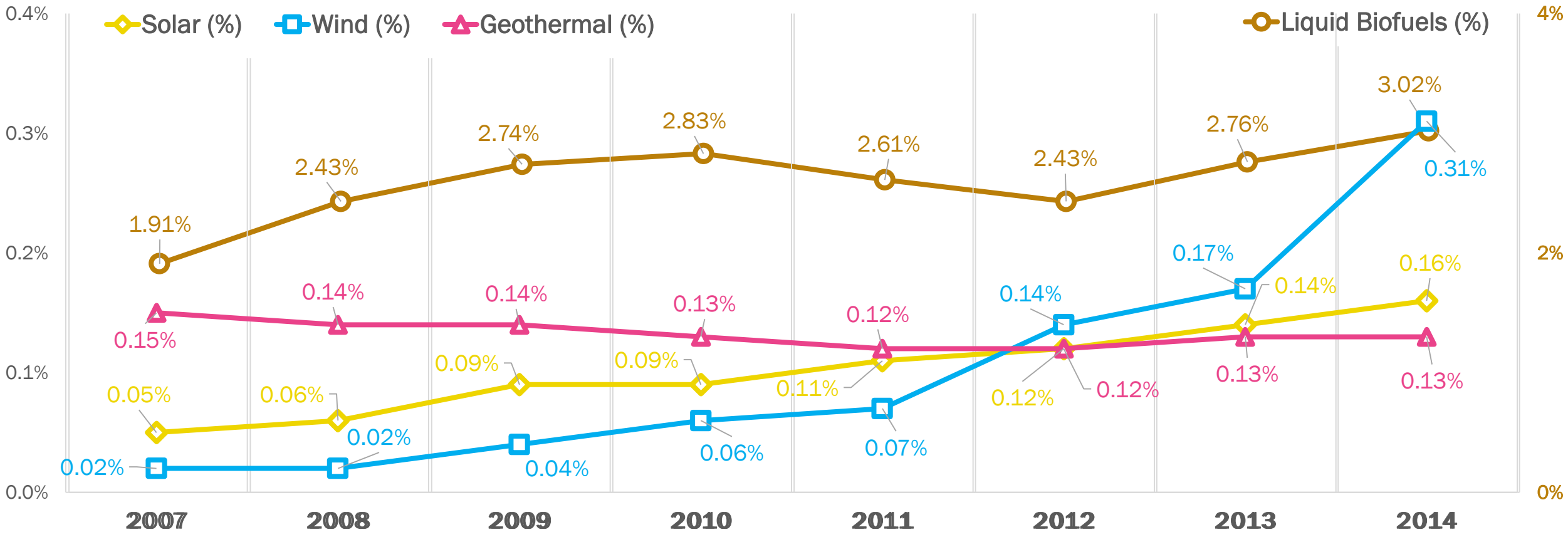
	PAR	BRA	COS	URU	COL	PER	PAN	SAL	VEN	CHI	ARG	ECU	NIC	HON	DOM	MEX	CUB	GUA	BOL	JAM	HAI	T&T
Liquid Biofuels (%)	2.26%	7.02%	0.00%	1.27%	0.12%	2.19%	1.00%	0.00%	0.00%	0.00%	2.15%	0.06%	0.00%	0.00%	0.26%	0.00%	3.16%	0.00%	0.00%	1.46%	0.00%	0.00%
Geothermal (%)	0.00%	0.00%	3.43%	0.00%	0.00%	0.00%	0.00%	5.23%	0.00%	0.00%	0.00%	0.02%	1.84%	0.00%	0.00%	0.39%	0.00%	0.16%	0.00%	0.00%	0.00%	0.00%
Wind (%)	0.00%	0.41%	1.64%	1.19%	0.01%	0.09%	0.25%	0.00%	0.00%	0.46%	0.10%	0.05%	2.35%	0.56%	0.85%	0.41%	0.02%	0.00%	0.01%	0.36%	0.00%	0.00%
Solar (%)	0.00%	0.28%	0.01%	0.00%	0.00%	0.08%	0.00%	0.00%	0.00%	0.23%	0.00%	0.01%	0.00%	0.00%	0.33%	0.19%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%
Hydropower (%)	18.15	12.57	14.99	15.58	12.42	10.04	10.78	5.77%	10.60	7.40%	5.54%	7.27%	1.10%	3.65%	2.23%	2.50%	0.10%	3.10%	2.52%	0.42%	0.10%	0.00%

† Modern RE including hydropower, solar, wind, geothermal and liquid biofuels
‡ Solid biofuels including traditional biomass

Source (2014): http://gtf.esmap.org/results

Share (%) in TFEC from modern renewables (1/2)

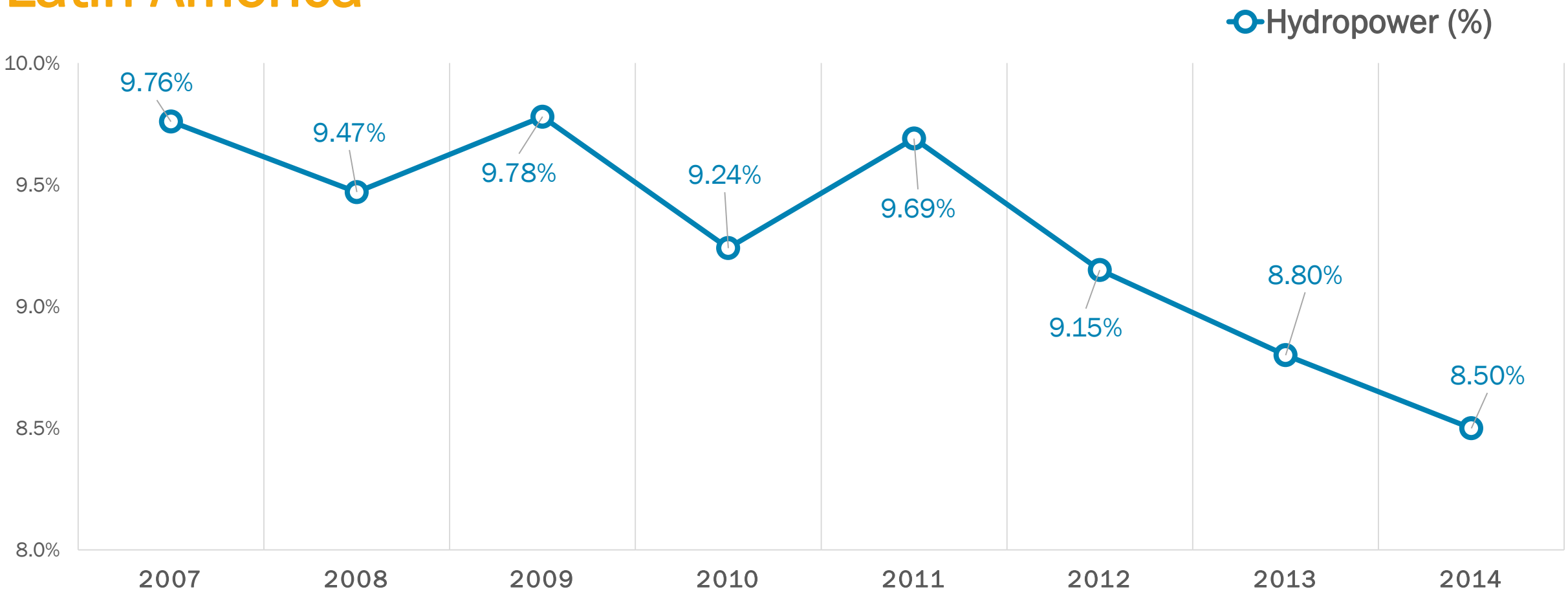
Latin America



Source (2014): http://gtf.esmap.org/results

Share (%) in TFEC from modern renewables (2/2)

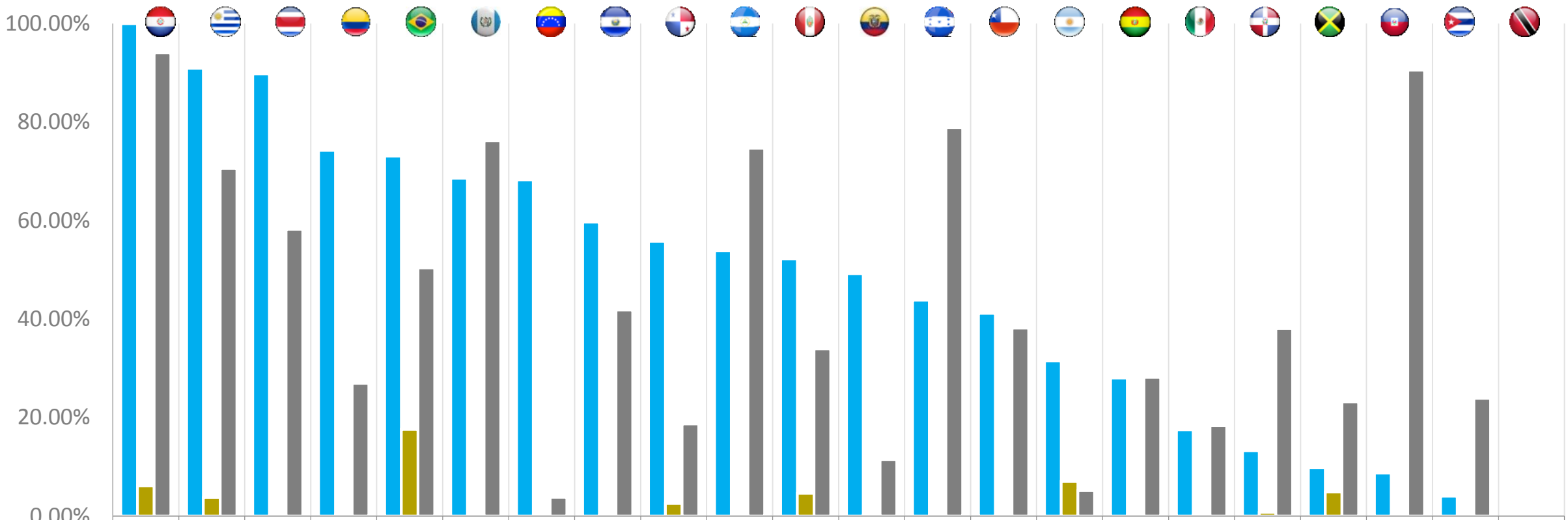
Latin America



Source (2014): http://gtf.esmap.org/results

Renewable share (%) in TFEC for... (1/2)

Latin America



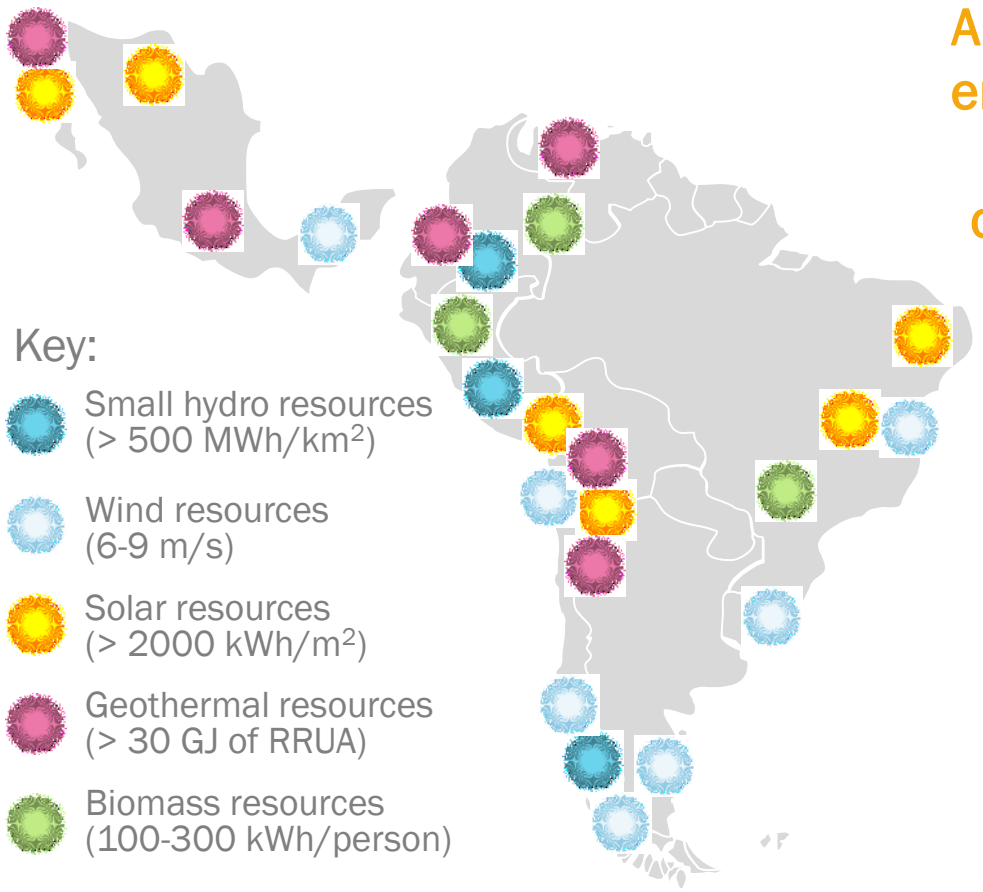
	PAR	URU	COS	COL	BRA	GUA	VEN	SAL	PAN	NIC	PER	ECU	HON	CHI	ARG	BOL	MEX	DOM	JAM	HAI	CUB	T&T
Electricity (%)	99.99	90.92	89.79	74.25	73.08	68.61	68.26	59.70	55.80	53.89	52.19	49.18	43.83	41.18	31.54	28.01	17.54	13.26	9.77%	8.71%	4.02%	0.00%
Transport (%)	6.14%	3.74%	0.00%	0.27%	17.59	0.00%	0.00%	0.00%	2.56%	0.00%	4.64%	0.14%	0.00%	0.00%	7.05%	0.00%	0.00%	0.75%	4.87%	0.00%	0.00%	0.00%
Heating (%)	94.06	70.60	58.20	26.95	50.39	76.23	3.78%	41.86	18.71	74.68	33.93	11.50	78.86	38.16	5.16%	28.17	18.39	38.09	23.19	90.55	23.93	0.51%

Source (2014): http://gtf.esmap.org/results

Long-term opportunities in Latin America*

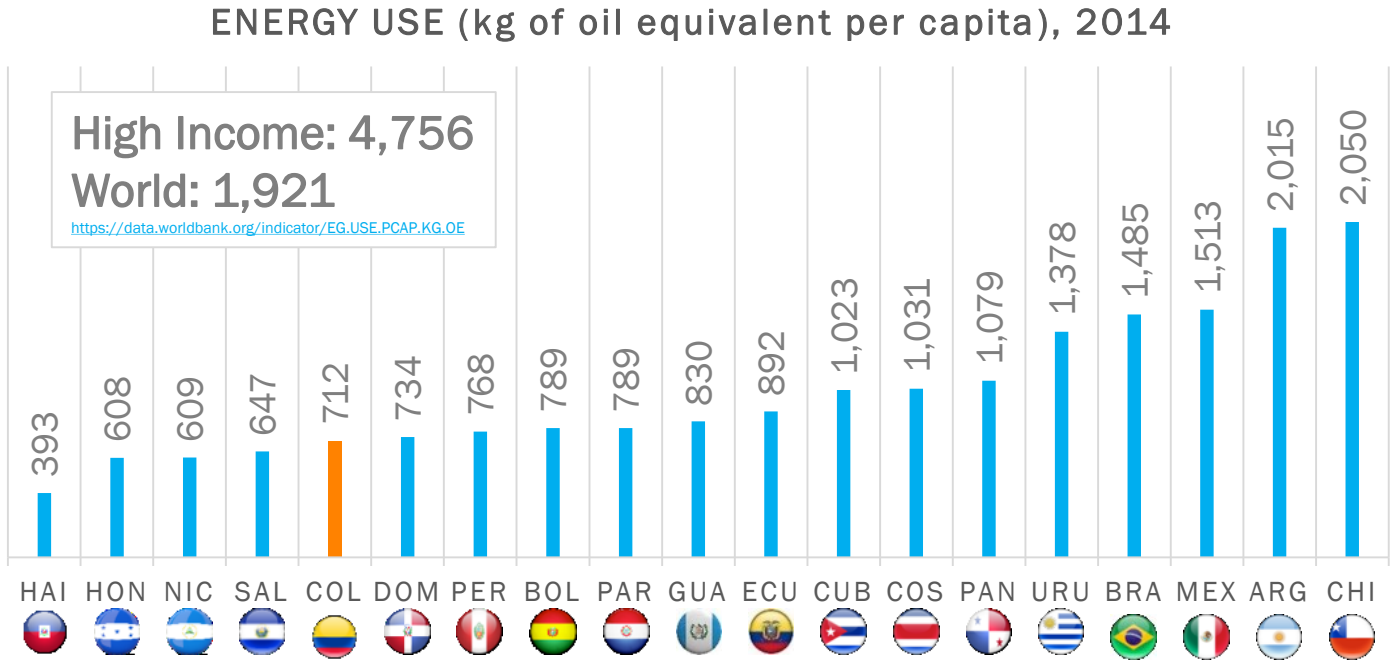
CIDET Innovation

In the long run, renewable energy will help address energy needs



Source:
- Northeast Group [+]
- Observatório Nacional [+]

Almost all Latin American countries can benefit from renewable energy, while electrification of the consumption (transportation, heating) will be necessary to assure sustainable supply when demand reaches developed levels in some countries by 2020s



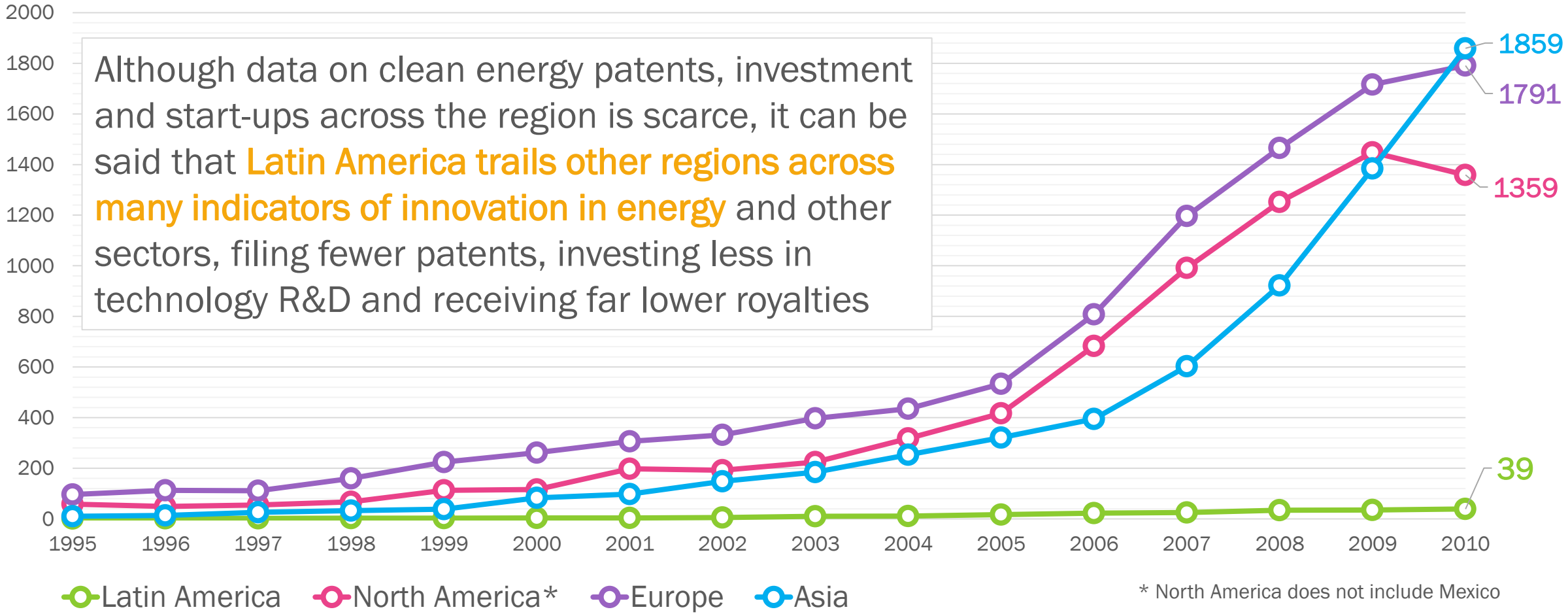
* Adapted from: Testa, C. "Emerging Smart Grid Markets: How Latin America's Smart Grid Potential compares to other Emerging Markets", November 2011, Sao Paulo, Brazil. Disponible en: http://www.northeast-group.com/reports/NortheastGroupLLC_Latin_America_Smart_Grid_Forum_2011.pdf

Clean Energy Technology Development (1/2)

Latin America

PCT Patent Applications: Energy Generation from Renewable Sources

OECD Statistics, 2014



Although data on clean energy patents, investment and start-ups across the region is scarce, it can be said that **Latin America trails other regions across many indicators of innovation in energy** and other sectors, filing fewer patents, investing less in technology R&D and receiving far lower royalties

* North America does not include Mexico

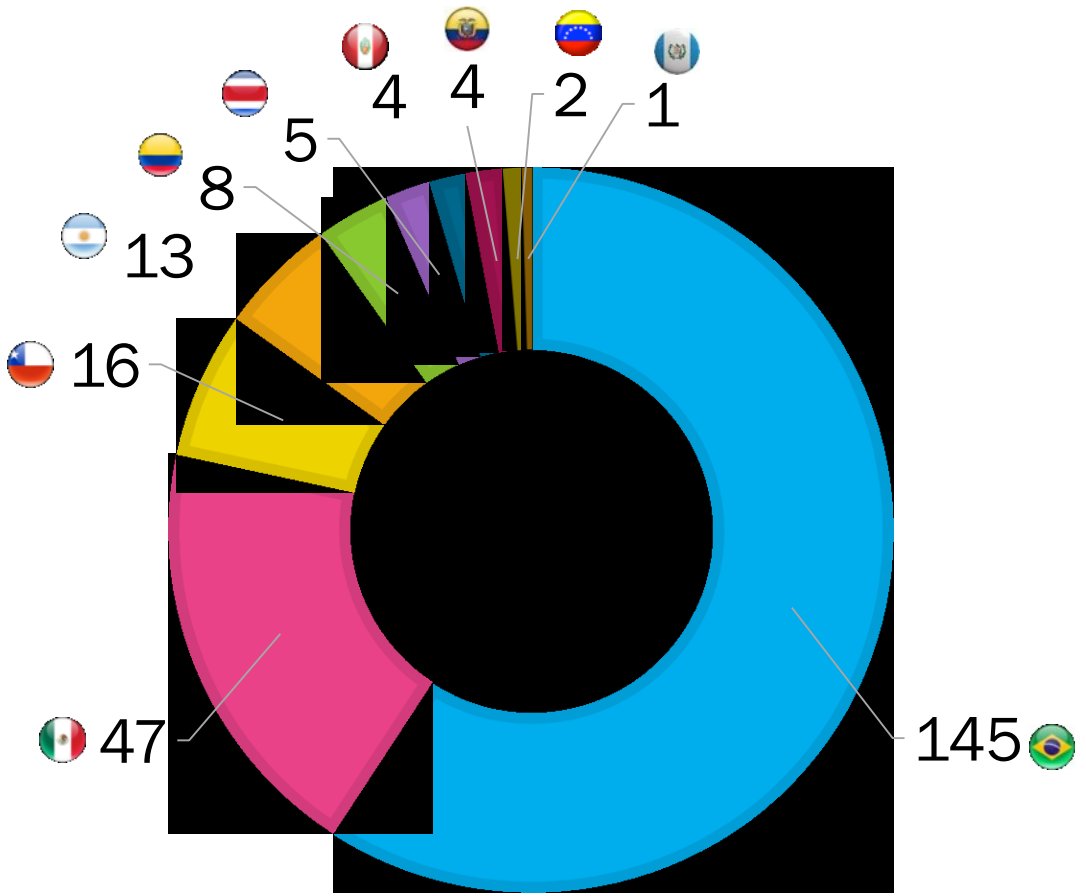
Justin Miller, Lisa Viscidi, "Clean Energy Innovation in Latin America", Energy Working Paper, March 2016. https://www.thedialogue.org/wp-content/uploads/2016/02/Clean-Energy-Innovation-in-Latin-America.pdf

Clean Energy Technology Development (2/2)

Latin America

PCT patent applications for energy generation technologies using renewable non-fossil fuel resources (1995-2011)

- Brazil outpaces other Latin American countries both in technology development broadly and in clean energy specifically
- Brazilians have led the largest number of patent applications in the region, including in clean energy
- The Brazilian government has accelerated the green technology patenting process through its Green Patent Initiative



Source: OECD Statistics (2014); Analysis: CAF – Development Bank of Latin America

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Brazil

Brazil's Breakthroughs

- Brazil is the clear **leader in clean energy innovation** within Latin America
- Its universities and research institutions have produced a sizeable volume of intellectual property, particularly in **bioenergy**, including biogas and biomass
- Behind bioenergy, significant resources for research also flow toward **wind**, **photovoltaic** (PV) and **thermal solar** energy and **ocean energy**
- Researchers have also focused on **batteries** and **fuel cells**, **power systems**, **smart grids**, **carbon capture and sequestration**, **power transmission optimization** and **energy efficiency**

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Brazil's Key of Success

Brazil

Public Sector

- Strong **government support** and **corporate heavyweights** (Petrobras with CENPES, Eletrobras with CEPEL) in the energy sector have helped Brazil surpass other Latin American countries in clean energy innovation
- The government provides incentives for clean energy innovation through **direct financial resources** to research activities (particularly those of public universities/institutes), **low interest loans** (Brazilian Development Bank, BNDES) and **regulations requiring electric power industry players to invest in R&D**

Private Sector

- Unlike in most other Latin American countries, the **private sector plays a prominent role in Brazil's clean energy technology sector**, dedicating significant financial resources to R&D
- This has led to the establishment of private-sector led research centers and **meaningful financial and operational linkages between companies, universities and independent Research and Technology Organizations (RTOs)**

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Brazil

Brazil's Challenges

- Clean energy technology players, particularly **small- and medium-sized actors not involved in bioenergy, face myriad challenges** in bringing their research to market in Brazil's challenging start-up climate:
  - **crowded out by larger players**
  - burdened by cumbersome **bureaucracy and high taxes** and
  - faced with **insufficient public R&D spending** and **little clean tech-focused Venture Capital**

- Beyond the bioenergy space, **Brazil has had limited success in bringing its clean energy IP to market** or **expanding its clean energy technology manufacturing base**

- **Brazil's government can take steps to address many of the challenges for clean energy start-ups**, for example by lowering taxes and tariffs and streamlining bureaucracy, in that way, clean energy innovation is more likely to thrive

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Top Barriers in Developing Clean Energy Technologies in Latin America

ACCESS TO CAPITAL

- To bring groundbreaking technologies to market, entrepreneurs need **access to capital and an innovation ecosystem** that allows them to take risks
- In Latin America, **investors tend to be more risk-averse** than their counterparts in other places and the **innovation ecosystems are still developing** (immature capabilities)
- Even when capital is available, local **regulations penalize risk-taking**, for example because of weak bankruptcy legislation in many countries

- These conditions pose major barriers to entrepreneurship and innovation in Latin America in general and for clean energy innovation in particular

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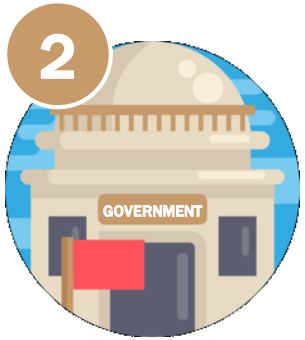
Top Barriers in Developing Clean Energy Technologies in Latin America



GOVERNMENT SUPPORT

- Clean energy innovation requires strong government support and incentives to drive both supply of new technologies and demand for clean energy solutions
- Government support (*through public investment in R&D, clean tech clusters and fiscal incentives*) is needed to encourage researchers to create and improve new products and services
- Governments can also provide incentives to create domestic markets for clean energy solutions through policies such as public procurement programs requiring minimum levels of domestically developed technology inputs

- While Latin American governments do invest in R&D efforts, investment is still too low and is not directed toward the most commercially relevant research

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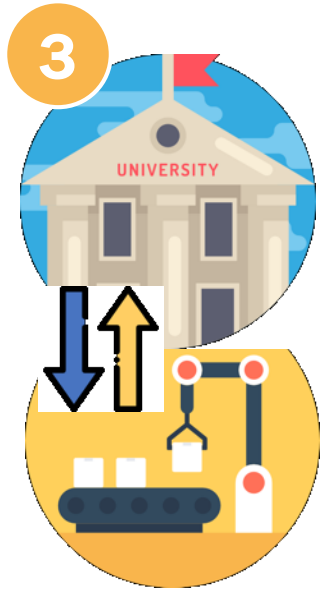
Top Barriers in Developing Clean Energy Technologies in Latin America

Innovation



INDUSTRY–ACADEMY PARTNERSHIPS

- For new technologies to be applied commercially, they need to serve a market need
- This requires researchers and government entities supporting R&D efforts to carefully coordinate their work with the private sector to ensure that research in the laboratory will eventually lead to a commercially-viable product or service
- However, in Latin America, there is often insufficient communication between academia and national or foreign industry players
- Researchers are too focused on academically oriented science rather than technology development with business applications

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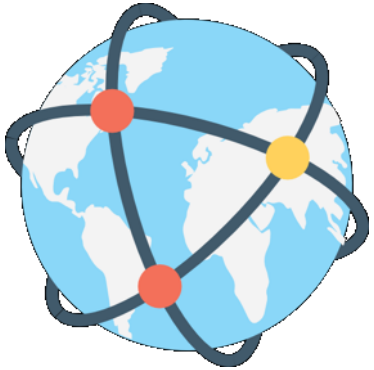
Recommendations



Improve links with international industry players

Latin American countries need to expand industry-academia ties, but it may be more effective to connect researchers with foreign private sector players

Strengthen policies to boost domestic demand

Latin American countries could establish public procurement programs that require government entities to buy a certain percentage of innovative technologies derived from R&D efforts within the country

Redirect research and development efforts

Most governments in the region need to increase R&D spending as a percentage of GDP to boost overall innovation, even a small percentage of R&D spending redirected toward innovation more engineering-based, would boost research capabilities in energy-related fields

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Bridging the gap to 36% in 2030…

Innovation Challenges in Latin America

PRODUCTION…

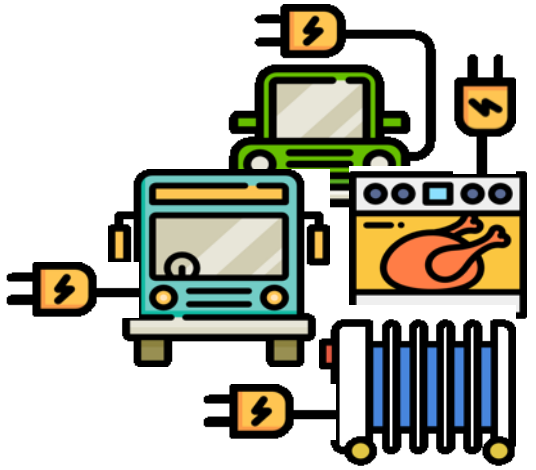
…with near-zero emissions

MINIMIZE LAND USE

and adapt technology to local condition

CONSUMPTION

ELECTRIFICATION



Not just transport and heating but also current or potential productive applications that can be improved or potentiated using “clean” electricity

Thank you!

Precise solutions for the power industry

Rubén Darío CRUZ, Ph.D.

Chief Innovation Officer (CINO)

Center for Research and Technological Development of the Power Industry (CIDET)

Carrera 46, No. 56-11, Medellín (COLOMBIA)

+(574) 444 1211 ext. 119

+(57) 321 636 7041

Ruben Dario Cruz [+]

rd_cruz

@rdcruzr [+]

@CIDET [+]

www.cidet.org.co [+]

Dr. Rubén CRUZ

Rubén CRUZ obtained the **BSc. degree in Electrical Engineering** and the **MSc. degree in Electrical Power** from the *Industrial University of Santander – UIS* (Bucaramanga, Colombia), and the **Ph. D. degree in Engineering** at the *Bolivarian Pontifical University – UPB* (Medellín, Colombia) sponsored by the major power transmission company of Colombia (*ISA*). During a semester of his doctoral studies he was a Visiting Fellow at the *Department of Electrical and Computer Engineering* of the *University of Texas at Austin* (USA)

In addition to his participation in the *Development and Network Optimization Team* of *ISA*, his career includes the Colombian petroleum company (*ECOPETROL*) and eight year as full professor at *UIS* where he also was the director of the *School of Electrical Engineering (E3T)* during six years. **Since 2012 he is with the *R&D Center of the Power Industry* (*CIDET*) as Chief Innovation Officer (CINO)**

During his **21 years of professional, research and teaching experience** he has focused his interests on **planning, management, operation, monitoring and regulation of energy markets**, the implementation of best practices management models and developing models for technological scouting and innovation management for the power industry. He has authored and co–authored several technical papers in all those areas