The coupled decarbonization of the power and transport sectors in Latin America & the Caribbean

Walter Vergara
“...on going pathway...will lead to significant disruptions of ecosystems, society and economies...” Letter from 11,000 scientists from 84 nations Dec 2019

“..no avenues left other than full decarbonization to avert major irreversible impacts on our biosphere...” IPCC 2019 Special Report on Global Warming 1.5 °C

“...1.5°C almost Impossible” without deeper and faster Cuts...” UNEP Emissions Gap Report 2019

“...leaving an inhabitable planet to future generations is first and foremost up to us...” Pope Francis, *Laudato Si*
Coupled decarbonization of power generation and transport: Opportunity, cost and benefits

Methodology

Based on available information in the technical literature and industry data.

Baseline based on Global Change Assessment Model (GCAM v5.1.3) created and maintained by the Global Change Research Institute of the University of Maryland & Pacific Northwest Laboratory

Projected costs using the Greenhouse Gas Abatement Model (GACMO) created and managed by UNEP/DTU partnership
Emissions of the power and transport sector

Region’s carbon footprint in 2018

<table>
<thead>
<tr>
<th>Category</th>
<th>Contribution</th>
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</thead>
<tbody>
<tr>
<td>AFOLU</td>
<td>2386</td>
</tr>
<tr>
<td>Transport</td>
<td>604</td>
</tr>
<tr>
<td>Electricity</td>
<td>404</td>
</tr>
<tr>
<td>Industry</td>
<td>234</td>
</tr>
<tr>
<td>Services</td>
<td>44</td>
</tr>
<tr>
<td>Waste</td>
<td>247</td>
</tr>
<tr>
<td>Others</td>
<td>224</td>
</tr>
</tbody>
</table>

- **AFOLU (2018):** 2386
- **Transport (2018):** 604
- **Electricity (2018):** 404
- **Industry (2018):** 234
- **Services (2018):** 44
- **Waste (2018):** 247
- **Others (2018):** 224

**Power and transport (2018):**

- 67% fossil GHG
- 25% all GHG

Source: GACMO, consulted, October, 2019; CAIT, Climate Data Explorer, for fugitive emissions and bunker fuels, included as others, http://cait.wri.org and GFW for deforestation rate of 3.2 M ha of primary forest in 2018
Power sector is already low carbon and moving toward even lower GHG emissions

57 GW added (2012 – 2018)
53% hydro
47% unconventional renewables

Non-conventional renewables X2 has reduced tCO2/GWh in 15%

Source: Based on data from ENERDATA, accessed August, 2019
Projected demand for transport and sector under BAU scenario

**Power sector**
*Projected demand 16.7 EJ*
*Investment: US$ 1083 billion*

**Transport sector**
*Projected demand 18 EJ*
*83% gas & diesel*

Source: As projected under GCAM BAU outputs, August 2019
Current trends are not enough to get to zero emissions by 2050

\[ x^2 \] emissions by 2050

BAU

Source: As projected under GCAM BAU outputs, August 2019
FAVORING CONDITIONS
FOR A COUPLED TRANSITION
The region has a **world-class endowment** of renewable energy resources

**SOLAR ENERGY**
- Atacama Desert
  - Potential generation: 2700 GW (with 10% of area under use)
- Sonora Desert
  - Potential generation: 4,940 GW (with 10% of area under use)

**HYDROPOWER ENERGY**
- All countries particularly the Andes and the Amazon basin
  - Potential generation: 675 GW

**MARINE ENERGY**
- Southern Pacific Coast
  - Potential generation: 200-240 GW

**GEOTHERMAL ENERGY**
- Andes Cordillera and Central American Cordillera
  - Potential generation: 44 GW

**OFF-SHORE WIND ENERGY**
- The entire region has 50,000 Km of coastline
  - Potential generation: 1,300 GW (Brazil)

**WIND ENERGY**
- High southern latitudes
  - Intensity: 600-1300 W/m²
- Southern Atlantic Coast
  - Intensity: 100-450 W/m²
- Brazil coastal and northeastern areas
  - Potential generation: 500 GW
- Guajira Peninsula
  - Intensity 10 GW
- Isthm of Tehuantepec
  - Potential generation: 30 GW
- Southern Atlantic Coast
  - Intensity 100-450 W/m²
Auctioned prices for wind and solar have fallen by more than 80% (2013-2019)

The generation cost of electricity from unconventional renewables in the region is already very competitive and costs are falling fast.
Cheapest source of new bulk power generation on a LCOE basis for the LAC region, 2H 2019

Considering purely economic grounds it is difficult to justify investments for power generation using fossil fuels in some LAC economies.

Source: Adapted from BNEF. This map shows the technology with the lowest benchmark LCOE in each market, excluding subsidies/tax credits.
Hydropower key role in the transition

Major baseload to integrate renewables due to complementarity with solar and wind regimes

Existing integration of the power sector is a plus

Additional investments are required

National investment in T&D lines is crucial for the well-connected and flexible grid of the future

Source: CIER, 2019
Battery prices fall nearly 50% in 3 years, spurring more electrification

The cost of electric vehicles is rapidly decreasing, and new technologies are entering the market.

Source BNEF, 2019; and author’s estimates.
Public transport in LAC

- Highly urbanized cities
- High bus utilization rate per capita
- 99 BRT systems in operation in the region
- Age of bus fleets in Latin America is very diverse: in some cases reaching up to more than 20 years of operation.
- Some cities are achieving electric buses TCO parity with ICE buses
- Electricity use in transport has increased x15 between 2010 and 2018
INTERVENTION

SCENARIO
Zero carbon pathway by 2050: key assumptions

1. **100% of power demand met by renewables.**
   LCOEs below natural gas and coal.

2. **All currently operated fossil-fuel plants will be decommissioned.**
   Coal & oil by 2030, gas by 2040

3. **Gradual electrification of the transport sector.**
   All modes for cargo and passenger transport, except air travel are gradually electrified as LCOTs outcompete IC options.

4. **No new refineries commissioned.**
   By 2030, existing facilities decommissioned by 2050.
New demand is met through a combination on renewables reflecting projected relative competitiveness.

Projected demand by 2050

16.7 EJ

Investment: US$ 800 billion

Solar PV comprised of
- Distributed Solar PV
- Utility-scale solar

Source: Author’s estimates
Electrification of transport will reduce energy consumption with savings of 12 EJ/year by 2050

Source: author’s estimates
ECONOMIC RESULTS
OF A COUPLED TRANSITION

Energy security · Load balancing · Avoided cost of illness · Impact on refining operations · Value of capital assets in refining & power generation · Cost of services
Diversified renewable matrix will eliminate fossil fuel dependency, eliminate imports of oil/coal/gas and improve resilience to climate events.
Load balancing

Electrification of transport will add substantial demand for power; demand management could reduce net impacts through “valley filling” (estimated 10 GW regionally by 2050).
Avoided costs of illness

Electrification of transport in a fully renewable energy matrix will eliminate its contribution to airborne pollutants including PM, NOx, VOCs.

Avoided health costs by mid-century

Avoid the early deaths of 24,000 people (in 5 cities).

Source: WHO Standard for PM10: not to exceed 20 μg/m3 annual mean
In 2018:
- Installed capacity of 172 GW of thermal power plants.
- Installed refinery capacity of 7.7 BBPD (optimized for production of transport fuels)

Cost of stranded assets:
- US$ 80 billion (2018) power plants
- US$ 10.5 billion (2018) refineries

Projected LCOES for the power sector

LCOEs for wind already outcompete gas (and coal). Projections through GACMO indicate further competitive advantage for wind and solar.

Compound LCOE for the región
50% less than in a BAU scenario

US$ 283 billions (2018) less with respect to BAU scenario

Source: As projected under GCAM BAU outputs, August 2019
Projected LCOTs for the transport sector

LCOTs projection through GACMO indicates significant gains for all electric modes outcompeting internal combustion options

Source: As projected under GCAM BAU outputs, August 2019
Coupled decarbonization results in substantial economic benefits.

Annual savings linked to the coupled transition by 2050:
621 US$ billion

Accumulated capital savings for provision of power and transport services by 2050:
386 US$ billion

Value of stranded fossil fuel capital assets by 2050:
90 US$ billion
Coupled decarbonization generates jobs
Jobs (millions) generated by 2050
The power sector is undergoing a profound transformation towards *decarbonization*, *decentralization* and *digitalization*.
Examples of business models

Examples of business models accelerating the transition

**ENSA**

*Energy distribution company in Panama*

This company offers solar PV panels installation and monitoring while providing financing through the electric bill.

**Megapower**

*Private sector initiative in Barbados*

The company pioneered introduction of EVs through the roll out of a network of public charging stations powered by renewable energy.

**Charging infrastructure**

*Utilities, Automakers, oil & private companies*

Different players involved in the deployment of charging infrastructure in different countries. Examples: BMW in Mexico and Brazil, La Casa de las Baterías in Panama, YPF in Argentina and Terpel in Colombia, Enel & Engie in Chile.

**Distributed Solar Generation**

*Finance*

*Mexico*

Catalysing financing for Commercial & Industrial (C&I) end-users by structuring a solar-customised financial scheme (USD$60 million) via commercial banks.
A just transition

The transition must:

· Minimize disruption for workers and communities reliant on unsustainable industries and energy sources

· Address social and economic inequalities

· Focus on bringing everyone on the table

Equal participation, equitable distribution, recognition and equal capabilities, as well as social justice
**Summary of elements of a macro policy agenda**

A well-constructed enabling environment, with clear, consistent and robust policy frameworks, will be critical to attract investment flows towards a coupled transition.

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<tr>
<th>Goal</th>
<th>Policy</th>
<th>Instrument</th>
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<tbody>
<tr>
<td>Reduce losses in stranded assets</td>
<td>Discourage investment in fossil capital assets</td>
<td>Decarbonization policy Sunset provisions to encourage early retirement</td>
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<tr>
<td>Modernize grid</td>
<td>Encourage investments in modern transmission and distribution infrastructure</td>
<td>Clear regulations on demand management and storage Regional power exchange market</td>
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<td>Internalize health and climate costs of transport emissions</td>
<td>Enable allocation of costs</td>
<td>Fiscal measures to pass costs to emitters</td>
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<tr>
<td>Encourage level playing field for new technologies</td>
<td>Open competition with fossil fuels Removal of policy barriers</td>
<td>Eliminate subsidies and rents Adopt standards for charging stations</td>
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<tr>
<td>Encourage innovation</td>
<td>Promote R&amp;D in zero carbon technologies</td>
<td>Fiscal and regulatory measures to encourage investments in R&amp;D</td>
</tr>
<tr>
<td>EV deployment</td>
<td>Promote electric transport adoption</td>
<td>Standards, electric tariff incentives, non-fiscal incentives, EV targets</td>
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Examples of policies to support the transition
The decarbonization pathway towards 2050

**Carbon pricing**
*Mexico · Chile · Colombia*
Carbon pricing based on “a polluter pays principle” can generate funds to support the transition.

**Electric Buses**
*Business & Government alliance in Chile*
Procurement plan that included technical and business model innovations to keep the total cost of electric buses close to that of an internal combustion bus to enable purchase without using subsidies.

**Renewable Energy auctions**
*Colombia*
Will be incorporating 2250 MW to the electrical system - equivalent to an investment of US$ 2,000 million.

**Regulation updates for DG deployment**
*Brazil · Chile · Mexico*
Allow net metering for larger installation capacities to stimulate the deployment of rooftop PVs.
Thank you

Walter Vergara