OVERVIEW OF THE ENERGY SECTOR IN LATIN AMERICA AND THE CARIBBEAN

VICTORIO OXILIA DÁVALOS
EXECUTIVE SECRETARY

12TH WIND WORLD ENERGY CONFERENCE

4th, JUNE, 2013
La Habana, Cuba
OLADE was created on November the 2nd, 1973, with the signing of the Lima Agreement, the constituent instrument of the Organization, ratified by 27 countries in Latin America and the Caribbean and a Participant Country, Algeria.

MISSION: To contribute to the integration, sustainable development and energy security in the region, advising and promoting cooperation and coordination among its Member Countries.

VISION: OLADE is the political and technical-support organization by means of which its Member States undertake common efforts to achieve regional and sub-regional energy integration.
Overview of hydrocarbon sector in Latin America and the Caribbean

Mix of energy total supply, LA&C vs. the World

LA&C (5,909 Mboe)

- Natural gas: 28%
- Coal and coke: 4%
- Biomass: 14%
- Nuclear: 1%
- Hydroenergy: 9%
- Other renewables: 3%
- Crude oil and derivatives: 41%

World (91,564 Mboe)

- Natural gas: 22%
- Coal and coke: 27%
- Biomass: 10%
- Nuclear: 6%
- Hydroenergy: 2%
- Other renewables: 1%
- Crude oil and derivatives: 32%

Source: SIEE-OLADE, 2013, data of year 2011
HYDROCARBONS
Overview of energy sector in Latin America and the Caribbean

Global proven reserves (1P) of hydrocarbons

**Crude oil (1,651,547 Mbbl)**

- North America: 12%
- Middle East: 48%
- Latin America and the Caribbean: 20%
- Africa: 8%
- Europe: 1%
- Former Soviet Union: 8%

**Natural gas (208,470 Gm³)**

- North America: 5%
- Latin America and the Caribbean: 20%
- Middle East: 38%
- Africa: 7%
- Asia & Australasia: 8%
- Europe: 2%
- Former Soviet Union: 36%

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Proven reserves (1P) of hydrocarbons in LA&C

Crude oil (335,709 Mbbl)

- Venezuela: 89%
- Brazil: 4%
- Mexico: 3%
- Ecuador: 2%
- Others: 2%

Natural gas (7,968 Gm³)

- Venezuela: 69%
- Brazil: 6%
- Trinidad & Tobago: 5%
- Peru: 5%
- Mexico: 4%
- Argentina: 3%
- Bolivia: 2%
- Colombia: 1%
- Others: 1%

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Global production of hydrocarbons

Crude Oil (83.2 Mbbl/day)

- North America: 14%
- Middle East: 33%
- Former Soviet Union: 16%
- Europe: 5%
- Africa: 10%
- Latin America and the Caribbean: 12%
- Asia & Australasia: 10%

Natural gas (9,151 Mcm/day)

- North America: 24%
- Former Soviet Union: 23%
- Europe: 8%
- Asia & Australasia: 14%
- Africa: 6%
- Latin America and the Caribbean: 9%

Source: SIEE-OLADE, 2013, data of year 2011
Overview of hydrocarbon sector in Latin America and the Caribbean

Crude oil, production & reserves reach in LA&C

Source: SIEE-OLADE, 2013, data of year 2011
Natural gas, production & reserves reach in LA&C

Source: SIEE-OLADE, 2013, data of year 2011
Overview of hydrocarbon sector in Latin America and the Caribbean

Hydrocarbon net exporters in LA&C

Crude oil and derivatives - Group 1 (kbbl/day)

- Venezuela
- Mexico
- Colombia

Crude oil and derivatives - Group 2 (kbbl/day)

- Ecuador
- Brazil
- Trinidad & Tobago
- Argentina
- Others

Natural gas (Mcm/day)

- Trinidad & Tobago
- Bolivia
- Colombia
- Peru

Source: SIEE-OLADE, 2013, data of year 2011
ELECTRICITY
Overview of energy sector in Latin America and the Caribbean

The demand of electricity in the Region

Per capita electricity consumption (MWh/hab. Year)

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Global electricity production

Total global: 22,040 TWh

- Africa: 3%
- Latin America and The Caribbean: 7%
- Asia & Australasia: 40%
- Europe: 17%
- Former Soviet Union: 7%
- Middle East: 4%
- North America: 22%

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Hydropower, potential and installed capacity

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Hydropower, potential and installed capacity

<table>
<thead>
<tr>
<th></th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>25,156</td>
</tr>
<tr>
<td>Ecuador</td>
<td>25,150</td>
</tr>
<tr>
<td>Paraguay</td>
<td>12,516</td>
</tr>
<tr>
<td>Guyana</td>
<td>7,000</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>6,633</td>
</tr>
<tr>
<td>Guatemala</td>
<td>5,000</td>
</tr>
<tr>
<td>Honduras</td>
<td>5,000</td>
</tr>
</tbody>
</table>

24% 9% 70% 0% 25% 18% 11%

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Hydropower, potential and installed capacity

<table>
<thead>
<tr>
<th>Country</th>
<th>Potential MW</th>
<th>Installed Capacity MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panama</td>
<td>3,282</td>
<td></td>
</tr>
<tr>
<td>Suriname</td>
<td>2,420</td>
<td></td>
</tr>
<tr>
<td>El Salvador</td>
<td>2,165</td>
<td></td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>2,095</td>
<td></td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td>1,815</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1,843</td>
<td></td>
</tr>
</tbody>
</table>

Source: SIEE-OLADE, 2013, data of year 2011
## Overview of energy sector in Latin America and the Caribbean

### Wind and Geothermal, potential and installed capacity

#### Wind

<table>
<thead>
<tr>
<th>Country</th>
<th>Potential (MW)</th>
<th>Installed capacity (MW)</th>
<th>% Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>200,000</td>
<td>130</td>
<td>0.1%</td>
</tr>
<tr>
<td>Brazil</td>
<td>142,000</td>
<td>1,509</td>
<td>1.1%</td>
</tr>
<tr>
<td>Chile</td>
<td>40,000</td>
<td>205</td>
<td>0.5%</td>
</tr>
<tr>
<td>Colombia</td>
<td>18,000</td>
<td>20</td>
<td>0.1%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>800</td>
<td>129</td>
<td>16.1%</td>
</tr>
<tr>
<td>Cuba</td>
<td>14,000</td>
<td>11</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>884</td>
<td>20</td>
<td>2.3% *</td>
</tr>
<tr>
<td>Honduras</td>
<td>1,200</td>
<td>102</td>
<td>8.5%</td>
</tr>
<tr>
<td>Mexico</td>
<td>71,000</td>
<td>1,215</td>
<td>1.7% *</td>
</tr>
<tr>
<td>Peru</td>
<td>22,000</td>
<td>142</td>
<td>0.6%</td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>N.D</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td>3,000</td>
<td>52</td>
<td>1.7%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>45,000</td>
<td>30</td>
<td>0.1%</td>
</tr>
<tr>
<td>LA&amp;C</td>
<td>557,884</td>
<td>3,256</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

* Data updated to 2012

#### Geothermal

<table>
<thead>
<tr>
<th>Country</th>
<th>Potential (MW)</th>
<th>Installed capacity (MW)</th>
<th>% Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>2,010</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>2,490</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Brasil</td>
<td>115</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Chile</td>
<td>3,350</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Colombia</td>
<td>2,210</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2,900</td>
<td>166</td>
<td>5.7%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>1,700</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>2,210</td>
<td>204</td>
<td>9.2%</td>
</tr>
<tr>
<td>Grenada</td>
<td>1,110</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Guatemala</td>
<td>3,320</td>
<td>49</td>
<td>1.5%</td>
</tr>
<tr>
<td>Honduras</td>
<td>990</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Jamaica</td>
<td>100</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>México</td>
<td>40,000</td>
<td>958</td>
<td>2.4% *</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>3,340</td>
<td>88</td>
<td>2.6%</td>
</tr>
<tr>
<td>Panamá</td>
<td>450</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Perú</td>
<td>2,990</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>910</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>LA&amp;C</td>
<td>70,195</td>
<td>1,465</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

* Data updated to 2012

Source: GWEC, data of year 2011

Source: GEA, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Installed capacity by technology

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Installed capacity by technology

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Installed capacity by technology

Source: SIEE-OLADE, 2013, data of year 2011
Overview of energy sector in Latin America and the Caribbean

Power generation structure by source

Source: SIEE-OLADE, 2013, data of year 2011
BIOFUELS
Overview of hydrocarbon sector in Latin America and the Caribbean

Global biomass potential

Distribution of potential arable land and water availability for biomass production.
Overview of the hydrocarbon sector in Latin America and the Caribbean

Global production of biofuels

Mainly global producer of ethanol approximately 80,000 millions of liters
- United States: 55%
- Brazil: 33%
- China: 2%
- Other: 10%

Mainly global producer of biodiesel approximately 20,000 millions of liters
- United States: 14%
- Argentina: 13%
- Germany: 12%
- France: 12%
- Brazil: 10%
- Colombia: 3%
- Other: 36%

Source: CEPAL, 2011
SOME RENEWABLE ENERGY DEVELOPMENT PERSPECTIVES
## Overview of energy sector in Latin America and the Caribbean

### Major expansion prospect of the wind energy in LA&C

<table>
<thead>
<tr>
<th>Country</th>
<th>Expansion Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRAZIL</strong></td>
<td>The Decennial energy expansion plan for 2020 foresees for this year, 11,500 MW of wind power capacity. (Source: MME/EP).</td>
</tr>
<tr>
<td><strong>MEXICO</strong></td>
<td>According to the SENER's Renewable Energy Prospective, the wind power until 2025 will Increase by 11,278 MW. (Source: SENER).</td>
</tr>
<tr>
<td><strong>ARGENTINA</strong></td>
<td>The renewable energy program hopes to achieve 2,974 MW of wind power capacity by 2015. (Source: ENARSA).</td>
</tr>
<tr>
<td><strong>URUGUAY</strong></td>
<td>This country expects to reach 1,000 MW of wind power capacity by 2015 (Source: MIEM).</td>
</tr>
</tbody>
</table>
Overview of energy sector in Latin America and the Caribbean

Forecast of the generation mix by sources in LA&C

Year 2011, Total 1,432 TWh

- Hydroenergy: 50%
- Natural gas: 26%
- Crude oil & derivatives: 12%
- Coal & coke: 5%
- Nuclear: 2%
- Biomass: 1%
- Other renewable: 4%

Year 2030, Total 3,314 TWh

- Hydroenergy: 48%
- Natural gas: 33%
- Crude oil & derivatives: 6%
- Coal & coke: 4%
- Nuclear: 2%
- Biomass: 1%
- Other renewable: 6%

Forecast of the power installed capacity

<table>
<thead>
<tr>
<th>Technology</th>
<th>Year 2011 (MW)</th>
<th>Year 2030 (MW)</th>
<th>Total increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>151,601</td>
<td>257,839</td>
<td>70%</td>
</tr>
<tr>
<td>Thermal</td>
<td>114,932</td>
<td>203,223</td>
<td>77%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>1,438</td>
<td>7,070</td>
<td>392%</td>
</tr>
<tr>
<td>Wind</td>
<td>3,903</td>
<td>40,507</td>
<td>938%</td>
</tr>
<tr>
<td>Nuclear and other</td>
<td>4,390</td>
<td>9,307</td>
<td>112%</td>
</tr>
</tbody>
</table>

Source: Model of Simulation and Analysis of the Energy Mix – SAME, OLADE, 2013
Comparative of unitary investment costs of some renewable sources

<table>
<thead>
<tr>
<th>Source: own elaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar thermal</td>
</tr>
<tr>
<td>Biomass</td>
</tr>
<tr>
<td>Solar photovoltaic</td>
</tr>
<tr>
<td>Hydropower</td>
</tr>
<tr>
<td>Geothermal</td>
</tr>
<tr>
<td>Wind</td>
</tr>
</tbody>
</table>
Comparative of unitary generation costs with some renewable sources

Generation costs USD/MWh

- **Solar photovoltaic**: $250
- **Hydropower (1700 US$/MW)**: $93
- **Hydropower (2500 US$/MW)**: $104
- **Wind**: $126
- **Biomass**: $93

Source: own elaboration
Overview of the energy sector in Latin America and the Caribbean

Forecast of the energy total supply mix in LA&C

Year 2011 (5,909 Mboe)

- Natural gas: 28%
- Crude oil and derivatives: 41%
- Biomass: 14%
- Hydroenergy: 9%
- Coal and coke: 4%
- Nuclear: 1%
- Other renewables: 3%

Year 2030 (11,026 Mboe)

- Natural gas: 30%
- Crude oil and derivatives: 36%
- Biomass: 12%
- Hydroenergy: 11%
- Coal and coke: 6%
- Nuclear: 1%
- Other renewables: 4%

Source: Model of Simulation and Analysis of the Energy Mix – SAME, OLADE, 2012
CONCLUSIONS
Conclusions

1. The regional energy mix is at present, largely dependent on oil and will continue to be in a very long term. However, LA&C is the region with higher indicator of renewable energy participation in the energy mix (26%). Regarding the participation of RE in electricity generation the indicator in LA&C is even higher (more than 55%).

2. There is great potential for expansion of crude oil production given the relationship between the volume of proven reserves and current production rate.

3. The expansion of natural gas production may require increased reserves in the majority of the producing countries.

4. The greatest contribution of renewable energy sources to diversify the regional energy mix, will be possible thanks to the huge increase in wind power generation by 2030.

5. Since the Latin American and the Caribbean region has a significant surplus of energy resources both renewable and non-renewable, it is clear that strategies for sustainable development should be focused on integration and increasing the renewability of the energy mix.
<table>
<thead>
<tr>
<th>South America</th>
<th>Central America and Mexico</th>
<th>Caribbean</th>
<th>Participant Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Belize</td>
<td>Barbados</td>
<td>Algeria</td>
</tr>
<tr>
<td>Brazil</td>
<td>Costa Rica</td>
<td>Cuba</td>
<td></td>
</tr>
<tr>
<td>Bolivia</td>
<td>El Salvador</td>
<td>Grenada</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>Guatemala</td>
<td>Guyana</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>Honduras</td>
<td>Haiti</td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td>Nicaragua</td>
<td>Jamaica</td>
<td></td>
</tr>
<tr>
<td>Paraguay</td>
<td>Panama</td>
<td>Trinidad &amp; Tobago</td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>Mexico</td>
<td>Dominican Republic</td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td></td>
<td>Suriname</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>