
12 – 16 May 2014, Vienna, Austria

Nuclear Education, Training and Outreach in Latin America and the Caribbean Region

R. O. Barrachina, J. L. François and M. Sbaffoni
**Facts**

- **Area:** $21 \times 10^6 \text{ km}^2$
- **Population:** $600 \times 10^6$
- **GDP-nominal:** $5 \times 10^{12} \text{ USD}$

absence of cultural or idiomatic barriers.

Português + Español = *Portuñol*

economic, social and cultural inequalities

**GINI Coefficient**

Português + Español = *Portuñol*
Status & Trends

NUCLEAR MEDICINE

ATUCHA - ARGENTINA

EMBALSE - ARGENTINA

ANGRAS - BRAZIL

LAGUNA VERDE - MEXICO
Status & Trends

### RESEARCH REACTORS

<table>
<thead>
<tr>
<th>Country</th>
<th>Name</th>
<th>Reactor Type</th>
<th>Thermal Power (kW)</th>
<th>Thermal Flux (n/cm²/s)</th>
<th>Fast Flux (n/cm²/s)</th>
<th>Criticality Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>RA-0</td>
<td>TANK</td>
<td>0</td>
<td>1.00E+07</td>
<td>1.00E+07</td>
<td>01/01/1965</td>
</tr>
<tr>
<td>Argentina</td>
<td>RA-1 ENRICO FERMII REACTOR</td>
<td>TANK</td>
<td>40</td>
<td>1.50E+12</td>
<td>1.00E+12</td>
<td>20/01/1958</td>
</tr>
<tr>
<td>Argentina</td>
<td>RA-3</td>
<td>POOL</td>
<td>5000</td>
<td>4.80E+13</td>
<td>1.40E+14</td>
<td>01/08/1968</td>
</tr>
<tr>
<td>Argentina</td>
<td>RA-4 (EX. SUR-100)</td>
<td>HOMOG (S)</td>
<td>0</td>
<td>6.00E+07</td>
<td>01/03/1972</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>RA-6</td>
<td>POOL</td>
<td>500</td>
<td>1.10E+13</td>
<td>1.80E+12</td>
<td>23/09/1982</td>
</tr>
<tr>
<td>Argentina</td>
<td>RA-8</td>
<td>CRIT ASSEMBLY</td>
<td>0</td>
<td>1.00E+08</td>
<td>17/06/1997 Temp. Shut.</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>ARGONAUTA</td>
<td>ARGONAUTA</td>
<td>0</td>
<td>4.40E+09</td>
<td>8.90E+09</td>
<td>20/02/1965</td>
</tr>
<tr>
<td>Brazil</td>
<td>IAEA-R1</td>
<td>POOL</td>
<td>5000</td>
<td>4.60E+13</td>
<td>1.30E+14</td>
<td>16/09/1957</td>
</tr>
<tr>
<td>Brazil</td>
<td>IPEN/MB-01</td>
<td>CRIT ASSEMBLY</td>
<td>0</td>
<td>1.00E+09</td>
<td>6.00E+09</td>
<td>09/11/1988</td>
</tr>
<tr>
<td>Brazil</td>
<td>IPR-RI</td>
<td>TRIGA MARK I</td>
<td>100</td>
<td>4.30E+12</td>
<td>1.50E+12</td>
<td>06/11/1960</td>
</tr>
<tr>
<td>Chile</td>
<td>RECH-1</td>
<td>POOL</td>
<td>5000</td>
<td>7.00E+13</td>
<td>5.00E+13</td>
<td>13/10/1974</td>
</tr>
<tr>
<td>Chile</td>
<td>RECH-2</td>
<td>POOL</td>
<td>2000</td>
<td>1.00E+13</td>
<td>1.00E+13</td>
<td>06/09/1980 Temp. Shut.</td>
</tr>
<tr>
<td>Colombia</td>
<td>JAN-R1</td>
<td>POOL</td>
<td>100</td>
<td></td>
<td></td>
<td>20/01/1965</td>
</tr>
<tr>
<td>Jamaica</td>
<td>UWI CNS SLOWPOKE</td>
<td>SLOWPOKE</td>
<td>20</td>
<td>1.20E+12</td>
<td>1.00E+11</td>
<td>13/03/1984</td>
</tr>
<tr>
<td>Mexico</td>
<td>CHICAGO MODELO 9000</td>
<td>SUBCRIT</td>
<td>0</td>
<td>2.60E+04</td>
<td>9.40E+04</td>
<td>14/05/1969</td>
</tr>
<tr>
<td>Mexico</td>
<td>NUCLEAR CHICAGO MOD 2000</td>
<td>SUBCRIT</td>
<td>0</td>
<td>3.20E+04</td>
<td>1.20E+05</td>
<td>01/03/1969</td>
</tr>
<tr>
<td>Mexico</td>
<td>TRIGA MARK III</td>
<td>TRIGA MARK III</td>
<td>1000</td>
<td>3.30E+13</td>
<td>3.10E+13</td>
<td>08/11/1968</td>
</tr>
<tr>
<td>Peru</td>
<td>RP-0</td>
<td>CRIT ASSEMBLY</td>
<td>0</td>
<td>1.00E+07</td>
<td></td>
<td>30/07/1978</td>
</tr>
<tr>
<td>Peru</td>
<td>RP-10</td>
<td>POOL</td>
<td>10000</td>
<td>1.20E+14</td>
<td>1.00E+14</td>
<td>30/11/1988</td>
</tr>
</tbody>
</table>
Cooperation between academy and Industries

INVAP

INST BALSEIRO - ARGENTINA

Nuclear Education

UFRJ - BRAZIL

UAM – IZTAPALAPA - MEXICO

INST BALSEIRO - ARGENTINA

InSTEC - CUBA
Outbound Mobility

Mobile students from a given country as a percentage of tertiary students enrolled in that country (outbound mobility ratio), 2004

Coverage: 275 out of 195 countries.
Source: UNESCO Institute for Statistics, National Time Use.

Higher Education

High dropout 25% - 75%

Good Luck with your Engineering Studies
Outreach

- Lack of interest of high school students for technical disciplines.
- Inadequate dissemination of existing careers and job opportunities.
- Gap between the secondary and the higher levels.
Outreach

10,000 visitors / year from 600 cities

Post-Graduate Studies
The Academic Puzzle

Example: the “Master” certificate might have different names, different meanings and address different levels and capacities throughout the region.

Evaluation of academic institutions

CAPES (Coordenação de aperfeiçoamento de pessoal de nível superior).
Level 7: (internationally competitive)
Level 6: (excellent)
Level 5: (very good)
Level 4: (good)
Level 3: (acceptable)
LANENT

The Latin American Network for Education in Nuclear Technology (LANENT) was set up to contribute to preserving, promoting and sharing nuclear knowledge as well as fostering the transfer of nuclear knowledge in the Latin American region.

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Location</th>
<th>Dates</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultancy Meeting</td>
<td>Bariloche, Argentina</td>
<td>20-24 April 2009</td>
<td>2009</td>
</tr>
<tr>
<td>Consultancy Meeting</td>
<td>Vienna, Austria</td>
<td>1-3 September 2010</td>
<td>2010</td>
</tr>
<tr>
<td>Technical Meeting</td>
<td>Lima, Peru</td>
<td>6-8 December 2010</td>
<td>2010</td>
</tr>
</tbody>
</table>

General Assemblies

Lima, Peru, 6 – 8 December 2010
Santiago, Chile, 17 – 20 October 2011
Cuernavaca, Mexico, 5 – 9 May 2014
Members

ARGENTINA, BOLIVIA, BRASIL, CHILE, CUBA, ECUADOR, MÉXICO, NICARAGUA, PARAGUAY, PERÚ, URUGUAY, (ESPAÑA)
Networking

Networking Networks

- General Assembly ENEN
  - Madrid, March 2011
  - Saclay, March 2012
  - Vienna, March 2013

- IFNEC
  - Paris, April 2011

- IAEA
  - December 2011
  - November 2012
  - February 2013
  - June 2013

- AATN
  - Buenos Aires, Dec 2012

- ICENES
  - Madrid, March 2013

- A Common Action Plan was signed during the IAEA 57th General Conference (Sep 2013)
Activities

- WEB page, including an educative portal
- Courses and careers
- Educatve material
- Outreach
- Pedagogical Support
- Communication

WEB Page

- WEB page, including an educative portal

http://www.lanent-iaea.org/
In September 2012, Alexander Bychkov, general director of IAEA and Norma Boero, president of the National Atomic Energy Commission of Argentina (CNEA) signed Practical Arrangements, by which the CNEA will install and operate the IAEA Cyber Learning Platform and becomes the first hub for Latin America.

CONCLUSIONS

LANENT has been actively pursuing joint activities for networking educational institutions at a regional level, the creation of distance learning initiatives and the use of shared facilities. Let us hope that these initial endeavors in nuclear education and training would ultimately contribute to the common and cooperative development of a technology so essential for the present and the future of our region.
Regional Status and Trends

“The purpose of this report is to support the development of policies and strategies in nuclear education as part of the overall activities on nuclear knowledge management. This includes: key issues of nuclear education and national and regional needs and expectations; fostering strong regional or inter-regional nuclear education networks; promoting the harmonization of curricula in nuclear education and training programmes; addressing the use of nuclear facilities to enhance education, research, and to maintain capability; addressing national best practices in nuclear education; and analysing and sharing information to facilitate the further development of nuclear education.”

THANK YOU
GRACIAS
OBRIGADO
DEFINITIONS

• **GINI index**: A measurement of the income distribution of a country's residents. This number, which ranges between 0 and 1 and is based on residents' net income, helps define the gap between the rich and the poor, with 0 representing perfect equality and 1 representing perfect inequality.

• **GDP** is commonly used as an indicator of the economic health of a country, as well as to gauge a country's standard of living.

• **OECD** (Organization for Economic Co-operation and Development, global policy forum) is an international organization helping governments tackle the economic, social and governance challenges of a globalized economy.

DEFINITIONS

• **OUTBOUND MOBILITY**: Any form of international mobility that takes place within a student’s programme of study in higher education (HE). The length of absence ranges from a short trip to a full-duration programme of study such as a degree. In addition to study at a foreign institution, mobility can also involve a period in a workplace or other non-HE environments.
NPPs - Argentina

Operating Argentine nuclear power reactors

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Location</th>
<th>Model</th>
<th>Net MWe</th>
<th>First power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atucha 1</td>
<td>100 km NW of Buenos Aires</td>
<td>PHWR (Siemens)</td>
<td>335</td>
<td>1974</td>
</tr>
<tr>
<td>Embalse</td>
<td>Córdoba</td>
<td>PHWR (CANDU-6)</td>
<td>600</td>
<td>1983</td>
</tr>
<tr>
<td><strong>Total (2)</strong></td>
<td></td>
<td></td>
<td><strong>935 MWe</strong></td>
<td></td>
</tr>
</tbody>
</table>

NPPs - Brazil

Power generation

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Units operational</td>
<td>1 x 637 MW</td>
</tr>
<tr>
<td></td>
<td>1 x 1,350 MW</td>
</tr>
<tr>
<td>Units under const.</td>
<td>1 x 1,405 MW</td>
</tr>
<tr>
<td>Annual generation</td>
<td>12,983</td>
</tr>
</tbody>
</table>
## NPPs - Mexico

### Operating Mexican power reactors

<table>
<thead>
<tr>
<th>Reactors</th>
<th>Model</th>
<th>Net MWe</th>
<th>First power</th>
<th>Operating to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laguna Verde 1</td>
<td>BWR</td>
<td>800 approx</td>
<td>1989</td>
<td>2029</td>
</tr>
<tr>
<td>Laguna Verde 2</td>
<td>BWR</td>
<td>800 approx</td>
<td>1994</td>
<td>2034</td>
</tr>
<tr>
<td>Total (2)</td>
<td></td>
<td>1600 MWe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>