Energy for Underserved Populations

Meeting the basic needs of the poorest people in Latin America and the Caribbean

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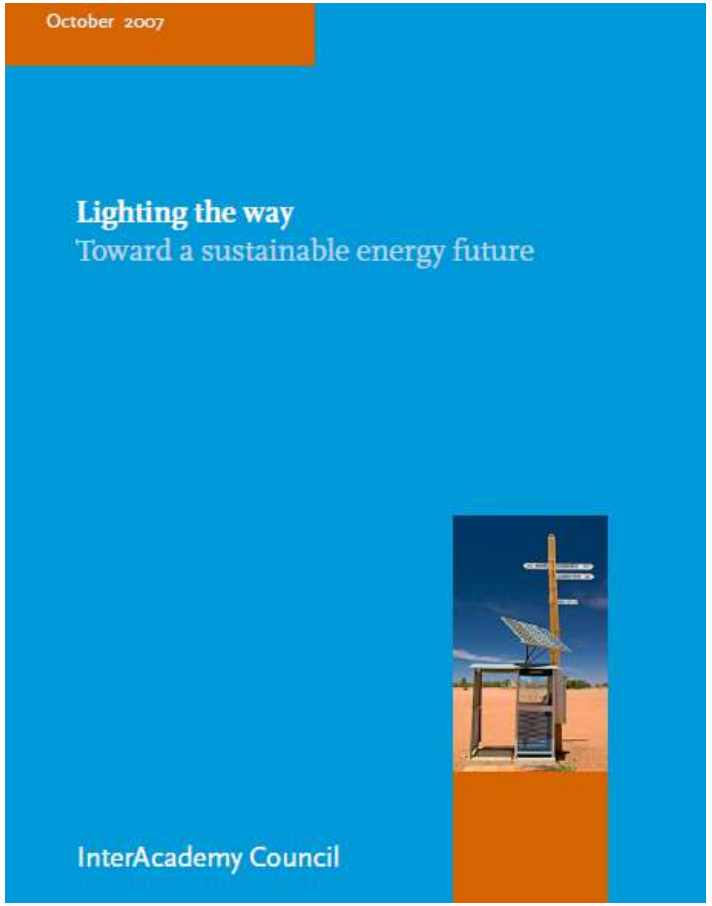
UNIVERSITY OF ARIZONA BIOSPHERE 2

Starting point for the IANAS Energy Program was a report of the Inter Academy Council, published 2007 and titled :
"Lighting the way towards a future with sustainable Energy"

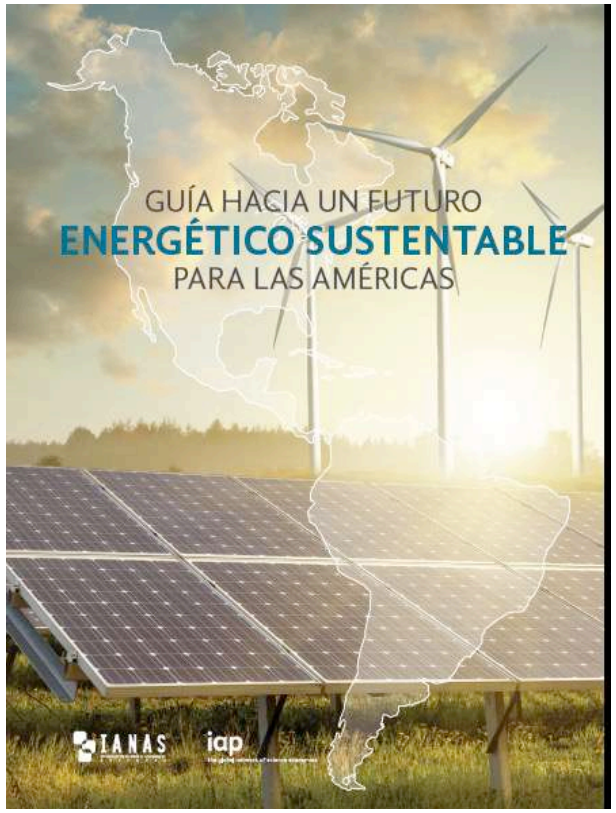


One of the main conclusions of this study was:
"Meeting the basic Energy needs of the poorest people on this planet is a moral and social imperative that can and must be pursued in concert with sustainable objectives".

Co - Chairs of the study panel of the book:
Steven Chu, United States ; José Goldemberg, Brazil

IANAS published in 2016, in Spanish and English, the book:

"GUIDE TOWARDS A SUSTAINABLE ENERGY FUTURE FOR THE AMERICAS"



Chapter 2: "Energy for Underserved Populations"

"Meeting the basic needs of the poorest people
in Latin America and the Caribbean"

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The chapter 2: "Energy for underserved populations: Meeting the Basic Energy Needs of the Poorest People in Latin America and the Caribbean (LAC)", was prepared by the Peruvian focal point of the IANAS Energy Program (*), with the subchapters

- **2.1 Energy and poverty**
- **2.2 Energy for cooking**
- **2.3 Energy for lighting**
- **2.4 Energy for heating**

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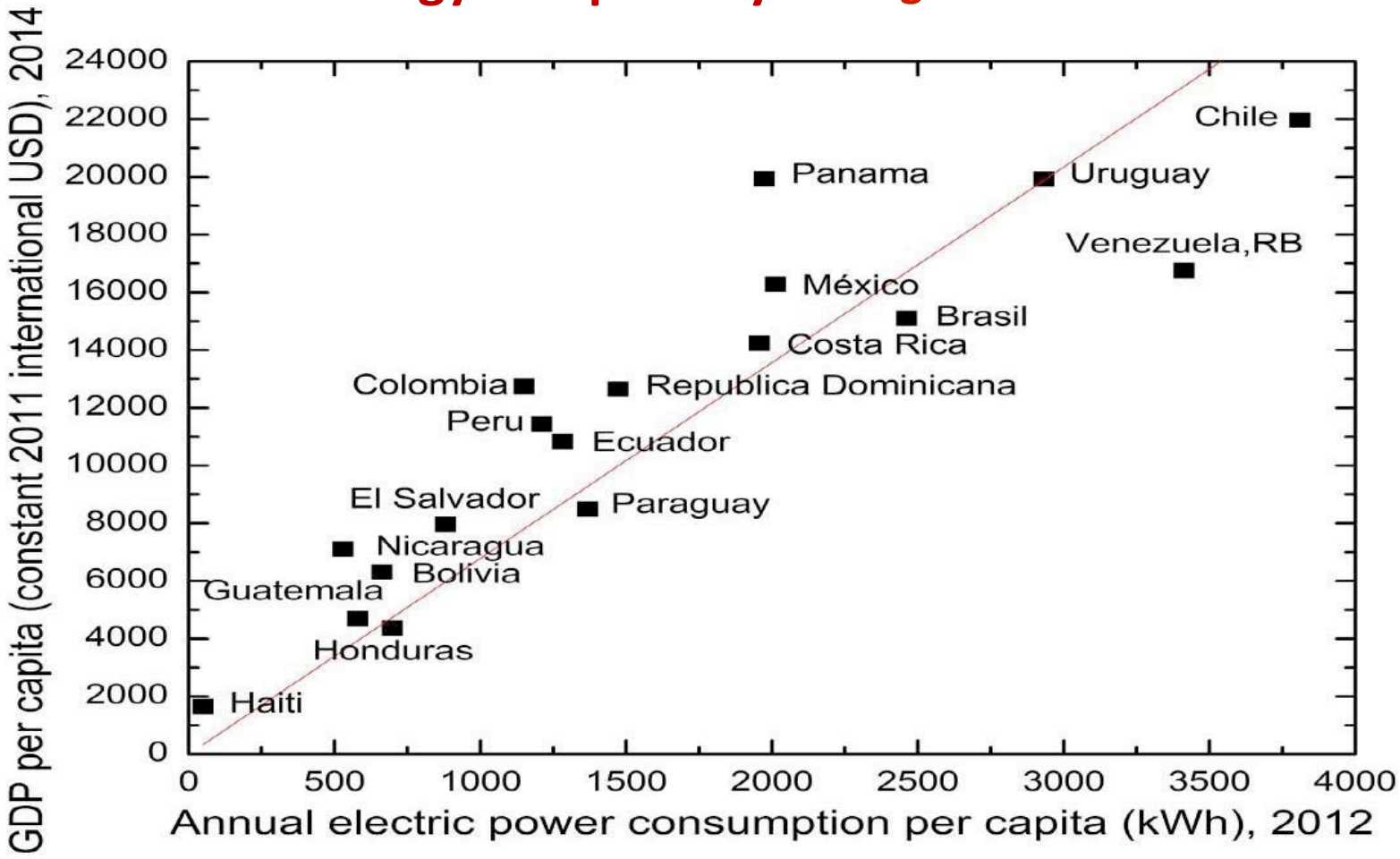
Box

Firewood Use in Latin America and its Effects on the health

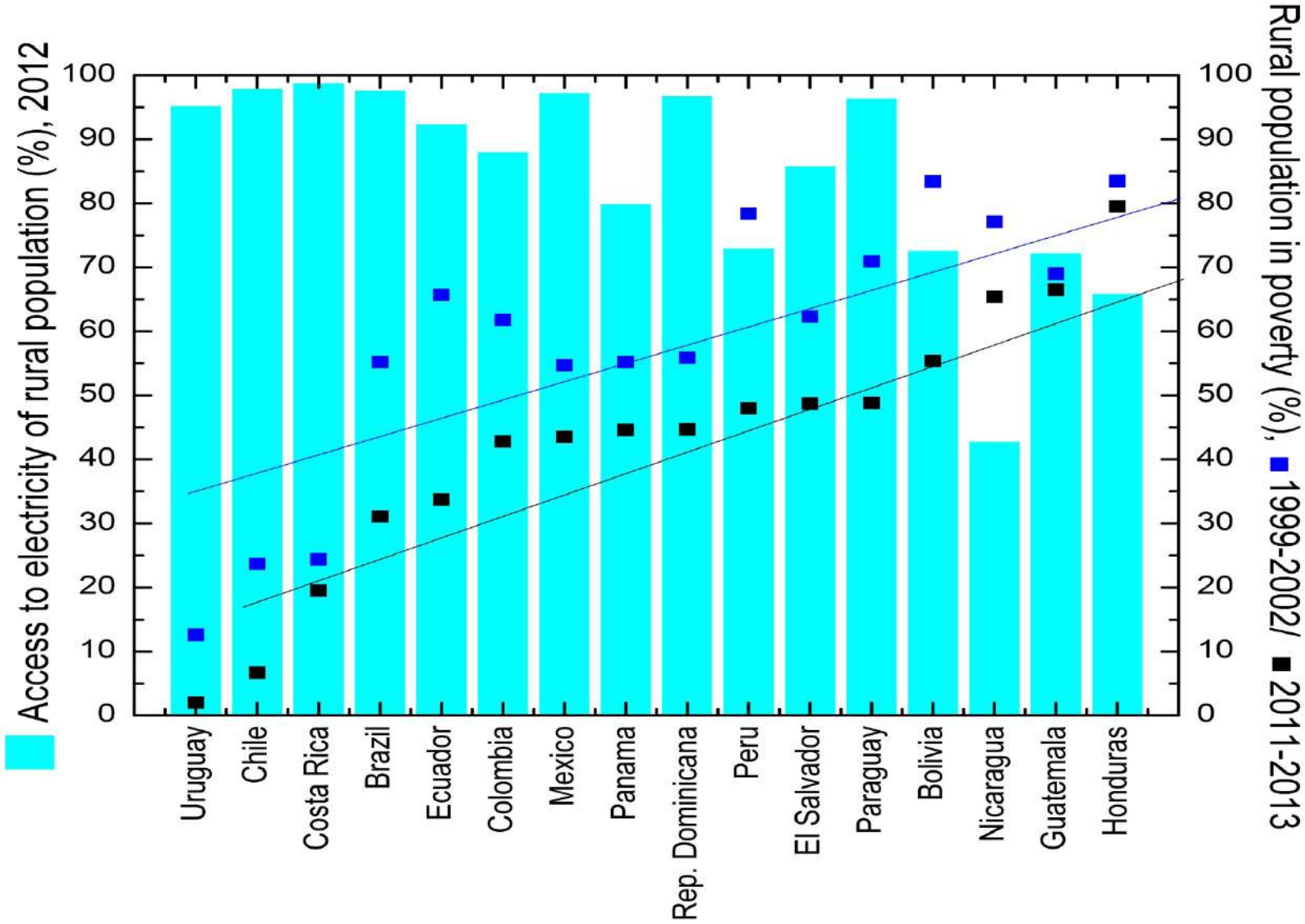
Gustavo Sequiera and Mario Jiménez | Nicaragua

The first part of the chapter shows the need for the poorest people in Latin America and the Caribbean to have Access to Energy. To this end, through statistical data obtained from the the World Bank and ECLAC, Energy consumption is linked to GDP and poverty, depending on whether the area is rural or urban. The chapter highlights aspects such as the fact that over 90% of the population have electricity in their homes, and in most countries, rural areas constitute the "underserved population", with 17 million lacking Access to electricity. The comparison of various countries shows how electricity consumption generally implies a proportional growth of the Gross Domestic Product (6.7 US$/kWh), yet has an inverse relationship with poverty. It also demonstrates that poverty has declined by an average of 10% between 1999/2002 and 2011/13.

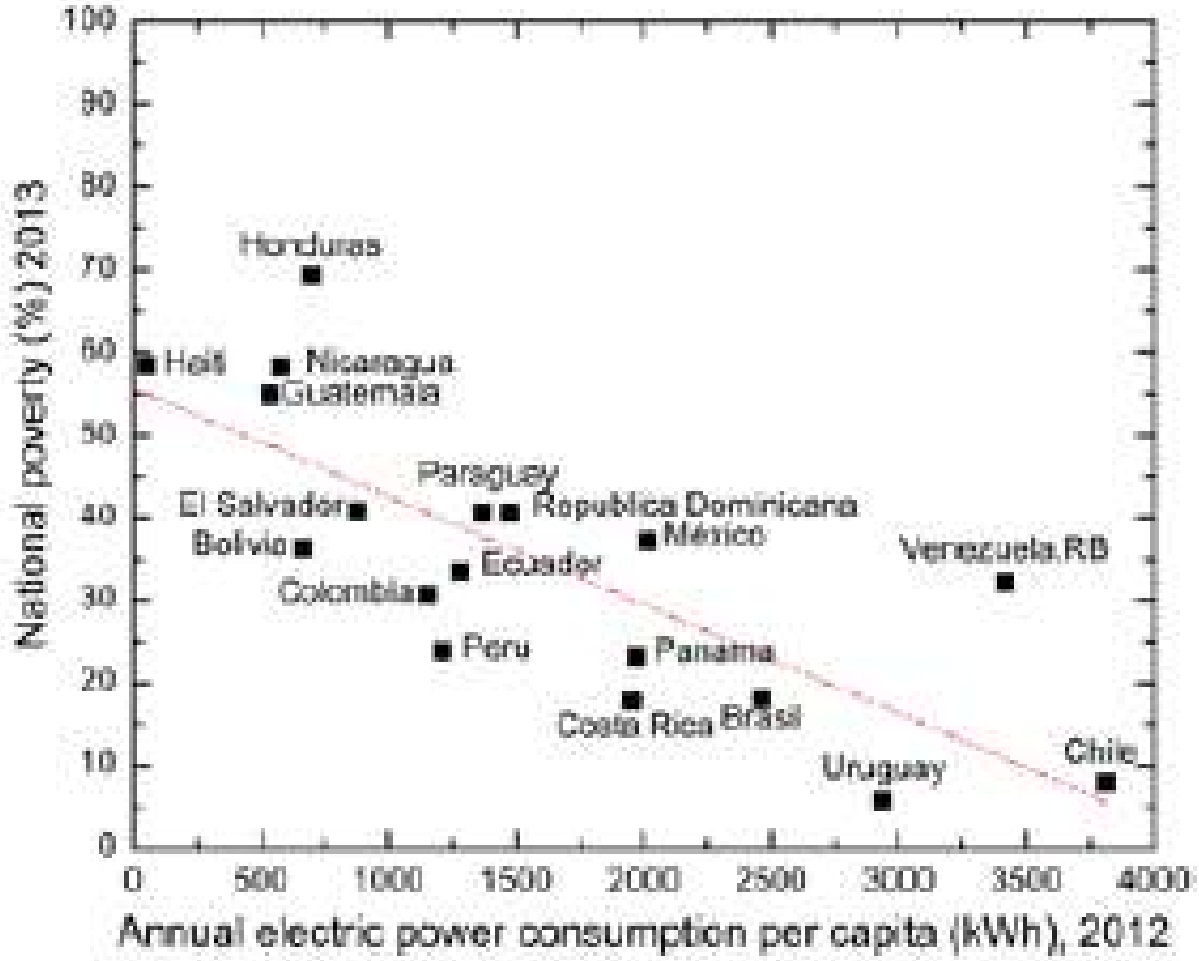
2.1. Energy and poverty - The general situation



Electricity consumption per capita for some LAC countries, in relation to the GDP per capita (data from WB and CEPAL)
Mean relation : 6.7 US$/ kWh



Access to electricity in 2012 and poverty in 1999-2002 (■) and 2011-2013 (■) , in rural areas (data from WB and CEPAL)



Poverty related to electricity consumption per capita for certain LAC countries. The points are the data and the line corresponds to their linear adjustment. Source: World Banc and ECLAC

2.2. Energy for cooking – The contamination of the air in the home

The most serious energy problem in rural areas:

In ALC, about 150 millions of persons (3000 millions in the world) use solid fuels for cooking, mostly wood or manure , burned in an open fire inside the house.

Beside serious ecological consequences, the toxic gases and solid particles produce deaths , specially of children below 5 years (4.3 millions in the world, WHO , 2014)

Photo EnDev, GIZ

Technical solution: Improved cook stoves

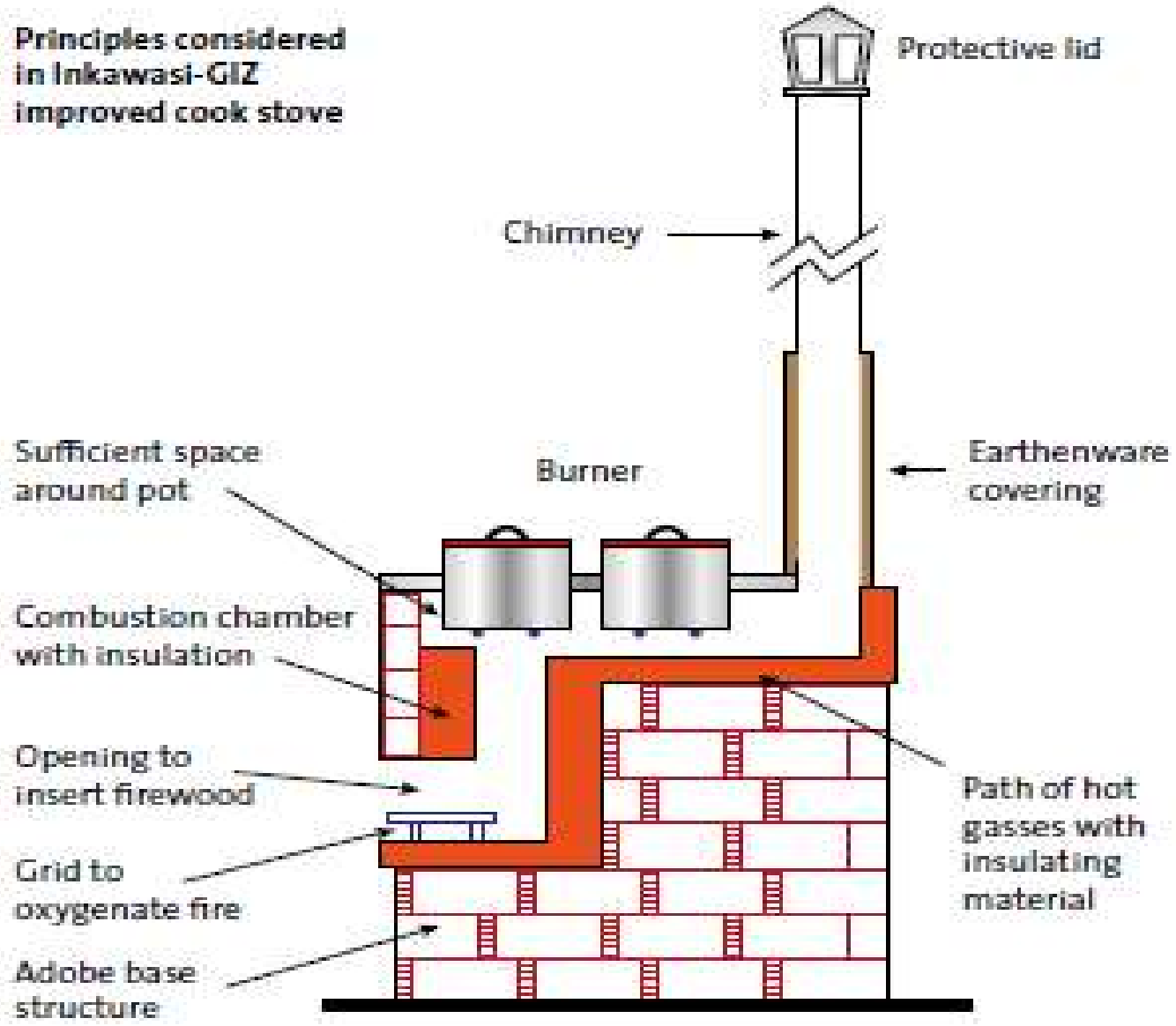
There exists a vast experience in many countries with improved cook stoves (see, for example, "Global Alliance for Clean Cook stoves").
In Peru, about 280000 improved cook stoves were installed during the last 10 years.

Photo: EnDEv, GIZ

However, these stoves still present diverse deficiencies, questioning even their sustainability in the long term. Therefore different alternatives are studied, like portable improved cook stoves, stoves with gasification of pellets of biomass, LPG stoves, solar cookers, etc.

In Peru, in 2015, the government distributed among poor rural people more then 400000 LPG stoves .

Figure 9. General diagram of improved Inkawasi cookstove (13)



2.3 Energy for lighting – The use of candles and oil lamps

Without electricity, people in rural areas have to use candles and oil lamps for lighting, that produce poor, expensive and unhealthy light .

Photo: EnDev, GIZ

For modern, healthy and sustainable lighting one needs electricity

Light for the poorest, with Pico PV

Rural grid connected households consume in Peru, on the average, 12 kWh/month, mainly for lighting, using incandescent light bulbs. The same luminous energy can be obtained with a modern Pico PV system (2 W LEDs, 5 Wp PV)

With the support of GIZ, CER-UNI tested in 2011 eleven different LED lamps in the laboratory.
GIZ made then a 8 month field test with the best lamps, followed by a laboratory evaluation of the used lamps. The main conclusions of these studies are indicated in the following slide *.

* The complete report is published in the proceedings of the 3rd Symposium "Small PV-Applications", Ulm, Germany, June17 -18, 2013

Advantages of Pico PV

The access to modern energy for illumination and communication can produce important local impacts on a social, economic and ambient level, without pretending the substitution of future electrification programs offering more possibilities.

Pico PV Systems are a technology capable to solve basic needs of illumination and communication at a low cost (about US$ 30 -135) and a fast impact on a social, economic and ambient level in families in rural areas, far away from electricity grids.

(photos: EndeV /GIZ).

Pico Photovoltaic lighting

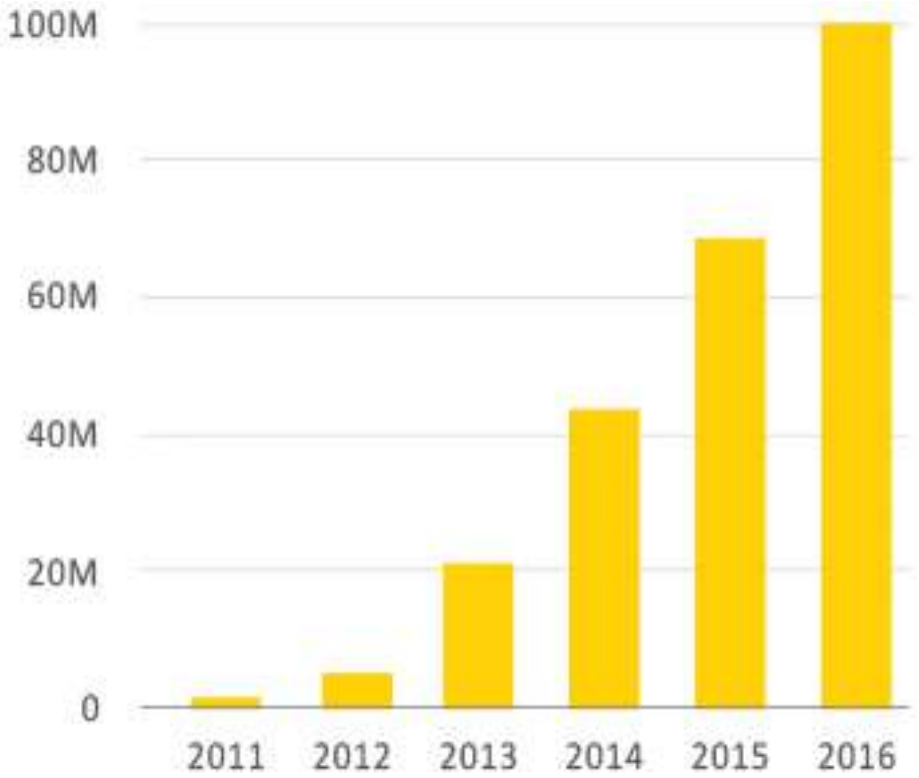


Fig.: Millions of people in the world, whose basic lighting needs are met by qualified solar lighting products
Source: www. lightingglobal.org

There exist now a great variety of qualified solar lighting products, type " plug and play", including with "Pay-As-You-Go"

Why use LED lamps?

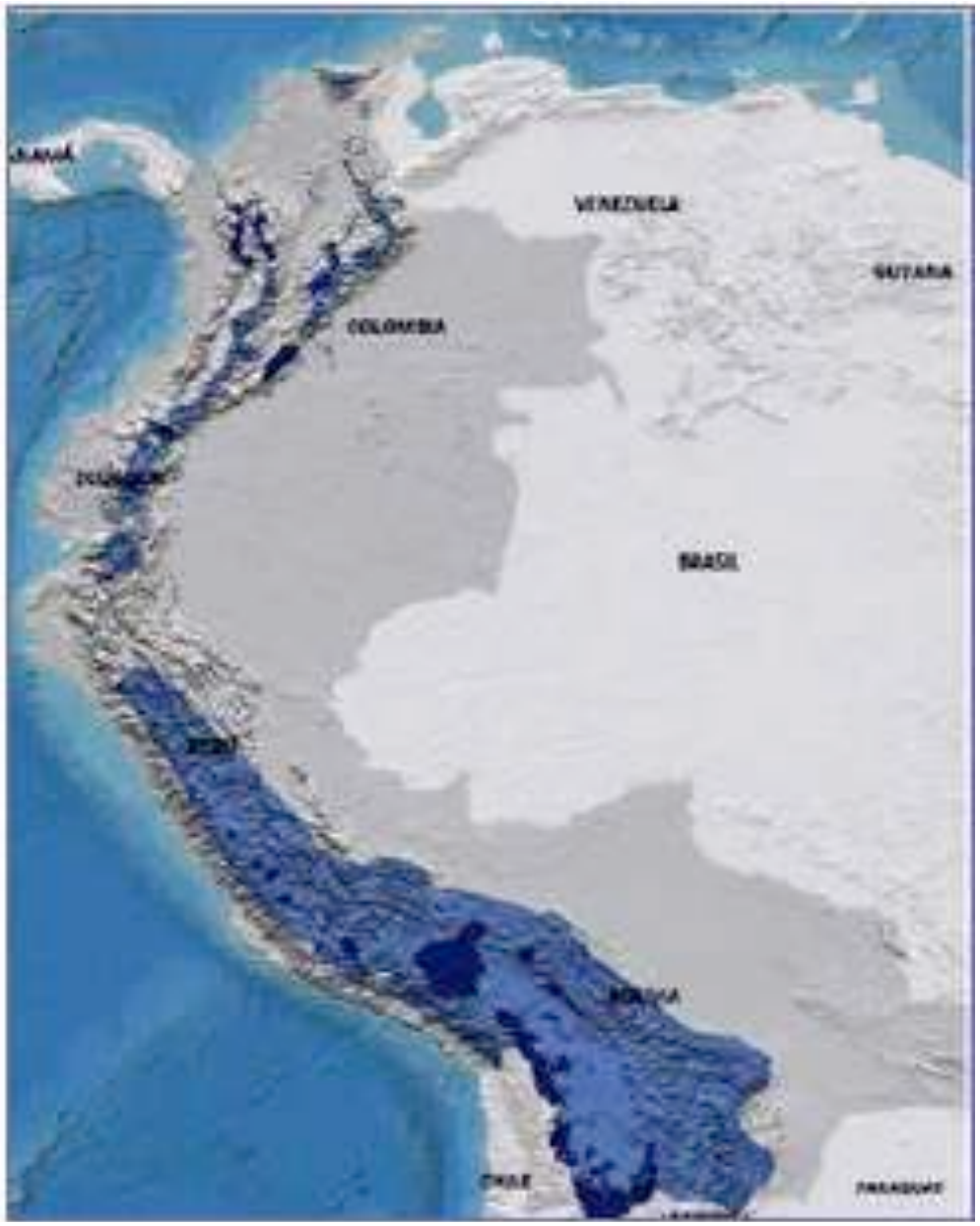
The efficacy of an electric lamp indicates the light intensity obtained (as seen with our eyes), measured in lumen (lm) for each Watt (W) of electrical power consumed: An incandescent lamp has an efficacy of 10 to 15 lm/W, a compact fluorescent lamp of 40 to 75 lm/W and a good LED, 100 – 150 lm/W. In other words, LEDs consume 10 times less electricity than incandescent lamps to produce the same light intensity. Moreover, a LED has a lifespan 10 – 50 times that of an incandescent lamp and is much more robust than the later or an CFL.

2.4 Energy for heating – Populations in cold climates

Despite to be located in the tropics, in the high altitude regions of the Andes exist freezing temperatures, specially in the period Abril – September. There live about 13 millions of people in rural areas above 3000 m, in houses without heating or thermal isolation, resulting that the inside and outside temperatures are similar, down till – 20 °C.

Source: "Confort térmico en viviendas Altoandinas, 2010; in www.care.org.pe

As a result, every year die young children and old people, as well as animals, often the only resource for these people, like the case of alpacas, providing meat, wool and manure (used for cooking).



Map of frosts in America, showing a wide area of frost located in the highlands of Bolivia and Peru, with the greatest frequency in the Collao Plateau

Technical solution

The high solar radiation (5 – 7 kWh/m^2 day) in this region is ideal for implementing solar heating, mainly passive.
However, some of the technics appropriate in higher latitudes, like Trombe walls, can not be used, since the sun is always very high in the sky.

Direct gain with transparent parts of the roof and annexed solar green houses are the best solution, in addition to good thermal isolation.

There exists now a notable experience in Peru in this field.

Solar houses in Peru
Source: CER –Uni, Lima

Solar radiant floor heating in school in Imata (Arequipa, Peru), at 4500 m altitude and temperatures till – 20 °C

Forced water circulations through solar collectors and floor of living room (with heat exchanger)

Conclusions

There exist a variety of technologies to satisfy the energy needs in rural areas for cooking, lighting and heating. But to implement these technologies in a massive and sustainable way, one needs:

- To disseminate the knowledge of these technologies with educational programs that permit that the future users know their advantages and participate in the following appropriation.
- To establish a technical and commercial network to supply spare parts and services to introduce and maintain these technologies.
- To promote the establishment of institutions that certificate and normalize the technologies.
- To develop a system of micro financing, considering that the implementation of these technologies represents mainly an initial cost.