



Bioenergy Use Patterns in Mexico

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Road Map

- Socio-economic issues Rural Mexico
- Bioenergy Use Patterns in Mexico
 - Energy Issues
 - Environmental Issues -- “fuelwood hot spots”
- Bioenergy potential in Mexico
 - Resource potential
 - Current Experience with specific technologies
- Bioenergy and sustainable rural development
- Conclusions

Socio-economic Issues

Mexican Rural Sector

- Rural population of 25 million people, distributed in aprox. 150,000 settlements
 - Currently in a deep crisis
 - About 40% of total rural inhabitants in extreme poverty
 - High migration rates to the United States
 - Forestry sector
 - 95% of total harvesting from native forests
 - 80% of forests socially owned by communities and ejidos
 - Agriculture
 - Crisis with NAFTA
 - Sugar production in crisis due to fructose imports from US
- There is an urgent need to reactivate the local-regional economies through local income generation activities and local employment

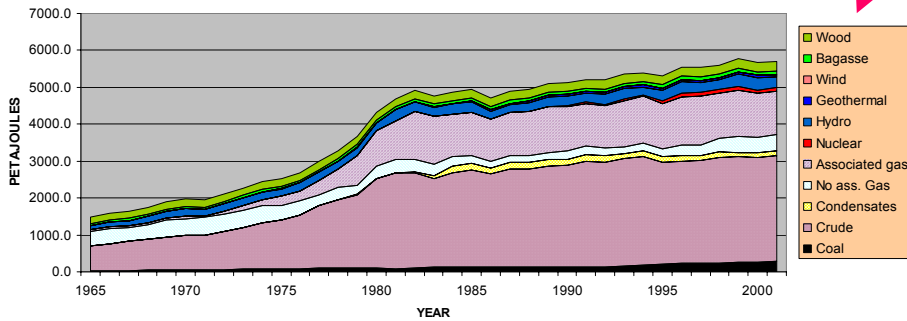
Bioenergy



Energy Issues

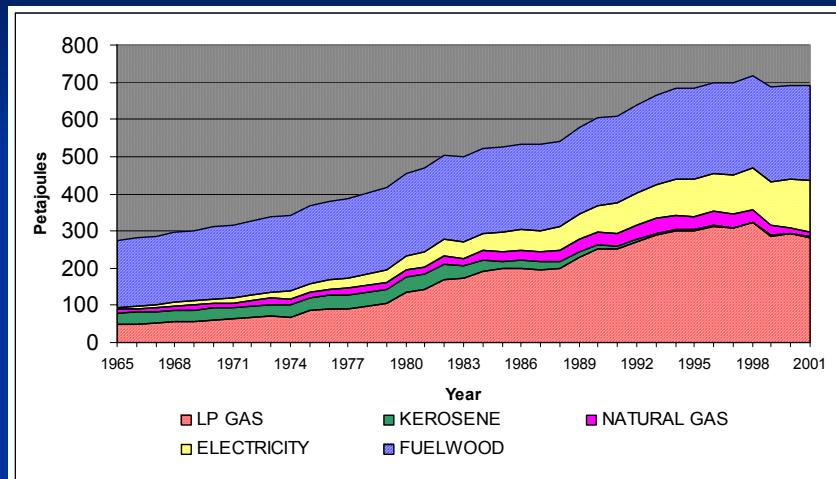
Bioenergy Use in Mexico

EVOLUTION OF GROSS PRIMARY ENERGY SUPPLY IN MEXICO 1965-2001



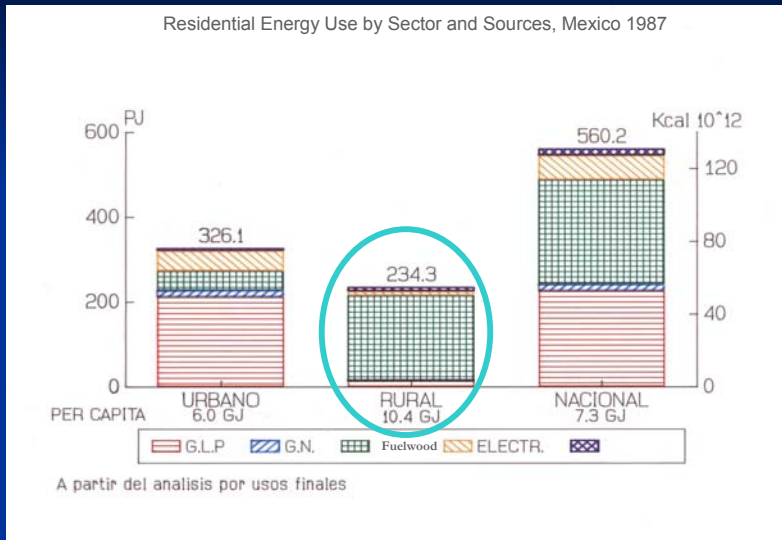
Bioenergy is 5%- 8% of total primary energy use in Mexico (455 out of 5,690 PJ/yr)

Fuelwood Use in Mexico



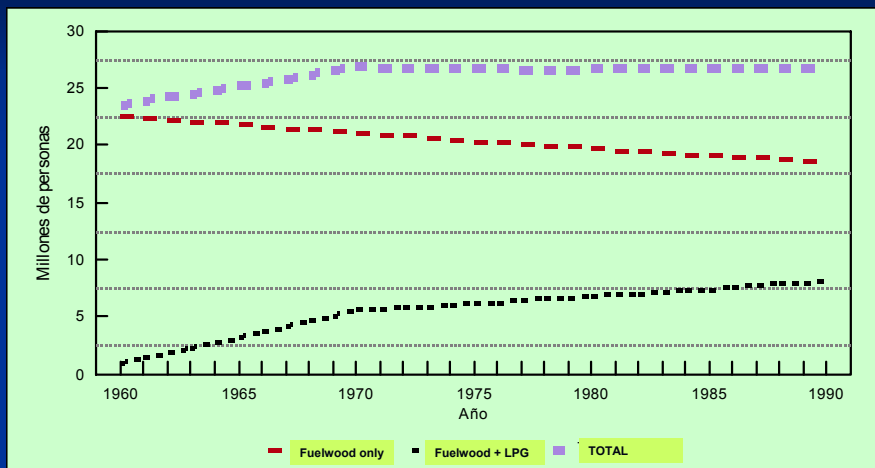
Fuelwood is half of total residential energy use in Mexico (320 PJ/yr)

The use of fuelwood is concentrated in the rural sector and peri-urban areas



Source: Masera, Friedmann and De Buen, 1991

Historic Evolution of Fuelwood Users México 1960-1990



The total number of fuelwood users keeps constant

Source: Díaz, 2000

End Uses of Biofuels (1990s)

Sector/End Use	Energy Use PJ/yr
Residential Uses	
Cooking	300
Water Heating	35
Space Heating	??
Small Industries	
Charcoal Production	10-20
Other (pottery making, brick making..)	20-30
Other Industrial	
Bagasse	90
TOTAL	455-475

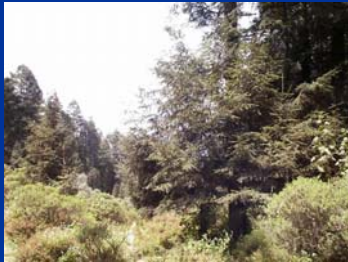
Source: Masera, 1996; Riegelhaupt, 1997; BNE, 2001



Bioenergy



Resource Issues



Biomass Resource Issues

- Current patterns of biomass resource use
 - Fuelwood is mostly renewable, it contributes to degradation in specific regions
 - Large potential for a more efficient use of fuelwood in households and industries;
 - Large potential for the use of residues both in forests and agriculture;
- Very good conditions for the establishment of forest, agriculture and agroforestry plantations
 - Rainfed agriculture lands are being abandoned
 - Closed native forests cover 50 million ha., additionally 22 million ha of former forest lands are degraded
 - 600,000 ha (40 million ton/yr) for sugar cane plantations, 63 sugar mills (57 million ha within the agriculture sector)
- Large potential for biogas production from landfills and animal manure

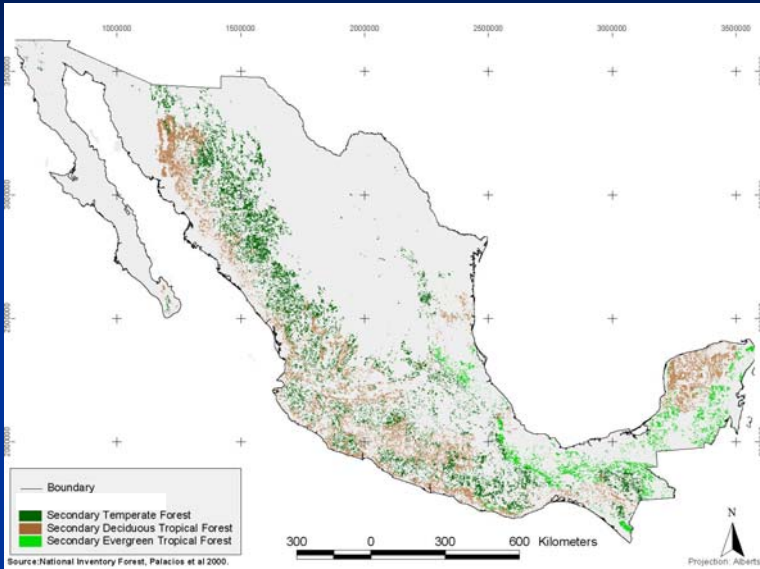
Vegetation Map, Mexico 2000



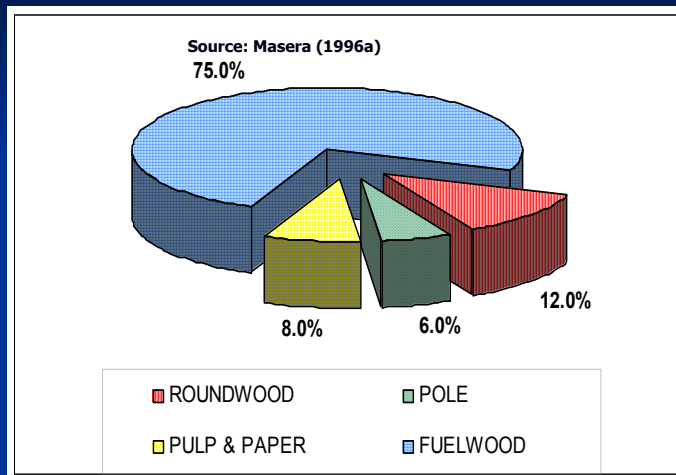
Area by Land Use Class Mexico 2000

LAND USE CLASS	AREA (HECTARES)
Agriculture/Pasture	55,711,048
Urban areas	1,248,011
Lakes	1,104,246
Mangroves	886,690
Scrubland	55,821,548
Other vegetation	16,533,813
Primary temperate forest	20,595,061
Secondary temperate forest	12,310,332
Primary deciduous tropical forest	9,709,208
Secondary deciduous tropical forest	11,134,597
Primary evergreen tropical forest	6,764,626
Secondary evergreen tropical forest	3,189,543
TOTAL	195,008,722

Degraded Forest Lands, Mexico 2000

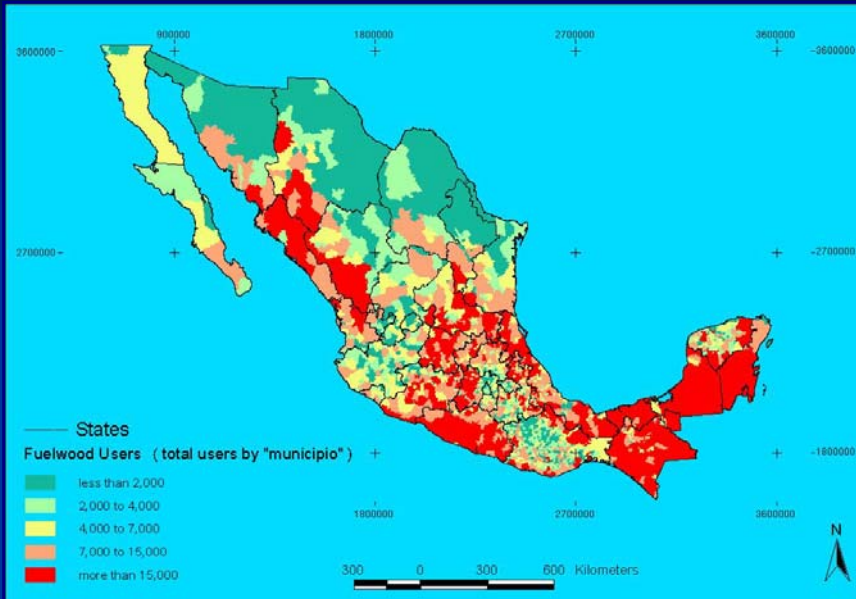


Fuelwood Use in Mexico

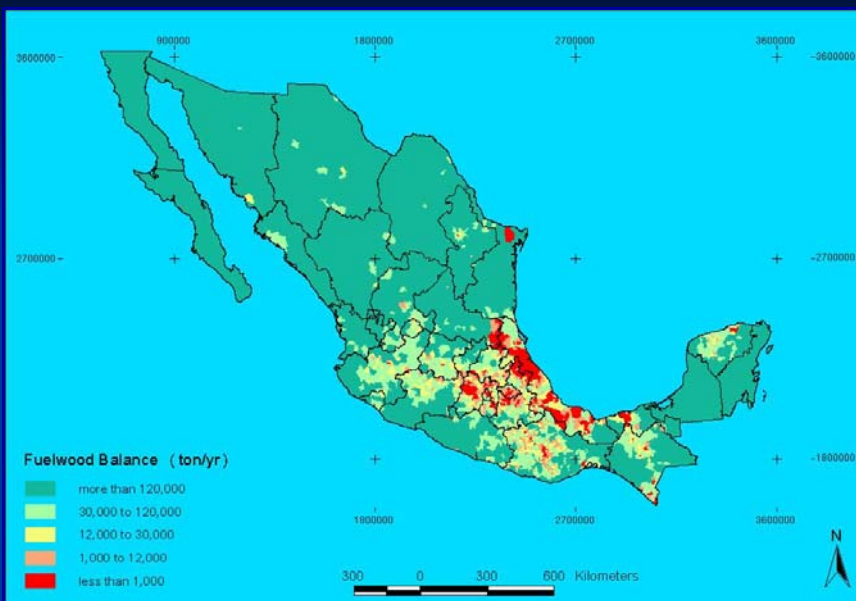


Fuelwood accounts for 75% of total wood use in Mexico,
37 million m³/yr

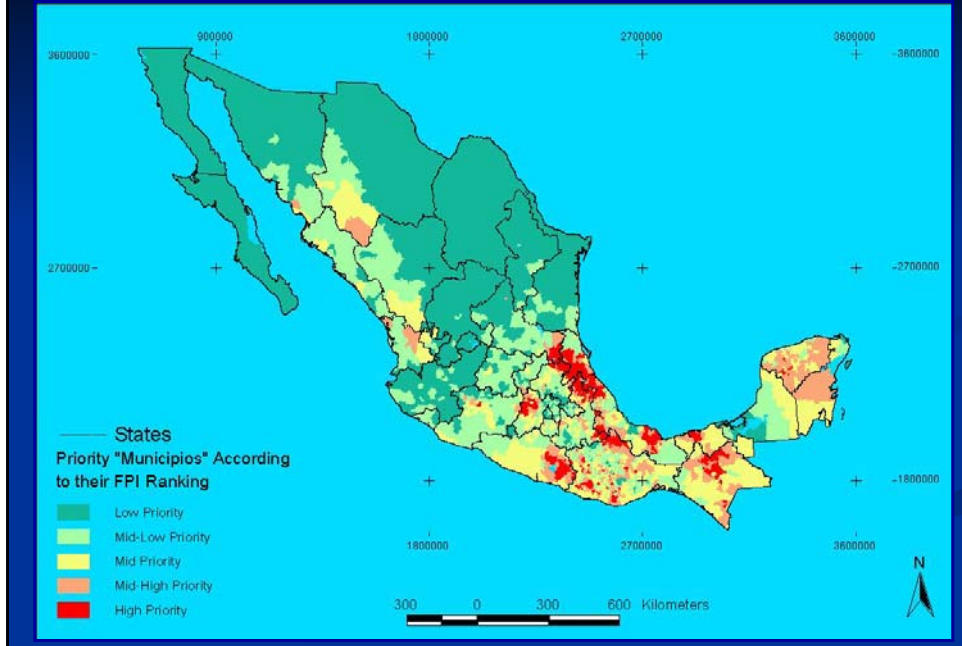
Total number of fuelwood users



Woodfuel Balance Index by Municipality



Priority Municipalities for Fuelwood Sustainability



Bioenergy Potential and Experience with Improved Technology in Mexico

Technical Potential Bioenergy

Biofuel	Potential (PJ/yr)
Fuelwood from native forests	432
Forest Residues	64
Energy Plantations	211
Bagasse and sugar cane residues	133-304 (70)
Agricultural Wastes	?-605
Animal Wastes	?-920
Total	~840-2200

Source: Aguillón, 1999; Arvizu, 2003

Improved Bioenergy Technologies in Mexico

Technology	Issues
Efficient Cookstoves	More than 15,000 efficient stoves disseminated. Experience in Michoacan, Chiapas, Veracruz and other states.
Small Industries	Efficient kilns for pottery production, bakeries, brick-making
Charcoal Production	Experience with Improved Charcoal Kilns, Sustainable (Certified) Charcoal production systems from native forests in Durango

Improved Bioenergy Technologies in Mexico

- Biogas for Electricity Production in Landfills, 2 projects, 11 MW installed capacity, and potential generation of 54 GWh.
- Hibrid Systems bagasse-fuel oil, 22 permits, 201 MW installed capacity and potential generation of 350 GWh
- Costs range from -630 to 1,170 USD/KW or 4 to 6 US cts/KWh. (BNE, 2003)

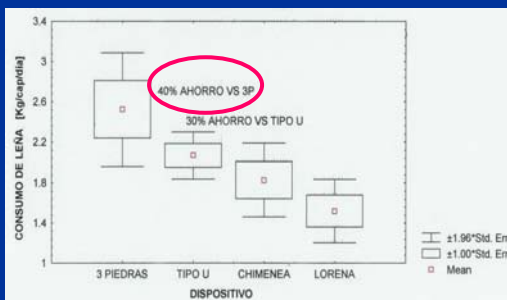
Searching for Alternatives: Bioenergy for sustainable rural development

Key Issues

- Need of a participative, systemic, interdisciplinary approach that accounts for technical, environmental and socio-economic issues
- Need to consider the variety of needs ranging from small scale applications to large industrial devices, from process heat and mechanical power, to electricity
- Energy not an end in itself but a means to solve essential needs
- Use innovative schemes for technology development and dissemination
- Find synergies: production of clean energy by eliminating residues, cleaning water, generating local jobs
- Profit from global environmental benefits, such as **climate change mitigation**

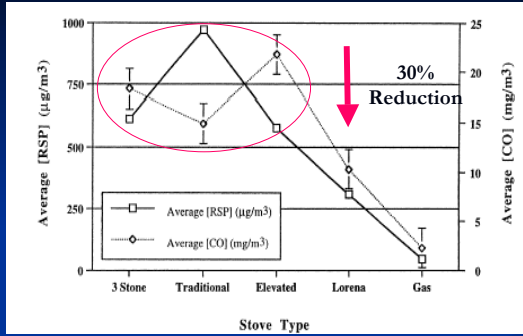


Participative approach
to technology development
and dissemination



Efficient Cookstoves
Savings in Fuelwood
Consumption and
IAP

Pollutant concentrations at the location of household cook



Saatkamp *et al.*, 2000.

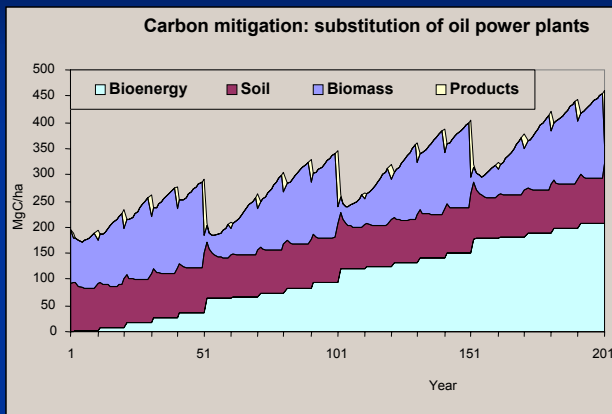


Open fire



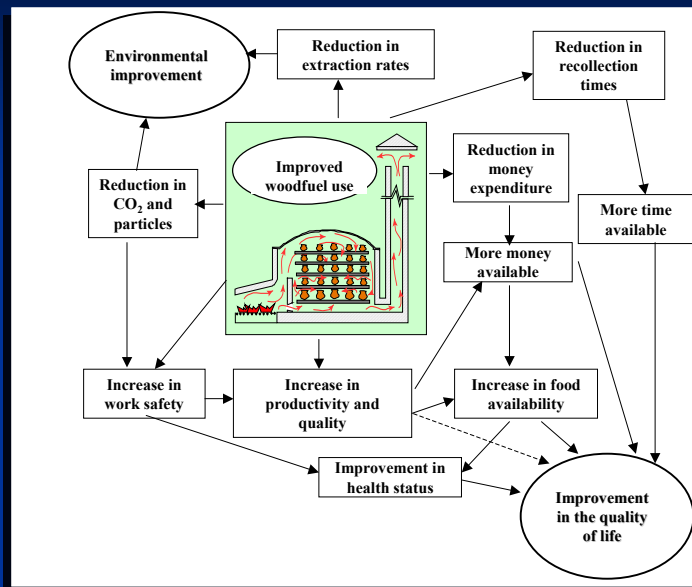
Efficient Cookstove

Mitigation of Greenhouse Gas Emissions



Simulation of the Carbon Benefits Obtained by Substituting an Oil-fired Power Plant with a Bioenergy Power Plant using the CO2fix V.3 Model, Martínez and Masera, 2003

MULTIPLE BENEFITS FROM THE EFFICIENT USE OF BIOFUELS



Conclusions

- Bioenergy resources are an important component of the current pattern of energy use in Mexico, particularly within the rural areas
 - The current technologies are inefficient, substantial improvement may be achieved with strategic interventions
 - The environmental impacts are location specific and can be overcome by identification of **PRIORITY AREAS** and the establishment of multi-purpose energy plantations
- Biofuels have a large potential in Mexico, coupled with other renewable energy sources and energy efficiency, they can bridge the gap to a sustainable energy system.
 - Can help activate the rural economy by creating local income and job opportunities
 - Can accommodate the diversity of needs: domestic, small-industries to large industrial complexes. Can produce heat, power and liquid fuels
- Definite actions are needed
 - Proper identification and quantification of bioenergy resources
 - Promising technologies and approaches, international cooperation
 - Information exchange on on-going and demonstration projects
 - Support to R&D
- Urgent! Better coordinate and pull together existing efforts → **Creation of a Mexican bioenergy network**

Thanks !