

# Future participation of Bioenergy in the Mexican energy mix for power generation

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# METHODOLOGY

- ENERGY SCENARIO BUILDING FOR MEXICO 2025
- PLANT MODELLING
  - ENERGY CONSUMPTION
  - CO<sub>2</sub> EMISSIONS
- ECONOMIC ANALYSIS
  - MITIGATION COST



# ELECTRIC ENERGY SCENARIO BUILDING FOR MEXICO 2025

- GENERAL HYPOTHESIS
  - GDP 4% AAGR
  - Population 1.21% 130 million in 2025
  - Energy Demand 4%
  - Electricity Demand 4%
  - Installed Capacity 3.4%
  - Peak Demand 0.1%
  - End Use Demand Structure FIXED

## BIOENERGY RESOURCES ASSUMPTIONS

ENERGY CROP	BAGASSE	FIREWOOD (SALIX)
AREA [hA]	580,000 (1986)	342,945
PRODUCTION [Mton]	35.7 (1986)	3.4
CROP YIELD [ton/hA]	61.6	10
ENERGY YIELD* [kWh/ton]	430	4,500
TECHNOLOGY	Gasification + Gas turbine	IGCC; EFF=47%; PF=60%
GENERATED ELECTRICITY [GWh]	15,351	15,432
MAXIMUM INSTALLED CAPACITY	3,400	DEPENDING ON AREA
<b>INSTALLED CAPACITY [MW]</b>	<b>1,529</b>	<b>1,380</b>
*SOURCES	Navia, J. et al. ANES proc., p 304 (1987)	Gustavsson, L. And Borjesson, P. En. Pol. 26(9), p 699 (1998)

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## Energy technologies mix including new renewables

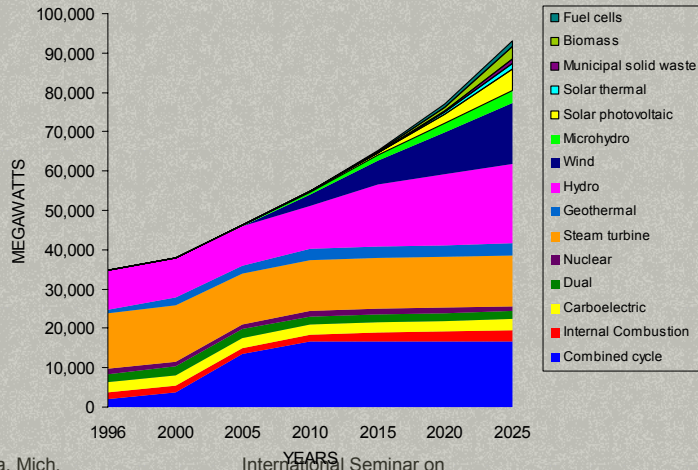
SCENARIOS	BASE YEAR		TREND		OFFICIAL TRANSITION	
	1996	2025	1996	2025	2025	2025
	%	%	%	%	%	%
<b>POWER PLANTS</b>						
NON RENEWABLES	69%	87%	87%	87%	41%	
RENEWABLES	31%	13%	13%	13%	59%	
<b>TOTAL BIOMASS (BAGASSE+ FIREWOOD)</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>3.1%</b>	
<u>NON RENEWABLES</u>						
COMBINED CYCLE - NG	5.6%	2.1%	61.3%	16.1%		
STEAM TURBINE - OIL	41.1%	74.6%	15.4%	15.4%		
INTERNAL COMBUSTION - OIL	4.8%	4.2%	4.2%	2.9%		
COAL	7.5%	2.8%	2.8%	2.8%		
FUEL OIL AND DIESEL FIRED	6.0%	2.3%	2.3%	2.3%		
NUCLEAR	3.8%	1.4%	1.4%	1.4%		
<u>RENEWABLES</u>						
HYDROELECTRIC	28.8%	11.5%	11.5%	23.5%		
GEO THERMAL	2.2%	1.0%	1.0%	4.7%		
WIND	0.0%	0.1%	0.1%	13.8%		
SOLAR PHOTOVOLTAICS	0.03%	0.01%	0.01%	5.9%		
MICRO-HYDRO	0.12%	0.05%	0.05%	3.2%		
<b>BAGASSE</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>1.7%</b>		
<b>FIREWOOD</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>1.5%</b>		
FUEL CELLS	0.0%	0.0%	0.0%	1.7%		
MUNICIPAL SOLID WASTE	0.0%	0.0%	0.0%	1.5%		
SOLAR THERMAL-ELECTRIC	0.0%	0.0%	0.0%	1.4%		
TOTAL GENERATING CAPACITY %	100.0%	100.0%	100.0%	100.0%		
TOTAL GENERATING CAPACITY, MW	24733	92499	92499	92499		

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## Mexican installed power capacity profile in a Transition scenario



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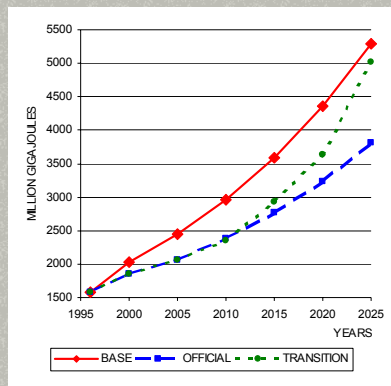
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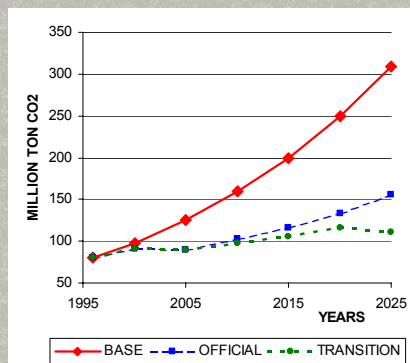


## RESULTS (1)

### ENERGY CONSUMPTION



### CO<sub>2</sub> EMISSIONS



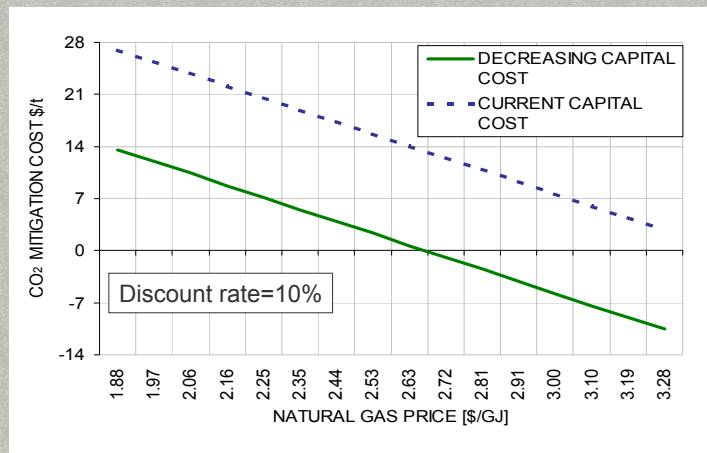
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## RESULTS (2)

CARBON DIOXIDE MITIGATION COST



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## CONCLUSIONS

- In order to have ~1400 MW of firewood fuelled power plants by 2025, Mexico would need to have to start planting ~n•350,000 hA of trees (n=years to maturity)
- Transition is the only scenario in which it is possible to have both long-term economic growth and dropping level of CO<sub>2</sub> emissions. And it is a no-regrets investment scenario at NG prices of 2.67\$US1997/GJ or greater.
- Transition scenario is also the only one that can offer the possibility to have a sustainable Mexican Electric System in the future (59% Renewables, (3% Bioenergy)), according to OLADE criteria.

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