Effect of the energy and climate policies in the future Mexican electricity system

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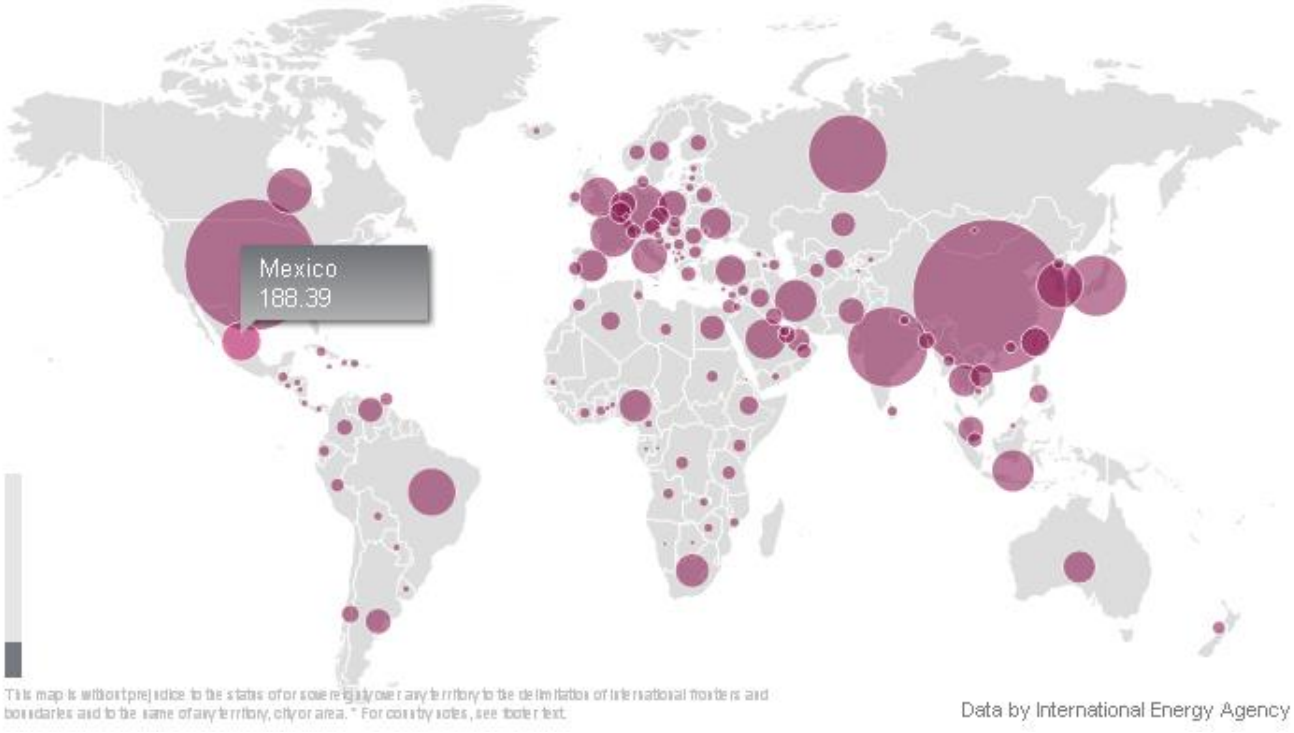
Content

Introduction
Methodology
Long term scenarios
Results
Conclusions

Introduction

In 2012, Mexico with around 117 million inhabitants and a GDP of 1,028 billon 2005 USD$, produced 1.6% of the global primary energy, the main source being hydrocarbons

Total Primary Energy Supply (Mtoe)



http://energyatlas.iea.org/

Total CO_2 emissions amounted to 435.79 Mt

Introduction

Mexico in the World (IEA Key World Statistics 2014):

- 10th in crude oil exports, but…4th in oil products imports

Fossil fuels (BP Statistical Review of World Energy June 2013):

Natural gas 2012 (ktoe)

Production	52,600
Consumption	75,300
Imports (79% from USA)	20,776

Crude oil 2012 (ktoe/day)

Production	408
Consumption	290
Exports	191

Coal 2012 (ktoe)

Production	6,600
Consumption	8,800
Imports	2,200

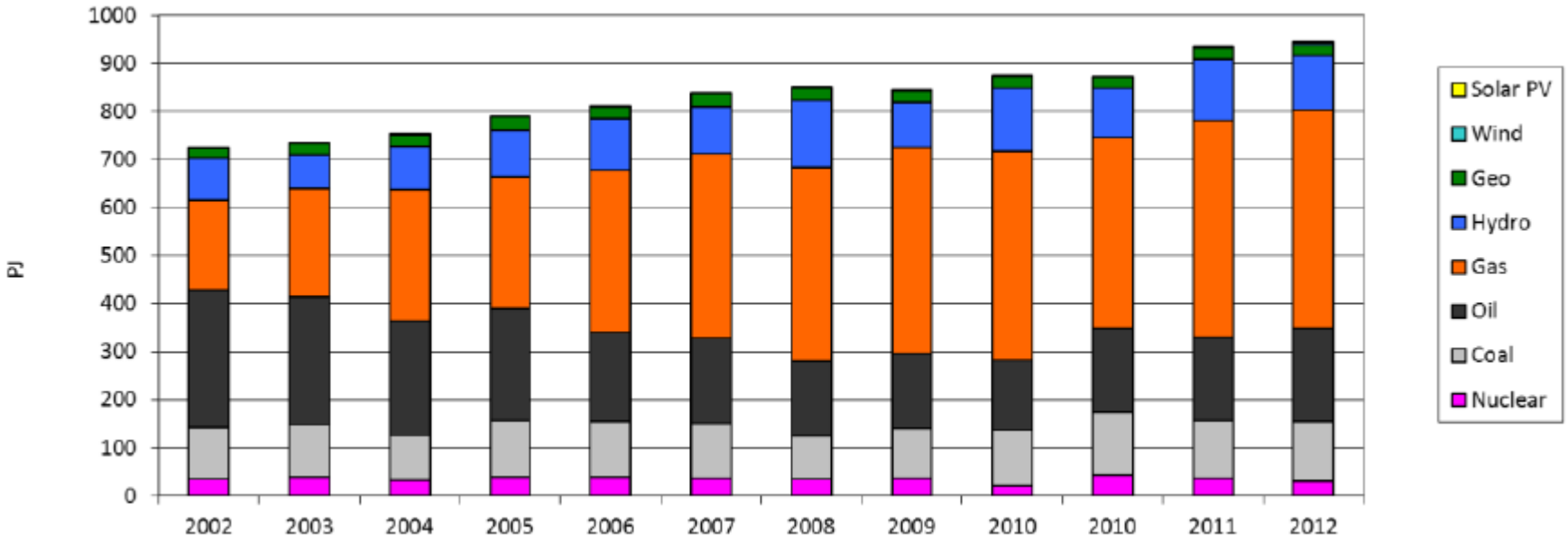
Resources (ktoe)	Gas	Crude oil	Coal
Proved	371,000	1,596,000	844

Renewable (SENER):

Resources (PJ)	Geothermal	Small Hydro	Wind	Solar	Biomass
Possible	58.19	-	315.36	23,400	41.35
Probable	344.05	6.50	34.55	-	1.41
Proved	3.21	4.91	35.24	1.95	2.08

Introduction

Evolution of the public electricity system in Mexico in the period 2002-2012



Source: SENER

The Mexican electricity system is moving from oil to natural gas

In 2012, 48% of the electricity came from gas, 34% from other fossil resources, 15% from renewable resources, and 3% from nuclear

Introduction

Energy and Climate Change national targets

Law for the Renewable Energies Exploit and Energy Transition Financing (2012)	Maximum generation with fossil fuels 65% by 2024 60% by 2035 50% by 2050
General Law of Climate Change (2012)	Minimum generation with clean energies (Renewable + Nuclear + CCS) 35% by 2024 Creation of a system to support renewables …
National Strategy of Climate Change (2013) (Estrategia Nacional de Cambio Climático- ENCC)	I. Climate objectives GHG emissions reduction compared to 2000 levels -30% by 2020 -50% by 2050 II. Electricity objectives Share of clean technologies in electricity generation 35% by 2024 40% by 2034 50% by 2054

Methodology

EFDA TIMES Model (ETM)

Built in the framework of EUROfusion (former European Fusion Development Agreement), within the Socio-Economic Studies project, SES (former Socio Economic Research of Fusion). First version was produced in 2004, last version in 2012

ETM uses the TIMES model generator developed by IEA-ETSAP (IEA Energy Technology Systems Analysis Programme Implementing Agreement)

The EFDA Times Model is a

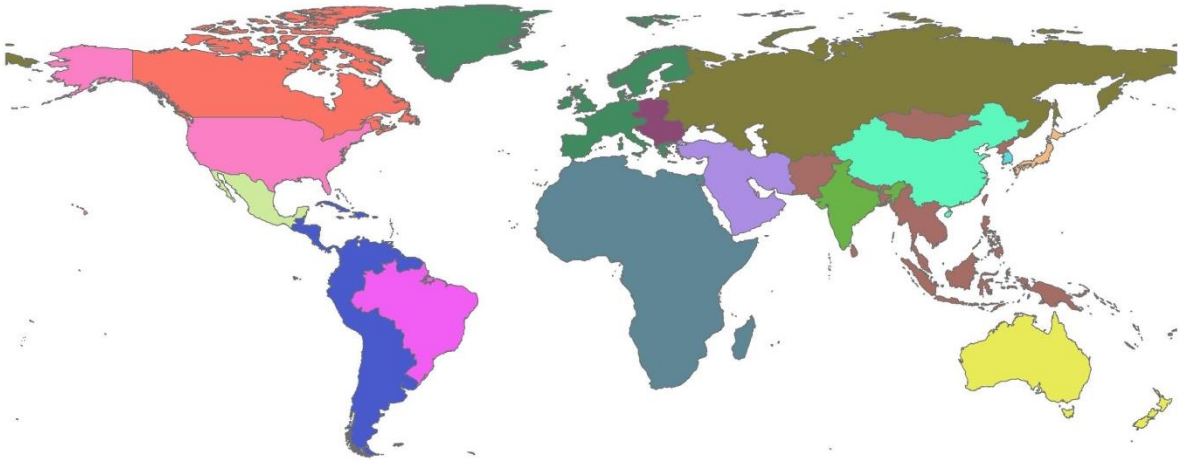
✓ Multi-regional, global, and long-term energy model of economic equilibrium, covering the entire energy system from mining to final consumption

✓ Optimization model which aims at providing the optimum energy system composition in terms of social wealth and sustainability at the minimum cost

✓Bottom-up, technology rich model with thousand of technologies well defined by technical, economic and environmental data

Methodology

Main characteristics



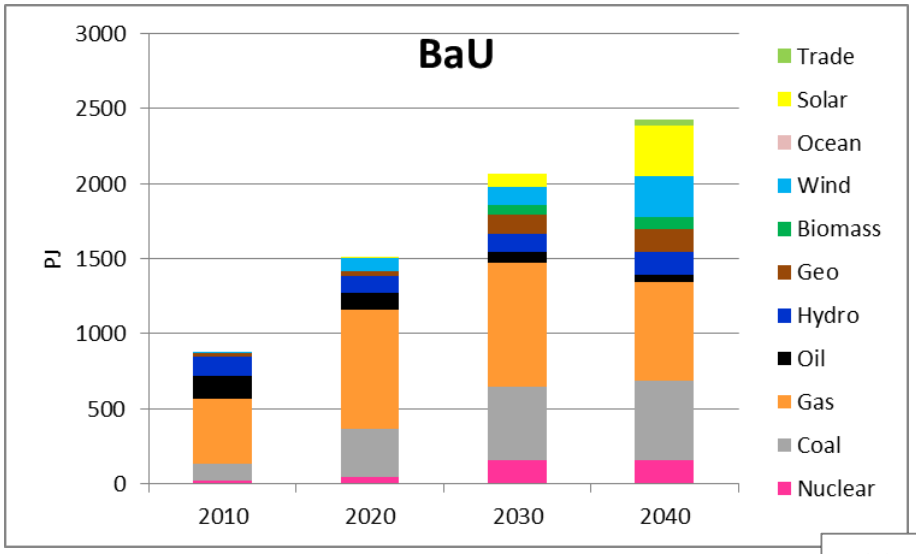
- 17 world regions: Africa, Australia-New Zealand, Brazil, Central Asia and Caucasus, Canada, China, Europe, India, Japan, Middle East, Mexico, Other Developing Asia, Other Eastern Europe, Other Latin America, Russia, South Korea, and United States
- Time horizon: 2100
- Six time slices: three seasons (winter, summer and intermediate), and day/night
- Demand sectors: residential, commercial, agriculture, industry and transportation
- Supply sectors: electricity and heat production, and upstream
- Demand scenarios: energy demand driver projections from the general equilibrium models GEM-E3 and Gtap
- Trade: inter-regional exchange process (trade of commodities) among the different regions
- Renewables suitable areas, potentials and AFs estimated using GIS
- Some new technologies recently introduced such as CSP with storage or advanced nuclear with fuel reprocessing

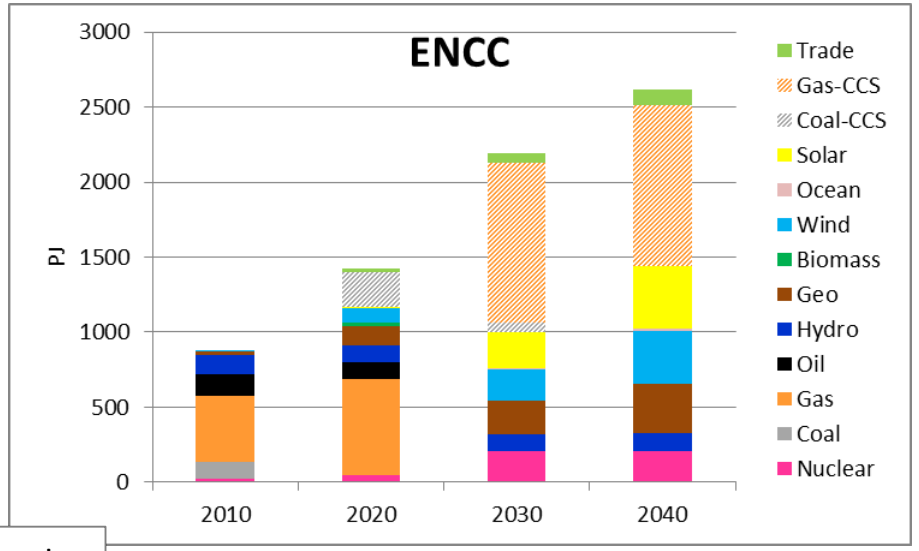
Long term scenarios

Scenario	Assumptions
Business as Usual (BaU)	No energy or climate policies
National Strategy of Climate Change (ENCC)	I. Climate objectives 442,859 kt CO_2 total by 2020 (-30% compared to 2000 levels) 210,880 kt CO_2 total by 2050 (-50% compared to 2000 levels) II. Electricity objectives 35% share clean energies in electricity generation by 2024 40% share clean energies in electricity generation by 2034 50% share clean energies in electricity generation by 2054

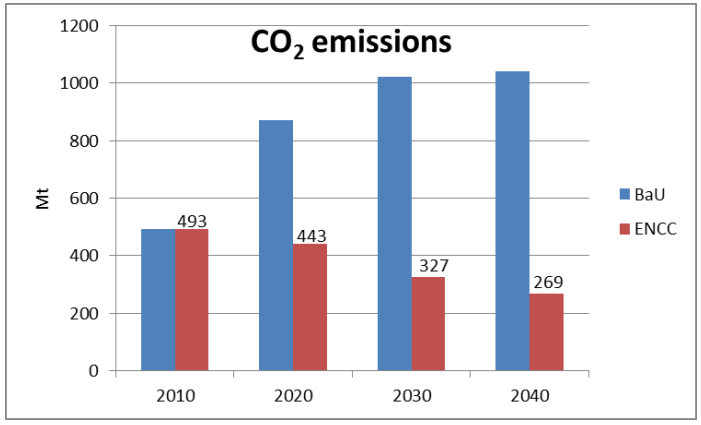
Results

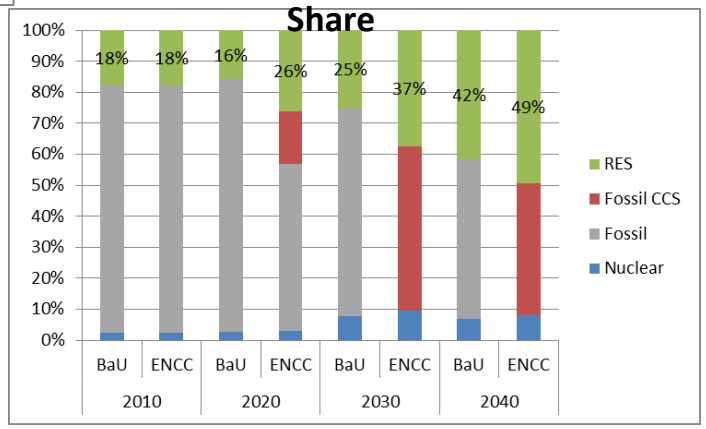
Mexican public electricity system evolution under the BaU and ENCC scenarios





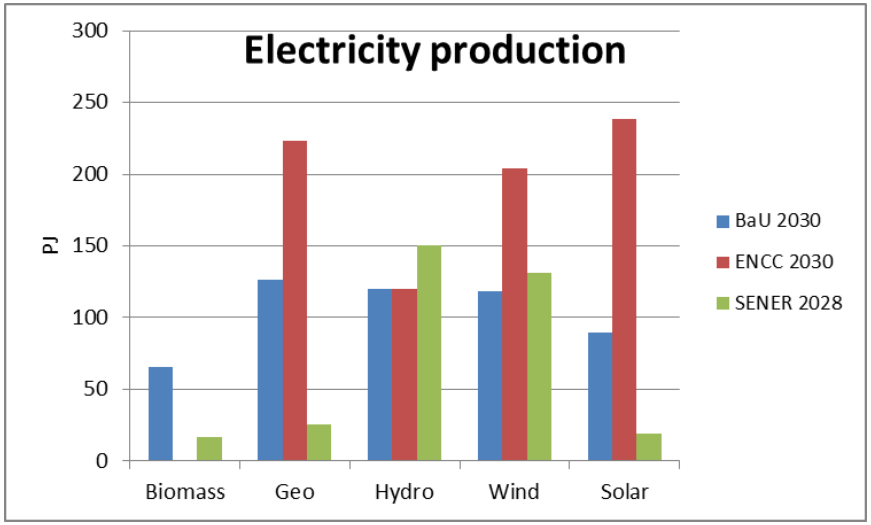
+33% costs

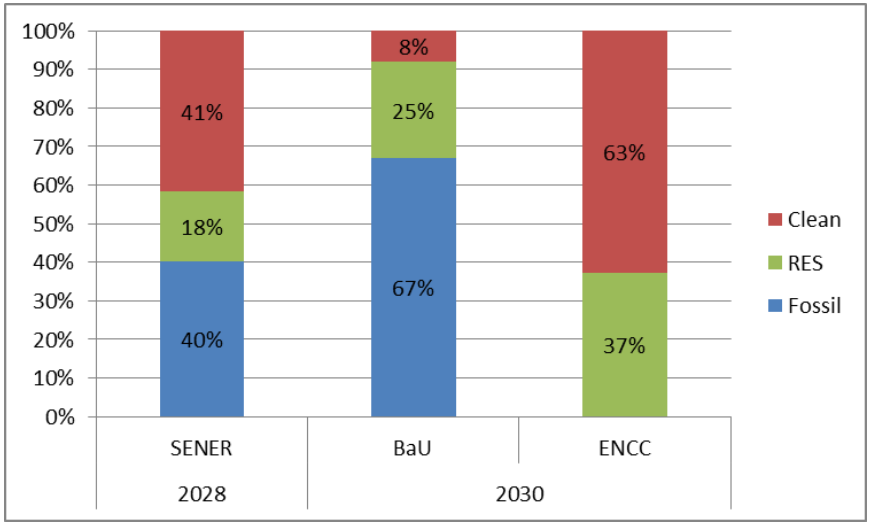


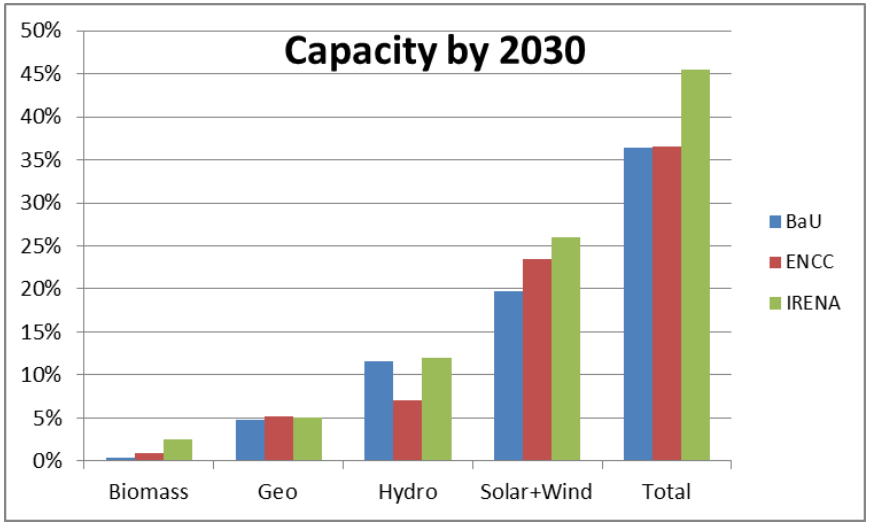


Results

Comparison with other studies: IRENA and SENER



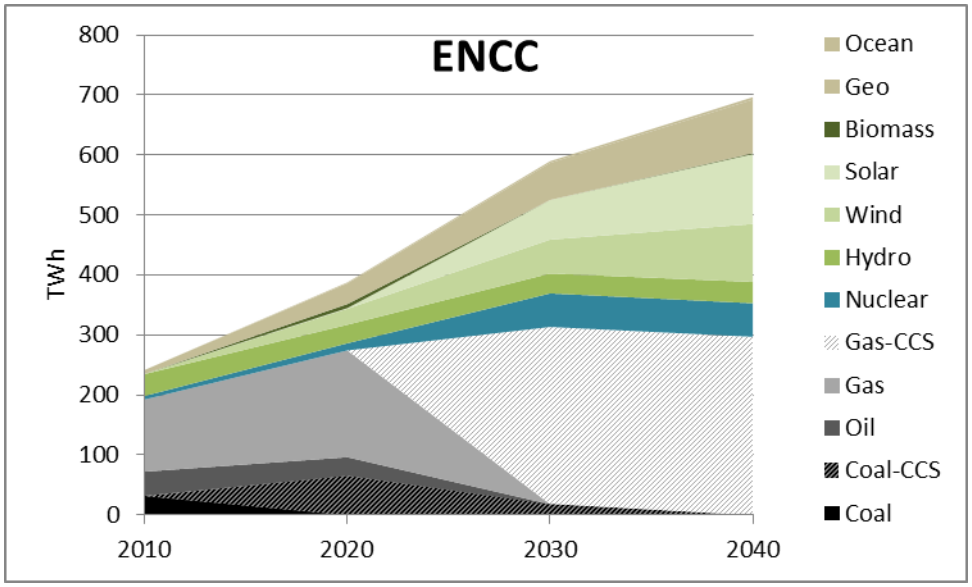


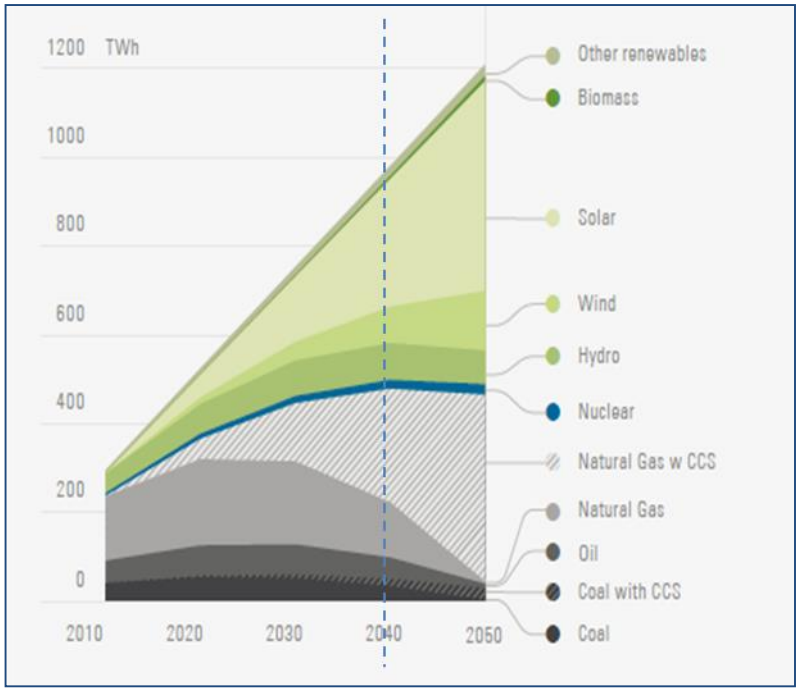


Renewable Energy Prospects: Mexico. Executive Summary. IRENA. January 2015

Results

Comparison with other studies: DDPP (Deep Decarbonization Pathways Project)





Pathways to deep decarbonization. 2014 report. Mexico chapter. SDSN and IDDRI (2014)

Conclusions

The Mexican government has recently launched an ambitious energy reform to modernize the energy system. The main aim of this reform is to make the most of the national resources in a rational and sustainable way under the principles of energy security, economic efficiency and social benefit

Two scenarios have been built to analyse the evolution of the public Mexican electricity system under different assumptions on policies using a global energy optimization model

The results of the analysis show that meeting the CO_2 emission limits is achievable in terms of technologies and resources availability but at a high cost. However, the clean energy targets could be met even in a BaU scenario

When CO_2 targets are set, solar thermal technologies seem to be a good option for the Mexican electricity system as well as gas with CCS technologies

Socioeconomic analysis

23rd International Input-Output Conference
& 5th Edition of the International School of I-O Analysis
22-26 June 2015, Mexico, Mexico City

Socioeconomic and environmental effects of the Mexican climate policies

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