North American Perspectives
MEXICO

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Federal Commission for Electricity

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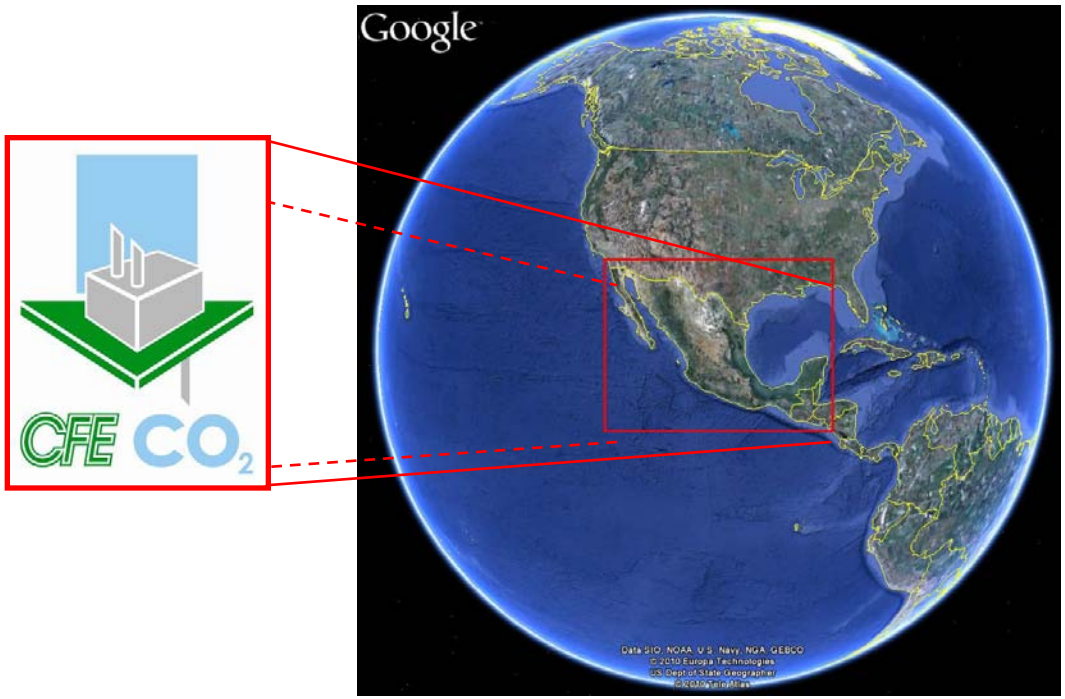
Carbon Storage Program Infrastructure
Annual Review Meeting
(Featuring DOE's Regional Carbon Sequestration Partnerships)
November 15-17, 2011, Pittsburgh, Pennsylvania, USA

OUTLINE

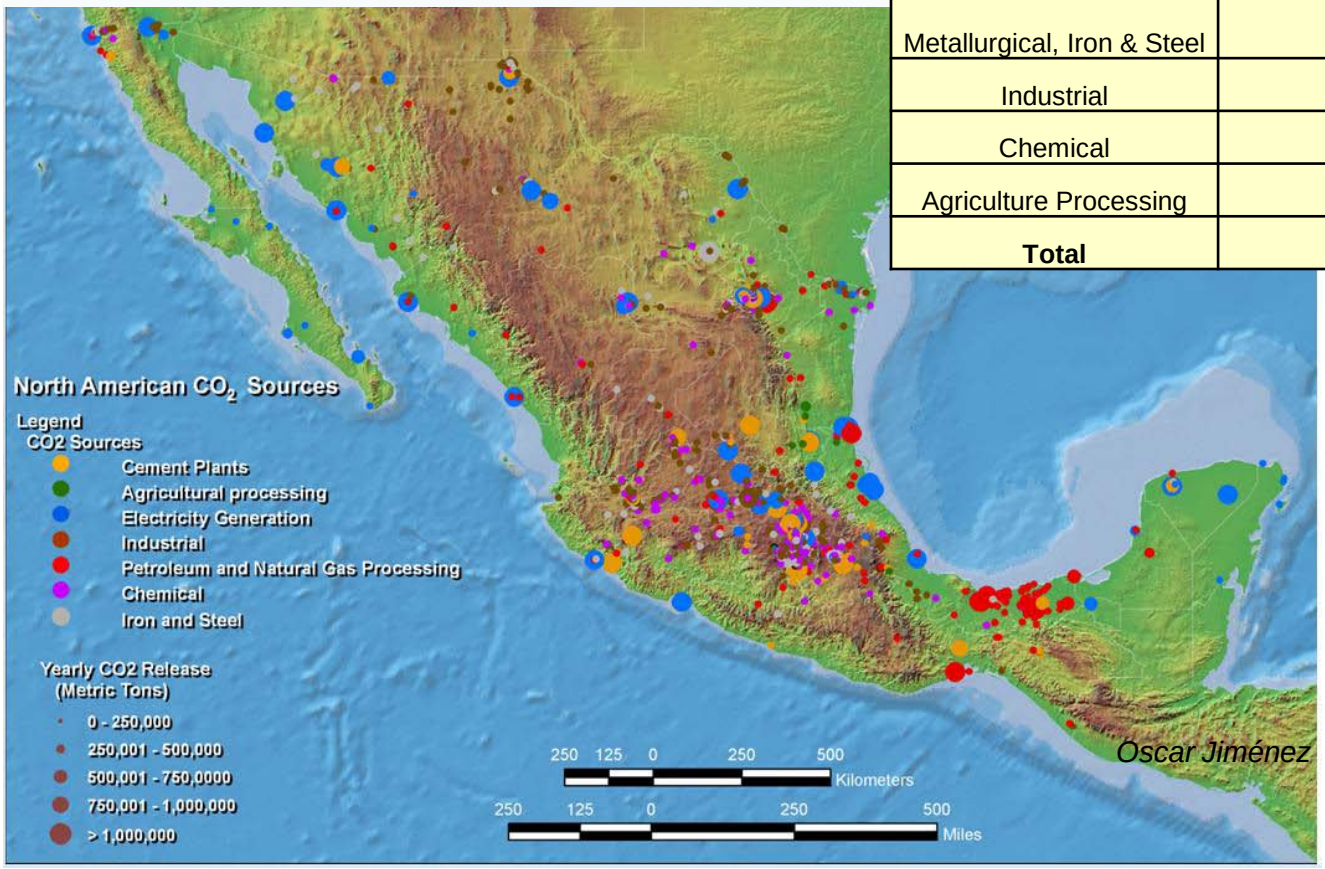
- PREVIOUS WORK
- CURRENT ACHIEVEMENTS
- FUTURE TASKS



POINT SOURCES

The electricity production industry is the largest contributor, and it does from a small number of stationary sources.

SECTOR	CO_2 EMISSIONS (metric tons)	No. of SOURCES
Electricity Generation	107,351,754	113
Oil & Petrochemical	47,556,986	273
Cement	26,016,726	60
Metallurgical, Iron & Steel	21,367,965	261
Industrial	8,764,815	709
Chemical	4,027,475	438
Agriculture Processing	735,319	6
Total	**215,821,040**	**1,860**



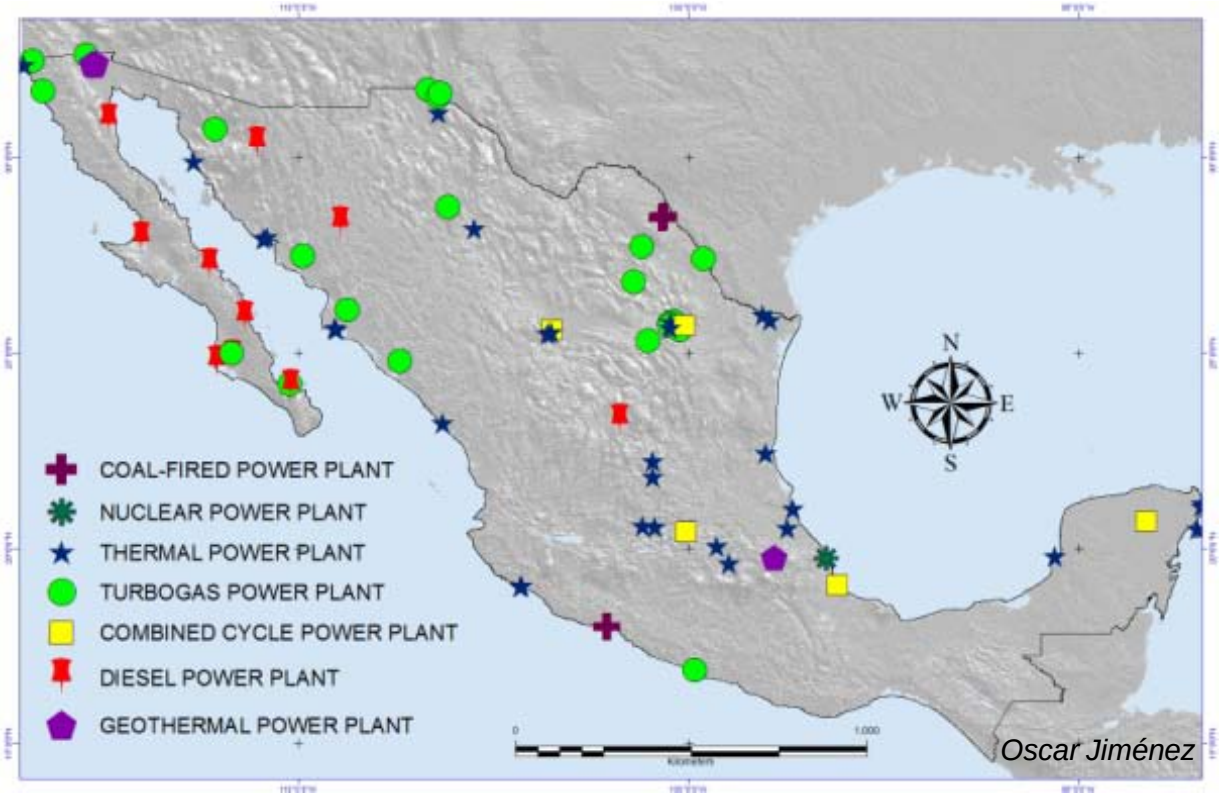
The energy sector is responsible for more than 70% (around 154 million metric tons) of CO_2 emissions in the country.

GOALS

A) IDENTIFY ***ZONES*** WITH POSSIBILITIES FOR CO_2 GEOLOGIC STORAGE

B) DETERMINE PROSPECTIVE ***GEOLOGICAL PROVINCES***

C) ESTIMATE THEIR THEORETICAL ***STORAGE POTENTIAL*** IN SALINE FORMATIONS.

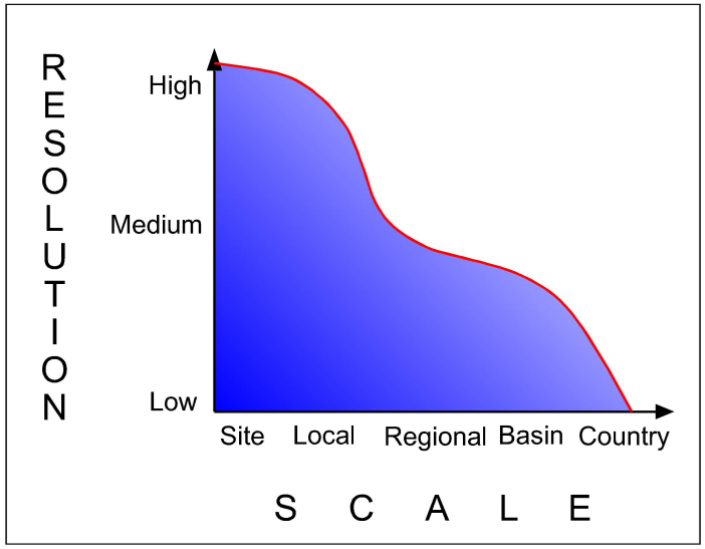


D) LOCATE SPECIFIC REGIONS IN NORTHEAST MEXICO TO ***STORAGE*** ANTHROPOGENIC CO_2 IN SALINE FORMATIONS.

METHODOLOGY

HOW DO WE ACHIEVED THIS?

1) APPROACH BASED ON BACHU´S SCALE AND RESOLUTION.

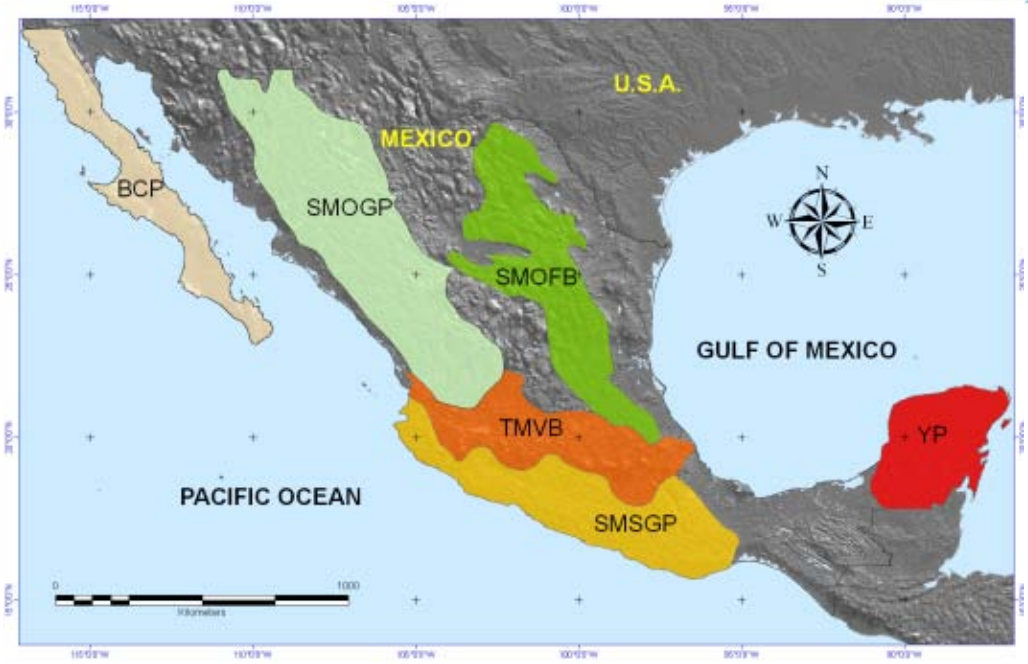


Bachu S, Bonijoly D, Bradshaw J, Burrus R, Holloway S, Christensen NP, Mathiassen OM (2007). ***CO_2 storage capacity estimation: Methodology and gaps***. Int. Jour. Greenhouse Gas Control 1(4):430-443.

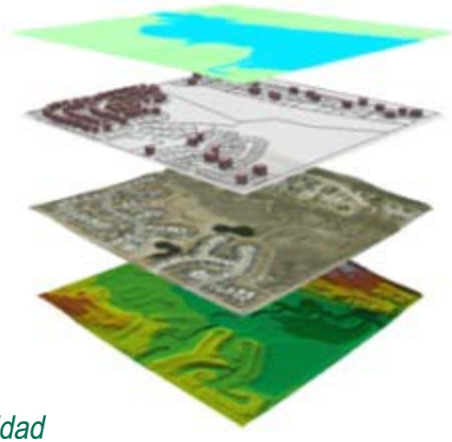
2) CAPTURE, REVIEW, COMPILATION AND ANALYSIS OF AVAILABLE DATA FROM **CREDITED SOURCES** TO SET A DATABASE.

METHODOLOGY

3) THE MAP ANALYSES WERE BASED ON **SURFACE INFORMATION** AND SOME **DRILL CORE** DATA FROM **PUBLIC DOMAIN.** SCALES RANGE FROM 1:250 000 (state) TO 1:4 000 000 (country).

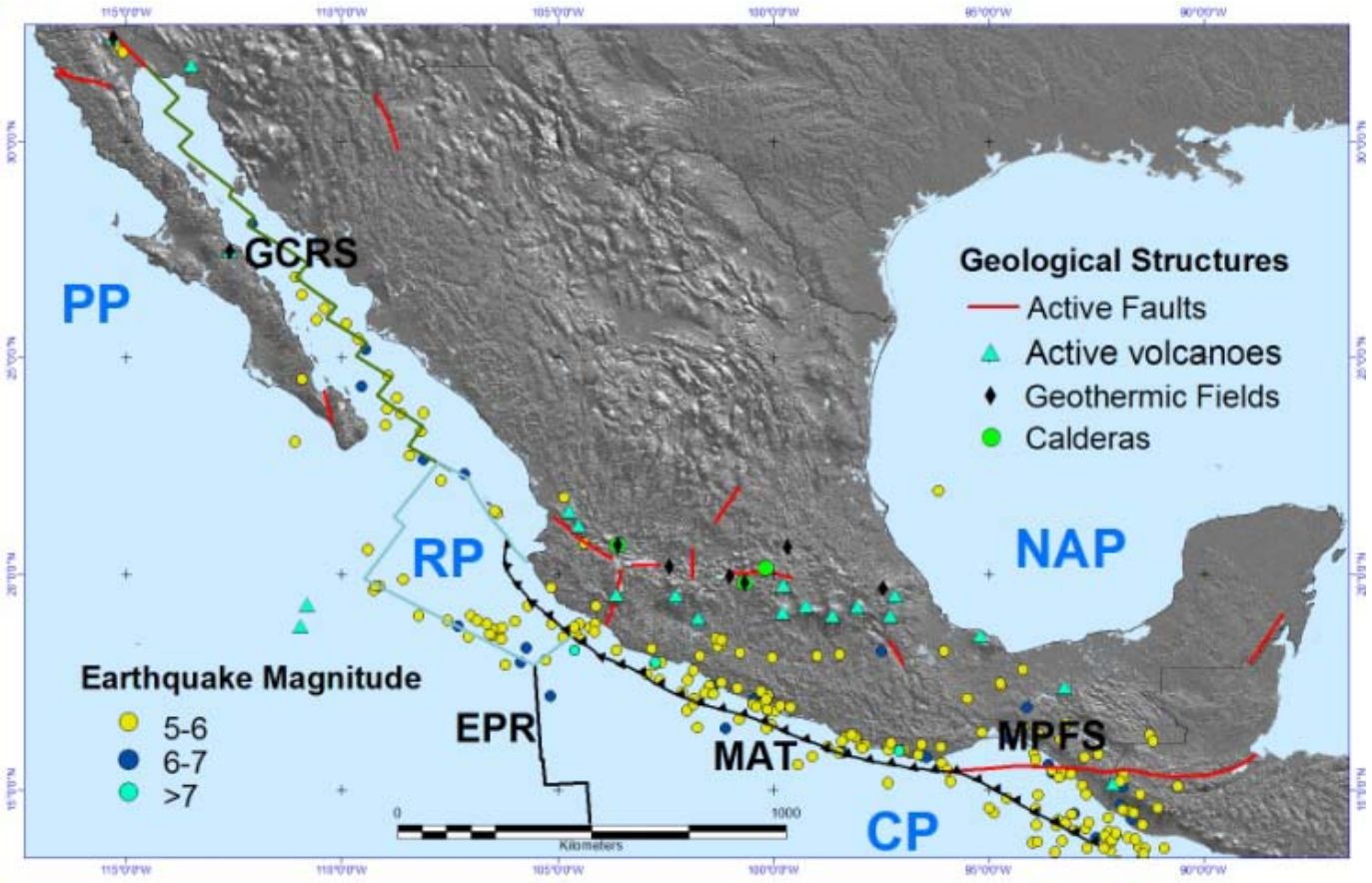


4) THE MAP JUXTAPOSITION, COM*PARISON AND SYNTHESES OF* ELEMENTS FOR INPUT INTO A **GEOGRAPHIC INFORMATION SYSTEM** (GIS) BY MEANS OF THE ARCINFO FILE STRUCTURES (ESRI).

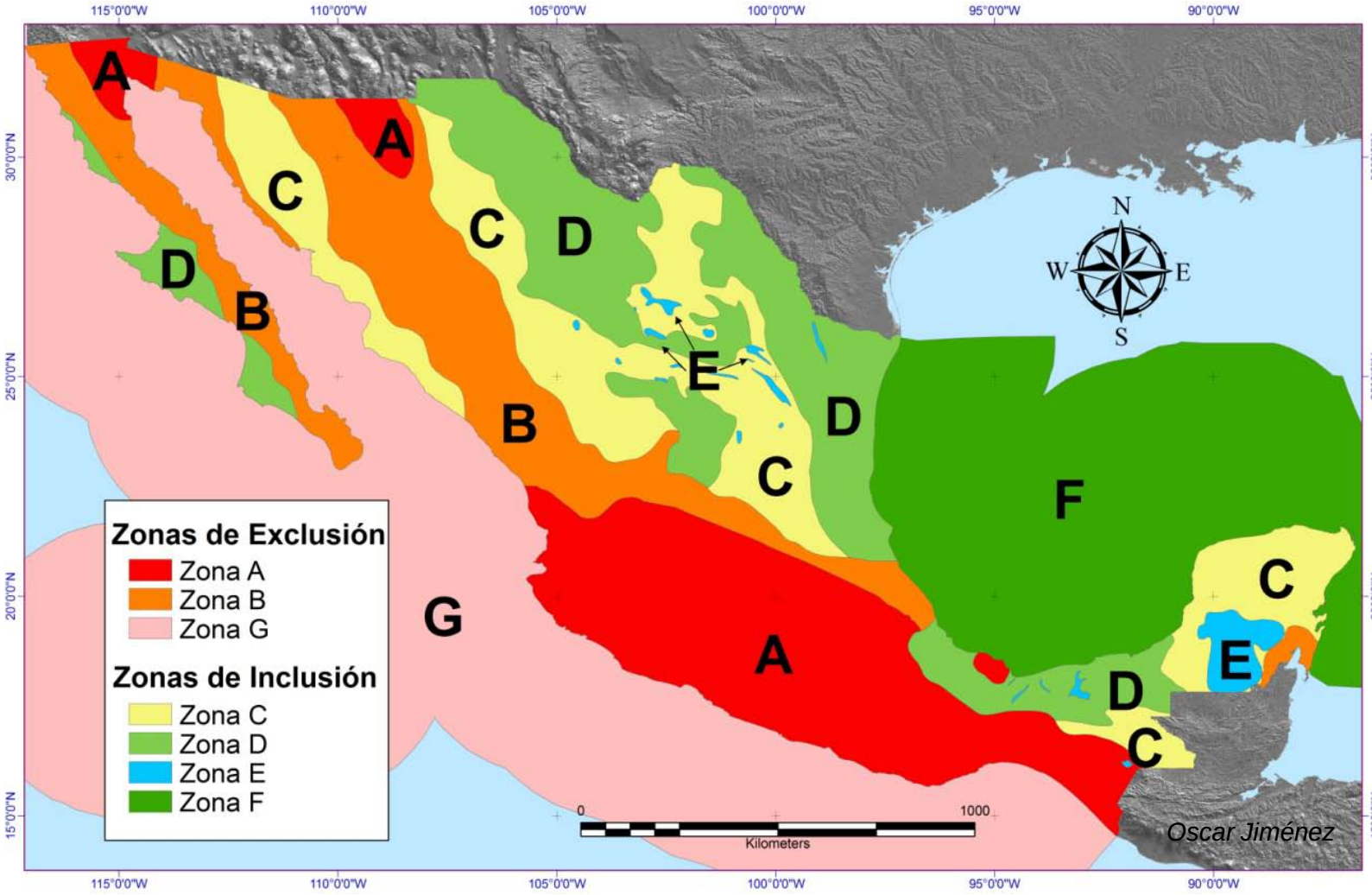


METHODOLOGY

5) THE CRITERIA USED WERE CONSIDERING THEIR **SURFICIAL EXPRESSION AND THE HAZARDOUS POTENTIAL** IN ORDER TO OBTAIN THEMATIC MAPS.



EXCLUSION AND INCLUSION ZONES



OUTCOME 2009-2010

3rd NACAP (North American Carbon Atlas Partnership)
Cuernavaca Meeting
Mexico, March 9 - 10, 2010

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International Journal of Physical Sciences Vol. 5(5), pp. 408–414, May 2010
ISSN 1992-1950 © 2010 Academic Journals

Full Length Research Paper

A preliminary selection of regions in Mexico with potential for geological carbon storage

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Accepted 2 April, 2010.

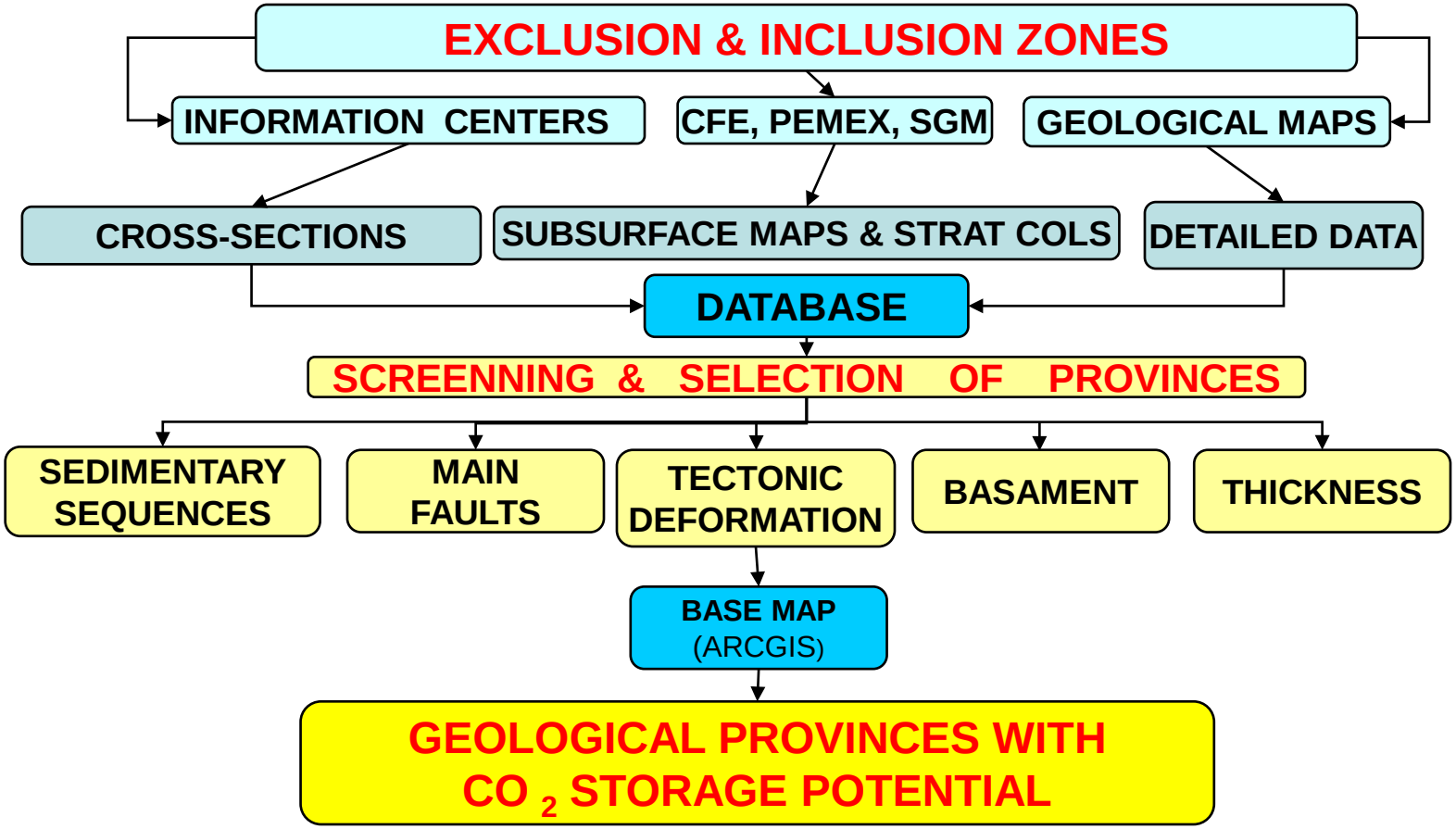
Abstract

Using a compilation of information about Mexican surficial geology and recent tectonic activity, zones for possible geological carbon storage were defined. There were seven zones defined on the basis of volcanic, geologic, lithologic, seismic and tectonic features. Most importantly at this stage, zones of exclusion were defined in which geologic storage is not recommended. These zones will aid in further exploration of the geological carbon storage possibilities in Mexico.

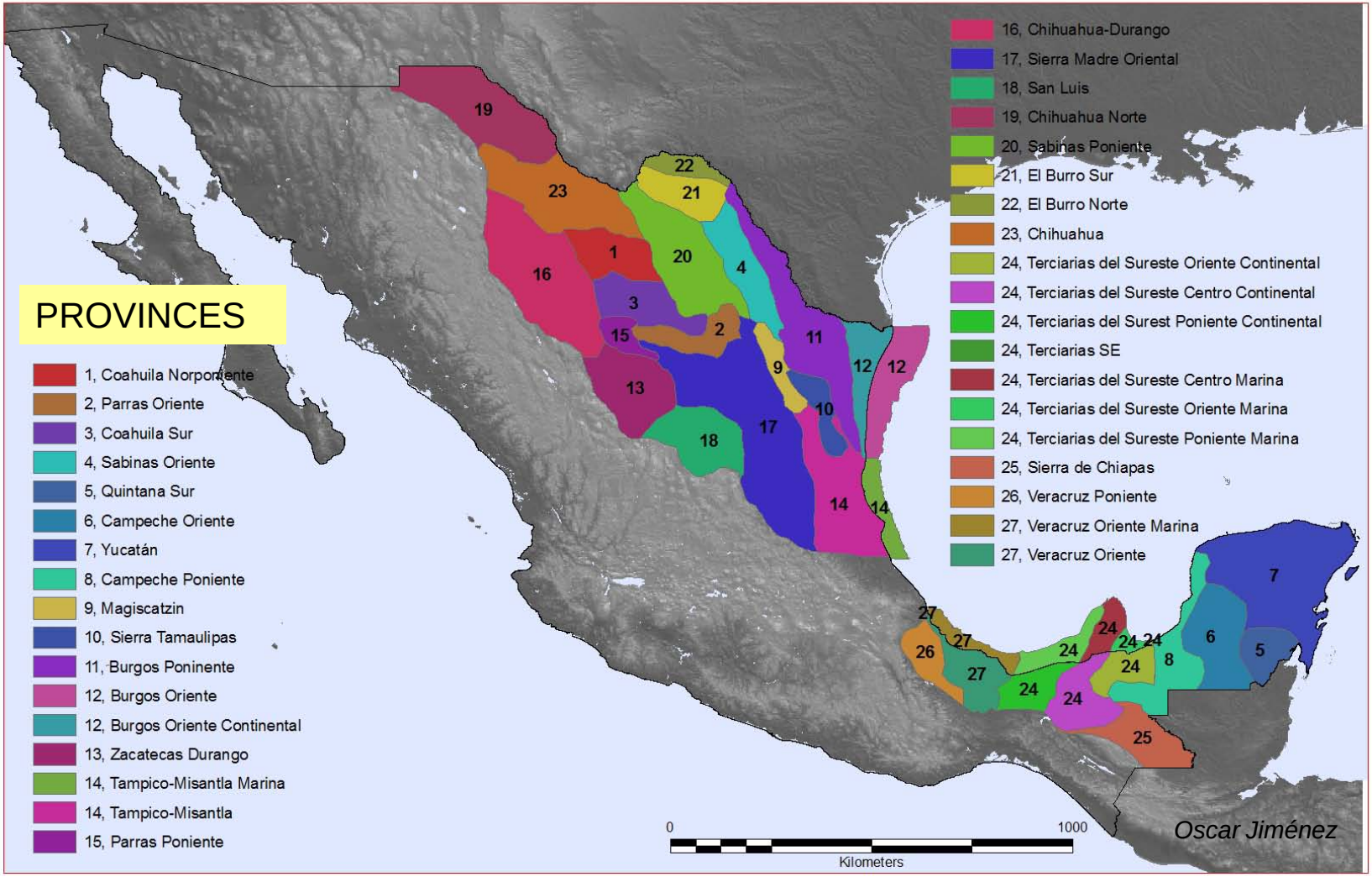
Key words: Carbon dioxide, geological carbon storage, seismic, volcanic hazards,

http://www.academicjournals.org/ijps/abstracts/abstracts/abstract2010/May/D%C3%A1vila%20et%20al.htm

METHODOLOGY



SUBDIVISION OF PROVINCES



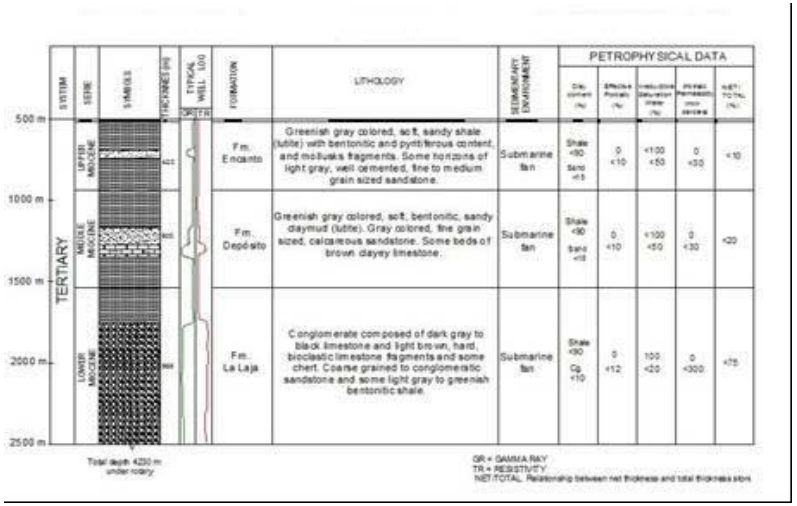
CFE Comisión Federal de Electricidad

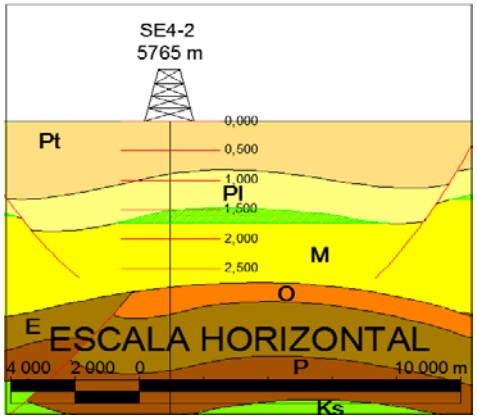
FINAL PROVINCES

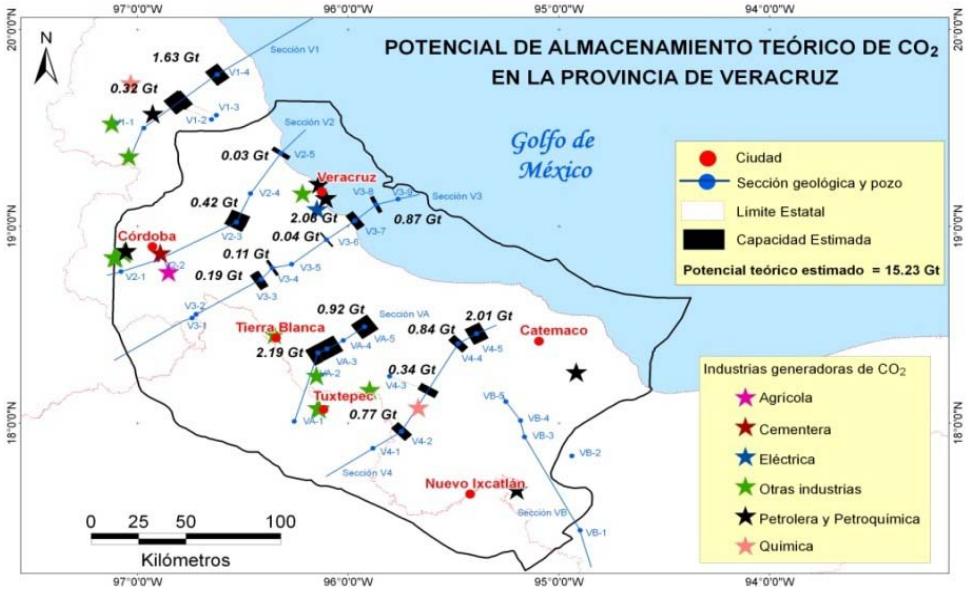
CFE Comisión Federal de Electricidad

2010-2011

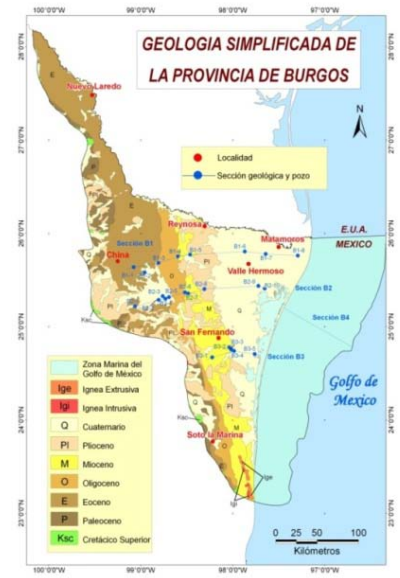

PROVINCIA DE VERACRUZ
Golfo de México
Sección V1
Sección V2
Sección V3
Sección V4
Sección VA
Sección VB
Veracruz
Córdoba
Tierra Blanca
Tuxtepec
Catemaco
Nuevo Ixcatlán
Ciudad
Sección geológica y pozo
Ige Ignea Extrusiva
Igi Ignea Intrusiva
Q Cuaternario
M Mioceno
E Eoceno
P Paleoceno
K? Cretácico
Ksp Cretácico Superior
Ksc Cretácico Superior
Kmp Cretácico Medio
Kip Cretácico Inferior
Kic Cretácico Inferior
Js Jurásico Superior
Tr-J Triásico-Jurásico
0 25 50 100
Kilómetros

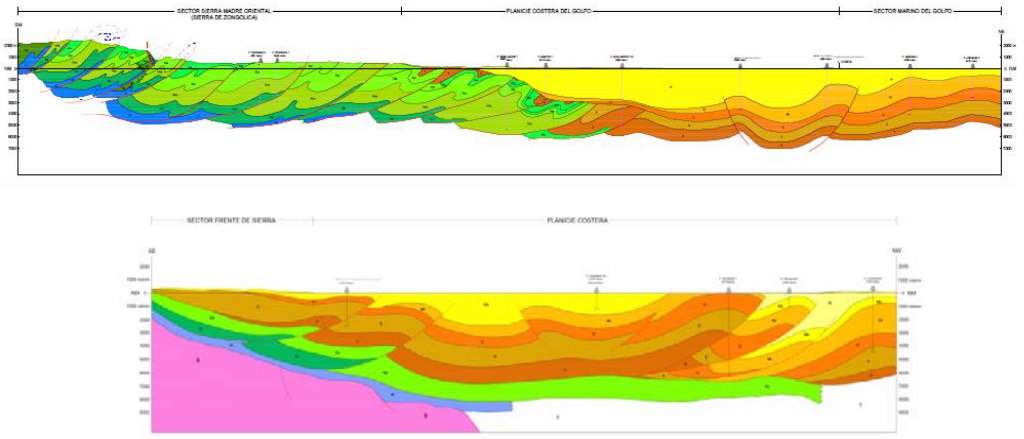

PETROPHYSICAL DATA
LITHOLOGY
TERTIARY
Fm. Encanto
Fm. Depósito
Fm. La Laja
Greenish gray colored, soft, sandy shale (lutite) with bentonitic and pyritiferous content, and molluska fragments. Some horizons of light gray, well cemented, fine to medium grain sized sandstone.
Greenish gray colored, soft, bentonitic, sandy claymud (lutite). Gray colored, fine grain sized, calcareous sandstone. Some beds of brown clayey limestone.
Conglomerate composed of dark gray to black limestone and light brown, hard, bioclastic limestone fragments and some chert. Coarse grained to conglomeratic sandstone and some light gray to greenish bentonitic shale.
Submarine fan
GR = GAMMA RAY
TR = RESISTIVITY

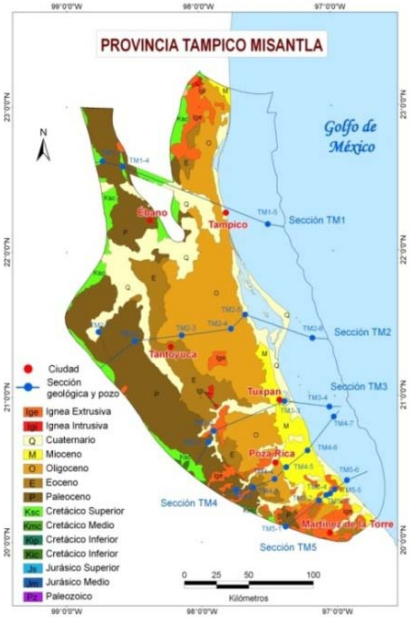

SE4-2
5765 m
Pt
Pl
M
O
E
P
Ks
0,000
0,500
1,000
1,500
2,000
2,500
ESCALA HORIZONTAL
4 000 2 000 0 10.000 m

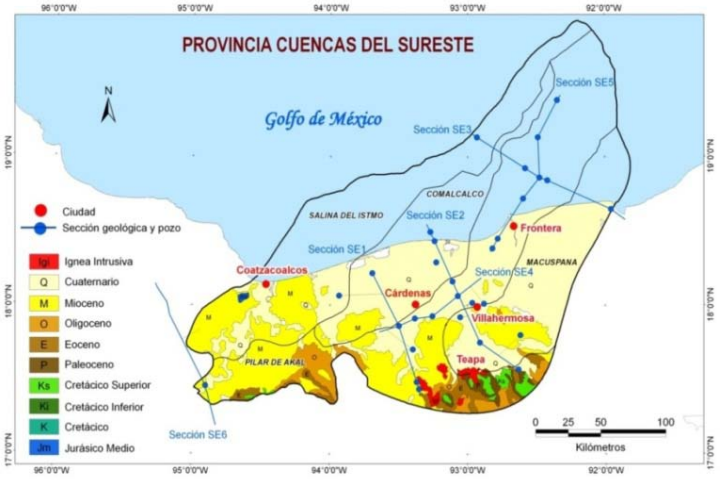

POTENCIAL DE ALMACENAMIENTO TEÓRICO DE CO2
EN LA PROVINCIA DE VERACRUZ
Golfo de México
1.63 Gt
0.32 Gt
0.03 Gt
0.42 Gt
2.08 Gt
0.87 Gt
0.04 Gt
0.11 Gt
0.19 Gt
0.92 Gt
2.01 Gt
0.84 Gt
2.19 Gt
0.34 Gt
0.77 Gt
Veracruz
Córdoba
Tierra Blanca
Tuxtepec
Catemaco
Nuevo Ixcatlán
Ciudad
Sección geológica y pozo
Límite Estatal
Capacidad Estimada
Potencial teórico estimado = 15.23 Gt
Industrias generadoras de CO2
Agrícola
Cementera
Eléctrica
Otras industrias
Petrolera y Petroquímica
Química
0 25 50 100
Kilómetros

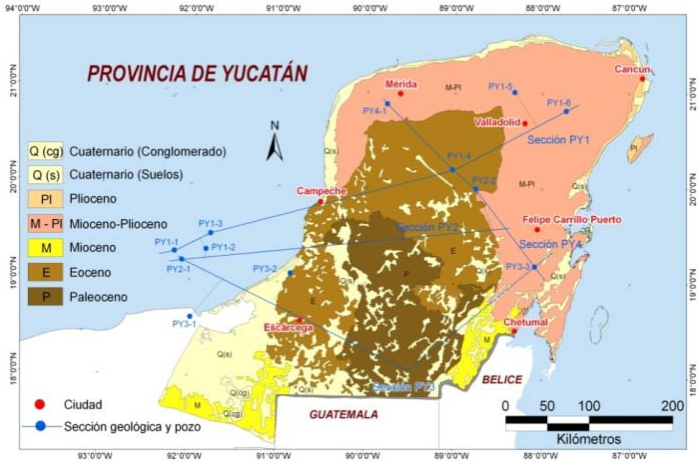
PROVINCES/BASINS











THEORETICAL STORAGE CAPACITY

PROVINCE	THEORETICAL CO_2 STORAGE POTENTIAL (Giga tons)	ASSESSED SECTORS
VERACRUZ	15	21
TAMPICO MISANTLA	9	12
BURGOS	17	31
SURESTE	24	17
YUCATAN	17	9
TOTAL	**82**	**90**

$$Vco_2t = V\,\varphi\,(1 - Swirr) \equiv Ah\;\varphi\,(1 - Swirr)$$

Where ,
Vco_2t : Theoretical volume, **V** : volume in the trap, **φ** : effective porosity,
Swirr : irreducible water saturation, **A**: trap area, **h**: average thickness of the rock sequence

Following Bachu *et al.,* 2007

OUTCOME 2011-2012

Chapter Number

Geological Carbon Dioxide Storage in Mexico: A First Approximation

Oscar Jiménez, Moisés Dávila, Vicente Arévalo, Erik Medina and Reyna Castro
Comisión Federal de Electricidad
México

1. Introduction

Carbon dioxide (CO_2) is one of the industrial gases that contribute to the greenhouse gas (GHG) effect. During the last decades, the emissions of CO_2 due to human activity have increased significantly all over the world. There are different and important efforts to reduce or stabilize the concentrations of greenhouse gases in the atmosphere, such as improvements in the efficiency of power plants and the development of renewable energies. However, those approaches cannot deliver the level of emissions reduction needed, especially against a growing demand for energy that promotes economic growth and prosperity. Carbon capture and storage (CCS) approach encompasses the processes of capture and storage of CO_2 that would otherwise reside in the atmosphere for long periods of time. Among the different carbon capture and storage options currently in progress all over the world, the geological storage option is defined as the placement of CO_2 into an underground repository in such a way that it will remain permanently stored. Mexico is one of the countries which are signatories of different international treaties which call for stabilization of atmospheric gases emissions at a level that prevent anthropogenic interference with the world's regional climates. In Mexico CO_2 represents almost 70% of the total greenhouse gases emissions where the primary sources of CO_2 are the burning of fossil fuels for power generation. CCS is a technological approach that holds great promise in reducing atmospheric CO_2 concentrations in Mexico. This is the first coordinated assessment of carbon storage potential across the country.

1.1 Geographical location of Mexico

Mexico is a country located in the southern portion of North America, and is bordered to the north by the United States, to the southeast by Guatemala, Belize and the Caribbean Sea, to the west and south by the Pacific Ocean, and to the east by the Gulf of Mexico (Figure 1). The country's total area is about 1 972 550 square kilometers.

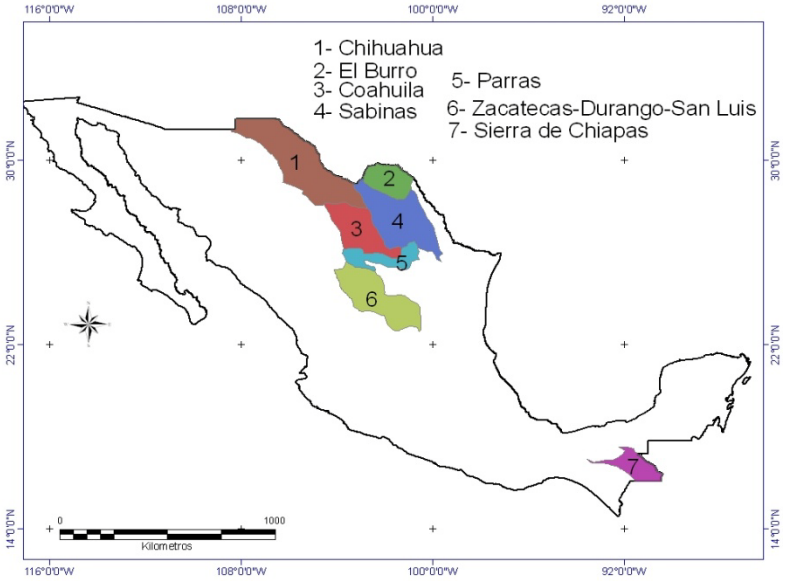
1.2 Previous work

With the aim of searching for places where to store carbon dioxide, Mexico was subdivided into three *exclusion zones* and four *inclusion zones* [1](Figure 2). The exclusion zones are zones A, B and G. Zone A is composed by igneous rocks with high seismic and volcanic hazard.

CONCLUSIONS

- MAP OF INCLUSION AND EXCLUSION ZONES.
- MAP OF 12 PROMISING GEOLOGICAL PROVINCES/BASINS FOR CO_2 STORAGE.
- BROAD ESTIMATION ON CO_2 STORAGE CAPACITY IN SALINE FORMATIONS WITHIN FIVE ASSESSED GEOLOGICAL PROVINCES/BASINS.

FUTURE TASKS

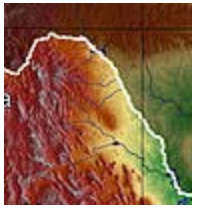


- **4th NACAP** (North American Carbon Atlas Partnership) **Meeting**, México, 2012

- **Publication** of the North American Carbon Atlas, version 2012

NACSA
The North American Carbon Storage Atlas

- Move to **Region Scale** within the **Coahuila State** in northern Mexico: field geological exploration and assessment.



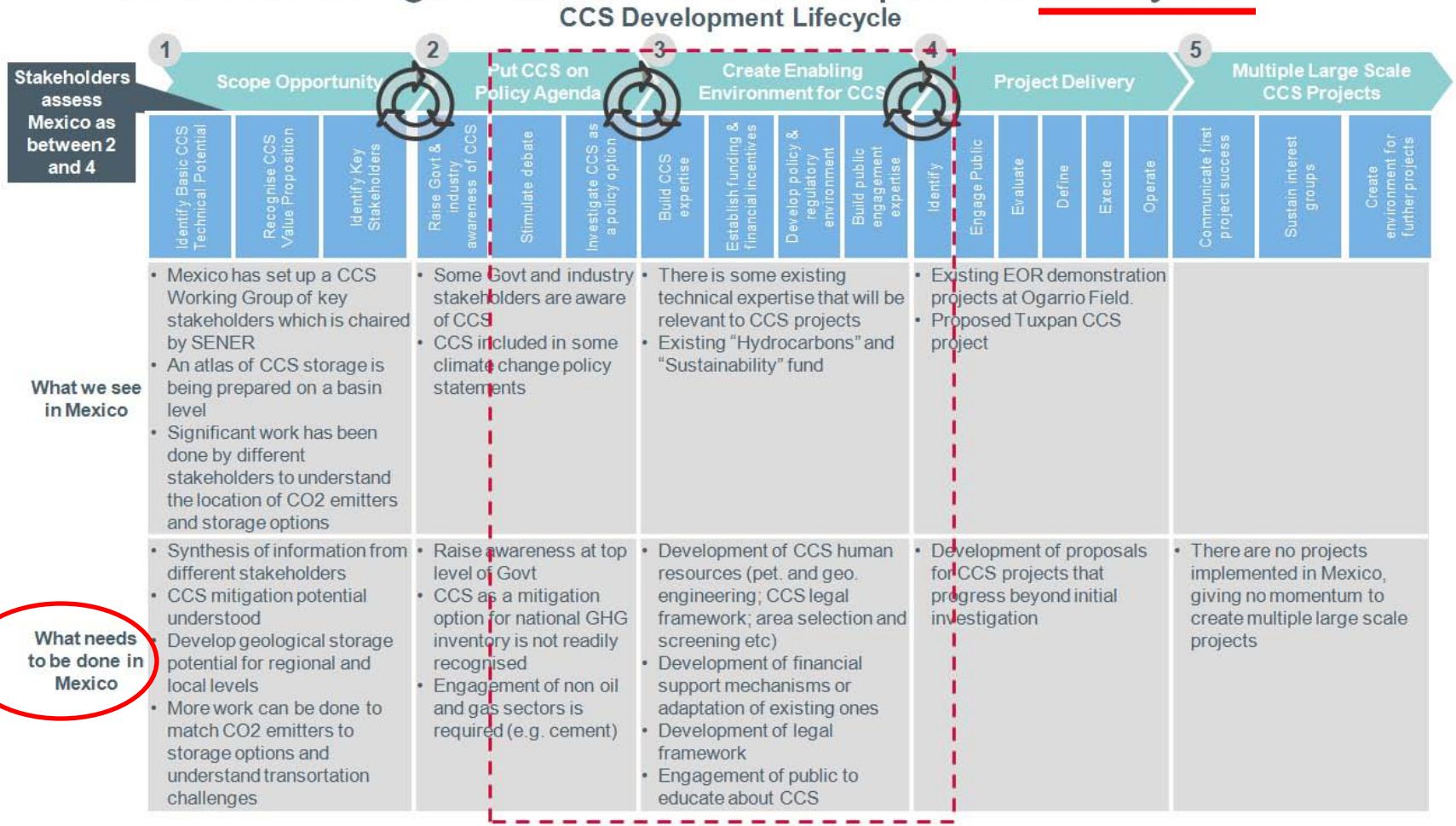
- **Promote CCS** as a clean technology.
- **Interchange** experiences, best practices and information between national and international agencies.

NEAR FUTURE WORK

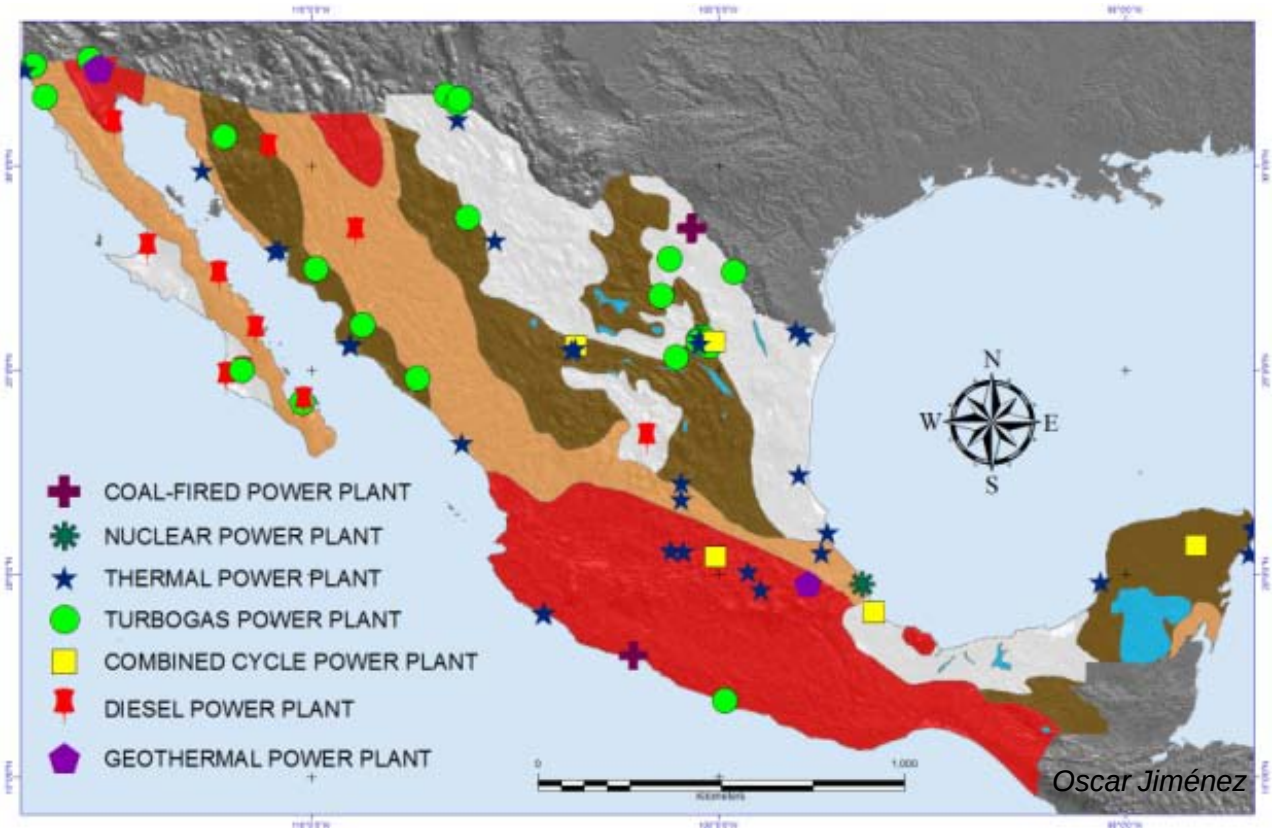
GLOBAL CCS INSTITUTE

A

Stakeholders assess Mexico as being between stages 2 and 4 in the generic CCS Development Lifecycle



THANK YOU!



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