



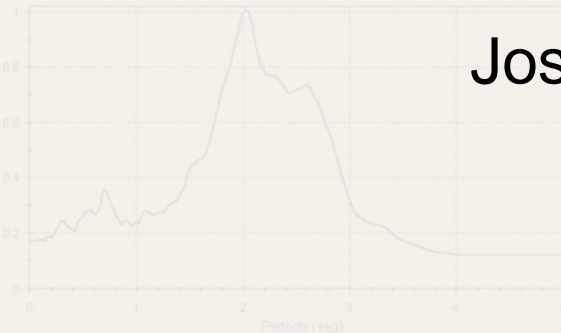
# CARBON CAPTURE AND STORAGE. WHY?

JPAC Meeting

Vancouver, March 24, 2010

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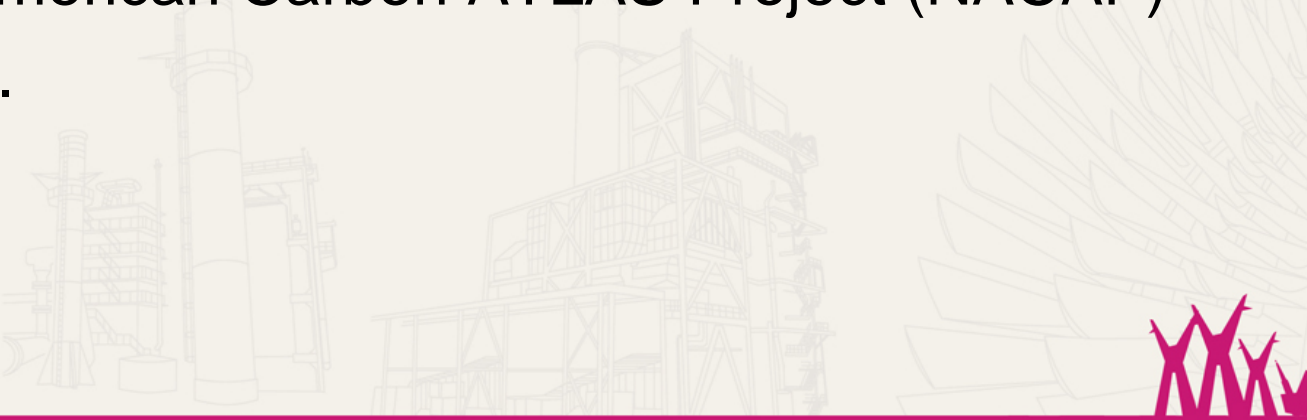
Espectro de respuesta del sismo de Michoacán  
(19 de Septiembre de 1985)

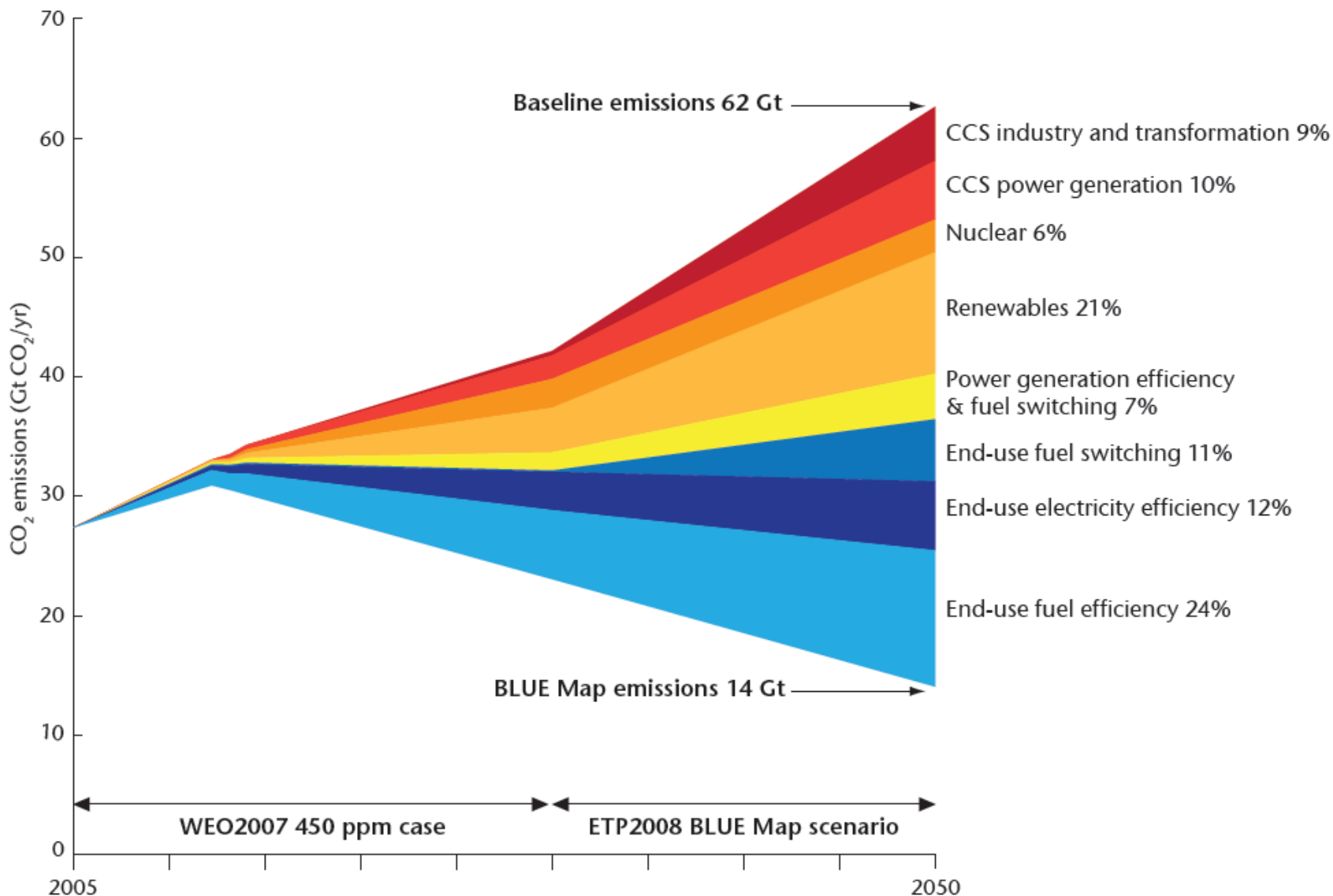




1. World emissions derived from fossil fuels and mitigation options
2. What is CCS?
3. CO2 Capture Technologies and costs
4. The situation in México today
5. Current activities in México in CCS
6. The North American Carbon ATLAS Project (NACAP)
7. Conclusions.

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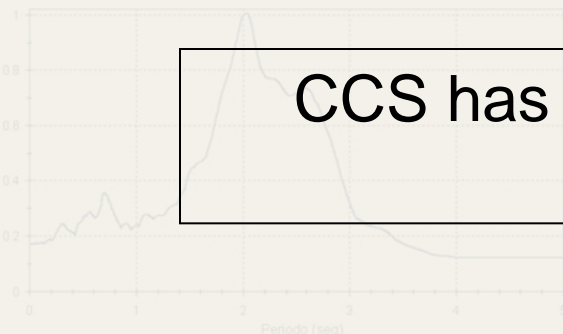






- The ETP 2008 blue map scenario requires to reduce emissions to a level of 2.0 tons/person/year. *Today's level 7 t/p/y aprox*
- CCS will contribute with about 20% Of the required emissions reduction by 2050
- Not using CCS would increase the cost of meeting the emissions reduction goal by 70 %

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CCS has to be a part of the portfolio of mitigation actions

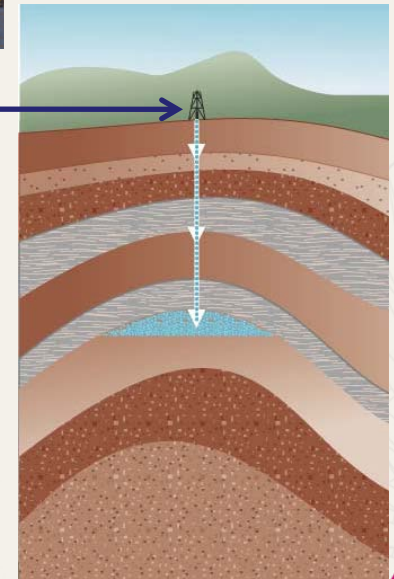


CCS is a two step process:

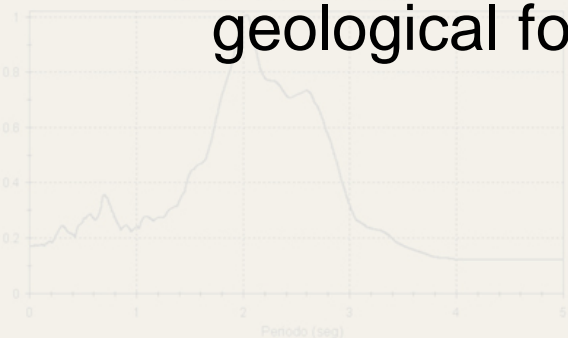
1. Separate the  $\text{CO}_2$  from the combustion gases.
2. Store the  $\text{CO}_2$  permanently in geological formations



$\text{CO}_2$



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Three technologies proven at the pilot plant level:

## 1. Post combustion

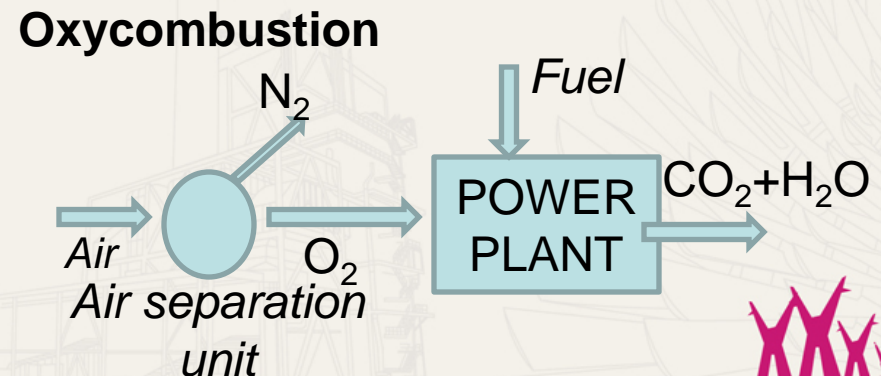
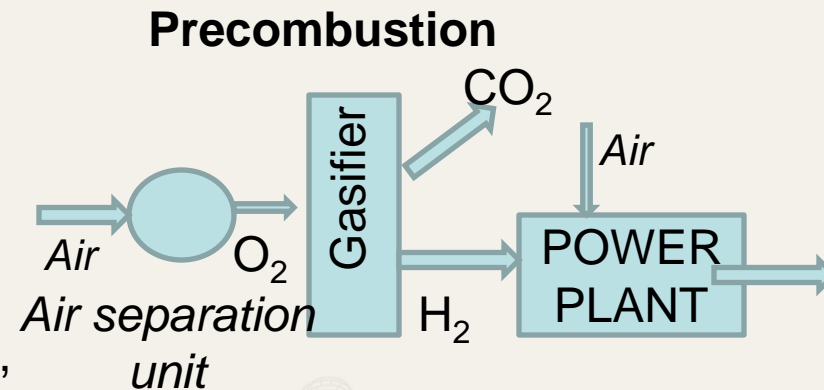
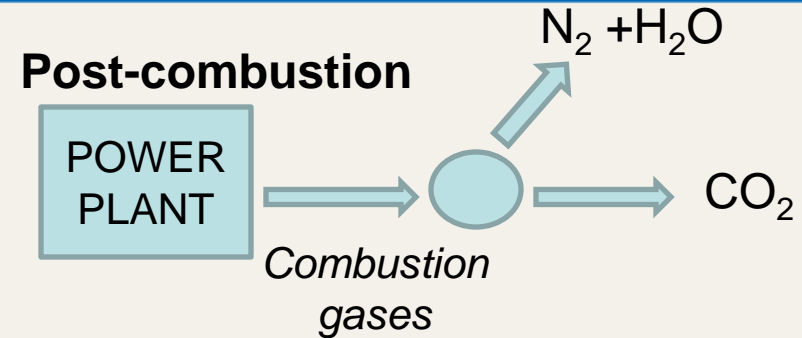
A system added at the end of the process that takes the combustion gases and separates the  $\text{CO}_2$

## 2. Precombustion

Separates  $\text{CO}_2$  before combustion, after gasification

## 3. Oxycombustion

Combustion with  $\text{O}_2$  instead of air.  
 Products  $\gg \text{CO}_2 + \text{H}_2\text{O}$







	Units	PC Supecrit.	Oxyfuel	IGCC	NGCC
		USD/MW-hr	USD/MW-hr	USD/MW-hr	USD/MW-hr
Levelized cost of electricity	Without CCS	78	78	96	78
	With CCS	135	122	132	111
	% Increase	77%	60%	39%	43%
Cost of CO2 avoided USD/ton		86	64	59	109

The GCCSI report gives cost ranges. Here only the mean values are presented. Tthe report also gives estimated costs for a first of a kind and subsequent plants and here, only the latter are presented

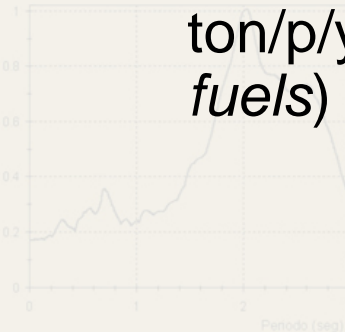


- To limit the global temperature raise to 2°C, a reduction of emissions from fossil fuels of 77% from the base line is required
- CCS has to be part of the portfolio of mitigation actions. It can contribute with 20% of the reduction. Not using it would increase the costs of mitigation by about 70%
- There are three proven technologies at pilot plant level with no clear winner among them: Post combustion; Precombustion and Oxycombustion.
- All the technologies will imply an increase of the cost of electricity in the range of 40 to 80%



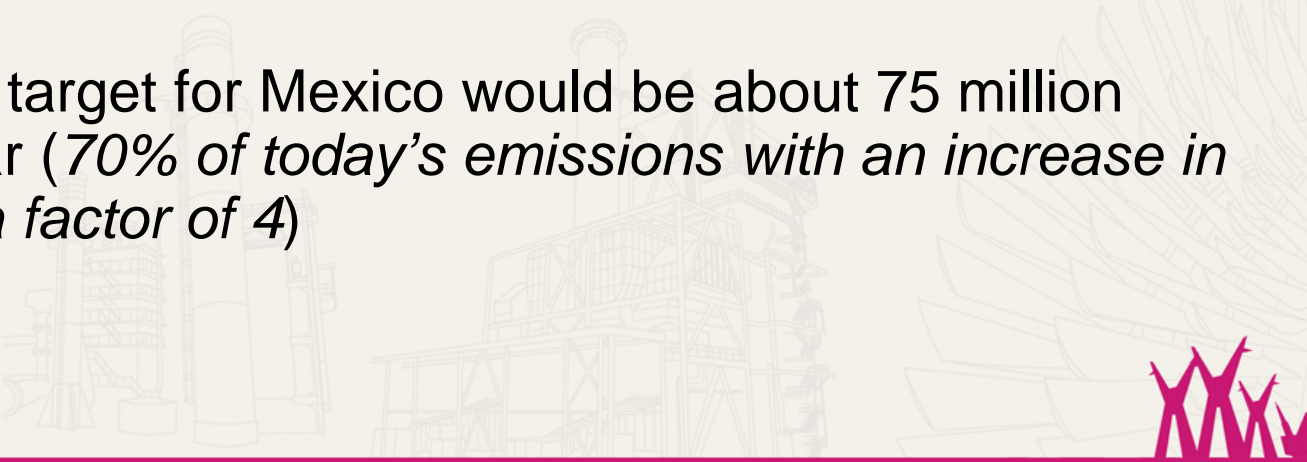
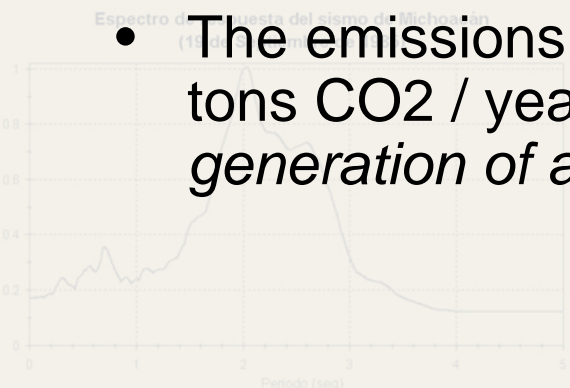


- México emitted, in 2006, 600 million tons of CO<sub>2</sub>, of which 400 million were produced by the combustion of fossil fuels in power generation; production of fuels, industry, residential and commercial uses and transportation
- The breakdown by use is as follows:
  - Power generation
  - Fuel production
  - Industry
  - Transportation
  - Others
- These emissions represent 6 tons/person/year total and 4 ton/p/y from fossil fuels. (*Goal 1.5 ton/p/y dedrived from fossil fuels*)



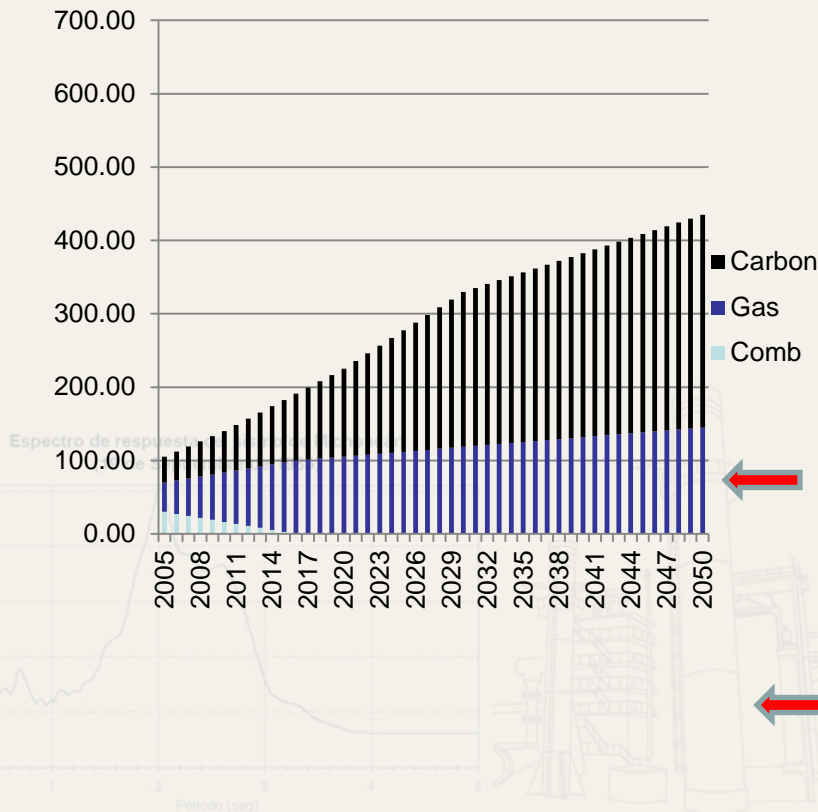


- Additionally, México as a developing country, needs to increase its energy consumption in order to increase standards of living
- The estimated increase is from 2,000 kw-hr/p/y in electrical energy to 8,000 kw-hr/p/y and possibly more if electric transport is implemented
- Energy security requires fuel diversification and coal and nuclear are the main options for base load.
- Renewables will be favored but they will not be significant by 2050
- The emissions target for Mexico would be about 75 million tons CO<sub>2</sub> / year (*70% of today's emissions with an increase in generation of a factor of 4*)

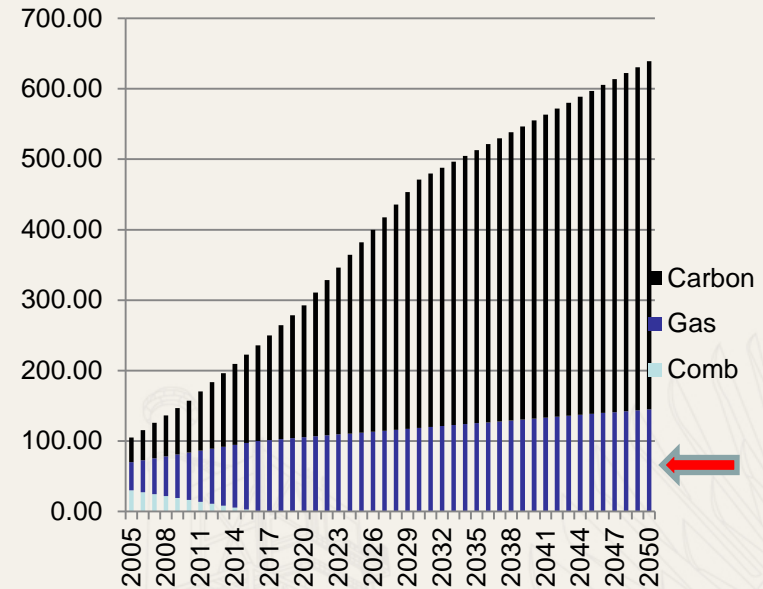




- Emissions with growth in coal, gas and nuclear



- Emissions without nuclear

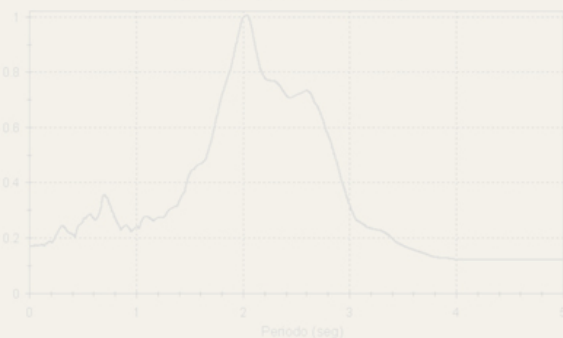


Denotes emissions target



- CCS will be needed in the power sector, the energy sector and the industrial sector.
- The needed participation of CCS will depend on how is the nuclear option included in the portfolio of generation technologies

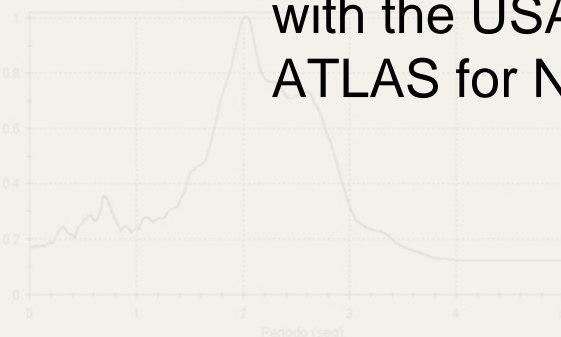
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- México is preparing itself to cope with CCS with the following actions:
  - México has started the analysis of a post-combustion CO<sub>2</sub> capture for a coal fired unit
  - The research institutions such as IIE and IMP are working on CCS technology development and application to EOR
  - México is an active member of the CSLF and has participated in capacity building in the Country
  - México is a foundation member of the GCCSI
  - México is active in cooperation projects worldwide, particularly with the USA and Canada there is a project to publish a CO<sub>2</sub> ATLAS for North America (NACAP)

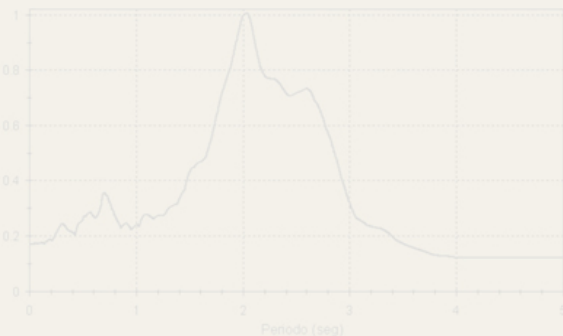
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- North American Carbon ATLAS Project
- Under the NAEWG umbrella
- Based on previous work by the US Regional Partnerships
- DOE/USA – NRC/Canada – SENER/México
- 1st meeting. December 2008

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- Identify and quantify CO<sub>2</sub> emission sources in the Region
- Identify sites of potential CO<sub>2</sub> storage and estimate capacities
  - Oil and gas fields
  - Saline formations
  - Unmineable coal
- Present the information above in an interactive digital ATLAS

Provide a basis for the institutions in the energy sector to plan their CO<sub>2</sub> management programs



- The threat of climate change requires intense and immediate actions from all countries
- CCS is a necessary technology for CC mitigation that can contribute up to 20% of the required reductions
- There are three technologies for CO<sub>2</sub> separation with no clear winner for all situations
- México will need CCS to curb its CO<sub>2</sub> emissions to levels similar to the required values worldwide
- México is actively involved in international collaboration programs as the CSLF and the NAEWG

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