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The Need for an Integrated and Holistic Socio-Economic Approach to Carbon Planning - The Brazilian Case -

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AGENDA

INTRODUCTION

POINT 1: THE G8/IEA/CSLF CARBON PLAN

- The near-term first phase
- The longer-term second phase
- Key issues governing the deployment of CCS
- *Holistic and integrated socio-economic approach to gain community confidence and support*

POINT 2: THE CASE OF BRAZIL

- *Why a carbon plan for Brazil?*
- *A plan for Brazil: the CCS Technology Roadmap*
- *Socio-economic aspects and impacts on technical issues*

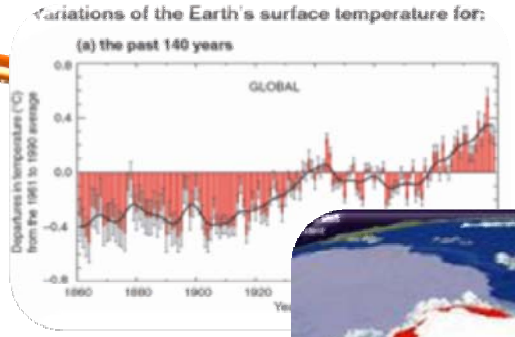
CONCLUSIONS

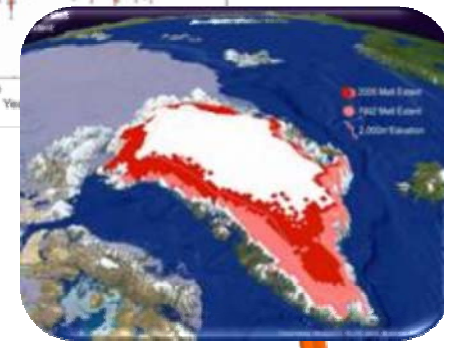
XXI Century's Interconnected Challenges

Sustainable Consumption of Resources

Energy

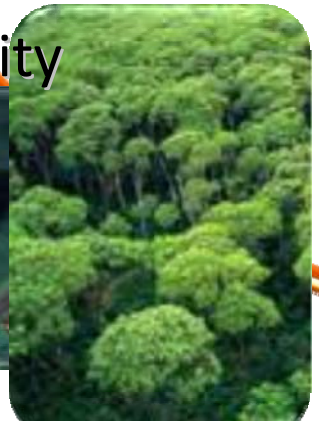
Climate Change





Hunger

Biodiversity



Social Inequality

Ref.: Adapted of Ricardo Castello Branco in "The importance to Petrobras of R&D with focus in biodiversity" at The Biodiversity and the Oil and Gas Industry's Seminary, Rio de Janeiro, June, 2006

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THE G8/IEA/CSLF CARBON PLAN: The near-term first phase 200 Mt/yr (by 2025)

• Low-cost forms of CCS (processes that already capture CO2 or have “little” additional capture cost such as NG processing, ammonia and hydrogen plants).

• Forms of CCS with costs are offset by EOR or avoided emissions taxes.


Statoil


www.princeton.edu

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THE G8/IEA/CSLF CARBON PLAN: The longer-term second phase 6000 Mt/yr (by 2050)

• Widespread deployment of CCS for power generation, facilitated by reduction of capture costs.

• Forms of CCS with heavy industries, such as steel and cement.

• As opportunities for EOR decline, CCS will likely be in saline formations.

ZEROGEN - ARTISTS IMPRESSION - PROPOSED ZEROGEN POWER STATION SITE VIEW SOUTH FROM FALLS CREEK HILL

gc3.cqu.edu.au

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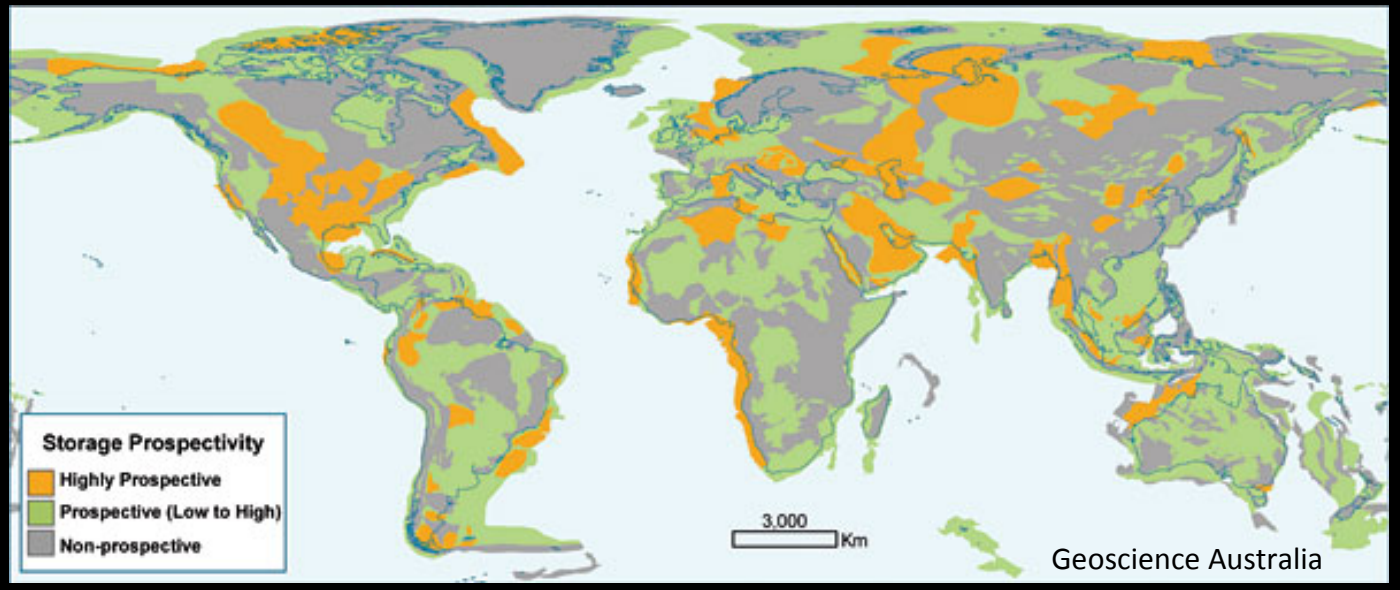
THE G8/IEA/CSLF CARBON PLAN: Key issues governing the deployment of CCS to be resolved already in the FIRST phase:

1. Identification and characterization of storage resources
2. The development and implementation of regulatory and incentive regimes
3. Deployment on a sufficient scale to gain community confidence and support
4. The development of low-cost capture technologies.



Geoscience Australia

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Holistic and integrated socio-economic approach to gain community confidence and support:

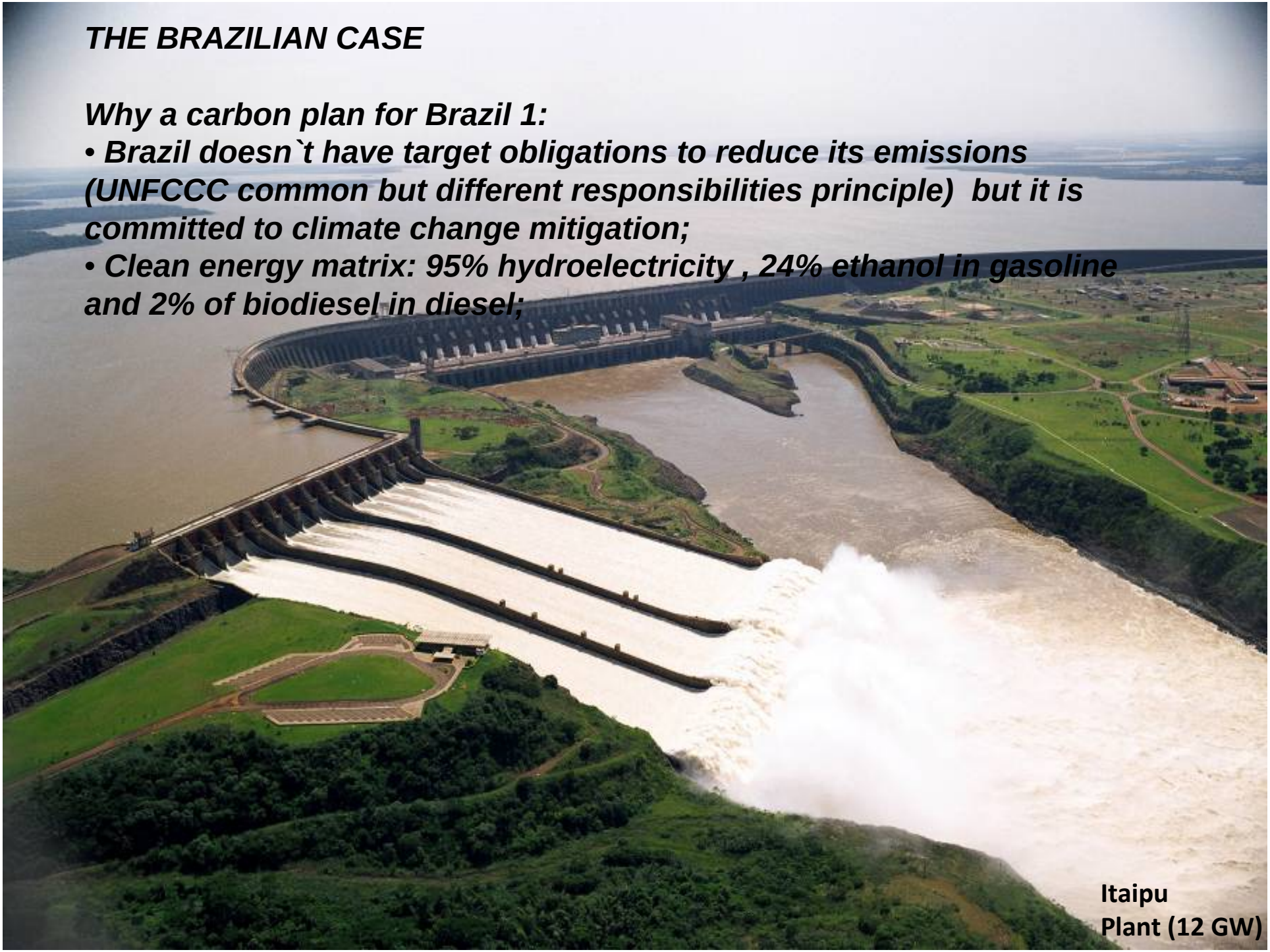
Public support will be much stronger if CCS positively influence people`s daily life and at local scale…

…and one way to do so is to include socio-economic aspects in the carbon planning, measuring and demonstrating their benefits (eg., jobs, taxes, investments) related to CCS activity;

"NIMBY"
(Not In My Backyard)

Socio-Economic benefits

"PIMBY"
(Please In My Backyard)
Ketzer et al.



THE BRAZILIAN CASE

Why a carbon plan for Brazil 1:

- ***Brazil doesn`t have target obligations to reduce its emissions (UNFCCC common but different responsibilities principle) but it is committed to climate change mitigation;***
- ***Clean energy matrix: 95% hydroelectricity , 24% ethanol in gasoline and 2% of biodiesel in diesel;***

Itaipu Plant (12 GW)

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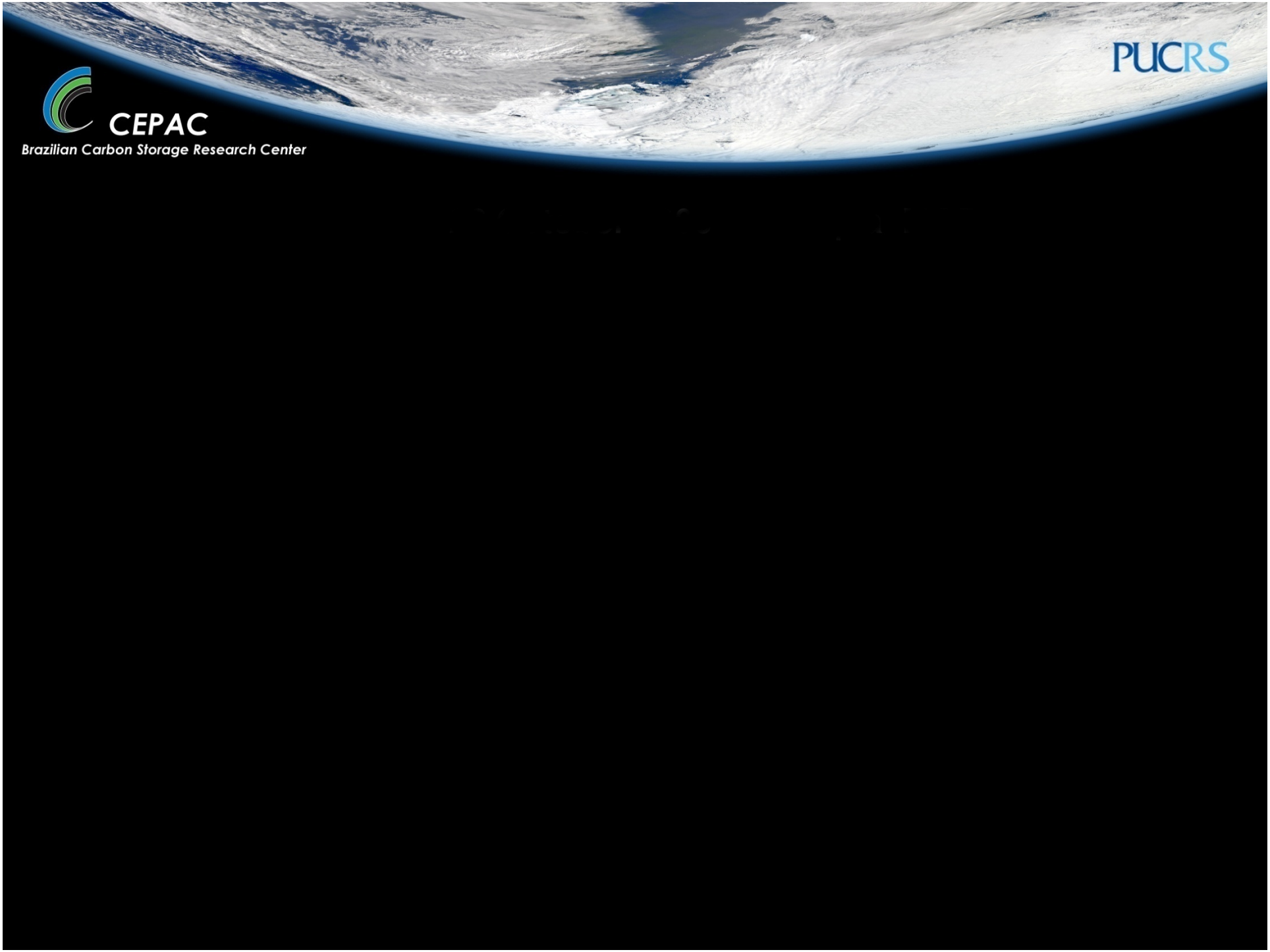
Why a carbon plan for Brazil 2:

• Activities of PETROBRAS and other industries in Brazil and abroad can be directly affected;

• Business opportunities and local development that can come with CCS projects implementation (EOR and ECBM, social and environmental aspects aiming to obtain sustainability of CCS, including possible compensation of future extra hydrocarbon emissions, such as through forestation);

• Brazil is a leader in biofuels and ultra-deep water hydrocarbon exploration and production, and wants to be one of the major players in CCS technologies too.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Brazilian Approach for developing Climate Change Mitigation through CO_2 Capture and Geological Storage (CCGS) technologies

Energy and Mobility Sustainability Principles considering some of the XXI Century's Challenges :

- Economical Growth on the energy and fuels business
- Social responsibility applied in CCGS projects, taking into account the challenges:
  - to implement the CO_2 storage projects educating and creating a technological base with investments in infrastructure, R&D projects, capacity building and job generation for CCGS in Brazil.
  - to implement the CO_2 storage projects involving the surrounding communities to generate jobs, alimentary security and wealth, considering the local conditions and possibilities.
- Environmental responsibility trough the development of climate changeless energy and mobility activities without impacts to the Earth. Also, to establish compensation measures for the advent emissions of the "new fossil fuels produced in the CCGS activities" (EOR and ECBM), through:
  - reforestation with native species associated with perennial oilseeds and food specimens (agro forests);
  - conservation of ecosystems, E.g.. financial contribution to avoided deforestation fund in the Amazon
  - agricultural practice changes in the production of bio-fuels for GHG emissions reduction

Elaboration of the Brazilian Map of sources and sinks, considering sustainability and security aspects of CO_2 leak, through risk analysis studies

Preparation of the 1st "CCGS Sustainability Road Map" in the World

Development of CCS methodology for projects implementation (to be started in 2008)

Ref.: Translated from Paulo Cunha et alli "Tendências, pesquisas e desenvolvimento tecnológico em Seqüestro de Carbono na PETROBRAS" em II Seminário Brasileiro sobre Seqüestro de Carbono e Mudanças Climáticas, Maceió /AL , 25 a 28 de Março de 2008

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A carbon plan for Brazil: CCS Technological Roadmap (under construction)

Socio-economic aspects of the carbon plan for Brazil:

1. Large capacity building effort for broad audience;

2. Implementation of a CCS network with 100`s of people involved with large investments in infra-structure and HR;

3. Implementation of sustainability tools to measure and demonstrate socio-economic and environmental aspects of CCS in Brazil.

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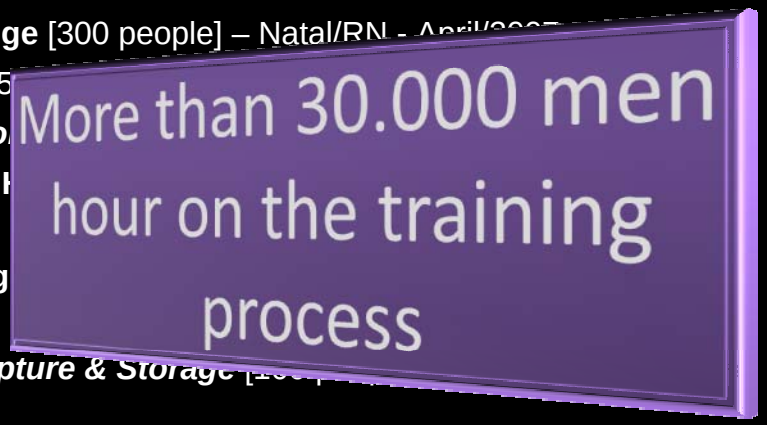
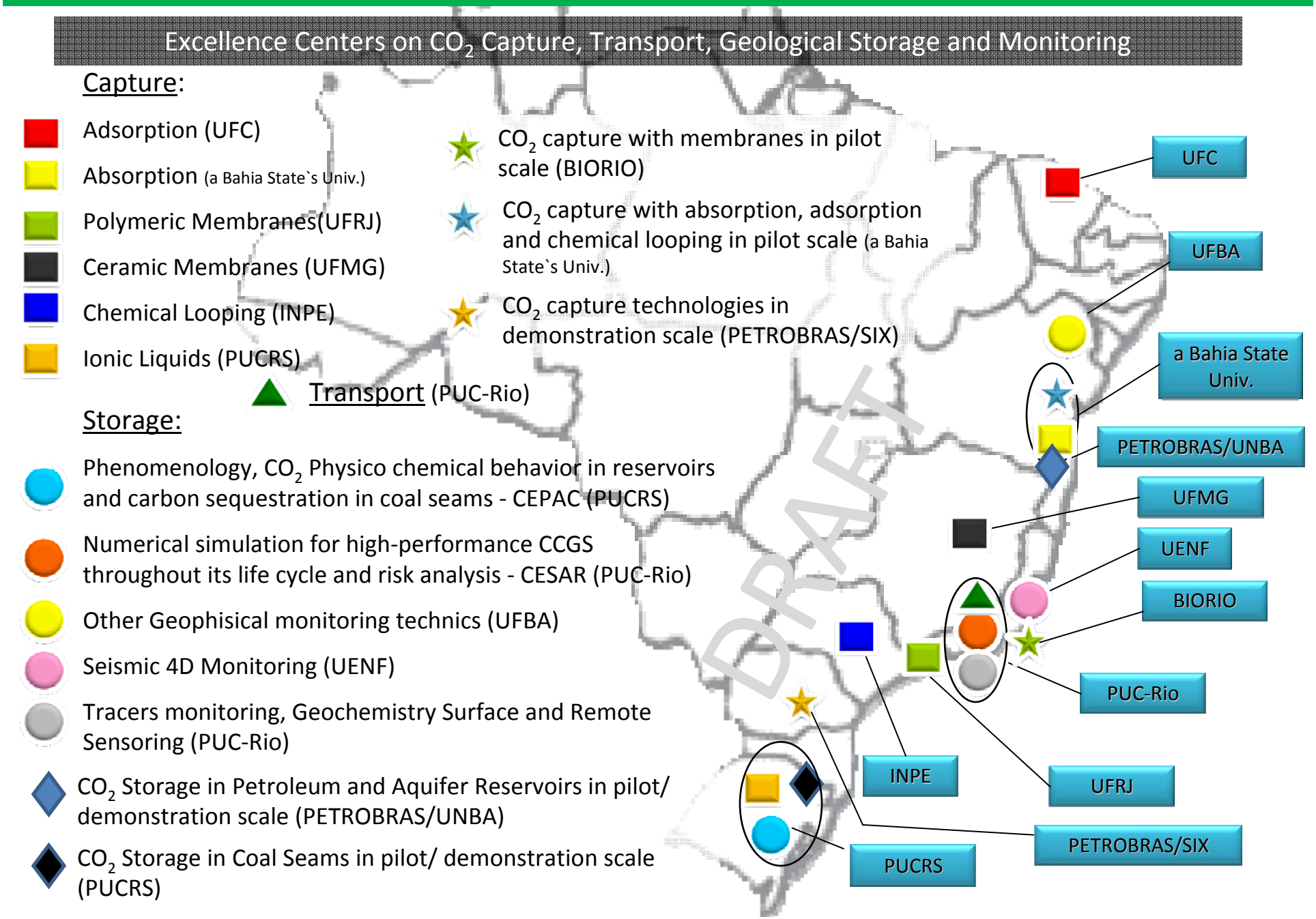
Capacity Building for Petrobras and other Brazilian Partners

- **International Seminary 'Carbon Sequestration: a way to the climate change mitigation'** – CENPES [100 people] - Aug/04
- **Capacity Building/Technology Transfer on CO_2 capture and Storage results from phase I of BP's CCP project [100 people]** – **Rio de Janeiro, Jan/05**
- **I International Petrobras Congress on CCGS** [400 people] – Rio de Janeiro - 2006
- **I Brazilian Seminary on Carbon Sequestration and Climate Change** [300 people] – Natal/RN - April/2007
- ***Sixth Annual Conference on Carbon Capture & Sequestration*** [15
- ***CSLF Workshop on Capacity Building for Carbon Capture & Sto***
- **I Brazilian Middle-west Congress on Climate Change and Green H**
  Aug/2007
- **Constrution of the Brazilian Road Map on CO_2 geological storag**
  Alegre/RS - Oct/2007
- **I *CSLF Brazilian Workshop on Capacity Building for Carbon Capture & Storage*** [1
  Oct/2007
- **Contrution of the Sustainability on the CCGS Road Map in Brazil** [60 people] – Rio de Janeiro/RJ - Oct/2007
- **CCGS and Ethics** [50 people] – Rio de Janeiro/RJ - Oct/2007
- **II Brazilian Seminary on Carbon Sequestration and Climate Change** [200 people] **– Maceió/AL – Mar/2008**
- **II International Petrobras Congress on CCGS** – Salvador/BA – Sep/2008
- **II *CSLF Brazilian Workshop on Capacity Building for Carbon Capture & Storage*** *– Salvador/Bahia -Sep/2008*
- *CSLF Workshop on Capacity Building for CCS – Washington/USA - Nov/2008*



Carbon Sequestration and Climate Change Network:

Excellence Centers on CO_2 Capture, Transport, Geological Storage and Monitoring



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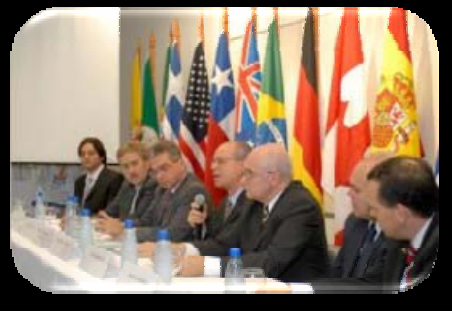
→ "to the petroleum industry"

- Pontifical Catholic University of Rio Grande do Sul - PUCRS / Porto Alegre,
- Operating since March, 2008
- 55 professionals in activity – chemical, engineers, geologists and geographers



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Implementation of a Combustion Technology R&D Center through Chemical Looping for CO_2 Capture

INPE/CACHOEIRA PAULISTA/SÃO PAULO
Beginning of the activities in May, 2008

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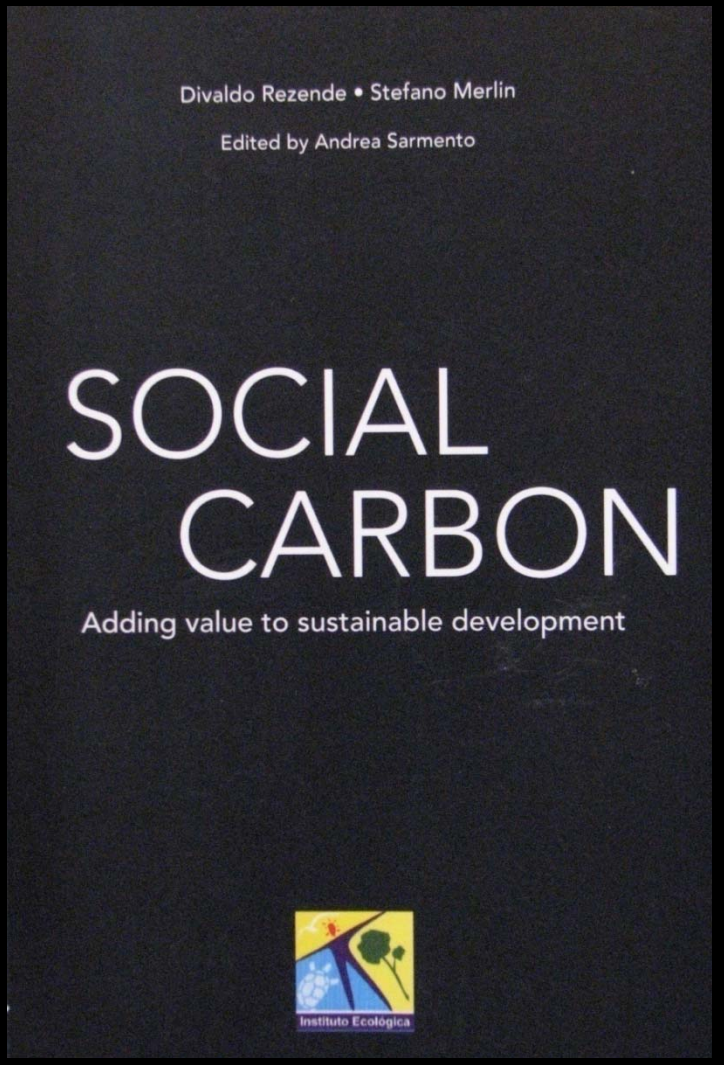
The CCS Sustainability map (economic-social-environmental aspects)

Tecnologias de Armazenamento de CO_2 e MMV							
Dimensão	**Fator de Sustentabilidade**	**TA0 - Injeção** Compreende a ação de introduzir o CO2 dentro de reservatórios geológicos, através de poços injetores, via pressurização do gás. Para tanto, compressores são utilizados.					
		grau de sustentabilidade			**meta**		**Linha de ação**
ambiental	uso de energia fóssil	+	3	justificativa:	2008	-	Otimização de processo. Avaliação de oportunidades para utilização do uso de fontes de energia renovável
				Uso de combustivel fossil é o mais comum nessa atividade.	2013	Modelagem matemática do processo e testes experimentais	
		-			2017	Definição de princípios e critérios para uso de energia renovável	
ambiental	uso de energia do grid	+	2	justificativa:	2008	-	Otimização de processo. Avaliação de oportunidades para utilização do uso de fontes de energia renovável
				Uso do grid leva ao aumento da demanda de energia eletrica.	2013	-	
		-			2017	melhorar a eficiencia em 20% do sistema de compressão.	

The CCS Social Carbon Project



Technological scaling acceleration for the reduction of the implementation time of CCGS technology

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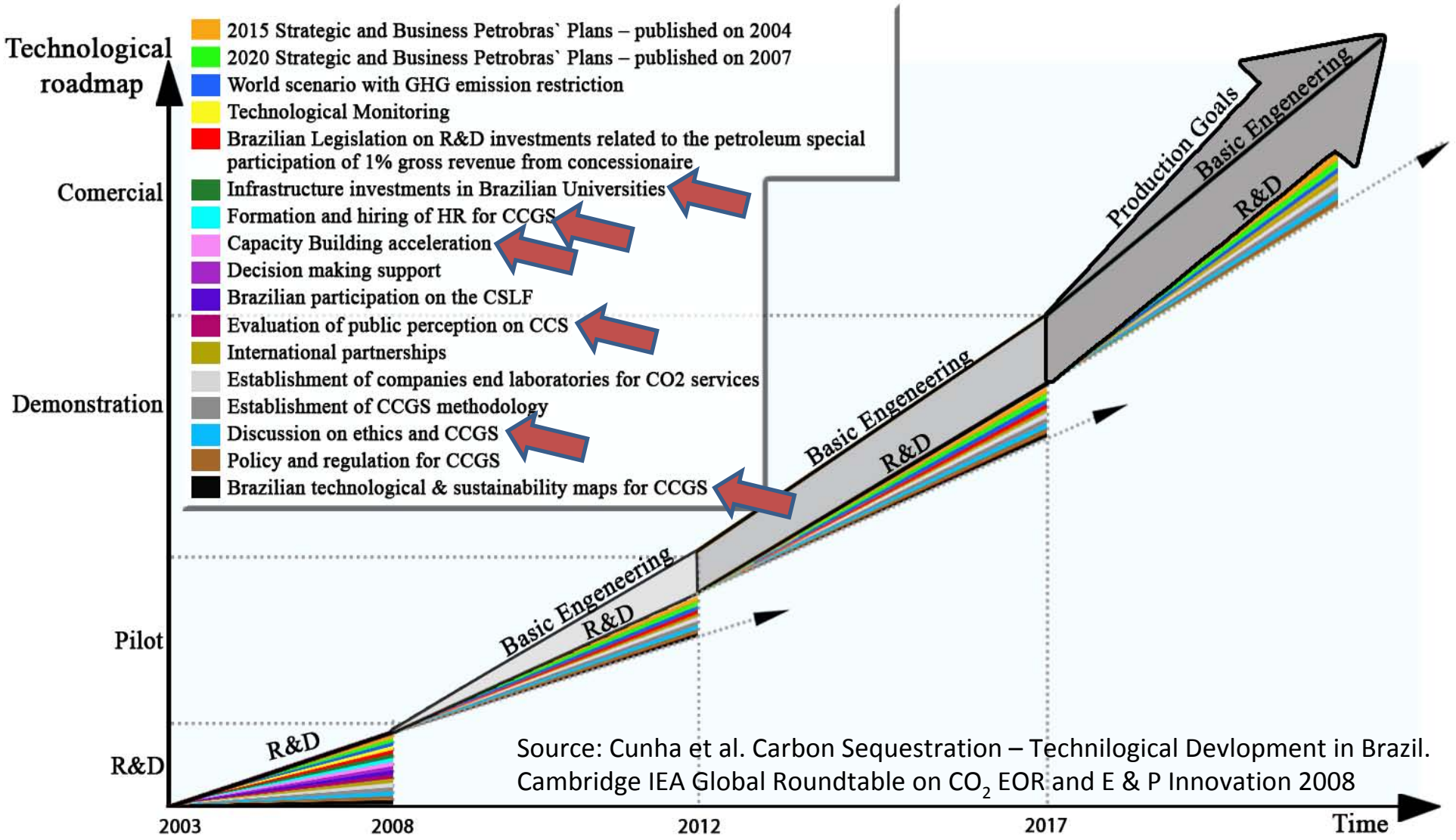
Accelerating Factors of CCGS in Brazil



Source: Cunha et al. Carbon Sequestration – Technilogical Devlopment in Brazil. Cambridge IEA Global Roundtable on CO_2 EOR and E & P Innovation 2008

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CONCLUSIONS

An integrated and holistic socio-economic approach to carbon planning…

1. impact key issues governing CCS deployment (THE G8/IEA/CSLF CARBON PLAN), such as (a) the development and implementation of regulatory and incentive regimes, and (b) gain community confidence and support.

2. can be applied to first and second phases of the G8/IEA/CSLF CARBON PLAN, but is critical already for the first phase.

3. NIMBY to PIMBY concept.

Socio-economic benefits of CCS can eventually be measured and demonstrated.

Socio-economic approach may impact technical readiness for CCS commercial deployment.

Socio-economic aspects need to be part of the decision…

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