



Saudi Aramco's Carbon Capture and Sequestration Technology Road Map

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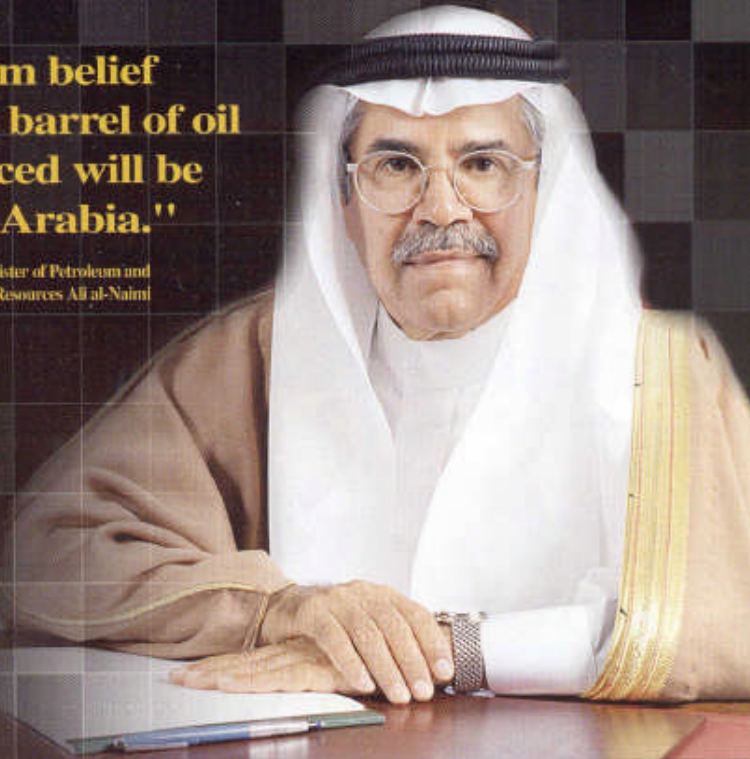
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**"It is my firm belief
that the last barrel of oil
to be produced will be
from Saudi Arabia."**

- Saudi Arabian Minister of Petroleum and
Mineral Resources Ali al-Naimi



**"I believe there is
enough technology
to sequester CO₂
and to take CO₂
out of the
atmosphere."**

April 5th, 2004



Abdallah S. Jum'ah told Davos session participants of his vision for the energy sector of the world's economy, including solidifying the image of energy.

“Saudi Aramco believes that we need to take well-considered actions to manage greenhouse gas emissions – but without harming the world economy”.

Mr. Jum'ah addressing World Economic Forum, Davos, January, 2006

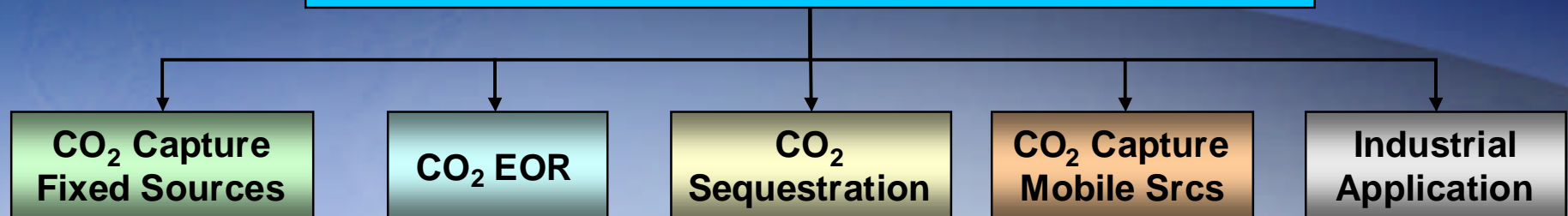
Saudi Arabia Carbon Management Activities

- Party to the UNFCCC and the Kyoto Protocol, but is not part of Annex I countries that are obligated to reduce their CO₂ emissions
- KSA is an active member of the international partnership in CSLF
- KSA held Regional CDM conference in Riyadh (Sep 2006)
- KSA pledged \$300 Million for R&D in energy, environment and climate change (Nov 2007)
- KSA is actively engaged in UNFCCC deliberations and instrumental in reaching the "Bali Roadmap" agreement on the development of future climate change regime

Saudi Aramco Carbon Management Activities

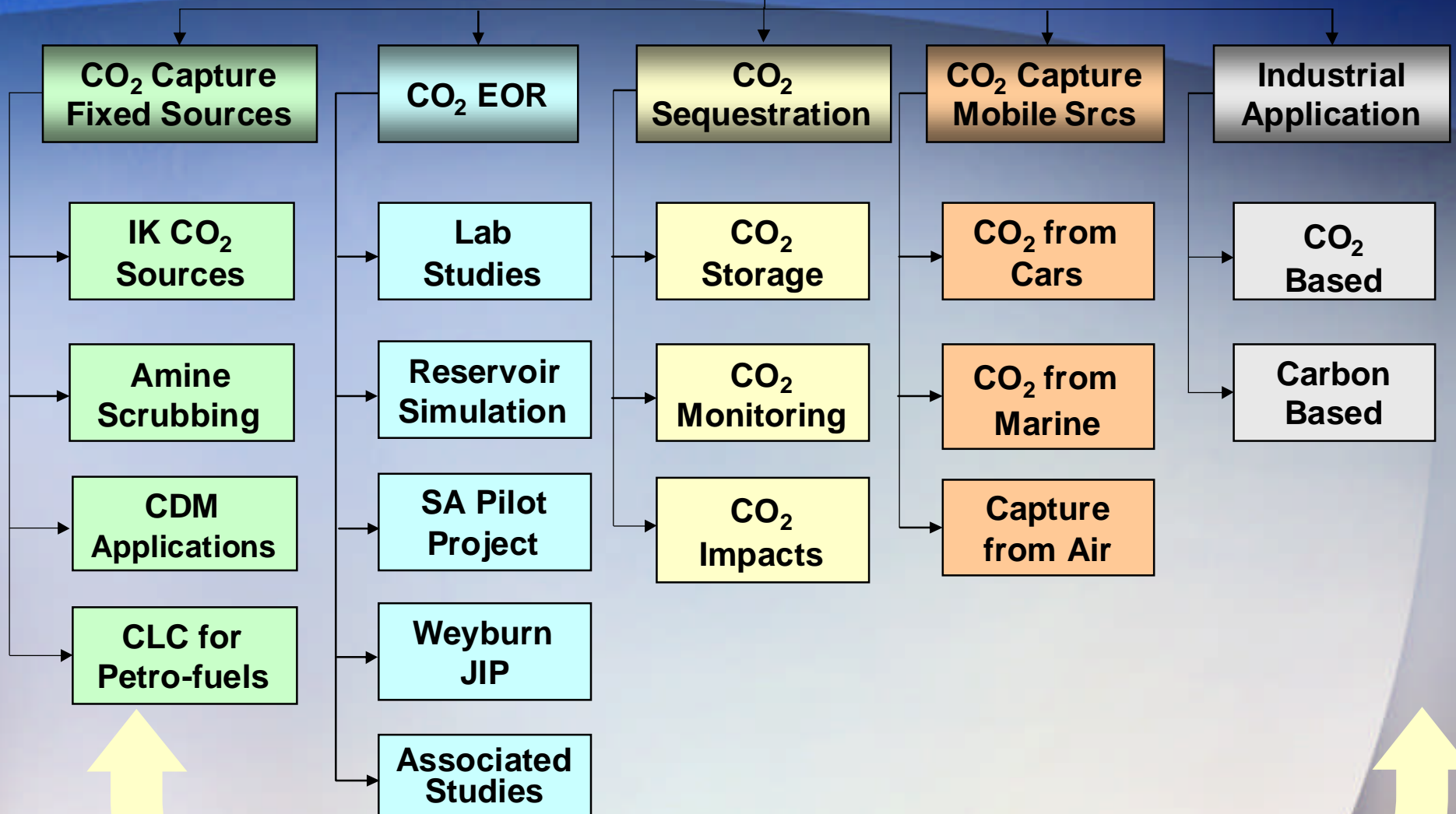
- Formed a multidisciplinary team to address the issue of climate change
- Developed a Carbon Management Technology Roadmap
- Raising regional and industry awareness
 - Enhancing collaboration among National Oil Companies
 - Saudi Aramco organized the first regional symposium on carbon management (May 2006)
- Saudi Aramco sponsored the IEA GHG Weyburn-Midale CO₂ monitoring and storage research project (2007)
- Active in conducting R&D studies in CO₂-EOR

CARBON MANAGEMENT TECHNOLOGY ROAD MAP



- Identifies focus areas
- Two primary motivations:
 - Protect the market for liquid hydrocarbon fuels
 - Reduce greenhouse gas emissions for social good
- Leverages petroleum industry resources and know-how
- Maximizes utilization of present and future CDM and other emission reduction mechanisms

CARBON MGMT TECHNOLOGY ROAD MAP



- PTRC & CO₂ CRC
- IEA-GHG program
- IK R&D Centers
- CCP & MIT-CSF
- CSLF
- Columbia Chalmers
- OPEC NOCs

Industrial & Research Alliances

CARBON MGMT TECHNOLOGY ROAD MAP

CO₂ Capture
Fixed Sources

CO₂ EOR

CO₂
Sequestration

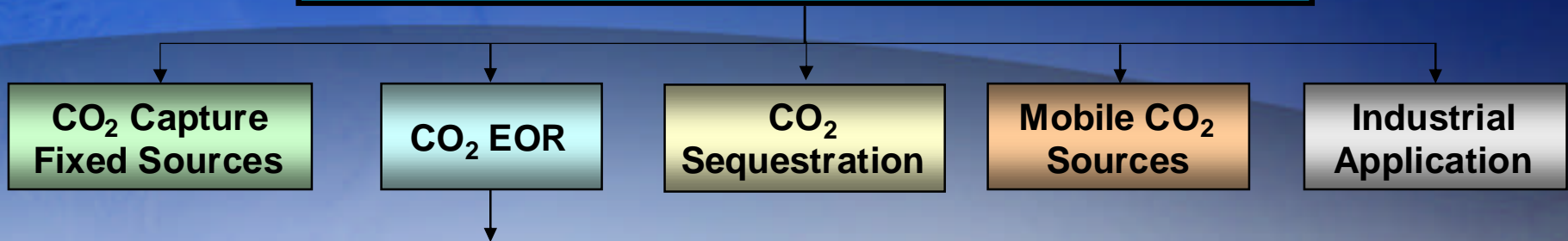
Mobile CO₂
Sources

Industrial
Application

Objectives

- Reduce the cost of Carbon Capture technology
- Develop Carbon Capture solutions for oil-based applications in stationary sources
- Promote value-added applications for domestic CO₂ streams
- Promote utilization of CDM

CARBON MGMT TECHNOLOGY ROAD MAP



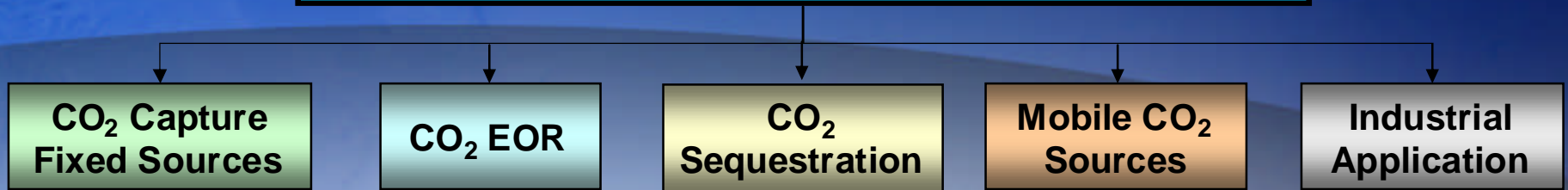
Global perspective:

- CO₂ EOR is a mature technology practiced for more than 2 decades
 - Most projects are in North America
 - Most inject CO₂ produced from natural deposits

Saudi Aramco's Perspective:

- Enhanced Oil Recovery is not needed for decades to come
 - Gain a better understanding of the science behind CO₂-EOR and to assess the impact of its use on oil reservoirs

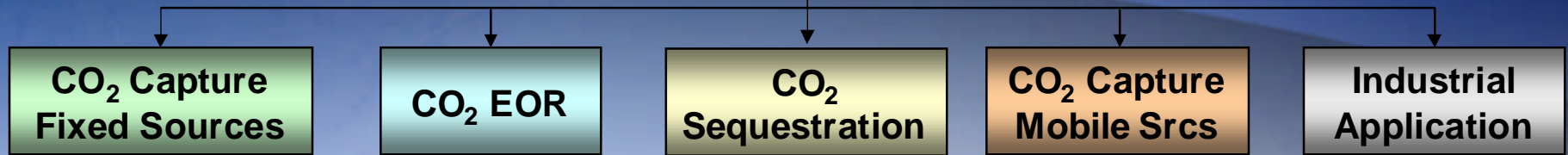
CARBON MGMT TECHNOLOGY ROAD MAP



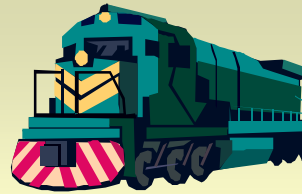
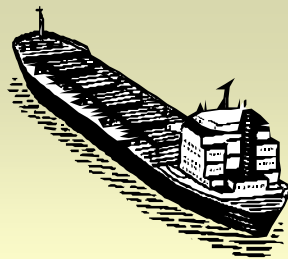
Saudi Aramco's Perspective:

- Research and if warranted develop appropriate technologies for carbon storage
- Promote utilization of CDM in geo-sequestration

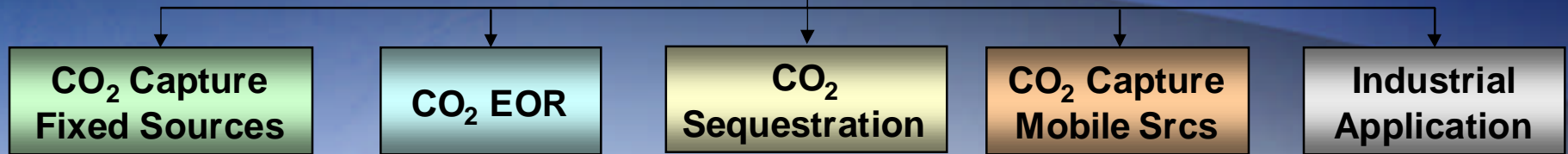
CARBON MGMT TECHNOLOGY ROAD MAP



The transportation sector is the most vital market for oil. The Carbon Management Team will pursue partnerships to research capture from:



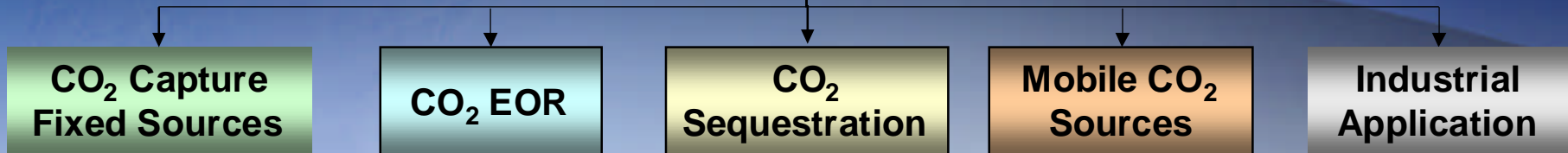
CARBON MGMT TECHNOLOGY ROAD MAP



Carbon Management Team Approach:

- ◉ Monitor developments in this sector (emissions, regulations & technologies)
- ◉ Enhance collaborations with technology developers
- ◉ Complement rather than duplicate world's efforts

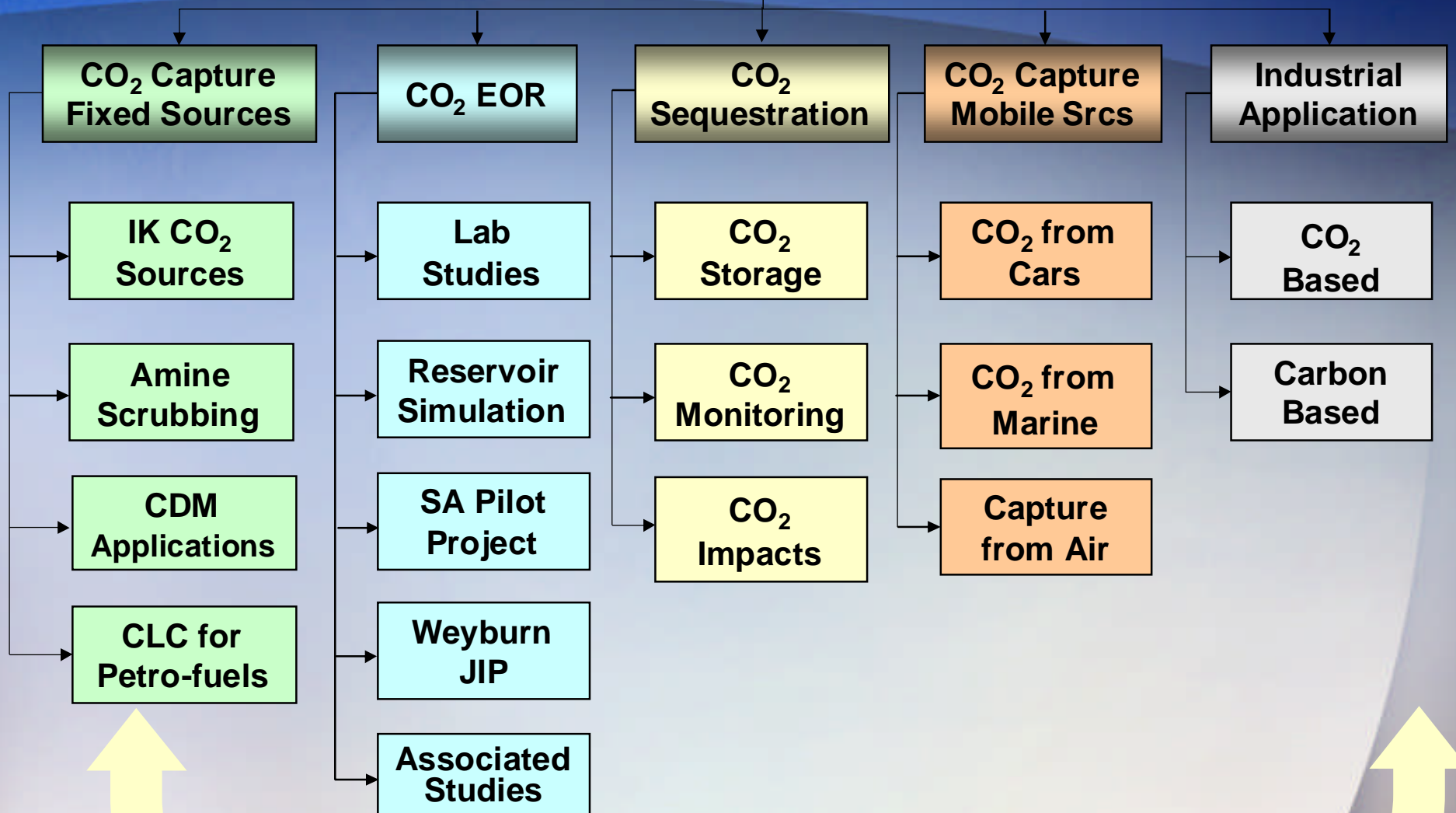
CARBON MGMT TECHNOLOGY ROAD MAP



Utilize captured CO₂ or carbon to maximize value of capture from combustion of fuels.

- ◉ Investigate usage of CO₂ for alkaline waste water treatment
- ◉ CO₂-based polymers
- ◉ Carbon-based industrial applications

CARBON MGMT TECHNOLOGY ROAD MAP



PTRC & ITC

IEA-GHG program

IK R&D Centers

CCP & MIT-CSF

CSLF

Columbia Chalmers

OPEC NOCs

Industrial & Research Alliances

Concluding Remarks

- Saudi Aramco addressing global climate change by promoting R&D in carbon capture and storage
- Our Carbon Management strategy aims at turning CO₂ challenges into opportunities
- Saudi Aramco's activities are a synergetic team effort among several internal and external organizations
- Relationships have been established with many international consortia on Carbon Management R&D