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Carbon Capture and Storage Technology

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The prospect of global warming is a matter of genuine public concern. The concentration of carbon dioxide in the atmosphere has been increasing since industrialization in the 19th century. There is a wide consensus from extensive research in the last three decades that rapid climate change is already happening, that global average temperatures are increasing at unprecedented rates and mankind is having a visible impact on the world's climate. Fossil fuel fired plants are responsible for the one third of the carbon dioxide (CO₂) emissions which thought to be a major contributor to the current rise in the Earth's surface temperature. The global warming occurs when the added greenhouse gases trap more of the earth's outgoing heat radiation.

Contributors of the CO₂ emissions in can be grouped under three categories:

- *Point sources* - Industrial plants, oil and gas processing sites, power plants;
- *Line sources* - Road transportation vehicles and,
- *Scattered sources* - Residential areas, buildings.

Reducing CO₂ atmospheric concentrations by capturing emissions at the source—power plants or chemical units—and then storing them in subsurface reservoirs is thought by many scientists to be a reliable solution until emission-free energy sources are developed and viable. The current options for captured CO₂ utilization are; Enhanced Oil Recovery (EOR), Enhanced Coal Bed Methane Recovery (ECBM), Enhanced Gas Recovery (EGR), Food processing applications, Mineral products, Fertilizer manufacture, Algae growth promoter, enhanced plant growth. The capture and storage of CO₂ continues to accelerate as new projects are initiated and existing projects confirm the development scenarios.

Crucial elements in CO₂ storage are site selection, well field development and reliable monitoring of CO₂ migration behavior and storage volumes. An innovative seismic monitoring techniques, has recently been developed with the application of time-lapse (4D) seismic technology and advanced reservoir simulation to optimize CO₂ storage operations. Well design, cementing, completions techniques and long life cycle mechanical integrity assurance are currently subject of many R&D projects.

Industry expertise also is being tapped in CO₂ projects across Europe and in Australia, including four major EU proposals under the Framework Program Six and the Australian CO₂CRC Otway Project. These projects address pertinent issues in CO₂ capture and storage such as site selection, storage monitoring and verification techniques, developing local CO₂ storage sites from hydrogen- and power-generation plants, and industry training. In our paper framework of CO₂ sequestration and vital aspects such as; site selection, reservoir characterization, modeling of storage and long term leakage monitoring techniques will be illustrated.