



**OGW SRL**

Office: VIA ETRURIA 47—00183 ROMA - ITALY

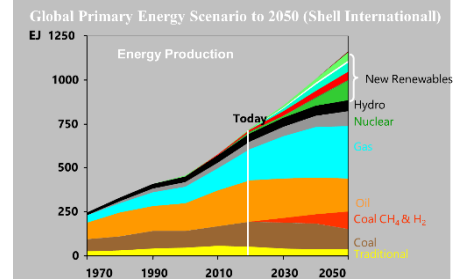
Factory: VIA DELL'INDUSTRIA 14—37070 MOZZECANE (VR) - ITALY

info@ogw-srl.com – ogwsrl@gmail.com - Tel: +39.045.5118465

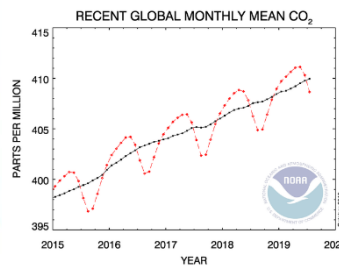
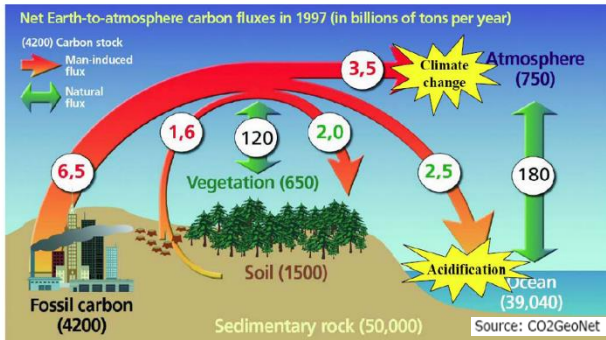


# CARBON CAPTURE AND STORAGE (CCS)

FOSSIL FUELS (COAL, OIL, GAS) ARE NECESSARY FOR TENS OF YEARS TO COME BECAUSE RENEWABLE ENERGY SOURCES ARE INSUFFICIENT AND DISCONTINUOUS. THEREFORE, CO<sub>2</sub> MUST BE CAPTURED AND STORED TO MITIGATE CLIMATE CHANGE.



Worldwide CO<sub>2</sub> emissions from fossil fuel use: 6.5 Gt C/y (or 24 Gt CO<sub>2</sub>/y)

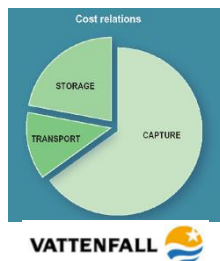
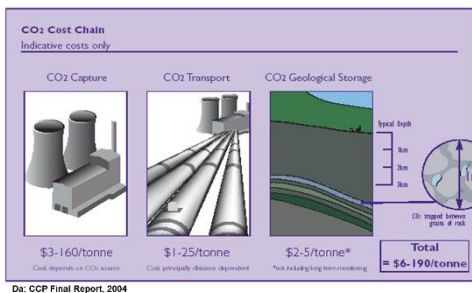
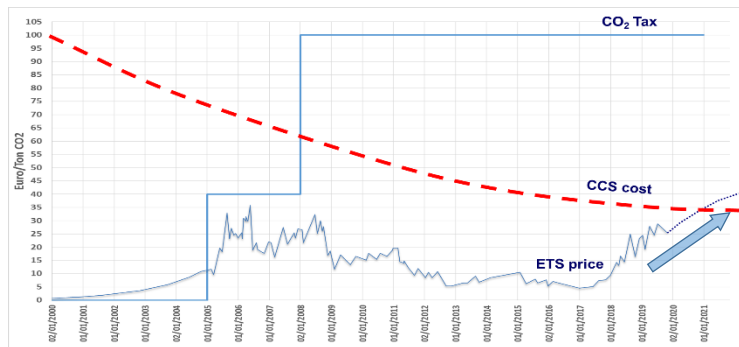


EVERY YEAR MANKIND EMITS MORE CO<sub>2</sub> THAN NATURE CAN TAKE BACK. CCS IS A NECESSITY.

FROM THE CO<sub>2</sub> CAPTURE VIEWPOINT, THE BEST TECHNOLOGIES ARE POST-COMBUSTION, PRE-COMBUSTION AND OXY-FUEL CAPTURE. FROM THE STORAGE VIEWPOINT, CO<sub>2</sub> CAN BE INJECTED IN SUITABLE OIL FIELDS (CO<sub>2</sub>-EOR) TO ENHANCE PRODUCTION, IN UNMINEABLE COAL BEDS OR IN DEEP SALINE AQUIFERS. THE LATTER HAVE THE LARGEST CAPACITY, WHILE THE FIRST OFFER THE MOST ECONOMIC RETURNS.

THE GRADUAL REDUCTION OF CO<sub>2</sub> ALLOWANCES ON THE MARKET IS PUSHING THE EMISSION CERTIFICATE PRICE HIGHER AND HIGHER.

THE TWO CURVES, LOWERING CAPTURE COST AND RISING CERTIFICATE PRICE, WILL CROSS ALLOWING CCS TO DEVELOP WORLDWIDE.



CO<sub>2</sub> CAPTURE IS THE LARGEST COST IN CCS. PROJECT PROFITABILITY IS MAXIMIZED BY SELECTING WHERE THE CO<sub>2</sub> CAPTURE IS CHEAPEST, NEAR A SUITABLE CO<sub>2</sub> STORAGE SITE.



**OGW SRL**

Office: VIA ETRURIA 47—00183 ROMA - ITALY

Factory: VIA DELL'INDUSTRIA 14—37070 MOZZECANE (VR) - ITALY

[info@ogw-srl.com](mailto:info@ogw-srl.com) – [ogwsrl@gmail.com](mailto:ogwsrl@gmail.com) - Tel: +39.045.5118465



**SCENARIO A**

**CAPTURE 1 MILLION TON/YEAR OF CO<sub>2</sub> AT 5 USD/TON**  
**TRANSPORT THE CO<sub>2</sub> AT 1 USD/TON**  
**STORE THE CO<sub>2</sub> AT 2.5 USD/TON**  
**SELL CO<sub>2</sub> EMISSION CERTIFICATES AT 25 USD/TON**  
**CAPEX 100 MILLION USD, OPEX 8.5 MILLION USD/YEAR**  
**YEARLY PROFIT = 16.5 MILLION USD, PAYBACK IN 6 YEARS**

**SCENARIO B**

**CAPTURE 12 MILLION TON/YEAR OF CO<sub>2</sub> AT 15 USD/TON**  
**TRANSPORT THE CO<sub>2</sub> AT 1 USD/TON**  
**STORE THE CO<sub>2</sub> AT 2.5 USD/TON**  
**SELL CO<sub>2</sub> EMISSION CERTIFICATES AT 29 USD/TON**  
**CAPEX 550 MILLION USD, OPEX 18.5 MILLION USD/YEAR**  
**YEARLY PROFIT = 126 MILLION USD, PAYBACK IN 4.4 YEARS**

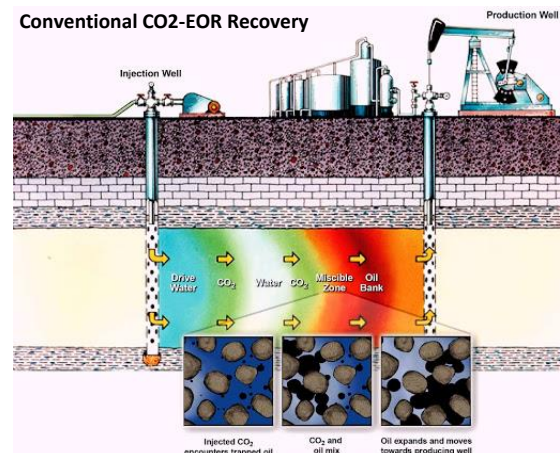
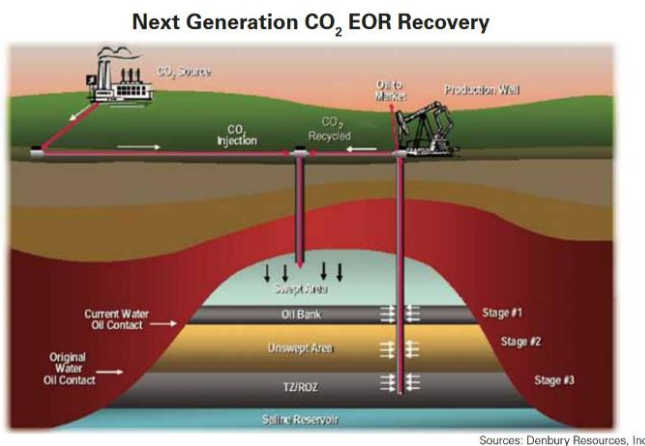
**SCENARIO C - CEMENT PLANT**

**CEMENT PRODUCTION 1,500,000.00 TON/YEAR**  
**CO<sub>2</sub> PRODUCTION 900,000.00 TON/YEAR (66% FROM PROCESS AND 34% FROM GAS BURNER)**  
**CAPTURE 900,000.00 TON/YEAR OF CO<sub>2</sub> AT 15 USD/TON**  
**TRANSPORT THE CO<sub>2</sub> AT 1 USD/TON**  
**STORE THE CO<sub>2</sub> AT 2.5 USD/TON**  
**SELL CO<sub>2</sub> EMISSION CERTIFICATES AT 25 USD/TON**  
**OPEX+CAPEX PRO RATA = -16,650,000.00 USD/YEAR**  
**YEARLY PROFIT<sup>1</sup> = + 5,850,00 MILLION USD**

DEVELOPED WITH



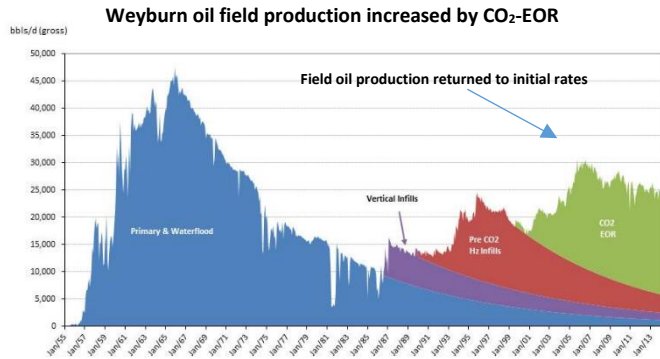
ALTERNATIVELY, PROJECT PROFITABILITY IS IMPROVED BY SELLING CAPTURED CO<sub>2</sub> TO A NEARBY CO<sub>2</sub>-EOR (*ENHANCED OIL RECOVERY*) PROJECT, BECAUSE THE REVENUE FROM SELLING CO<sub>2</sub> TO OIL PRODUCERS IS ADDITIONAL TO THE REVENUE FROM SELLING CO<sub>2</sub> EMISSION CERTIFICATES TO THE MARKET.



<sup>1</sup> If the plant need certificate for the CO<sub>2</sub> emission this rapresents saving.

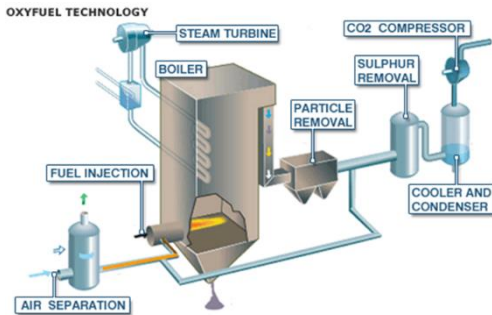
CO<sub>2</sub>-EOR USES CO<sub>2</sub> CAPTURED FROM AN INDUSTRIAL PROCESSES TO INCREASE THE PRODUCTION OF OIL FROM EXISTING OIL FIELDS.

AT THE WEYBURN OIL FIELD (CANADA) CO<sub>2</sub>-EOR INCREASED OIL PRODUCTION SIGNIFICANTLY, OFFSETTING THE CO<sub>2</sub> PURCHASE COST.

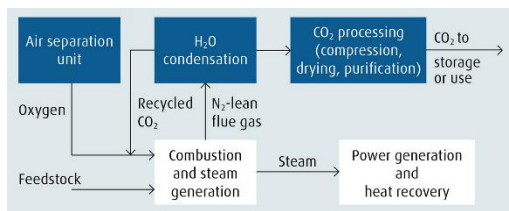


DEDICATED CO<sub>2</sub> UNDERGROUND STORAGE COMPANIES WILL PROSPER SELLING GUARANTEED CO<sub>2</sub> EMISSION CERTIFICATES TO WHOEVER NEEDS THEM, FROM PETROL STATIONS TO POWER SUPPLIERS OR FOOD RETAILERS.

THE CO<sub>2</sub> CAPTURE OPTIONS CAN BE CLASSIFIED AS OXY-FUEL COMBUSTION AND CAPTURE, POST-COMBUSTION CAPTURE, PRE-COMBUSTION CAPTURE AND SEPARATION FROM NATURAL GAS.

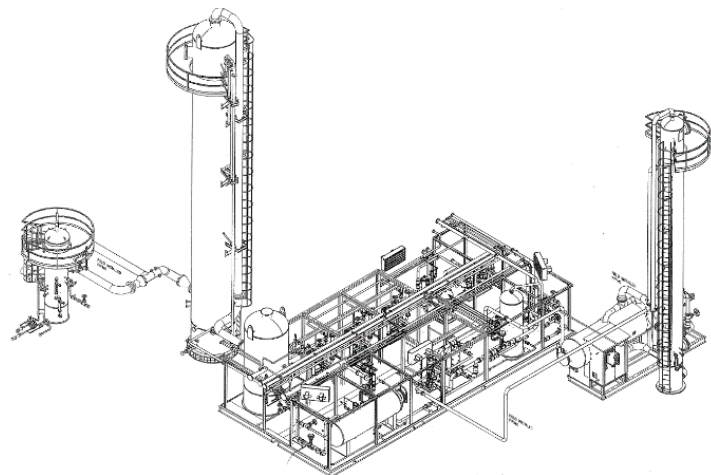


OXYFUEL COMBUSTION MAKES A VALUABLE CONTRIBUTION TO IMPROVING THE CARBON BALANCE OF FOSSIL FUEL COMBUSTION. WITH THIS PROCESS, COAL OR OTHER FUEL IS COMBUSTED IN AN ATMOSPHERE CONSISTING OF PURE OXYGEN AND RECYCLED CARBON DIOXIDE (CO<sub>2</sub>).



THE RESULTANT FLUE GAS IS NOT DILUTED BY NITROGEN PRESENT IN AIR, BUT PRIMARILY CONSISTS OF CO<sub>2</sub> AND WATER VAPOUR. THIS VAPOUR IS EASILY CONDENSABLE, LEAVING A HIGHLY CONCENTRATED CO<sub>2</sub> STREAM. THE CO<sub>2</sub> CAN THEN BE COMPRESSED AND STORED.

POWER PLANTS, OIL REFINERIES, NATURAL GAS OR BIOGAS SWEETENING AS WELL AS PRODUCTION OF AMMONIA, ETHYLENE OXIDE, CEMENT AND IRON AND STEEL ARE THE MAIN INDUSTRIAL SOURCES OF CO<sub>2</sub>.





**OGW SRL**

Office: VIA ETRURIA 47—00183 ROMA - ITALY

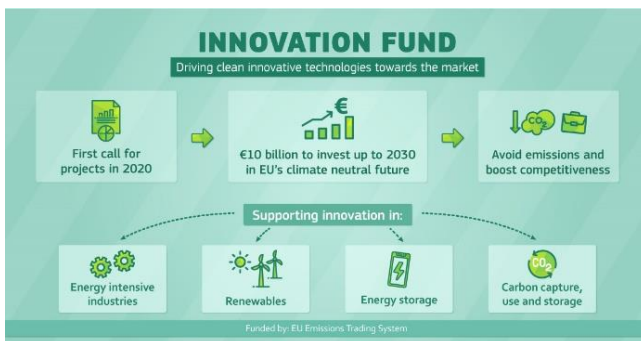
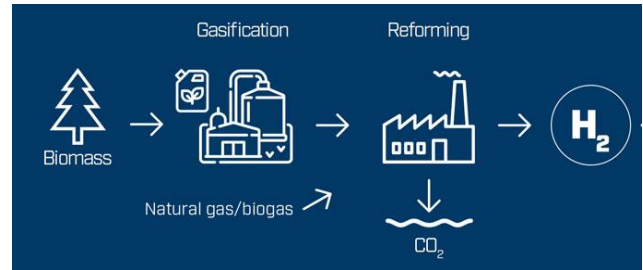
Factory: VIA DELL'INDUSTRIA 14—37070 MOZZECANE (VR) - ITALY

[info@ogw-srl.com](mailto:info@ogw-srl.com) – [ogwsrl@gmail.com](mailto:ogwsrl@gmail.com) - Tel: +39.045.5118465



WITH REFORMING PLANTS IS POSSIBLE TO TRASFORM THE BIOGAS IN H<sub>2</sub> WITH THE EMISSION OF CO<sub>2</sub> AND H<sub>2</sub>O. THE CO<sub>2</sub> CAN BE CAPTURED AND STORED IN SUBSURFACE.

IN SITU PRODUCTION OF H<sub>2</sub> FROM METHANE OR BIOGAS IS SAFE, CONTINUOUS, AND NOT LINKED TO POTENTIALLY PROBLEMATIC H<sub>2</sub> TRANSPORT.



THE INNOVATION FUND OF THE EUROPEAN UNION IS FOCUSED ON LOW-CARBON TECHNOLOGIES IN ENERGY INTENSIVE INDUSTRIES, CARBON CAPTURE AND STORAGE (CCS) AND CARBON CAPTURE AND UTILISATION (CCU).

PRODUCTION OF H<sub>2</sub> FROM METHANE OR BIOGAS IS INCLUDED IN THE INNOVATIVE RENEWABLE ENERGY GENERATION.

## OGW SRL AND LOGO ENGINEERING CONSULTING

- WE SUPERVISE THE DESIGN OF THE ENTIRE CARBON CAPTURE AND STORAGE (CCS) SYSTEM FROM INDUSTRIAL CAPTURE TO TRANSPORT AND WELL DRILLING, INJECTION AND STORAGE.
- LOGO ENGINEERING DESIGN, SUPPLY AND INTEGRATE THE CO<sub>2</sub> CAPTURE PLANT IN CEMENT PLANTS
- WE DESIGN AND SUPPLY THE ENTIRE BIOGAS PLANT AND SYSTEM FOR CONVERSION BIOGAS OR METHANE TO H<sub>2</sub> AND CARBON CAPTURE AND USE (CCU) OR CARBON CAPTURE AND STORAGE (CCS).
- WE EVALUATE THE RESERVOIR PERFORMANCE, THE CO<sub>2</sub> STORAGE CAPACITY AND THE INJECTION PROFILE.
- WE EVALUATE THE SUITABILITIES OF EXISTING WELLS AND THE NEED OF NEW INJECTION WELLS.
- WE EVALUATE THE ENHANCED OIL RECOVERY (EOR) EFFICIENCY USING CO<sub>2</sub> AND THE ULTIMATE CO<sub>2</sub> STORAGE POTENTIAL OF THE OIL FIELD AFTER THE END OF OIL PRODUCTION.
- WE PROVIDE LOW IMPACT DRILLING SERVICES WITH "CO<sub>2</sub> ENHANCED DRILLING <sup>2</sup>", HIGH SAFETY STANDARDS AND ENVIRONMENTAL PROTECTION.
- WE SUPERVISE THE DESIGN, SUPPLY AND CONSTRUCTION OF CARBON CAPTURE SYSTEMS FROM LARGE INDUSTRIAL SOURCES.
- WE DESIGN AND SUPPLY CARBON CAPTURE SYSTEMS FROM SMALL INDUSTRIAL SOURCES (EPC).
- WE SUPERVISE THE DESIGN, SUPPLY AND CONSTRUCTION OF THE INJECTION GAS FACILITY WITH BOOSTER COMPRESSORS AND INJECTION COMPRESSORS, AS WELL AS UTILITIES & OFFSITE FACILITIES.

<sup>2</sup> A possible solution to integrate drilling activities and CO<sub>2</sub> is to use it as underbalanced drilling gas. This possibility can be followed in the last part of the new well drilled for CCS purposes. The idea is to use part of the CO<sub>2</sub> coming from the sequestration plant as a drilling fluid. Commonly is not used for corrosion and pressure problems, but can be a possible idea to use it on the sand face to decrease damages and eventually increase permeability. The control of the underbalanced drilling can be integrated into the fluid dynamic model of the well. If used CO<sub>2</sub> requires special equipment to recover it from the gas trap and to reduce the corrosion of equipment.

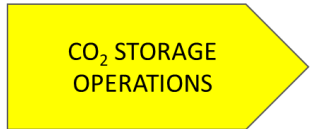


**OGW SRL**

Office: VIA ETRURIA 47—00183 ROMA - ITALY

Factory: VIA DELL'INDUSTRIA 14—37070 MOZZECANE (VR) - ITALY

[info@ogw-srl.com](mailto:info@ogw-srl.com) – [ogwsrl@gmail.com](mailto:ogwsrl@gmail.com) - Tel: +39.045.5118465



**18-24 Months**

- Regional study and capture-storage matching
- CO<sub>2</sub> storage site ranking and characterization
- Capture system design
- Environmental Impact Study
- Storage site appraisal work programme design and supervision
- Front End Engineering Design (FEED)

**18-36 Months**

- Detailed engineering
- Procurement
- CO<sub>2</sub> capture plant construction
- CO<sub>2</sub> storage site construction, including compressors

**24-48 Months**



- Appraisal and development well drilling (10 – 30 wells)
- Innovative UBD-CO<sub>2</sub> system

- CO<sub>2</sub> injection
- CO<sub>2</sub> storage certification
- CO<sub>2</sub> emission certificates sale

**CCS**



**18-24 Months**

- Regional study and capture system selection
- CO<sub>2</sub> compatibility study and EOR evaluation
- Capture system design
- Environmental Impact Study
- Storage site appraisal work programme design and supervision
- Front End Engineering Design (FEED)

**18-36 Months**

- Detailed engineering
- Procurement
- CO<sub>2</sub> capture plant construction
- CO<sub>2</sub> EOR equipment construction, including compressors

**24-48 Months**



- Development well drilling (20 – 40 wells)
- Innovative UBD – CO<sub>2</sub> drilling

- CO<sub>2</sub> injection
- Enhanced oil production
- CO<sub>2</sub> recycling
- Final CO<sub>2</sub> storage certification
- CO<sub>2</sub> emission certificates sale to offset abandonment cost

**CO<sub>2</sub> EOR**