

# 二氧化碳捕獲及封存技術研發與示範計畫

執行單位

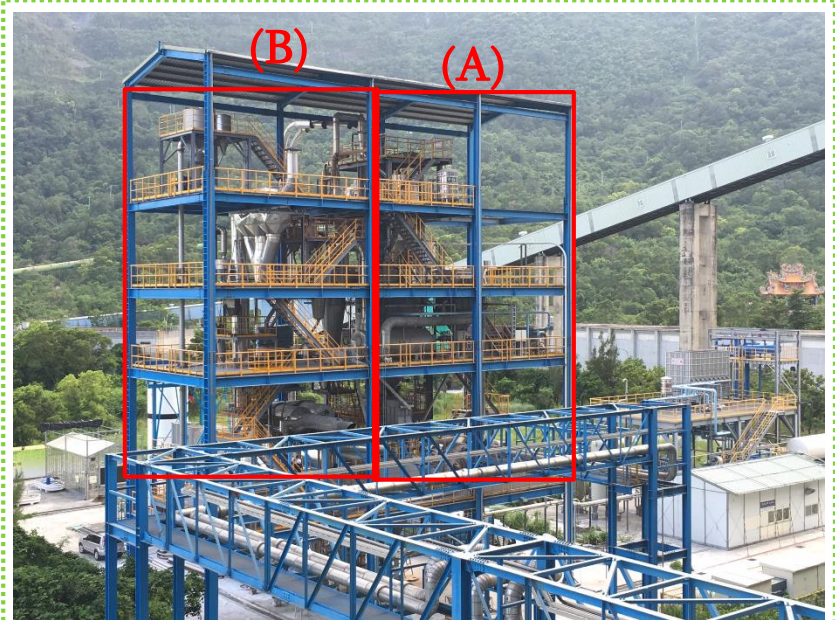
財團法人工業技術研究院

計畫主持人

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- 計畫未來應用標的：本計畫開發之鈣迴路捕獲二氧化碳技術可應用於水泥、發電、鋼鐵、石化、造紙業之二氧化碳排放減量處理。

- 專利佈局方向分為二氧化碳捕獲製程、碳酸化爐系統、煅燒爐系統、吸附劑再生及再利用四部份。
- 已經提出**13項26件**專利之申請。
- 已獲證**19件**發明專利，其中中華民國發明專利**11件**；中國大陸發明專利**6件**；美國發明專利**2件**



(A)：1.9MWt鈣迴路捕獲CO<sub>2</sub>先導廠

(B)：500kWt鈣迴路捕獲CO<sub>2</sub>新世代先導廠  
(500kWt整合蒸氣水合與多階旋風式捕碳系統)

## ● 技術介紹

鈣迴路捕獲CO<sub>2</sub>技術是利用天然石灰石為原料，經由碳酸化與煅燒兩種反覆循環的化學反應，可捕獲來自電廠鍋爐或工業爐之燃燒煙氣中之CO<sub>2</sub>。在碳酸化反應，利用氧化鈣(CaO)與煙氣中的CO<sub>2</sub>反應形成碳酸鈣(CaCO<sub>3</sub>)，產生之碳酸鈣再經由第二種化學反應，稱之為煅燒反應，再生為氧化鈣與高濃度的二氧化碳。經由碳酸化與煅燒反覆反應形成一循環迴路，可將煙氣中之CO<sub>2</sub>捕獲並濃縮成90%以上之CO<sub>2</sub>，並加以地質封存或再利用。

## ● 目前發展情形

### □ 1.9MWt鈣迴路捕獲CO<sub>2</sub>先導廠

- CO<sub>2</sub>捕獲量：1 ton/hr
- 累積運轉時數2,600小時，連續運轉時數 > 106小時
- 二氧化碳捕獲效率 > 80%
- 失活吸附劑可作為水泥廠原料

### □ 500kWt鈣迴路捕獲CO<sub>2</sub>新世代先導廠

- CO<sub>2</sub>捕獲量：0.27 ton/hr
- 整合蒸氣水合程序於多階旋風式鈣迴路捕獲系統
- CO<sub>2</sub>捕獲效率 > 90%、Ca/C莫耳比3.9、額外能源損耗小於20%

## ● 國際獎項

此項技術獲得2014年全球百大科技研發獎

# Research and Demonstration for Carbon Capture and Storage Technology

Execution Unit

Industrial Technology Research Institute (ITRI)

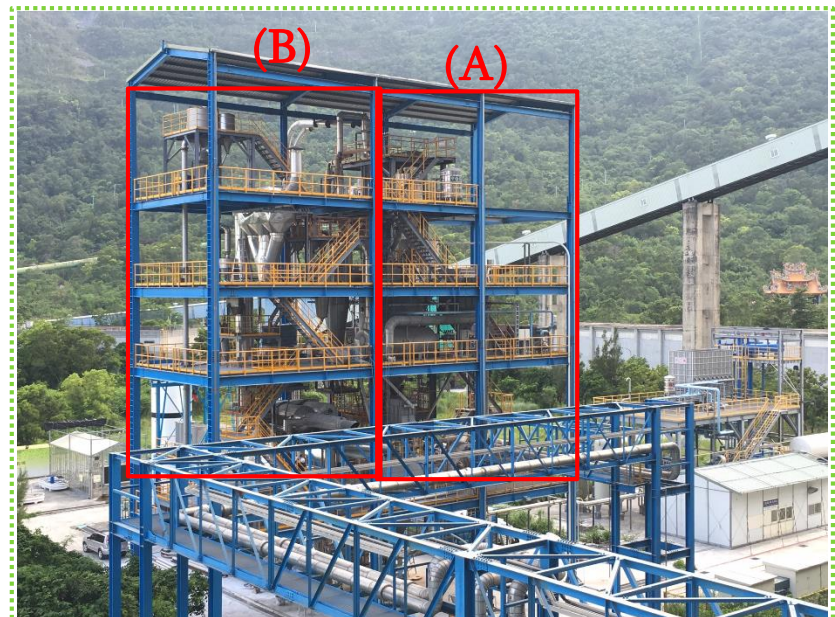
Project Director

Heng-Wen Hsu

## ● Content

The calcium looping CO<sub>2</sub> capture technology can be applied for carbon reduction of cement, power generation, steel, petrochemical, and pulp industry.

- Patent layout : CO<sub>2</sub> capture process, carbonator system, Calciner system, adsorbent recovery and reuse
- 26 patents have been applied
- 19 invention patents has been certified, include 11 invention patents of R.O.C., 6 invention patents of P.R.O.C., 2 invention patents of USA



(A) : 1.9MWt calcium looping capture pilot system

(B) : 500kWt new generation calcium looping capture pilot system

## ● Technology Introduction

The calcium looping process uses natural limestone ( $\text{CaCO}_3$ ) as carbon capture raw material. The process captures  $\text{CO}_2$  in the combustion flue gas coming out of power plant boilers or industry furnace. Calcium is looped between two chemical reactions involving Carbonation and Calcination. In the carbonation reaction, calcium in  $\text{CaO}$  captures  $\text{CO}_2$  in the combustion flue gas and becomes  $\text{CaCO}_3$ . In the second reaction, so called calcination reaction,  $\text{CaCO}_3$  is reversed back to  $\text{CaO}$  and released at high purity  $\text{CO}_2$ . By looping between these two reactions,  $\text{CO}_2$  can be collected and concentrated to >90%, and then transported for geologic storage or reutilization.

## ● Development Status

### □ 1.9MWt calcium looping carbon capture pilot system

- $\text{CO}_2$  capture capacity: 1 ton/hr
- accumulation operation time about 2,600hr, continuous run time > 106hr
- continuous steady > 80%  $\text{CO}_2$  capture efficiency
- deactivated adsorbent completely acts as raw material for cement plant

### □ 500kWt new generation calcium looping carbon capture pilot system

- $\text{CO}_2$  capture capacity: 0.27 ton/hr
- hydration-integrated cascade cyclone calcium looping pilot system
- >90%  $\text{CO}_2$  capture efficiency, Ca/C mole ratio 3.9, <20% additional energy consumption

## ● Honor

Calcium looping capture technology won the 2014 R&D 100 Awards.