

# 綠色融資、專案融資 與碳金融

報告人: 許智強

任職機構: 清華大學

2023/3/24

# 許智強簡歷

- 國立清華大學材料工程學士，美國賓州大學華頓商學院MBA
- 曾任職於美國紐約銀行業財務主管八年
- 新竹科學園區高科技業有十八年高階主管與執行長的經驗，目前專注於金融科技、私募與創投領域等。
- 清華大學金融科技與區塊鏈學程學分班兼任副教授
- 清華大學月涵學校主任

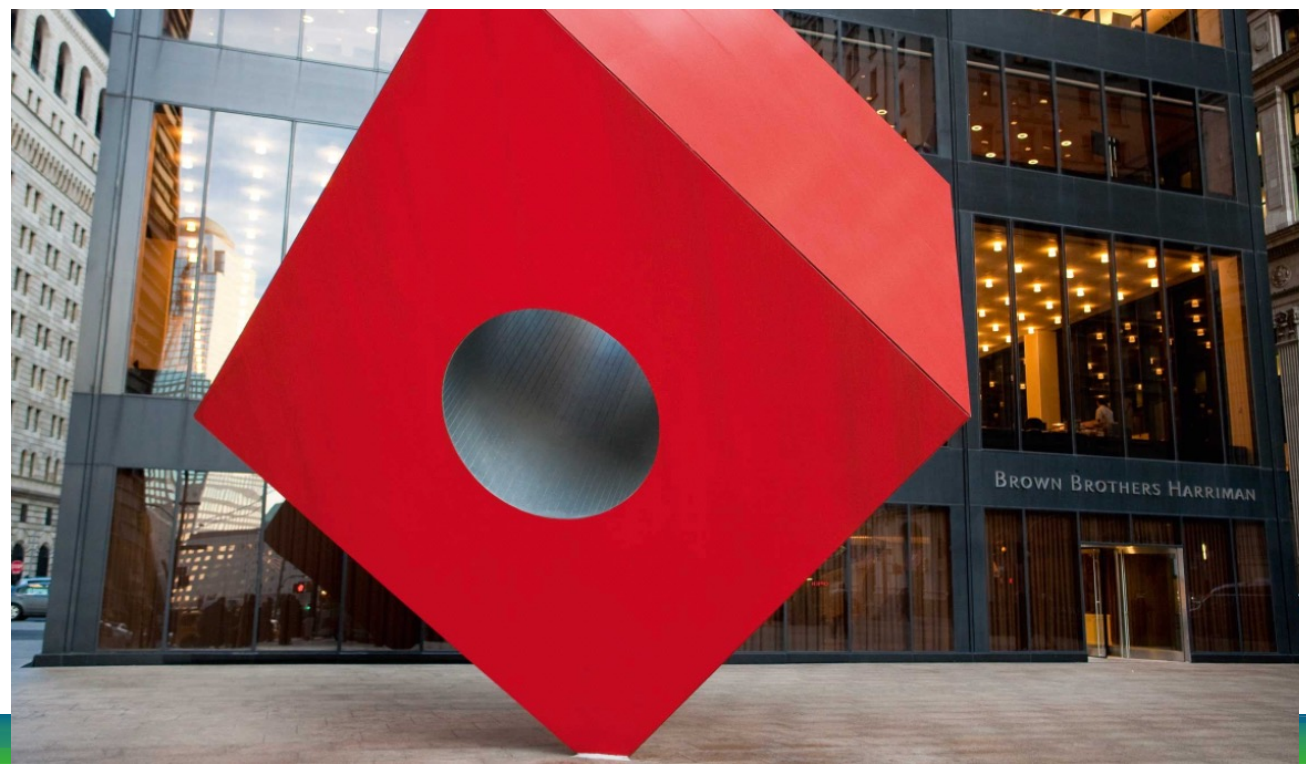
1981-1982 高利率  
造成經濟衰退



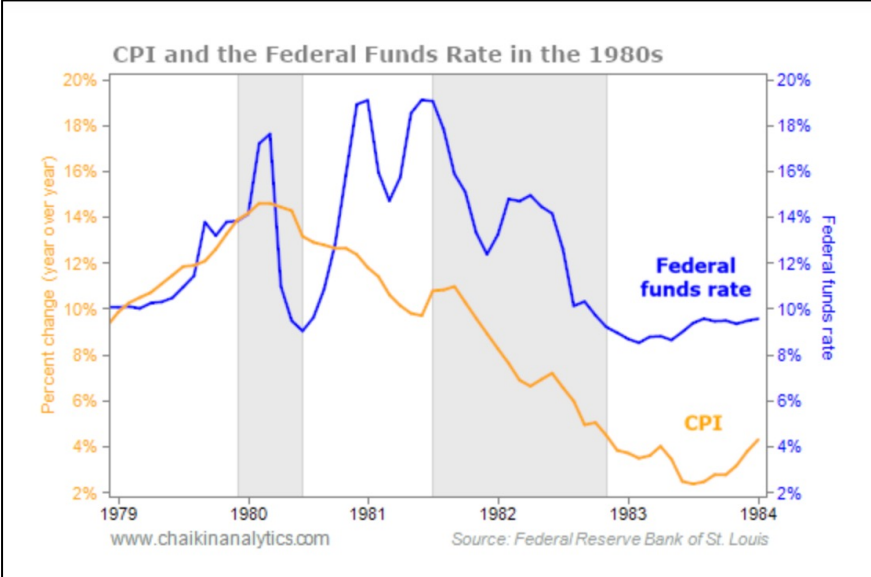


# The 9/11 photos we will never forget

By Kyle Almond, CNN  
Published September 10, 2021



# 利率風險



# Agenda

- 幾個碳金融有關數據談起
- 綠色融資與專案融資
- 專案融資與碳金融
- 結語 與 Key Takeaways

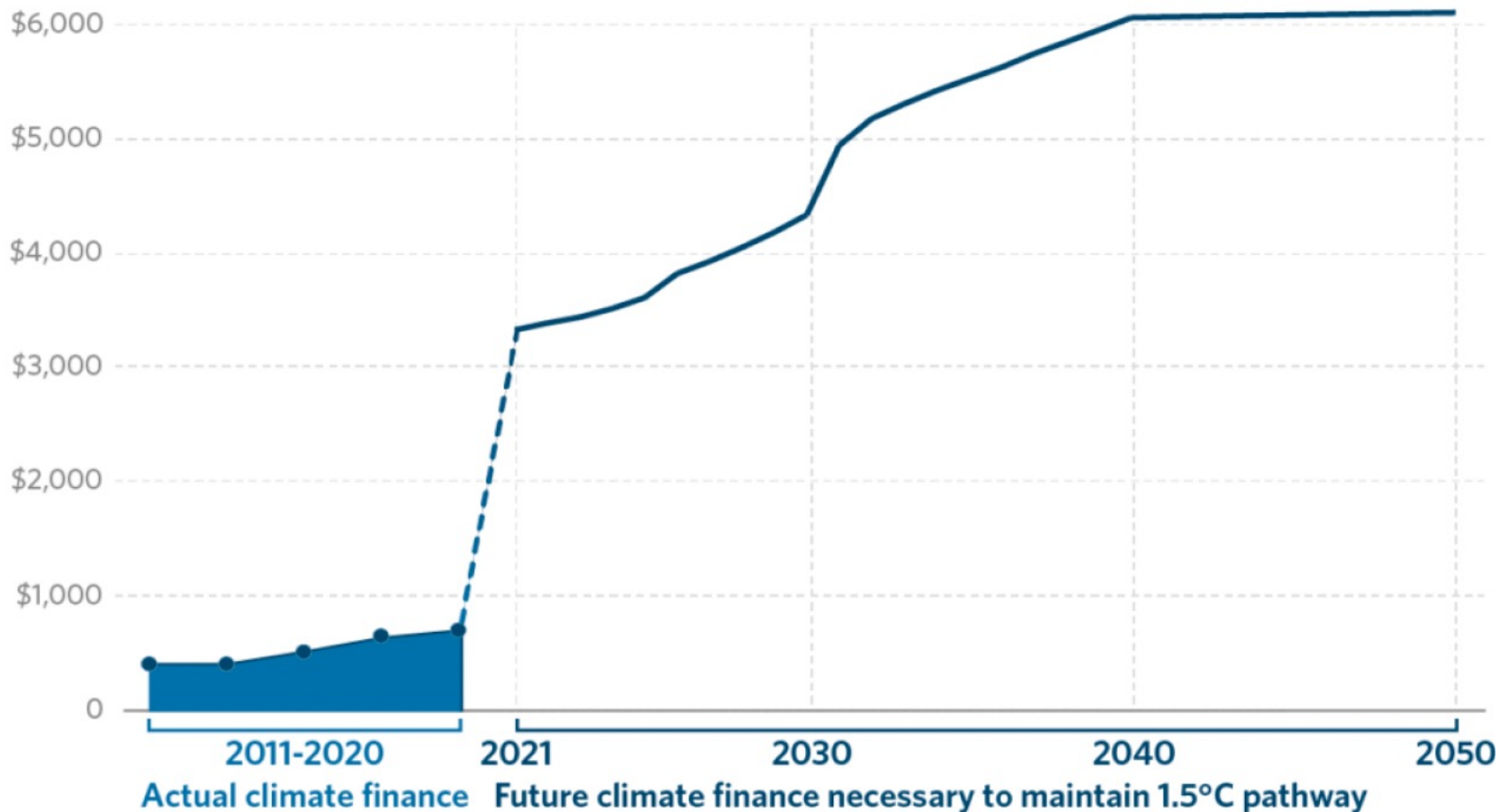
## 淨零轉型需要更多 氣候投融资

2020年氣候投融资達  
6320億美元，而全球  
每年在化石燃料產業的  
投資約8500億美元。

Global Landscape of Climate Finance 2021,  
Climate Policy Initiative

Figure 3: Global tracked climate finance flows and the average estimated annual climate investment need through 2050

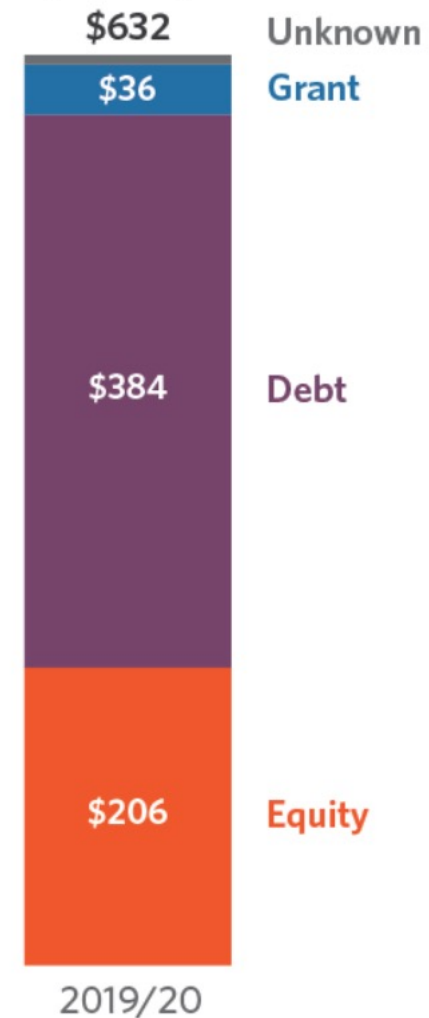
(USD billion)



# \$3.4 trillion

每年可以\$1 trillion (1% of Global GDP)  
用現有科技就可移除全球 > 50% 溫室氣體  
(高盛2022預估)

但2020 年僅有\$632 Billion 氣候投融资  
其中\$280 Billion 來自專案融資



**\$68 trillion** AUM

**5%**

Climate Action 100+

700 investors

80% Global Industrial GHG Emissions

# 綠色融資與專案融資

# 實現碳中和的三大金融領域

- 綠色金融：指能產生環境效益從而支持可持續發展的投資金融活動
- 碳金融：主要是指與碳排放交易有關的金融業務
- 轉型金融 (Transition Finance)：主要強調應對氣候變遷和低碳轉型，因此轉型金融的服務對象未必是綠色的，有可能是棕色或灰色。

—但把碳排放配額當作確定碳排放資產之後，在會計處理中便會列入資產科目，進一步可作為質押融資，這讓碳金融與綠色金融之間有了業務創新空間。

# 歐盟對綠色金融的基本準則

EU, and beyond.



顯著地貢獻  
六項環保目  
標之一



不造成其  
他五項的  
明顯傷害



要做到最低  
程度的安全  
保護機制

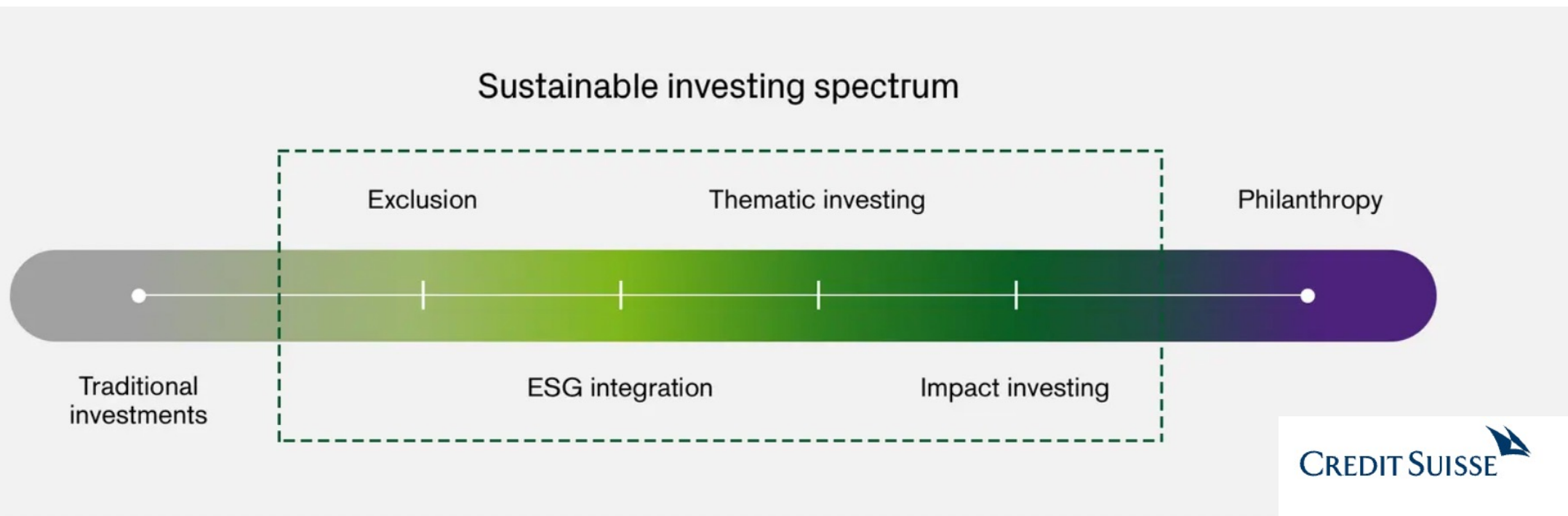
**Taxonomy: Final report of the Technical Expert Group on Sustainable Finance**

March 2020



- 減緩氣候變遷
- 適應氣候變遷
- 水資源保護與永續
- 轉型至循環經濟
- 污染防制
- 生物多樣性與生態系統的保護與回復

# 永續投資範疇(Sustainable Investing Spectrum)



負面排除、整合ESG因子、主題投資、影響力投資

若為達到社會影響力的目的，PRI (Program-Related-Investments)的社會企業投資甚或可低於資金成本來進行同時達到兼顧環境與社會雙重目的的投資。



## BREAKTHROUGH 能源投資基金投資四條件：

1. 衝擊面夠大：該技術成熟後起碼可減低5億噸碳排放量
2. 量產可行性：非停留在實驗室或尚待理論突破
3. 傳統金融不投資
4. 階段性投資後將可引入商業利益投資資金

投資期限可長達20年

影響力投資  
BREAKTHROUGH  
ENERGY VENTURE

**Bill Gates**  
FOUNDER, BREAKTHROUGH ENERGY

Breakthrough Energy

Our Challenge | Investing in Innovation | Scaling Innovation | Policy Solutions

Every Year, The World Adds

# 51 Billion Tons of Greenhouse Gases

to the Atmosphere



### H2Pro

Revolutionizing green hydrogen production with a water splitting technology that is over 95% efficient, safe and cost-competitive with fossil-fuel hydrogen.

[View Site](#)

# 綠色融資與專案融資

What's the cost of a wind turbine in 2021?

\$1,300,000 USD per megawatt. The typical wind turbine is 2-3 MW in power, so most turbines cost in the \$2-4 million dollar range. Operation and maintenance runs an additional \$42,000-\$48,000 per year according to research on wind turbine operational cost.

<https://weatherguardwind.com/how-much-does-wind-turbine-cost-worth-it/#:~:text=What's%20the%20cost%20of%20a,on%20wind%20turbine%20operational%20cost.>



(上緯歷經六年花了新台幣40億元建造兩部離岸風電8MW)

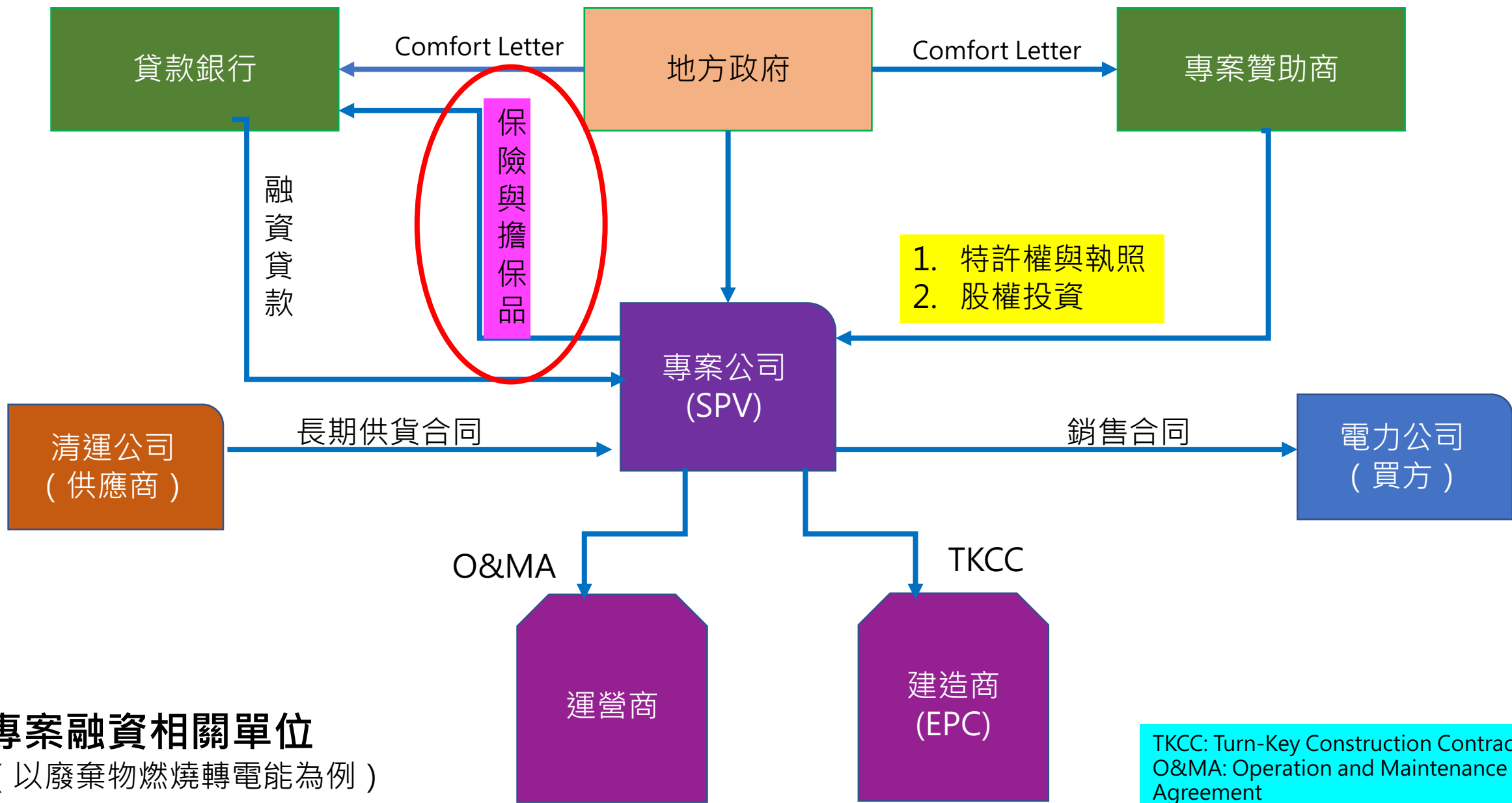
- 台灣離岸風電第三期預計投入1072億元產生3000MW容量
- 在美國建造一座傳統核電廠的成本約為**250 億美元 (1GW)**，**TerraPower**將美國產煤大州懷俄明州凱默勒市，視為全球首個新型鈉反應爐 (Natrium) 電廠首選廠址，電廠容量 345MW 約可為 250,000 戶家庭供電，造價美金\$10億元

# 促進民間參與公共建設(促參) Public-Private Partnership(PPP)

“A public-private partnership (PPP) is **a long-term contract** between a private party and a government entity, for providing a public asset or service, in which **the private party bears significant risk and management responsibility, and remuneration is linked to performance.**”

- Operation & Maintenance Services (O&M)
- Concession(Public Ownership) (DB,DBO)
- Concession(Private Ownership) (DBOT,BOT,..)
- Full Privatization(BOO)





**專案融資相關單位**  
 (以廢棄物燃燒轉電能為例)

TKCC: Turn-Key Construction Contract  
 O&MA: Operation and Maintenance Agreement

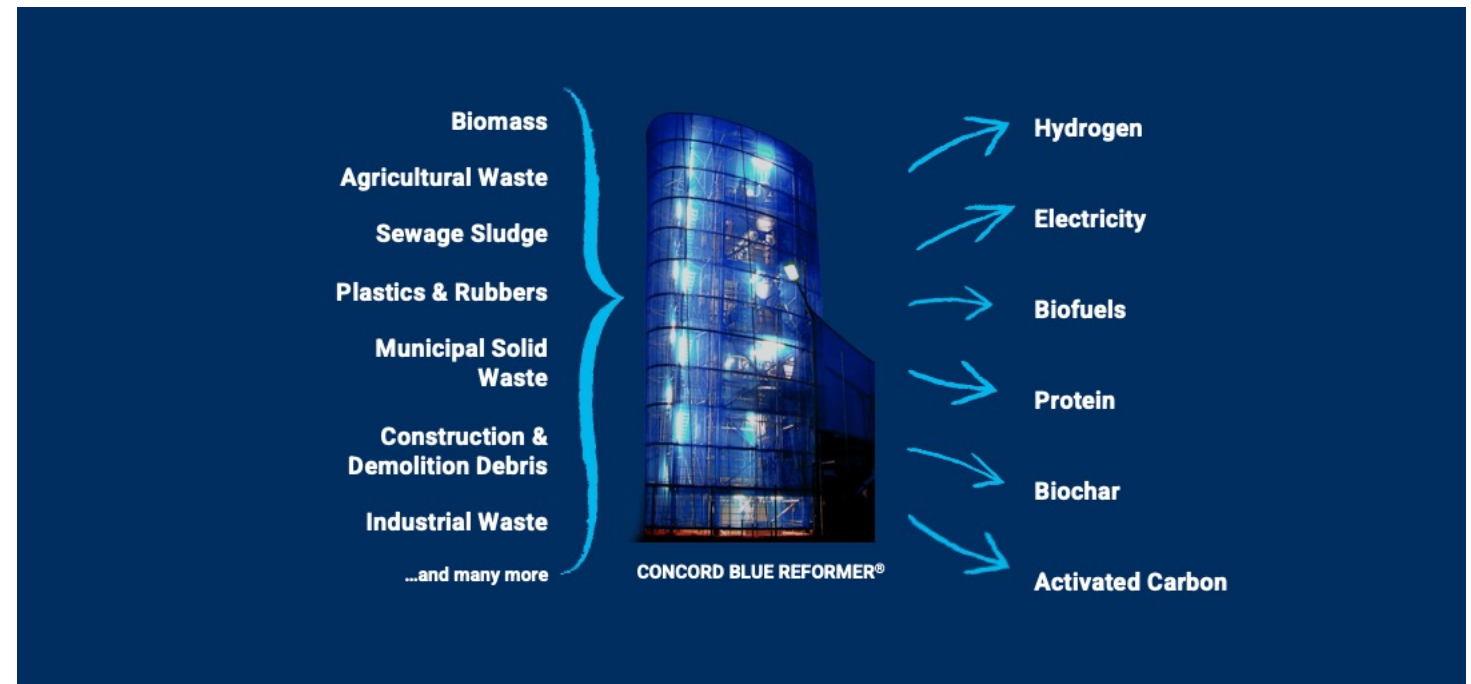
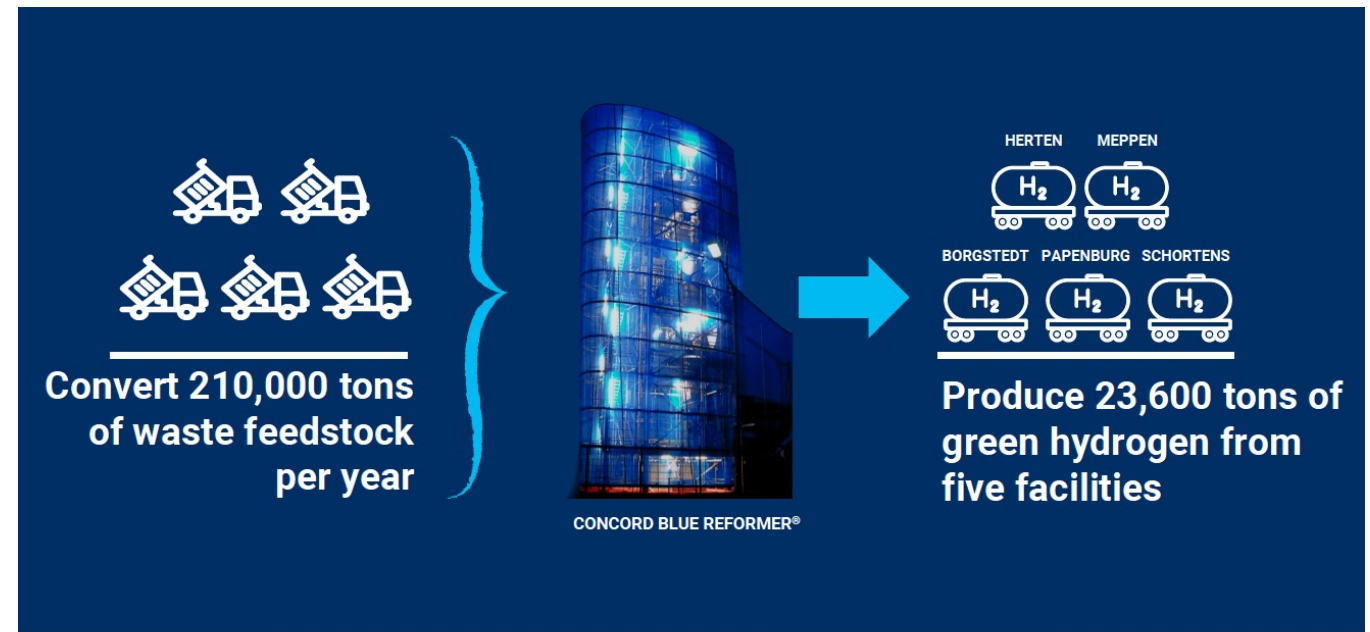
# 專案融資其實就是風險分攤



利率增加會提高投資綠能的成本，也凸顯碳資產的重要性

# 專案融資與碳金融

# 德商Concord Blue 的專案融 資報告



# 專案融資其實就是風險分攤

太陽能電廠相對其他再生能源是營運  
風險最低與可控性最高的一種專案

碳金融/綠色憑證

外包

- EPC
- O&M

保險

- 保險範疇
- 保費

SPV

- 貸款利息
- 債券價格

利率增加會提高投資綠能的成本，也凸顯碳資產的重要性

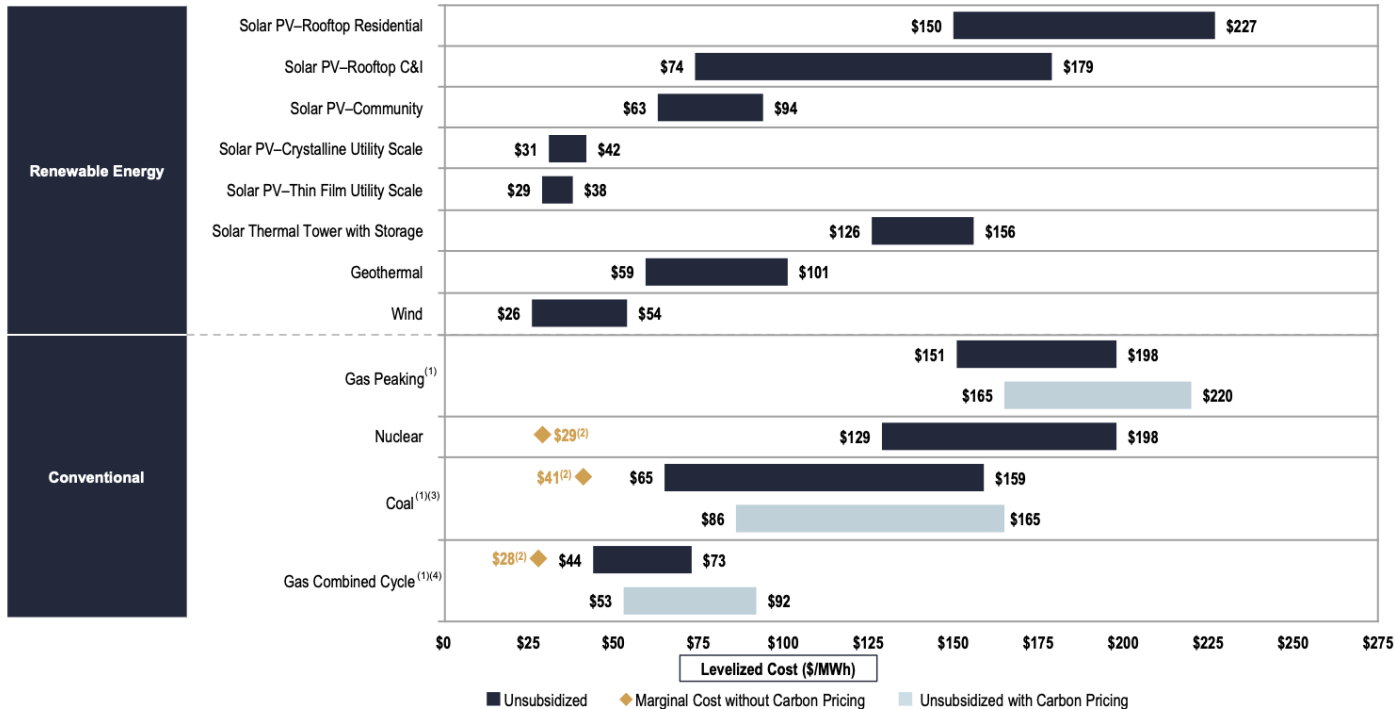
# 排碳計價後增加再生能源競爭力

LAZARD

LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 14.0

## Levelized Cost of Energy Comparison—Sensitivity to Carbon Pricing

Carbon pricing is one avenue for policymakers to address carbon emissions via a market-based mechanism; a carbon price range of \$20 – \$40/Ton of carbon would increase the LCOE for certain conventional generation technologies to levels above those of onshore wind and utility-scale solar



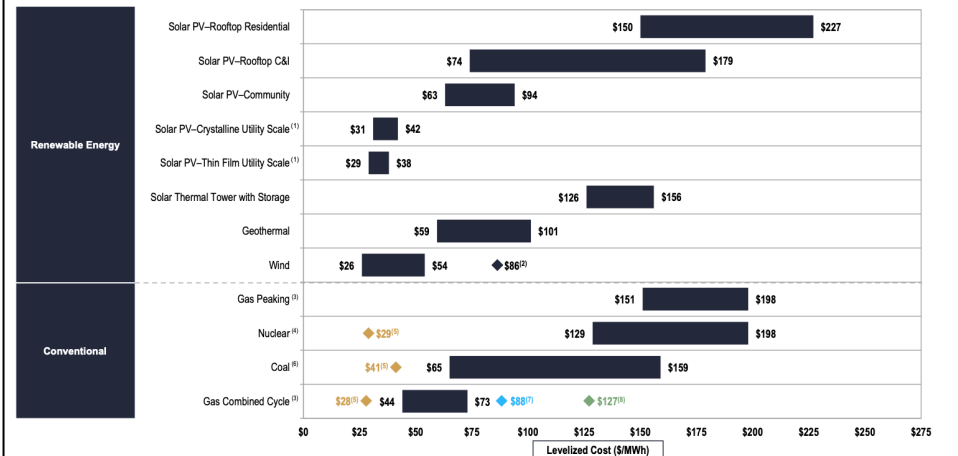
Source: Lazard estimates.

LAZARD

LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 14.0

## Levelized Cost of Energy Comparison—Unsubsidized Analysis

Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances

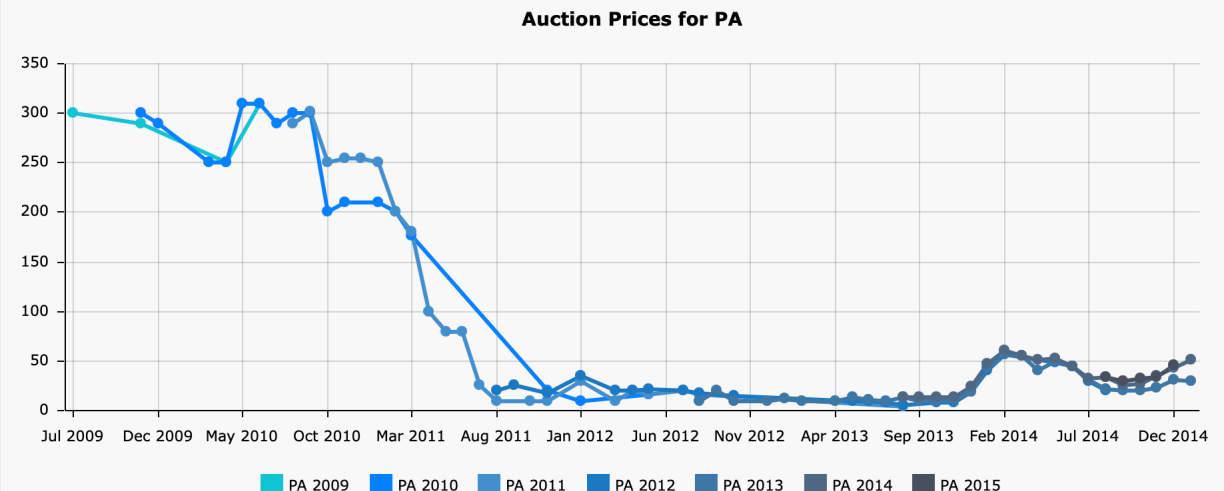
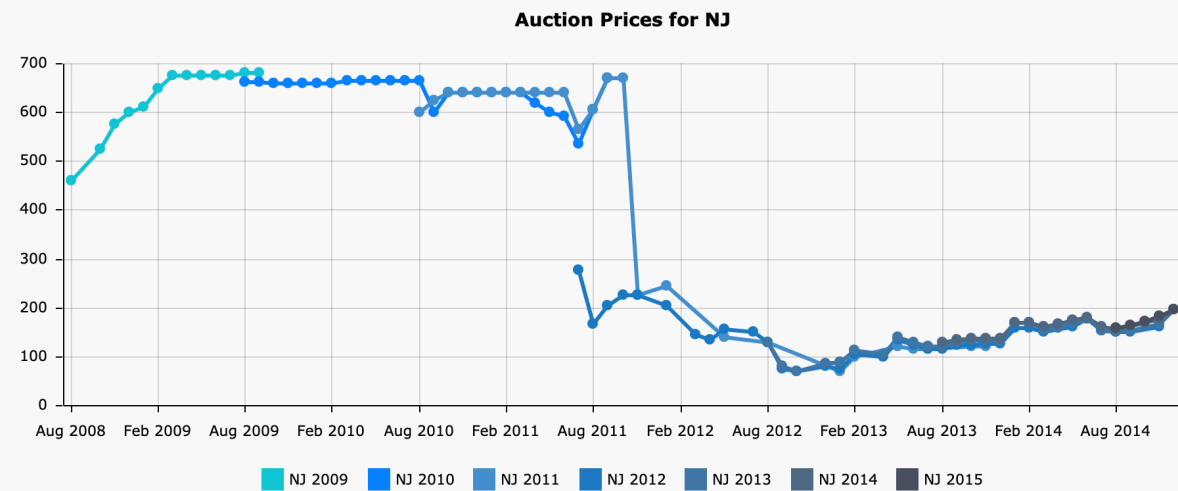


LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 14.0

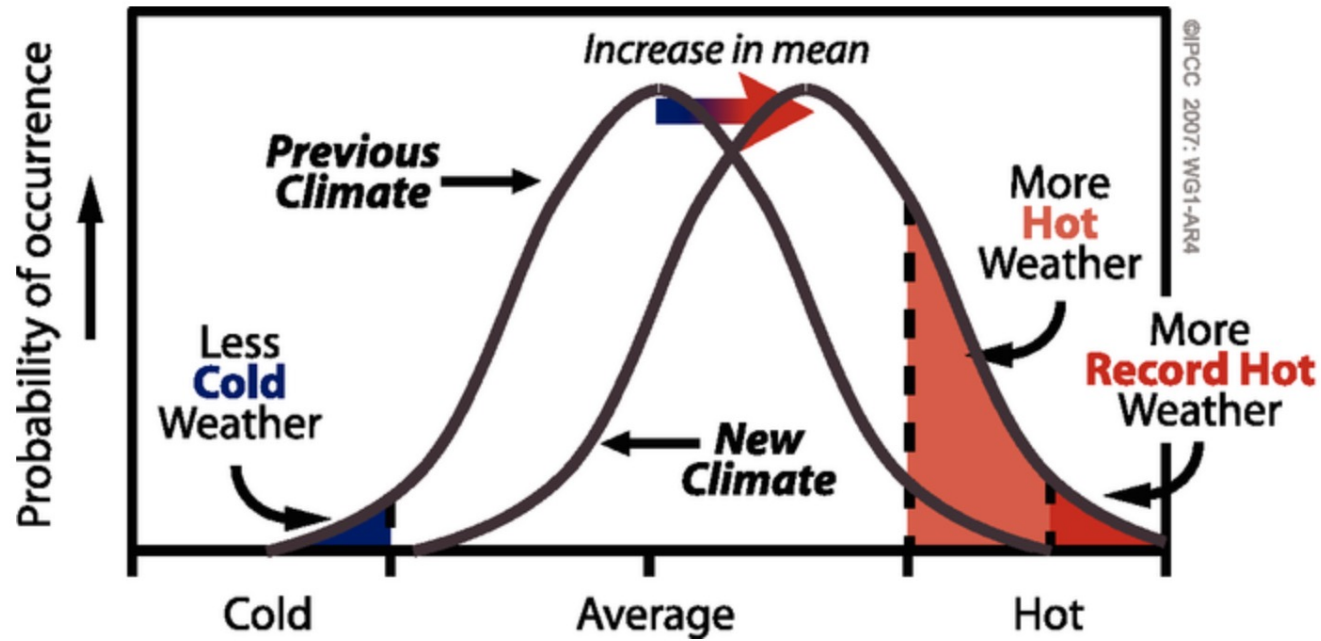
LAZARD

# 碳價的波動性因時地而異

- 再生能源憑證REC 因地區與時間而有所不同
  - 如2021 年美國SREC (太陽能再生能源憑證) 賣給電力公司來達到 RPS (Renewable Portfolio Standards)要求時，每MWh在New Jersey 可賣 \$230，可在麻州賣到 \$322。但在2011年可賣到\$640。



# 氣候變遷與投資風險



# 統計學上的長尾

- 目前美國一年中氣溫高於攝氏37.8°。總日數超過一個月都市有29座，預計到2050年將至少有250個城市超過人體可忍受的37.8度
- 當保險公司不在提供低窪地區房地產長期貸款所需保險。Zillow 預估到2050年將有 \$200 billion 美國房產受海水上升造成淹水而失去價值。

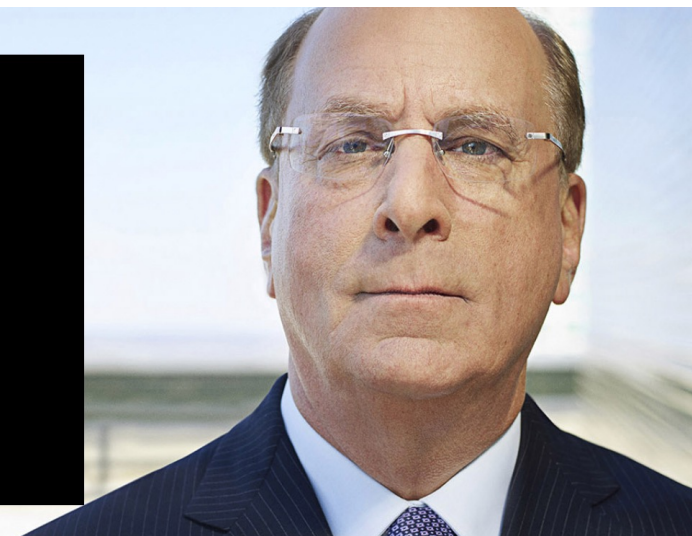
"Climate Change 2007: Working Group I: The Physical Science Basis," IPCC,  
[https://archive.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/box-ts-5-figure-1.html](https://archive.ipcc.ch/publications_and_data/ar4/wg1/en/box-ts-5-figure-1.html);



---

# 氣候風險是投資風險

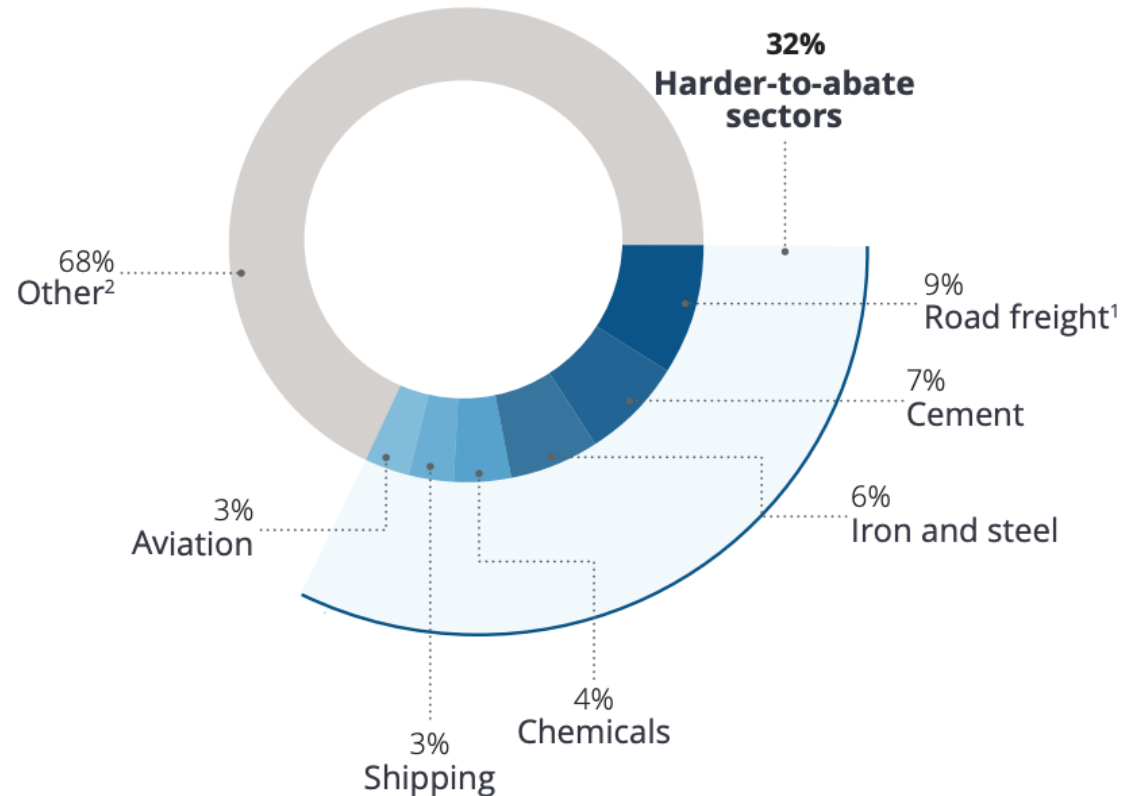
**Larry Fink's  
2021 letter to  
CEOs**



黑石基金董事長 Larry Fink

# 難減排產業(Harder-to-abate Sectors)

Global carbon dioxide emissions by sector in 2018



Notes: 1) Including LCVs, MDTs, HDTs and 1.5% from buses. 2) Including power (46.5%), other transport (10.8%), buildings (8.6%), feedstock (1.9%), and other industries (1.6%).

Sources: International energy agency (IEA), Global energy review, report, 2021; IEA, Sustainable development scenario 2020-2030, report, 2021; Deloitte analysis.

由於目前同時存在技術面與商業模式的落差，要克服他們要先從三個基本問題問起：

1. 為什麼產業要改變；
2. 多快產業會變得來；
3. 最佳的改變措施（技術與決策的對焦）

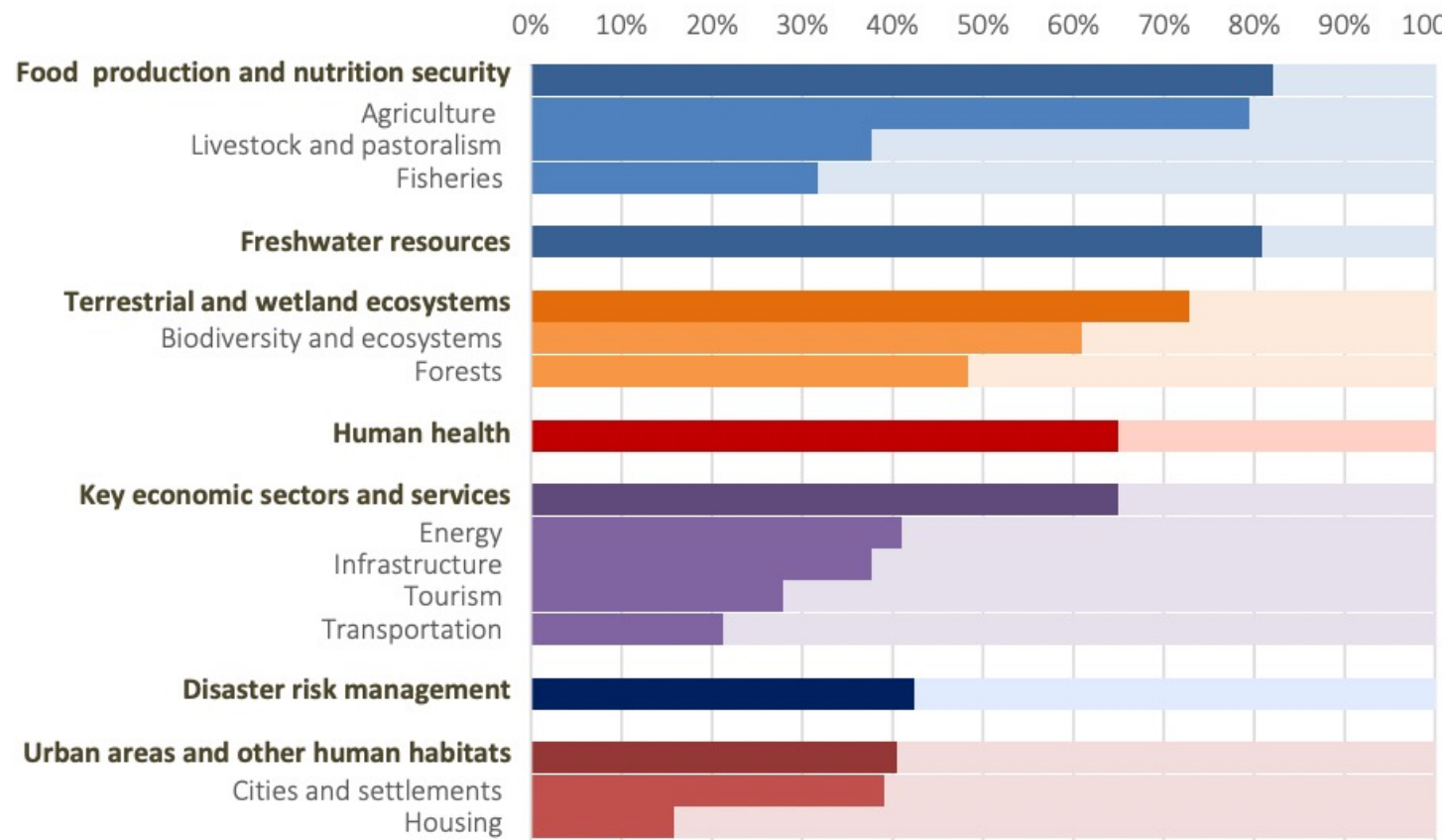
## Getting from hard-to-abate to a low-carbon future

Ecosystem approaches for the toughest climate challenges

A report from Deloitte Center for Integrated Research, 2021

# 還有，不要忘了考慮如何適應環境變遷

Share of adaptation components of nationally determined contributions referring to specific adaptation priority areas and sectors



氣候風險保險/CBIInsights.com

到2030年，全球將投入 \$ 180 Billion 處理水短缺適應問題，\$500Billion 處理因氣候變遷所引起的食物相關韌性問題

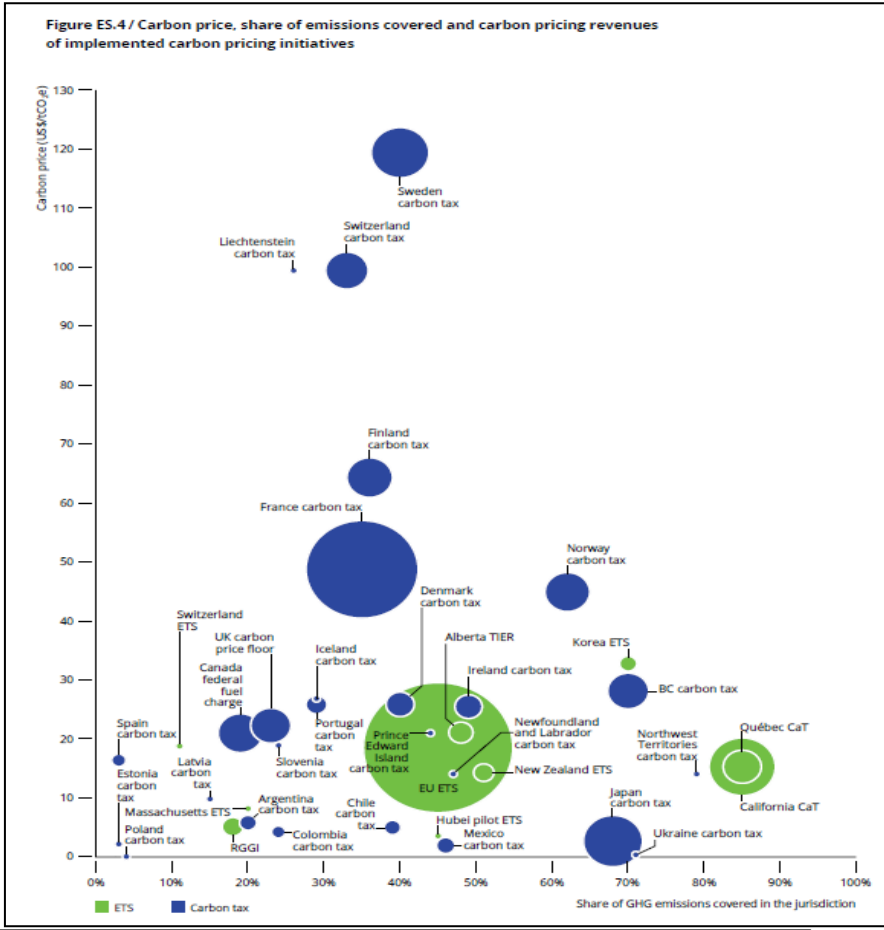
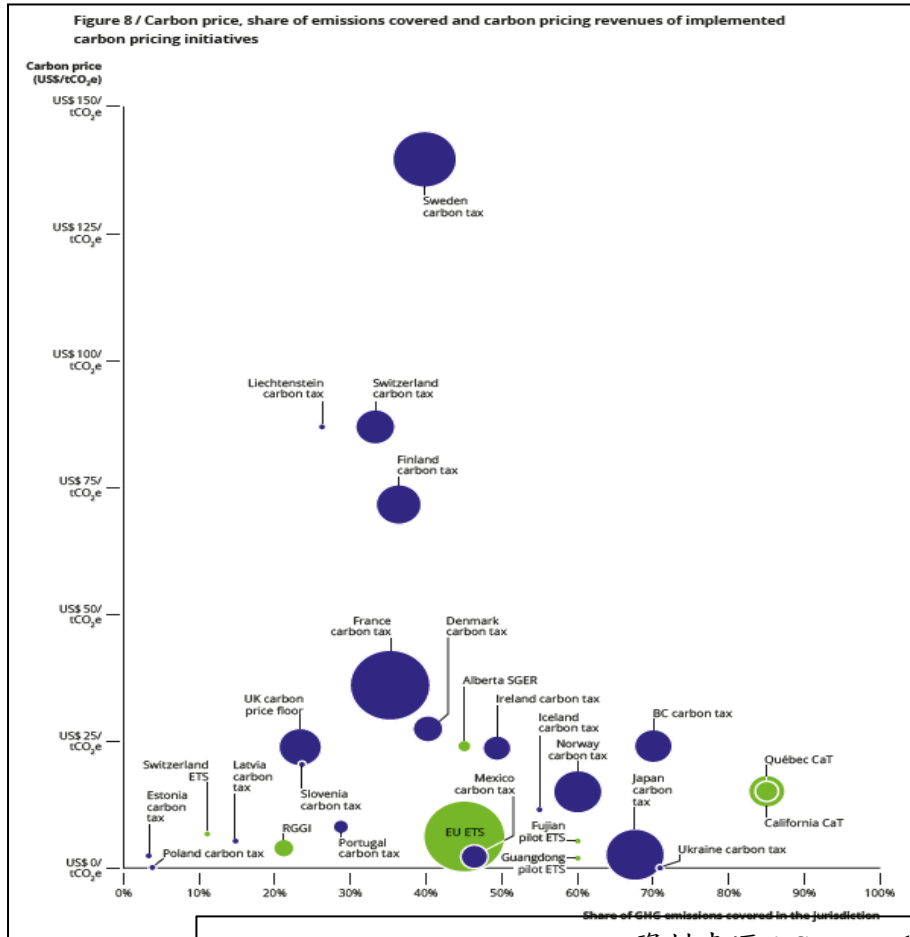
Conference of the Parties serving as the meeting of the Parties to the Paris Agreement  
Third session  
Glasgow, 31 October to 12 November 2021

Nationally determined contributions under the Paris Agreement

Synthesis report by the secretariat\*

# 結語與 Key Takeaways

# 全球碳價，差異巨大



可問ChatGPT:  
「為何瑞典碳價比  
亞洲國家高很多？」

資料來源：State and Trends of Carbon Pricing in 2017 and 2020, The World Bank

# 造假的碳資訊是全球達成淨零碳排並須克服的課題



News and intelligence on carbon markets, greenhouse gas pricing, and climate policy

[HOME](#) | [EMEA](#) | [CHINA](#) | [AMERICAS](#) | [ASIA PACIFIC](#) | [INTERNATIONAL](#) | [CARBON TAXES](#) | [CONVERSATIONS](#) | [RESOURCES](#)

[CARBON FORWARD](#) | [REGISTER](#)

[China](#) > [Municipal gov't confirms company caught falsifying China ETS data](#)

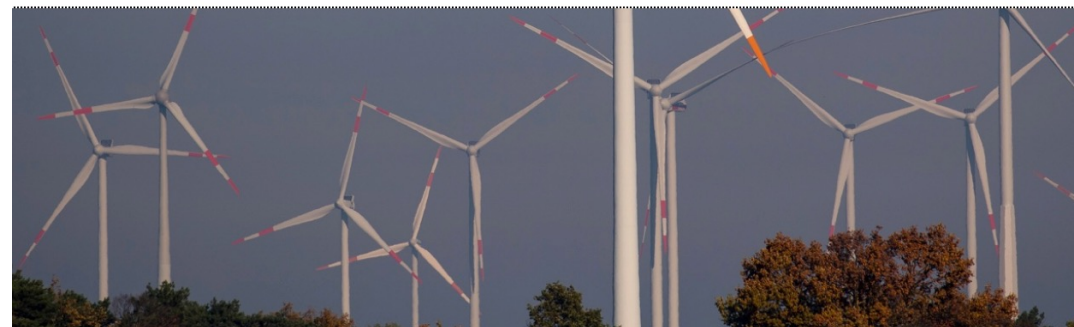
## Municipal gov't confirms company caught falsifying China ETS data

Published 11:10 on July 2, 2021 / Last updated at 11:10 on July 2, 2021 / [China, China's National ETS, China's Offset Market](#) / No Comments

The municipal government of Wuhai city in Inner Mongolia on Friday released documentation showing that provincial authorities have issued administrative punishment to a company for falsifying data related to its CO2 allocation under China's national emissions trading scheme.

自願減碳的碳價通常比政府單位合規市場碳價低(~\$5 vs. \$35)

## Bloomberg Green



Photog

Green

## Carbon Offsets Have an Integrity Problem. COP26 May Help Fix It

By [Ewa Krukowska](#) [+Get Alerts](#)

2021年11月17日 上午8:01 [GMT+8]

# Key Takeaways

- 碳金融重要，轉型金融也很重要
- 專案融資係大型綠色基建分攤投資風險的主要融資方法
- 造假的碳資訊是全球達成淨零碳排並須克服的課題
- 綠色金融投資風險，有技術營運風險、政策風險、碳市場交易風險、財務風險，還有道德風險
- 還有，企業不要忘了考慮如何適應環境變遷，這或許是金融業得持續投資的項目

# Q&A

