

Accelerating the uptake of CCS:
Industrial use of captured carbon dioxide

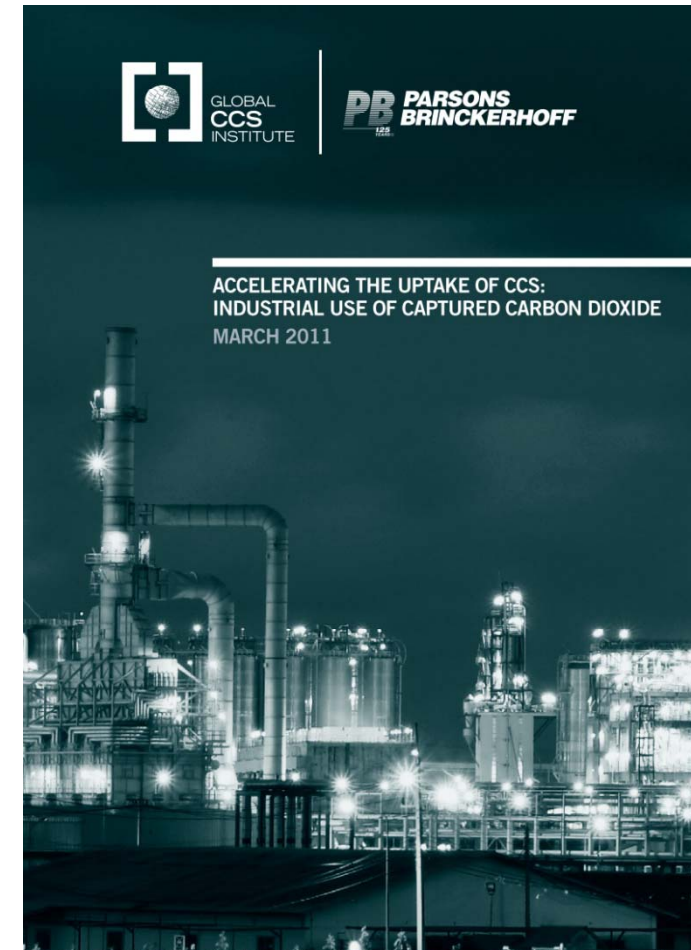
Accelerating the uptake of CCS: Industrial use of captured carbon dioxide

Undertaken on behalf of the Clean Energy Ministerial (CEM) to advance the CCUS Action Plan

Investigated '*whether the industrial use of captured carbon dioxide might help accelerate the deployment of CCS*'

Published in advance of the CEM2 held in Abu Dhabi 6–7 April 2011

Available for download at
www.globalccsinstitute.com/publications



Existing Industrial Uses of CO₂



Enhanced Oil Recovery

- 50Mtpa
- Other Oil and Gas applications



Coffee Decaffeination

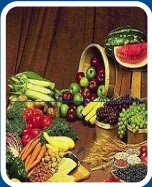


Urea fertiliser production

- 'Captive' use



Pharmaceuticals



Food processing, preservation and packaging



Horticulture



Beverage Carbonation



Fire suppression

Existing Industrial Uses of CO₂



Winemaking



Steel Manufacture



Pulp and Paper processing



Metal Working



Water Treatment



Electronics

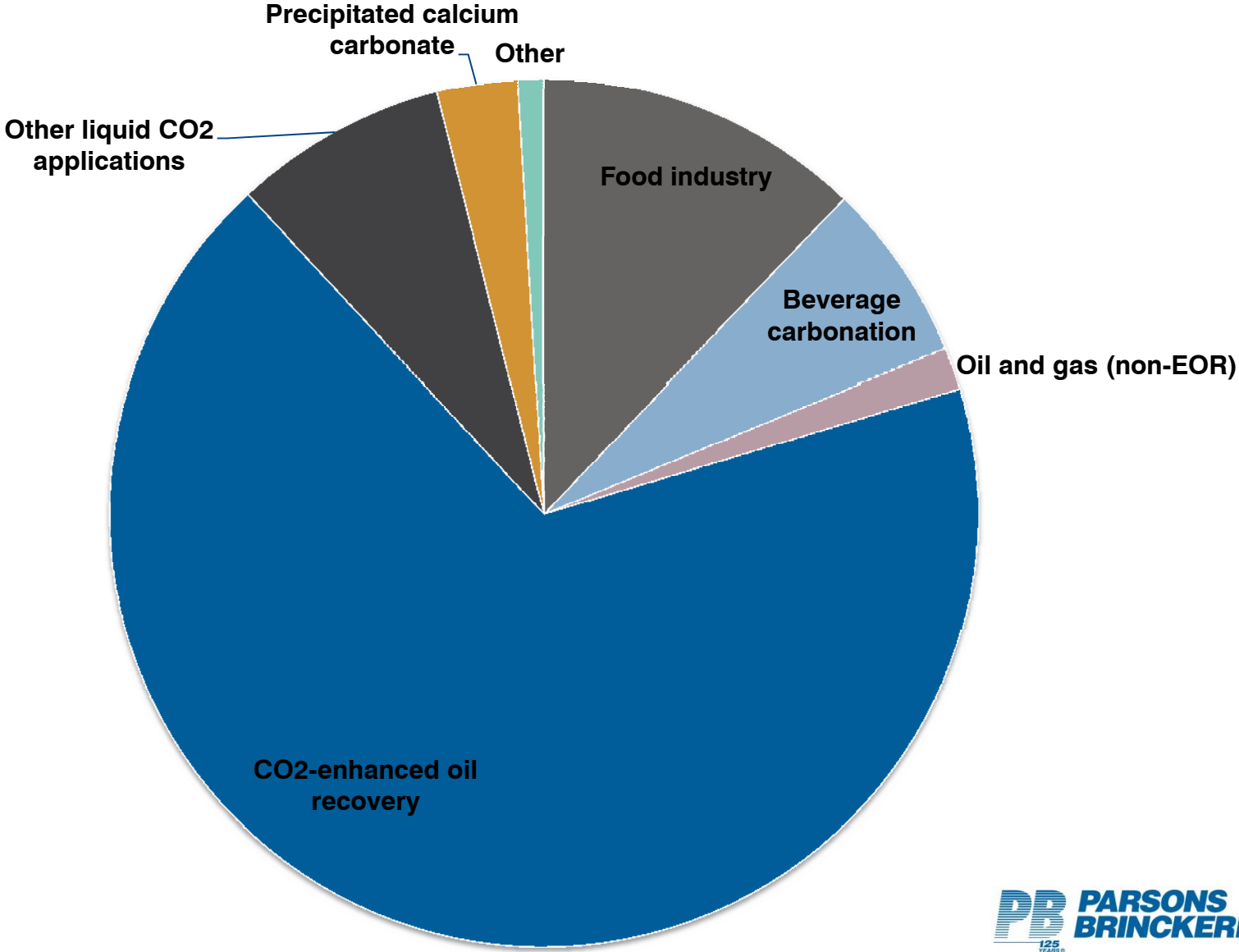


Inerting

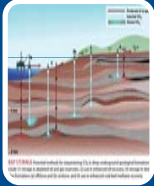


Pneumatics

Existing Bulk CO₂ market



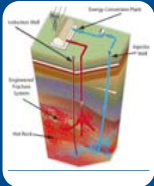
Emerging Industrial Uses of CO₂



Enhanced Coal Bed Methane Recovery



Algal bio-fixation and bio-fuel production



Enhanced Geothermal Systems (using CO₂ as a working fluid)



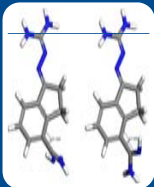
Bauxite residue processing



Power Generation with CO₂ as a working fluid



Carbonate mineralisation (aggregate production)

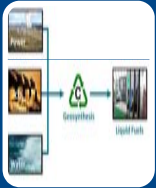


Polymer Processing

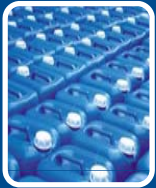


CO₂ concrete curing

Emerging Industrial Uses of CO₂



'Renewable' Methanol



Formic Acid Production

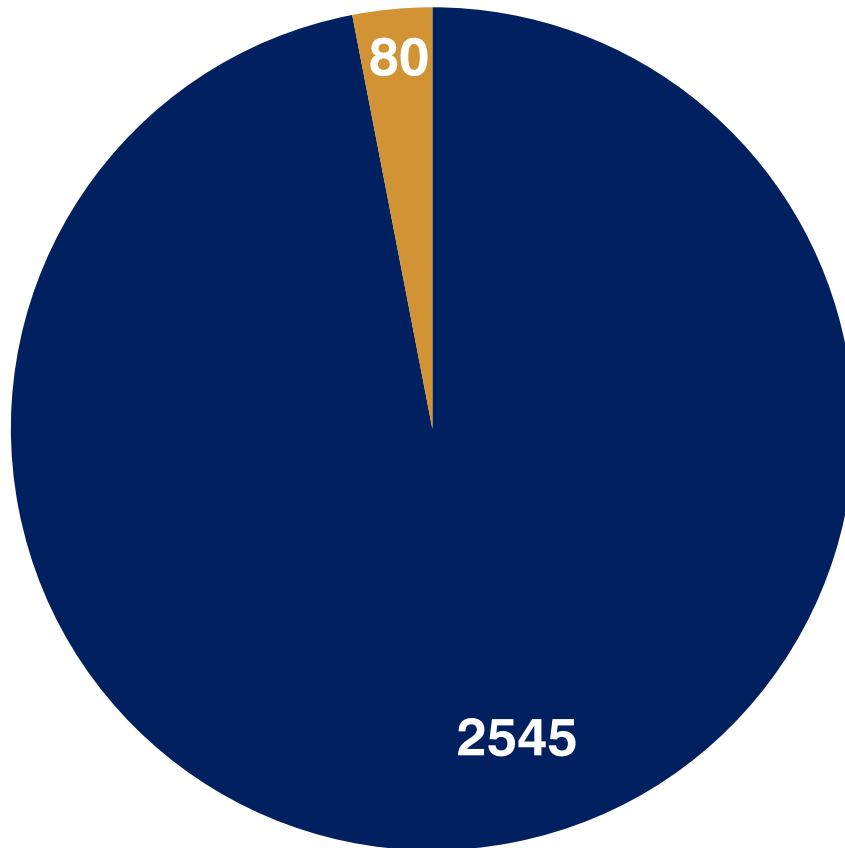
How can industrial use of CO₂ help accelerate CCS?

1. Additional revenues can result in more demonstration projects and accelerate the reduction of technology costs, specifically those related to capture;
2. CCS project delivery experience of addressing financial, environmental and regulatory barriers; and
3. Public acceptance of technologies and projects.

...But some qualifications:

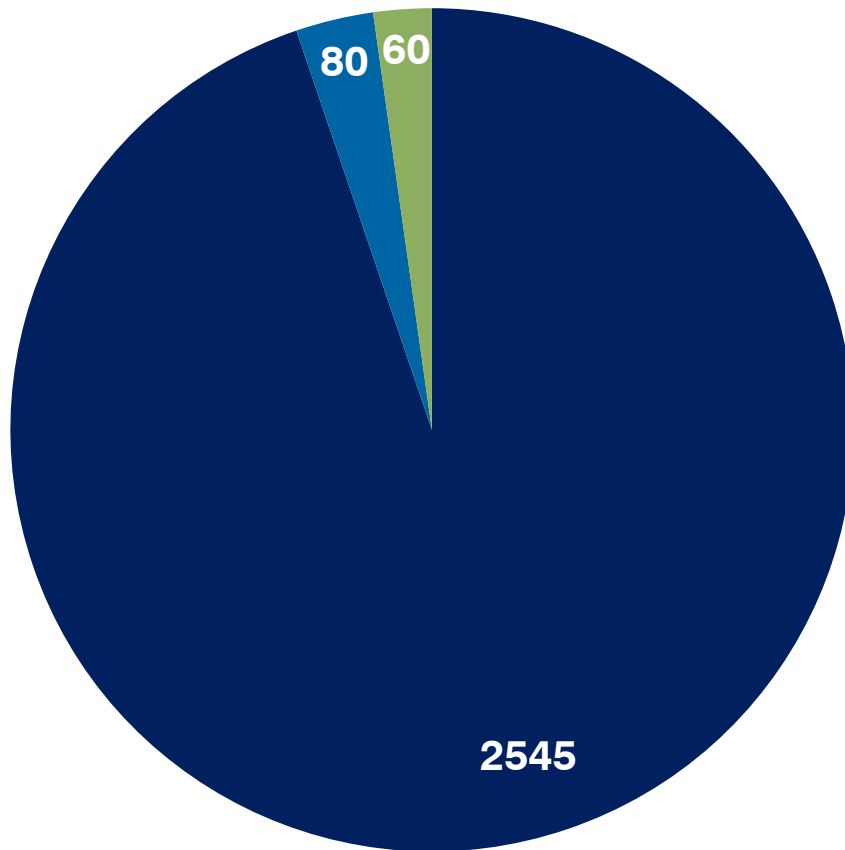
- Requirement for the end-product must be such that there is a significant demand (i.e. commensurate with capture from large scale emitters) & price for CO₂; and
- Utilisation technology / process must be a development stage such that it can be deployed at the same time as CCS.

Current demand for bulk CO₂ vs. potential supply (Mtpa)



- Remaining global CO₂ available from low to moderate cost point source emitters >0.1Mtpa
- Current demand for bulk CO₂ (non captive)

2020 demand for bulk CO₂ vs. potential supply (Mtpa)



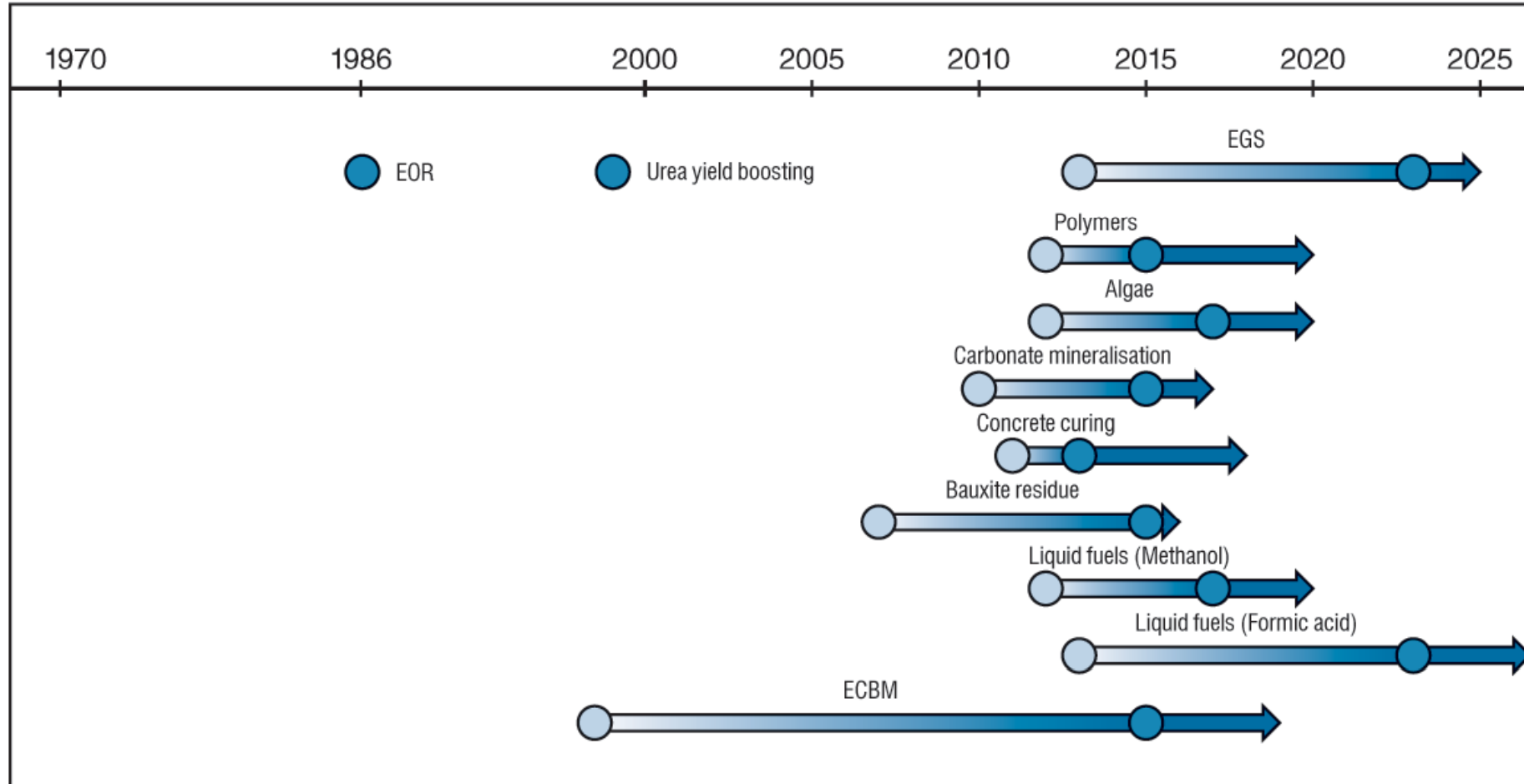
- Remaining global CO₂ available from low to moderate cost point source emitters >0.1 Mtpa
- Current demand for bulk CO₂ (non captive)
- Future additional demand (estimated)

Short-listed Industrial Uses of CO₂ by potential future demand (>5Mtpa)

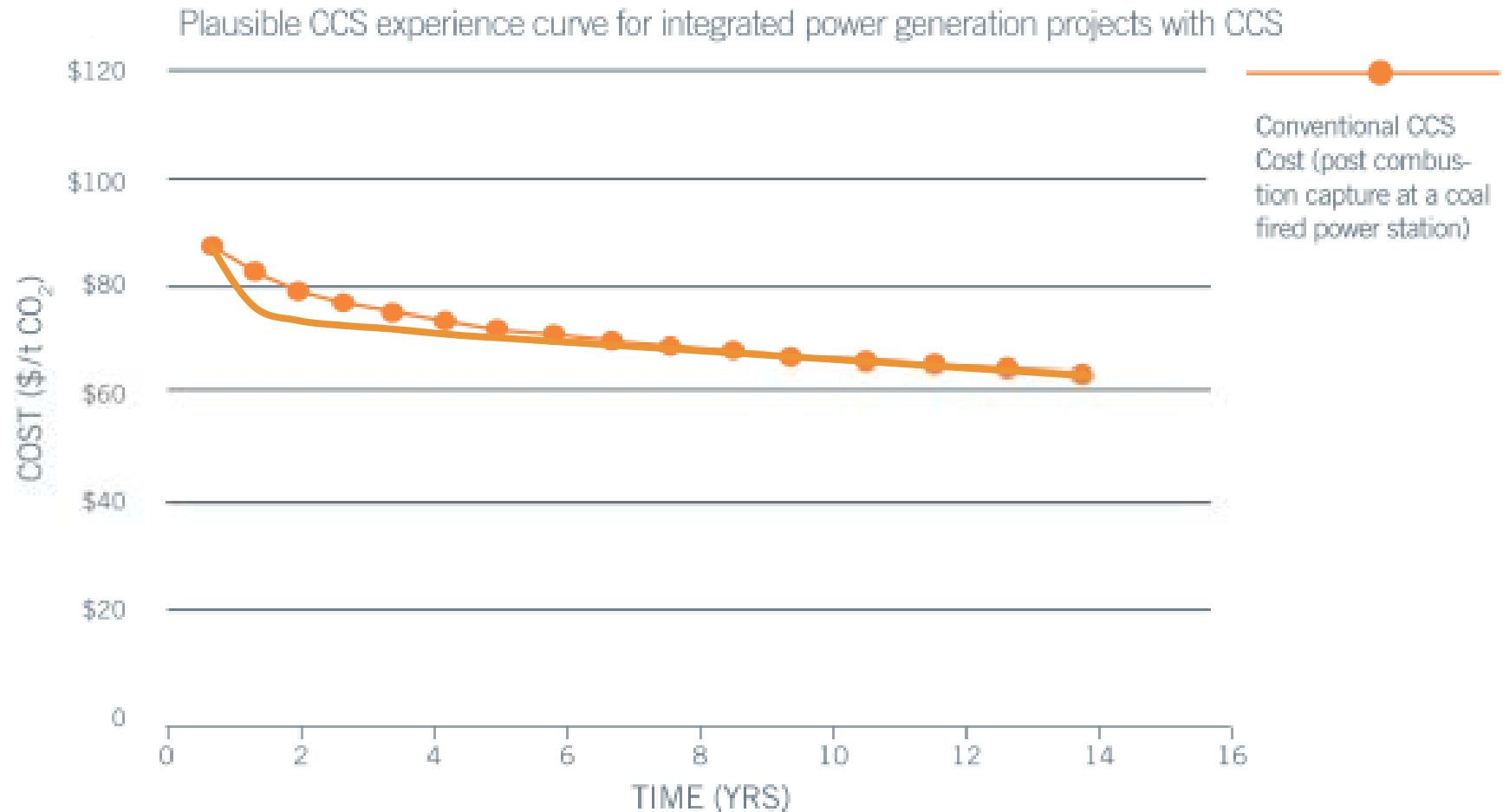
EXISTING USES	Current non-captive CO ₂ demand (Mtpa)	Future potential non-captive CO ₂ demand (Mtpa)
Enhanced Oil Recovery (EOR)	30 < Demand < 300	30 < Demand < 300
Fertilizer – Urea (Captive Use)	5 < Demand < 30	5 < Demand < 30

NEW USES	Future potential non-captive CO ₂ demand (Mtpa)
Enhanced Coal Bed Methane Recovery (ECBM)	Demand >300
Enhanced geothermal systems – CO ₂ as a working fluid	5 < Demand < 30
Polymer processing	5 < Demand < 30
Algal Bio-fixation	>300
Mineralisation	
Calcium carbonate & magnesium carbonate & Sodium Bicarbonate	>300
CO ₂ Concrete Curing	30 < Demand < 300
Bauxite Residue Treatment ('Red Mud')	5 < Demand < 30
Liquid Fuels	
Renewable Methanol	>300
Formic Acid	>300

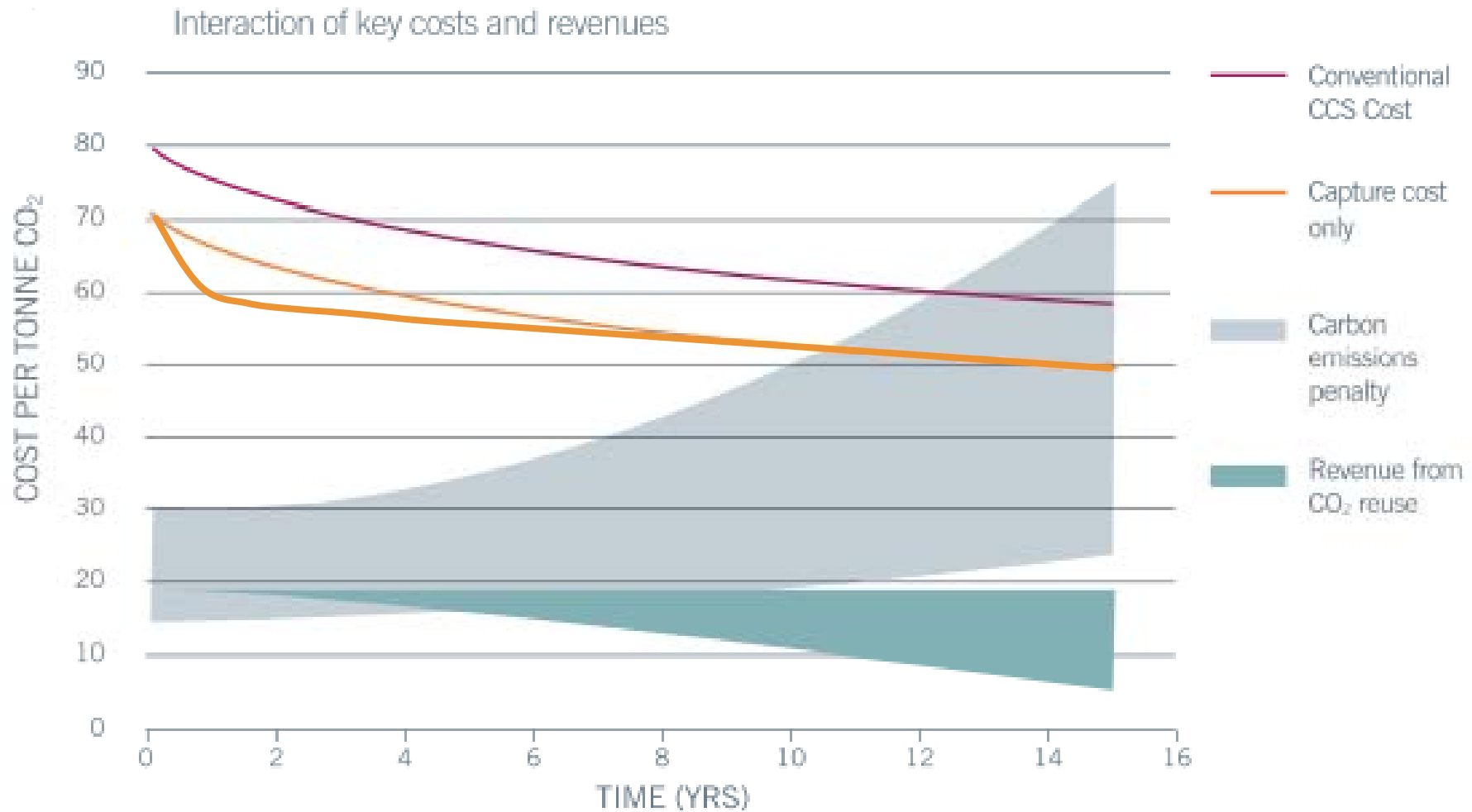
Development maturity of utilisation technologies



Accelerate the reduction of capture technology costs



Accelerate the reduction of capture technology costs



PB CCS projects



Technical advisor
(UK CCS competition)



Lead advisor
(CCS Flagship programme)



Department of Primary Industries

Technical advisor
(CCS ETIS program)



Technical advisor
(Project Funding & Support Program,
CO₂ re-use study, OpenCCS Project)



Technical advisor
(NER 300 CCS)
CCS feasibility studies
CCR assessments

