CO$_2$ utilization: companies and policy measures

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New C Economy: Thriving economy that consumes more than emits

Potential Reduction in CO₂ Emissions (tons)

- Aggregates: 0.018-0.18 (strategic) vs. 0.018-0.38 (non-strategic)
- Fuels: 0.018-0.038 (strategic) vs. 0.018-0.28 (non-strategic)
- Concrete: 0.048-0.28 (strategic) vs. 0.048-0.58 (non-strategic)
- Methanol: 0.00019-0.0018 (strategic) vs. 0.00019-0.0028 (non-strategic)
- Polymers: 0.000020-0.000058 (strategic) vs. 0.0000040-0.000068 (non-strategic)

https://www.icef-forum.org/roadmap/
New C Economy: Thriving economy that consumes more than emits

Potential Annual Revenue (dollars)
- **Strategic actions implemented**
- **Without strategic actions**

Carbon Dioxide Utilization Roadmap (CO2U): ICEF Roadmap 1.0, 2016

https://www.icef-forum.org/roadmap/
Example Companies and Projects in Carbon-to-Value

**Opus-12**
- Electrolyzer/reverse fuel cell
- Products: CO, CH₄, CO₃OH, C₂H₄
- 37,000 trees in a suitcase
- Will ship in 2019-20

**Solidia**
- Cement curing w/ CO₂ (large volumes)
- Strong investors (Total, BP, BASF, KleinerPerkins)
- 40% avoided CO₂
- 10-30% embodied CO₂
- Ready for scale-up

**Carbon Cure**
- Cement curing w/ CO₂ (large volumes)
- Ready-mix, masonry, white paper
- ~10% avoided CO₂
- 2-20% embodied CO₂
- Ready for scale up

**Solid Carbon Products**
- C nanotubes, C black & composites
- Deep IP portfolio
- High-bay plant in UT fully electrical
- CH₄ & CO₂ feedstock, can be tuned

*Low-C cement & concrete products: lower than market costs today!*
High commercial readiness for cement & concrete companies

Over 50 companies world-wide, partnered with EU heavyweights

Production facilities
- Centralized cement production / distributed concrete production
- 100’s of sites world-wide (US, UK, EU)
- Using trucked CO₂ today – looking to air-made CO₂ soon

Partnerships
- Key companies partnered with majors (LaFargeHolcim, Heidelberg Cement, CEMEX)
- Emerging public-private partnerships for procurement and commercialization

Standards in process
- WBCSD: Cement Sustainability Initiative
- ISO standard in development
- CA, NY directed agencies to develop standards
Policies options are required for market design and scaling

Policies to spur investment
• Investment and production tax credits
• Targeted financial incentives (e.g., tax-free bonds)
• Feed-in tariffs, contract for differences

Policies to spur markets
• Procurements (e.g., low-C building materials)
• Clean Energy Standards & Low-C Fuel Standards
• Critical infrastructure investments

Policies to spur innovation
• RD&D investment (Mission Innovation)
• Life-cycle assessments & performance standards
Early policy actions: US and EU

Policies to spur investment
• 45Q: $35/ton for CO2 utilization
• Economic Activity Zones (EOZ)

Policies to spur markets
• Procurements (e.g., low-C building materials)
  • Buy Clean (CA, WA, ID, OR; NY + NJ)
  • Highway reauthorization
  • New legislation (NY)
• Low-C Fuel Standards in CA, others
• EU Renewable diesel standard
• ICAO/CORSIA revisions (in progress)

Policies to spur innovation
• New US RD&D budget (DOE-FE); EFFECT Act
• Developing new standards built on performance, LCA