Building a New Carbon Economy

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www.centerforcarbonremoval.org
@CarbonRemoval
Overview

1. Who is the **Center for Carbon Removal**?

2. What is the “new carbon economy”?

3. How do we **build** the new carbon economy?
If you take away three things...

1. To meet climate goals, we must *both eliminate* GHG emissions *and clean up* large volumes of carbon from the atmosphere.

GHG Emissions

X

✓
If you take away three things...

2. We can build a growing and prosperous economy that removes more carbon than it emits through a *portfolio of natural and technological carbon removal* approaches.
If you take away three things...

3. With entrepreneurial spirit (and patience), you can find opportunities to build the new carbon economy via policy, business, and/or research.
1. Who is the Center for Carbon Removal?

2. What is the “new carbon economy”?

3. How do we build the new carbon economy?
Center for Carbon Removal: NGO on a mission to build a growing, prosperous economy that sequesters more carbon than it emits.

- **Policy**: US federal+state+UNFCCC policy analysis and education
- **R&D**: “New Carbon Economy” R&D consortium
- **Economic Development**
- **Carbon Recycling Labs incubator and impact fund**
1. Who is the Center for Carbon Removal?

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What is the “old carbon economy”?
Massive economic growth post-industrial revolution...

...coupled with massive growth in CO2 emissions.
The “old carbon economy” has produced a massive amount of cumulative CO2 emissions...

Cumulative CO$_2$ emissions: 2,000B tons

Global proven coal reserves: 1,000B tons

Annual CO$_2$ emissions: 50B tons
...which is a problem because much of that CO2 has ended up in the atmosphere, where it will remain naturally for centuries.
To solve these problems, we need a “new carbon economy” that continues to grow...

OECD’s Long Range Global GDP Forecast
...while fundamentally reversing the relationship between economic growth and CO2 emissions.

Source: Glen Peters and Kevin Anderson in Nature Climate Change
Building a new carbon economy is essential, possible, and will prove very challenging.

1. Deeply decarbonize
2. Eliminate land use emissions
3. Scale carbon removal

Source: Rockstrom et. al in Science
The solution “layer cake” for a new carbon economy:

- Forest and ecosystem restoration / expansion
- Soil carbon storage
- Clean energy + carbon capture and storage
- Rock weathering / CO2 mineralization
- Ecosystem conservation
- Agricultural intensification + decarbonization
- Point source carbon capture, use, and storage
- Low cost, abundant clean energy

Clean up excess CO2 from atmosphere

Prevent extra CO2 from entering the atmosphere
Natural solutions: dozens of options, mostly forests, half sequestration.

Griscom et al in PNAS
Technological approaches: big potential, big challenges, early days

Pete Smith in Nature Climate Change

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We know there is a learning curve, we just don’t know the slope…

LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE

Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT

Michael Liebreich, New York, 14 April 2015

@MLiebreich #BNEFSummit
Technological approaches
1. Who is the Center for Carbon Removal?

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Policy overview: patchwork of policies exists today, but needs major expansion to achieve goals

<table>
<thead>
<tr>
<th>International</th>
<th>US Federal</th>
<th>US state</th>
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<tbody>
<tr>
<td>• Paris Agreement: pledges fall short of “well below” 2C</td>
<td>• 45Q tax credits for carbon capture, use, and storage ($35-50/t CO2 sequestered)</td>
<td>• CA Low Carbon Fuel Standard (~$150/t CO2)</td>
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<td>• UK: ~$10M R&amp;D program for “GGR”</td>
<td>• USDA soil health and forest restoration programs</td>
<td>• “Healthy Soils” programs and natural and working lands baselines</td>
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<tr>
<td>• EU: Considering ~$10M R&amp;D program in 2020 timeframe</td>
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Business overview: corporates just beginning to incorporate a new carbon economy into their future

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<tr>
<th>“Carbon tech”</th>
<th>Regenerative Ag</th>
<th>Sustainable wood products</th>
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<tr>
<td>• Transforming waste carbon into value in building materials, fuels, consumer goods</td>
<td>• Annie’s, Patagonia, Ben and Jerry’s among leaders making supply chain commitments</td>
<td>• Increase in cross-laminated timber for built environment</td>
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Watch this space:

- **IPCC – 1.5C Special Report**: (Q3 2018) highlights essential role for deep decarbonization + carbon removal for meeting aggressive climate targets

- **National Academies – Carbon Removal R&D Roadmap**: (Q3 2018) informs funding needs and priorities for Congress

- **New Carbon Economy Consortium – R&D Roadmap**: (Q2 2018) informs university research agenda
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3. With entrepreneurial spirit (and patience), you can find opportunities to build the new carbon economy **via policy, business, and/or research.**
Thank you!

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New Carbon Economy Building Blocks

- Forest expansion
- Sustainable bioenergy
- Bioenergy + CCS
- Soil carbon storage
- Direct air/ocean CCS
- Ecosystem restoration
- CO2 mineralization
- Ag intensification
- Point source CCS
- Ag decarbonization
- Robust climate policy
- Economic development support
- Solution innovation engine
- Conservation
- Abundant, low cost clean energy