Climate Tech Bookmarks

By Grant Faber

There are some categories that contain both sub-categories and bookmarks. Any bookmarks that belong exclusively to the parent category are listed below the bookmarks in the sub-categories. E.g., “Carbontech” has its own bookmarks starting at “Carbon Herald,” which are at the bottom of the overall category.

Carbontech ***4***

Academic Articles **4**
- Repositories 4
- Reviews 5
- Targets and IAMs 7
- Earth Systems 8
- DAC Technology 9
- Storage 12
- CCU 13
- LCA and TEA 14
- Markets and Industry 20
- Politics 20
- Mitigation Deterrence/Moral Hazard 21
- Thermodynamics and Energy 21
- Bibliometric Analyses 21
- Expert Surveys 22
- Methane Removal 22
- New Tech Ideas 22

Articles **23**
- Status and Trends 23
- Major Deployments 24
- Substack 25
- DAC 26

Reports **27**
- Repositories 27
- Market Reports and Overviews 27
- Scalability 28
- Costs 28
- DOE and NREL 28
- Global CCS Institute 29
- Region-Specific 29
- Corporate Buyers 29
- SAF and E-Fuels 30
- Chemicals 30
- Job Creation and Economic Benefits 30
- mCDR, ERW, and BiCRS 31

Organizations **31**
- Trade Groups 31

Policy Groups....32
System Testing....32

Companies....33
DAC....33
Point-Source Capture....33
Investors and Accelerators....33
Frontier, Stripe, and Shopify....34
Insurance....34

Offsets....35
Articles and Reports....35
Offset Trackers....36
Standards and Ratings Bodies and VVBs....36
Marketplaces and Platforms....37
Criticism....37

MRV....38
Articles and Reports....38
MRV Landscape Mapping....39
MRV Organizations....39
General Methodologies....39
Specific Company Methodologies....40
Storage....41
AirMiners Videos....41

Policy....42
CDR Policy Options and Recommendations....42
Government CDR Procurement....42
Trackers and Specific Bills....43
International Policy....43
Municipal Involvement....44
45Q....44
DAC....45
ERW....45
Marine CDR....45

Equity and FF Involvement....46
Overview Materials....46
Academic Articles....46
Polling and Perceptions....47
Community Ownership and Engagement....47
Specific Projects....48
Leftism and CDR....49
Fossil Fuel Involvement....49

Criticism....50
DAC....50
Marine CDR....50
BiCRS....50
Soil Carbon Sequestration....50
CCS....51
CCU and Storage....51

Overviews and Resource Compilations....51

Articles 51

Videos and Podcasts 52
Podcasts 52
CDR Overviews 53
Playlists 53
Events 53

Maps and Siting 54
DOE Maps 54

Calculators, Databases, and Art 55

Cleantech 55

Companies, Organizations, and Jobs 55
Investors and Accelerators 55
Company Lists 56
Jobs 56

FOAK and Project Finance 57

Articles 57
Climate Tech VC 57

Reports 58
IEA 58
DOE 59
RMI 59

Startup Resources 60

Chemistry and Chemical Engineering 60

Energy 60
Academic Articles 60
Articles 60
Financing 60
Wikipedia 61

24/7 Carbon-Free Energy 62

Energy Storage 62

Hydrogen and Heat 62
Academic Articles 62
Green H2 and Renewable Matching 62

Metal 63
Steel 63

Cultivated Meat 64

Climate Change 65

Articles 65
Fossil Fuel Industry 65
Companies and Economics 65
Justice 65
Vox 65

The Atlantic 66
BBC 66
Academic Articles 67
Mortality, Social Costs, and Inequality 67
Oil and Gas Companies 68
GWP 68
Systems 68
Solutions....68
Agriculture....69
Emissions Modeling 69
Paris Agreement and Net Zero Progress 69
Electricity and Energy Emissions 70
Pledge and Action Trackers 70
Rhodium....70
Our World in Data 70
Calculators and Tools....71
IPCC....71
IRA 71
Geoengineering 72
Academic Articles....72
Energy Geopolitics 72
Tech Modeling 73
Scholars....73
Academic Articles 73
Climate Tech 73
TRLs, MRLs, and ARLs 74
Articles and Podcasts 75
TEA and Cost Resources....75
Futures Studies, Progress, and Science....76

Carbontech

Academic Articles

Repositories

Massive NET/CDR Bibliography
Massive AI-Based CDR Citation Discovery
SEAS CDR Lit Review
Deep Blue GCI Repository

CDRXIV
GENIE Project Publications
GENIE CDR Knowledge Hub
NEGEM Project Deliverables
EU RESCUE Publications
Oxford Energy Studies Carbon Management Programme
Royal Society on CDR
Frontiers in Climate - Negative Emission Technologies
Insights in NETs Article Collection
Jennifer Wilcox Publications

Reviews

NASEM

NAS Negative Emissions Technologies Report
NAS Ocean CDR
CCU Markets, Infrastructure, and R&D
NAS CCU Markets and Infrastructure
NAS Gaseous Carbon Utilization Report

DAC Reviews

Classification and Roadmap for DAC R&D
DAC Review, Costs, and Learning Rates/Scaling
DAC Technology and Company Review
DAC Company Review and Potential AI Use
Adsorption-Based DAC Review
Review of Scientific and Commercial DAC Progress
DAC Overview
DAC Review and Emerging Approaches
Review of DAC Systems, Costs, and Impacts
Comparative DAC Sorbent Study
January 2024 DAC Deployment Review
DAC Scale-Up Assessment
DAC vs. DOC Status and Scale-Up Comparison
DAC and CCU Review
DAC Lit Review
DAC Thermodynamics, Materials, and Cost Review
Keith 2005 DAC Article

mCDR, ERW, and BiCRS Reviews

DOC Technologies Review
mCDR Review with DOC Focus
mCDR Overview and Breakdown
Science and Validation of mCDR

OAE Research Best Practices
ERW Review
ERW Co-Benefits, Impacts, and MRV
ERW Soil Measurement Review
Mineralization Status and Challenges
Ex Situ Mineralization Overview
Enhanced Rock Weathering in Crops
Diverse Minerals with CO2 Capture Capacity
Alkaline NETs
Review of BECCS and Biomass CO2 Utilization
BECCS Review
Biochar Overview

SAF and E-Fuels Reviews

System for Fuels from Sunlight and Air
Power-to-Liquid Aviation Fuel Review
Cost and Emissions Toward Net-Zero Aviation
Socio-Technical Imaginaries of Net-Zero Aviation
Pathways to Net-Zero Aviation
Climate-Neutral Aviation in EU Planning

Part 1: NET Research Landscape
Part 2: NET Costs and Potentials
Part 3: NET Innovation and Upscaling
2022 NET Comparison and Scale-Up
CDR Pathway Potentials, Costs, and Recommended R&D
NET Review
Comparison of CDR Technologies
NET Potentials
Carbon Removal Budget
CDR Summary
CDR Sustainability Limits
Assessing CDR Pathways with ESG Criteria
CDR Feasibility Assessment Framework
CCS Deployment Feasibility and Timelines
Analysis of Failed CCUS Projects
Explaining CCS Successes and Failures
Taxonomy of CDR Side Effects
Chemistry of CDR
Review of CO2 Mineralization
Emerging Capture and Removal Technologies
Comprehensive CDR Assessment for Germany

Bio-Based CDR in Germany
Quantifying Potential of Land CDR
Point-Source Carbon Capture Review
Review of AI for CDR Energy System Optimization
Systems Levers for Sustainability and Negative Emissions

Targets and IAMs

Paris Agreement and Net Zero

CDR Overview, Paris Contribution, and Policies
Geological Net Zero Through Like-for-Like
Geological Net Zero and Like-for-Like Offsetting
2050 Net-Zero U.S. with CDR Modeling Runs
2050 Net-Zero U.S. with Carbon Management
Near-Term CDR Deployment to Minimize Net-Zero Disruption in U.S. Energy System Model CDR Results
CDR and Reduction Synergy for Paris
NET Portfolios for 1.5°C Target
Role of CDR in Net-Zero Pledges
Setting a 1.0°C Target
CDR Gap in NDCs
Getting Net Zero Right
Modeling for Post-Net-Zero World
Over-Reliance on Land for CDR in Net-Zero Pledges

Residual Emissions

Residual Emissions Estimates and CDR
Estimate of Global Residual Emissions
Reducing Hard-to-Abate Emissions to Limit CDR Need
Residual Emissions in Cities

Region-Specific

U.S. Pathway for Reaching 1 Gt/year of CDR
CDR Demands in Europe Climate Modeling
Residual Emissions in the EU
Role of CDR for UK Net Zero
DAC in Denmark Through 2050
CCUS in Nigeria
African Land-Based CDR IAM
DAC Requirements and Costs in Germany
Impacts on Asian Emissions from CDR
DAC/NETs to Play Large Role in China
China CCUS Pathways

DAC

Uncertainties for Global DAC Projections in IAMs
Role of DAC in SSPs
Role of DAC in Climate Stabilization
Modeling DAC Growth with Historical Analogs
DAC Scaling Lessons from Ammonia Synthesis
IAM Showing DAC Reducing Abatement Costs
Assessment of Role of DAC in Mitigation Pathways
Emergency DAC Deployment Modeling
Role of DAC in Mitigation

2023 Global CDR Capacity and Projections
Near-Term Supportive CDR Deployment
Near- and Long-Term CDR Targets
Inability of CDR to Truly Compensate for Overshoot
Reducing CDR Needs with Aggressive Decarb
CDR Strategy and Climate Sensitivity
Review of BECCS and DAC in IAMs and ESMs
Removal Integration into CMIP7
CDR IAMs Including DICE
Integrating NETs into IAMs
Biochar in Long-Term Mitigation Scenarios
Global Biochar Potential
Non-IAM, Bottom-Up NET Analysis
How CDR is Climate Mitigation
Uncertain CCS Prospects
Necessary Reform of "Science-Based" Targets
Fair National CDR Quotas
Importance of Portfolio of CDR Solutions
Impact of CDR on Electric Power Sector
Fuels Decarbonization and CDR Modeling

Earth Systems

Earth System Response to NETs
CDR and Carbon Cycle
Lag Time Between CDR and Response
Multi-Century CDR Dynamics
Effectiveness of Reversing Climate Change
Net-Negative CO2 and Temperature Change Interactions
CDR Not Equal to Emissions Mitigation
Specific CDR Asymmetry Drivers

CDR Asymmetry
Factors Influencing CDR Cooling Effect
CDR Needed for Pre-Industrial Climate
CDR Over Different Timescales
Durability of CDR Key for Paris Goals
Point of No Return and Need for CDR
Irreversible Changes Even w/ CDR
Global Carbon Cycle Response to NETs
Testing Earth System Responses for CDR Scenarios
Interaction of mCDR and Atmospheric CO2
Resisting Carbonization of Animals

DAC Technology

Sorbent Development

Review of Adsorption Materials for DAC
Modified PEI for Enhancing DAC
Polymer Sorbent Fibers for DAC
DAC w/ Polymerized Amines
DAC via Charged Sorbents/Hydroxide Lattice
Adsorbent Design for DAC
Accelerated Testing of PEI on Silica Sorbent
Testing Performance of Different Sorbents
Novel Peroxide DAC Sorbents
Sorbent Discovery and Optimization Platform
Porous Material Design
Sorbent-Coated Carbon Fibers
Bi-Amine DAC w/ High Adsorption Capacity
Efficient DAC w/ Diamine Solution
Porous Polymeric Electrodes for Electrochemical DAC
Novel Meso-Macroporous Polymers for DAC
Polymer DAC Sorbent Design
Functional Materials for DAC Dissertation
Crystal Engineering of Hydrogen Bonding

Contactors

DAC Contactor Design w/ Numerical Simulations
Novel Cost-Reducing Air Contactor Geometry
Review of DAC Air Contactor Designs
Effective Air–Liquid Contactor
Keith Air Contactor Design
Non-Equilibrium Solvent Effects in Enhancing Capture at Solvent Interface

Process Design and Optimization

Optimal Design of Solid Sorbent DAC
DAC Solid Sorbent Process Optimization
TVSA DAC Simulation and Optimization
DAC Design Considerations
Optimization of Moisture-Swing DAC
Simulation and Optimization of Absorption DAC Plant
Modeling and Optimization of DAC
DAC Experiment and Process Model Design

Reaction Mechanisms and Degradation

CO2–Amine Reaction Mechanisms
Water–CO2 Isotherm Modeling for DAC
Metal Oxide Sorbent Reaction Mechanism
PEI Oxidative Degradation Mechanisms
PEI Oxidative Degradation Products
Role of Water in Oxidative Degradation
Epoxide Functionalization Effects on PEI Degradation

Siting and Ambient Conditions

Siting Adsorption-Based DAC
Impact of Climate on Solvent-Based DAC
DAC Performance Across Geospatial and Temporal Conditions
Incorporating Diurnal and Ambient CO2 Concentration Variations
U.S. DAC Siting
Impact of Atmospheric Conditions on DAC Siting
DAC Hub Siting Considerations

Energy and Water Use

Water Management in DAC
Impact of DAC Water Co-Adsorption
DAC Integration w/ Low-Carbon Heat
DAC and MeOH Production w/ Intermittent RE
Grid Planning for DAC
Offshore Wind and DAC
Offshore Wind-Powered DAC and Storage Capacity
Offshore Wind and DAC Siting
Design Considerations for Offshore DAC
DAC Powered by Otherwise Curtailed Wind

MOFs and COFs

MOFs for DAC Overview w/ Thermodynamic Focus
Overview of MOFs for DAC
MOF Carbon Capture and Conversion Review

TVSA MOF DAC System Design and Costing
DAC MOF Review and Analysis
ML-Driven MOF DAC Sorbent Discovery
ML-Driven MOF DAC Sorbent Repository
ML-Assisted MOF Exploration for GHG Removal
MOFX-DB Online Database Description
MOFX-DB MOF Database
Data-Driven MOF Design for Capture
Ni-Node DAC MOF
Scalable Physisorbent MOF
Water-Enhanced MOF DAC
Ethylenediamine on MOF DAC
Sequential Pore Functionalization in MOFs
MOF and Ionic Liquid w/ Microwave Regeneration
COFs for DAC
Novel Development of DAC COFs
Fluorinated COFs for DAC
PEI Bonding in COFs for DAC
COFs for CO2 Capture

Electrochemical

DAC and Bicarbonate Electrolysis Issues and Opportunities
Electrochemical DAC w/ Bicarbonates
pH Swing Electrochemical DAC
DAC Process Combining Wet Scrubbing and BPED
Electrochemical Regeneration of Alkaline Absorbent for DAC

Membranes

Membrane Performance in DAC
Membrane Separation for DAC
Membrane-Based DAC for Low-Purity Stream
DAC via Humidity-Driven Molten Carbonate Membrane

Novel Pathways

High-Gravity Enhanced DAC
DAC w/ Aqueous Peptides
DAC via Reactive Crystallization
Amino Acid Dynamics for DAC
Amino Acid Salt DAC
Passive DAC with Amino Acid Paints
Acid–Base Concentration Swing DAC
Alkalinity Concentration Swing DAC Improvement
Alkalinity Concentration Swing DAC Dissertation

Alkalinity Concentration Swing DAC
Photochemical DAC
Amine-Functionalized Sorbent Regeneration w/ FBR and Microwaves
DAC with Liquid Amine–Solid Carbamic Acid Separation
Core-Shell Electrospun Fibers for DAC
Mobile DAC and Carbon Capture Review
Oak Ridge Decentralized HVAC DAC System
HVAC DAC Evaluation in Different Climates
Distributed DAC and Water Extraction
DAC in Building Ventilation System
Indoor DAC
Composite Film for Urban DAC

Hybrid Approaches

Coupling DAC and BECCS
Integrated BECCS and DAC System
Geo-Spatial Economic Assessment of BECCS/DACCS
Effectiveness of Biochar DAC Sorbent
DAC w/ Biochar-Based Sorbent
Vanadium Oxide Biochar for DAC
DAC with Biochar from Sewage

Company-Specific

Original Heirloom Technology
Heirloom Using Warehouse Automation Technology
Original Carbon Engineering Technology
Original Verdox Technology
Original CSIRO Technology
Original Equatic Technology

Confinement Effects on Moisture-Swing DAC
CFD Modeling for Passive DAC
Carbonation of Lime-Based Materials for DAC
Passive DAC w/ CaO
Comparing Post-Combustion Capture and DAC
Comparing 12 DAC Technology Trajectories
Regeneration Strategy Review
DAC for Specific National Contexts
1999 Lackner DAC Proposal

Storage

Full Explanation and Economics of Geologic Storage
Geological Carbon Storage Overview

Sequestration Methods and Opportunities
Modeling Geologic CO2 Leakage
Feasibility of Gigaton-Scale Storage by 2050
Estimate of CO2 Storage 1996–2020
Biochar Permanence
Soil Sequestration Limited to <1 Gt
Soil Carbon Storage Potential
Soil Carbon Reframing
Potential Approach for Valuing Temporary C Storage
Carbfix Papers

CCU

Green Chemistry and CCU Chemicals

Safe Operating Space for Novel Entities (Chemicals)
Green and Just Chemistry
Principles of Green Chemistry
Principles of Green Engineering
Decarbonizing the Chemical Industry
Decarbonizing Chemical Manufacturing
Avoiding Short-Termism in Chemical Industry
Achieving Net-Zero Plastics
Refinery of the Future
Achieving Circular Plastics in Planetary Boundaries
Bio-Based Aromatic Synthesis
Safer BPA Alternative Synthesis
Biorenewable and Circular PDK Polymers
CO2 to Carbon Nanofiber Catalytic Process
Microbial Electrosynthesis from CO2 Review
Electrocatalytic CO2 Conversion Special Issue
Electrochemical CO2 Reduction Review
Overview of Electrocatalytic CO2 Conversion
2022 Roadmap on Low Temperature CO2 Electrolysis
On-Site CO2 Recycling
Review of Electrofuel Feasibility
TOPSOE RWGS System
Liquid Gallium CO2 Reduction
CO2 Conversion w/ Radiation
Review of Radiolytic CO2 Conversion

Reactive Capture

Reactive Capture Review
Dual-Function Materials for Reactive Capture to MeOH

Electrochemical RCC for DAC to Ethanol
Electrochemical Reactive DAC and PSC to CO
DAC Subprocess Integration and Reactive Capture
Materials for DAC and Integrated Conversion
Reactive DAC to Olefins
Solar Thermal DAC to Methanol
Capture and Conversion to CH4 and MeOH
ARPA-E Reactive Carbon Capture Slides

Cement and Concrete

Exploring CCUS Feasibility and Costs in Cement Industry
Cementitious CCU
Overview of Cement and Concrete Decarbonization
Decarbonizing Cement Production
Strategies for Net-Zero Cement
Electrochemical Synthesis of Cement
Concrete Natural CO2 Uptake
Role of Concrete in US Building GHGs

Meta-Review of CCUS Feasibility
Review of CCUS Methods and Technologies
CCU Paradigm Shift
CCU Opportunities and Challenges
Capture and Utilization Sectoral Review
Review of CCU Reaction Pathways
Closing C Cycle for Difficult-to-Electrify Processes
CCU Value Chains
Comparing DACCS and DACCU Deployment Needs

LCA and TEA

TEA

Methodological

Towards Improved CCS Cost Evaluation Guidelines
Improved Guidelines Part 1: Power Plants
Improved Guidelines Part 2: CCS
Improved Guidelines Part 3: Uncertainty
Advances in CCS Cost Engineering
Methodology for CCS Cost Estimation
AACE Cost Estimate Classification
DOE Cost Estimating Guide
Efficiency, Feasibility, and Risk Framework for Early-Stage CCU TEA
TEA Practices at Sandia

Uncertainty Analysis in TEA
TEA Guidelines Article
TEA Guidelines for Adsorption Processes
Using TEA to Inform CCUS Policy
Electrochemical Process TEA
Burk TEA Overview
Chris Burk Techno-Economics Blog
Activate Techonomics

DAC

Review of DAC Processes and Techno-Economics
DAC Cost Reduction and Targets
Component-Level DAC Learning Rate Analysis
Component-Level DAC Learning Rate Analysis SI
Component-Level DAC Learning Rate Analysis Code
DAC TEA with Typology
DAC TEA Review
Sorbent-Focused DAC TEA
Effect of Ideal Sorbents on DAC Costs
NETL Sorbent DAC Design and Costing
NETL Solvent DAC Design and Costing
2011 APS DAC Costing
DAC TEA Dissertation
Energy and Cost Assessment for 3 DAC Processes
DACCS Cost Analysis
DAC and CCU TEA
DAC Regional TEA
TVSA DAC TEA in Europe
TEA for Calcium Hydroxide DAC in Cooling Towers
DAC TEA and CCS Comparison
Modeling and TEA of BPED DAC
Electrochemical DAC TEA
SOFC and DAC TEA
Ionic Liquid DAC Process Design and TEA
Liquid-Based Absorption DAC TEA
Adsorption-Based DAC Cost Analysis
Modeling DAC Costs Based on Sorbent Properties
Integrating DAC and SMR
Economics of Integrating SMR and DAC
Geothermal and DAC/BECCS TEA
TEA of Integrated NG Power Plant and DAC
Solar-Powered DAC TEA

Wind-Powered DAC and EOR TEA
Climate Impact on DAC Levelized Cost
Commercial-Scale DAC TEA
TEA for Integrated DAC and Mineralization
DAC vs. DOC TEA Formulas
Economic Analysis of DAC and Fischer-Tropsch
TEA for DAC CO2 to CH4
NG vs. Electricity for Solvent DAC
Integrated District Heating and DAC Costing

CCS

CCS Costs, Barriers, and Potential
NETL CCS Cost Report
CCS Retrofit Cost Database
TEA of Amine Regeneration
TEA for CCS Pathway Comparison
CCS Cost Analysis
CCS Operability–Economics Trade-Offs
ML-Based Mineral CCS Optimization TEA
Solvent Process Configurations TEA

Diverse CDR TEA Results
Technological and Economic Prospects for CCU/CDR
CDR Cost Estimates from Paris Contribution Report
Zimmermann CCUS TEA Dissertation
Economic Outlook for CO2 Conversion
Cost-Optimal Pathway for Net-Zero Chemicals and Plastics
How CCS and DAC Costs Affect End Product Costs
CO2 Compression, Transport, and Storage TEA
Shared CO2 Capture, Transport, and Storage Cluster Costs
CO2 Transport Costs
Ship-Based CO2 Transport
TEA of Emerging CO2 Electrolysis Tech
CO2 Electrolysis TEA Excel Tool
Electric Methanol and DAC TEA
Ammonia and Methanol TEA
TEA of Renewable Syngas Pathways
Hydrogen and BECCS TEA
Biomass CDR Value Higher Than Energy Value
Biochar CDR TEA Dissertation
Biochar TEA in Spain

LCA

Methodological

FECM DAC LCA Best Practices
LCA of Emerging Tech
LCA of Emerging Tech Review
Early-Stage CCU LCA Tool
Chemical LCA Screening with Machine Learning/ANNs
Machine Learning for Chemical LCI Prediction
Review of ML in LCA
GCI on Implications of Downstream Emissions for CCU
Attributional LCA Not Appropriate for CDR Credits
Issues w/ NET Carbon Accounting
Verifying NETs
Handbook on Life Cycle Sustainability Assessment
Chemical Industry Carbon Footprint Guidelines
LCA Guidelines Article
Recommendations for Stoich-Based LCI Estimates
Hierarchy of LCI Generation Methods
10 Principles for LCA + LCC + S-LCA
Diminished Rebound Effects with Less Natural Capital
CDR Net Removal and System Boundary Assessment
Carbon Accounting Without LCA
Consequential LCA for CCU
Attributional vs. Consequential LCA
Issues with Attributional LCA Relative to Consequential LCA
Unresolved Problems in LCA
Carbon XPRIZE Finalist LCA Review

DAC

DAC LCA Hydroxide Sorbents
DAC LCA and Energy Review
DACCS LCA
Climeworks DAC LCA
LCA Comparing DAC Types
Potassium Carbonate DAC LCA
DAC LCA Toward 2100
Ireland DAC LCA
DAC and FT Fuel Production LCA
DAC to Green MeOH LCA
DAC and Utilization LCA
DAC Material and Energy LCI
Comparative DAC Exergy-Based Assessment

Net-Negative Oil via EOR as Unlikely
Health and Climate Impacts of CC and DAC

CCU

Review of Catalysis and LCA for CO2 Conversion
Paris Compatibility of CCU
Pairing CCUS and CDR for Net Zero
CCU MeOH, C2H4, Etc. LCAs
Lit Review of CCU Chemical LCAs
CCUS Supply Chain LCA
Deloitte LCA Example for Origin Materials
CCU Concrete May Not Produce Climate Benefit
Carbon Uptake by Cement Carbonation
LCA for CO2 Mineralization Products
Mitigation Potential of CCU for Chemicals
CCU Plastics LCA and Potential
Bio-Based Aniline LCA w/ Indirect LUC Factors
LCA of CCU Polypropylene
Bio-Based Adipic Acid LCA
GREET Aviation Module
Net Carbon Sequestration for Bioproducts

Other Resources

GREET
Regulatory Versions of GREET
ecoinvent Knowledge Base
ecoinvent Fundamentals Videos
ISSST Sustainability Conference

Critical Review of CDR LCAs
Review of LCA Methods to Inform CDR Scale-Up
NET Sustainability Assessment
Mitigation and CDR LCA and Optimization
Carbon Footprint of CO2 Feedstock
Actually Carbon-Negative Biomanufacturing
BECCS and Water Stress
BECCS Fertilizer Issues
BECCS LCA Inventory Review
BECCS LCA Review
System Boundary Important for Cement BioCCS
CCS LCAs
CCS Water Footprint
ERW Geochemical and LCA Optimization

Eion ERW LCA
LCA for Coastal Enhanced Weathering
Unfavorable Microalgae LCA

Integrated Assessments

Integrated Review of LCA/TEA for DAC
Off-Grid DAC LCA and TEA
Geospatial TEA and LCA for Solid Sorbent DAC
Liquid Solvent DAC LCA and TEA by Environmental Conditions
TEA and LCA of Fiber-Encapsulated Nanoscale Hybrid Sorbents
Review of LCA and TEA for Echem CO2 Reduction
CDR TEA and Carbon Accounting Dissertation
Social Costs of CDR LCA Results
Integrated TEA/LCA for Cement CCS
Ex Situ Mineralization Process, TEA, and LCA
ERW TEA and LCA
California ERW LCA and TEA
DAC, BECCS, and Biochar Economic and Environmental Comparison
Bioenergy and BiCRS LCA and TEA Review
BiCRS Cost and Emissions Summaries
TEA and LCA of Carbon-Negative Pyrolysis

SAF and E-Fuels

DAC, RWGS, and F-T SAF TEA and LCA
Power-and-Biomass-to-Liquids SAF LCA and TEA
Synthetic Jet Fuel LCA and TEA
Fischer–Tropsch E-Fuel LCA and TEA
LCA and TEA of Solar Fuels
TEa and LCA for DAC and Fuel Production Integration
Biomass, F–T, and AtJ Jet Fuel TEA
Electrofuel Synthesis TEA Optimization
DAC for Jet Fuel Cheaper than SAF
Climate-Neutral Aviation and Non-CO2 Effects
LCA and Non-CO2 Effects from Alternative Jet Fuels
Renewable Jet Fuel LCA
SAF LCA
Aviation Fuel GHG Estimation from ICAO
Biojet Fuels LCA
Variability in Petroleum Jet Fuel LCA
Integrated Model for DAC and Methanation
Syngas Methanation LCA and TEA

LCA and TEA Guidelines for CCU V2.0

AssessCCUS
Special Issue on Carbon XPRIZE Assessment
Low TRL CCU Evaluation
Social LCA Guidelines
Adding Social Assessment to CCU
Review of LCA and TEA Integration
Prospective TEA and LCA for CCUS Review
Multi-Attribute Decision-Making for CCUS LCA/TEA
Assessing Early-Stage CCU
Path to Harmonized LCA and TEA
2019 GCI LCA TEA Workshop Report

Markets and Industry

Progressive (Mixed) Offsets Proposal
Historical Growth Rates and CDR Scaling
Historical Tech Adoption Data for CDR Comparison
Renewable Energy Lessons for CDR
Buying Down DAC Costs
Scaling DAC w/ Carbon Purchase Agreements and Dactories
CDR Commercialization Mechanisms
Paying for CDR
CCU Building Material Market Projection
Mining Industry Role for ERW CDR
Economic Analysis of CDR Policies
Aligning Incentives Across CDR Stakeholders

Politics

Removal Liabilities

Carbon Takeback Obligation
Carbon Removal Obligation Mechanism
Removal Liability for Emitters Proposal
Carbon Removal Obligations to Repay Carbon Debt
Agential Responsibilities for CDR

Wim Carton Publications
Undoing Various Equivalencies in Carbon Accounting
Political Ecologies of Circular Carbon Economy
Political Economy of DAC
Political Economy of Negative Emissions
Knowledge Politics of CDR and IAMs
Politics of Residual Emissions
Separating CDR for Luxury, Societal Membership, and Residual Emissions

Possible Limits on CDR from International Law
Possible Weaponization of NETs and SRM
NET Financing and Inequality
Moral Implications of CDR Pathways
U.S. CDR Marxist Analysis and Network Mapping

Mitigation Deterrence/Moral Hazard

Analysis and Proposals for NET Moral Hazards
Mitigation Deterrence Types and Quantification
Summary of Workshops on Moral Hazard
CDR Moral Hazard Review
Political Economy of Delay
Racial Capitalism and Mitigation Deterrence
EU CDR Mitigation Deterrence Research
CDR Delaying South Africa Emissions Reductions
CDR Delaying Emissions Reduction
Case for Separate CDR and Reduction Targets
New Climate Strategies as Delaying Decarbonization
Circular Carbon Plastics as Petrochemical Mitigation Deterrence
Swiss Mitigation Deterrence Discourse

Thermodynamics and Energy

Lackner on DAC Thermodynamics
Explainer on DAC Thermodynamics
Role of Energy in DAC
Energetic and Economic Analysis of DAC
Potential for Dilute DAC Product Stream
Hybrid DAC and Mineralization
Low-Purity DAC Carbonation in Aggregates
TEA and Prospects for CO2 Sequestration in Carbonates
Thermodynamic Analysis of CE Plant
Biophysics and Economics for NETs
Integrating NETs and Clean Energy Systems
Thermodynamic Constraints for CCU
Nuclear and CDR Integration
Thermodynamics of Electrochemical mCDR

Bibliometric Analyses

CDR Bibliometric Analysis
Bibliometric DAC Analysis
Bibliometric Analysis of Needed DAC R&D
Understanding Gap Between Projection and Deployment

Carbon Capture Bibliometric and Patent Analysis
CDR Patent Analysis
Bibliometric Analysis of CCS Materials
Bibliometric Study of Blue Carbon

Expert Surveys

Large-Scale CDR Expert Elicitation
Climate Change and CDR IPCC Expert Expectations
Expert Survey on NETs
Survey of DAC Experts on Trends
Expert Perspectives on DACCS Innovation
BECCS and DACCS Policy Support Expert Survey
Survey on Geologic Storage Development Time
Survey Assessing DAC Deployment Capacity
CDR Expert Survey
Expert Review on NBSs
Startup CDR Credit Perceptions

Methane Removal

NASEM Research Agenda for CH4 Removal
Methane Removal Review
Methane Removal Assessment
Methane Removal Options
Emerging Methane Mitigation and Removal Review
Methane Removal and Atmospheric Restoration
Methane Removal Requirements
Value of Methane Removal
Challenges and Opportunities for Methane Removal
Methane Mitigation and Removal
Legal Framework for Methane Removal
Solar Photocatalysis to Remove Non-CO2 GHGs
Co-Removing CH4 and CO2
Methane Removal vs. BECCS
Chlorine Radical Enhancement for CH4 Removal

New Tech Ideas

CO2 Separation w/ Bipolar Electrodialysis
CO2 Extraction from Seawater with Bipolar Electrodialysis
Electrochemical Acid–Base Generation for mCDR
Electrochemical Hydrogen Looping for DOC
Measuring ERW Carbon Flux
Energy Savings for Geochemical CDR

CO2 Snow Deposition in Antarctica Idea
CO2 Storage in Antarctica
Blockchain and CDR

Land-Based CDR Measures
BECCS Process Safety
1977 Early CDR Proposal

Articles

Status and Trends

2024

December 2024 CDR Gold Rush
December 2024 DAC Hubs Round 2 Announcement
December 2024 Skytree Acquisition of ReCarbn
December 2024 Breakthrough $40M to Deep Sky
December 2024 BCG 50,000-Ton Purchase
December 2024 Terradot–Google Deal
December 2024 Heirloom $150M Series B
November 2024 Michigan Carbon Storage Permitting
November 2024 Deep Sky Credit Sales
October 2024 Terraset $3M Purchase
October 2024 Additional CarbonSAFE Selections
October 2024 Meta $35M CDR Commitment
September 2024 mCDR Progress
September 2024 OCED DAC Hubs NOI
September 2024 AirMiners Kiloton Fund and Shopify Announcement
September 2024 Origen Sale to Shell and Mitsubishi
September 2024 Google and Holocene $100/t Deal
September 2024 Oxy Stratos Draft Class VI Permits
July 2024 2030 CDR Supply and Demand
July 2024 More CDR Startup Failures Expected
June 2024 CCI New 500-tpa Module
June 2024 CCI DAC Module Manufacturing Facility
May 2024 DOE Procurement Semifinalists
April 2024 Growth of CDR Purchasing
April 2024 MegaDAC Database Insights
March 2024 Google $35M CDR Commitment
March 2024 DAC Deployment Status
February 2024 DAC 1.0, 2.0, and 3.0
January 2024 CDR Expectations for the Year

2023

December 2023 Hijacking and Reclamation of DAC
November 2023 Plea for More CDR Attention
October 2023 DAC Progress
October 2023 Decisive Decade for DAC
September 2023 Heirloom Microsoft Purchase
August 2023 DOE DAC Hub TA-3 Selections
August 2023 DOE DAC Hub TA-1 and TA-2 Selections
August 2023 H1 CDR.fyi Progress Report
August 2023 DAC Hub Competition
July 2023 Utilities Against Carbon Capture
June 2023 CDR Market Grew 300%
June 2023 DAC Maturing
May 2023 CDR Market Snapshot
May 2023 CDR as a Trillion-Dollar Business

2022

December 2022 CDR.fyi Year in Review
December 2022 CCU Landscape
November 2022 Oxy DAC Cost Overruns
October 2022 CCS Status and Arguments
August 2022 1 Gt/yr CCUS Pipeline
April 2022 DAC Status
March 2022 CO2 Recycling Status
March 2022 Heirloom $53M Series A
January 2022 CDR Predictions

2021

December 2021 CDR Going Mainstream
September 2021 Positive DAC Trends
August 2021 DAC Overview

Major Deployments

2024

December 2024 Volkswagen 600-tpa DAC in Chile
November 2024 Skytree 30-kta in Texas
November 2024 ADNOC and 44.01 300 tpa DAC
November 2024 DACMA 300 tpa
October 2024 Origen EERC 1 kta
October 2024 Mission Innovation CDR Launchpad Projects
September 2024 Arbor BiCRS Credits to Microsoft
August 2024 Heimdal Bantam 5 kta
August 2024 Spiritus Class VI for 2 Megaton

August 2024 Deep Sky 3 kta DAC Testing Facility
July 2024 China 600-tpa DAC Test
June 2024 Heirloom 320 kta in Louisiana
June 2024 Equatic 109.5 kta Canadian Plant
June 2024 RepAir 1 kta in Greece
May 2024 Sustaera and Deep Sky 1–5 kta
May 2024 280 Earth 500 t/year
May 2024 Holocene Prototype Unveiling
May 2024 Climeworks Mammoth at 36 kta
May 2024 Mammoth Launch and Cost Improvements
May 2024 Mammoth Online
April 2024 DACMA South America Pilots
March 2024 Infinium F–T e-Diesel Plant
March 2024 Spiritus Wyoming DAC Plant
January 2024 LanzaJet SAF Deployment

2023

December 2023 Mission Zero 50 t/year
November 2023 Heirloom 1 kta Launch
July 2023 Octavia and Cella 1 kta
June 2023 Project Bison Delays
April 2023 DAC Hub Apps
April 2023 Global Thermostat 1 kta

2022

December 2022 Capture6 5 Megaton Plant
November 2022 Climeworks 1 Megaton in Louisiana
October 2022 CE Up to 30 Megaton Plant
September 2022 CarbonCapture 5 Megaton Plant

2021

November 2021 CE Norway Plant
September 2021 Climeworks Orca at 4 kta
June 2021 CE Plans for 2nd Megatonne Plant

Substack

The Carbon Curve
Marginal Carbon
Carbon Travels
Polymerist Substack
Terraform Now
Renaissance Carbon
Modularity and DAC

Innovative CDR Financing Mechanisms
Höglund on CDR Halfway Through 2020s
Necessary Amount of CDR
Balancing Open- and Closed-System CDR
Red Teaming CDR Development
Discounting Removed Tons Due to Uncertainty
CDR Credit Pricing vs. Costing
Technology Scaling Laws for DAC
Microsoft's Potential CDR Buying Strategy
Octavia Carbon Advantages
Evolution of CDR Players
Trillion-Dollar CDR Market
Creating Trillion-Dollar CDR Industry
CDR Bibliography
Need to Pay Down Carbon Debt
Forest CDR Durability Issues
Nori Downfall Story
SAF vs. CDR for Aviation Decarbonization
Ocean CDR Overview

DAC

Significance of DAC Hub Funding
DAC Resource Consideration (Land, Energy, Cost)
David Keith Slashing DAC Costs
Boosting U.S. DAC Credit Demand
Climeworks Deployment Lessons
Climeworks Nameplate Capacity Waterfall
Haru Oni F–T and DAC e-Fuel Initial Cost
Needed DAC Investments
DAC and CDR Patent Analysis
DAC Support of Kenyan Geothermal
Offshore Wind and DAC
New Yorker Overview of DAC/CCS
DAC Overview
DAC Player Overview
Mother Jones on DAC
Possible SMR Use by CCI in Project Bison

CDR and Hope
Charm Industrial Story
Biochar Overview

55 Uses of Biochar
Carbon Removal Potential from Veganism
CO2 Capture Coin via Blockchain
Carbon Coin Cryptocurrency Article
Global Carbon Reward: Carbon Coins/CDR Currency

Reports

Repositories

DAC Coalition Report Library
Rethinking Removals Knowledge Hub
Reports from Energy Futures Initiative
Mission Innovation CDR Reports and Resources
State of CDR Report Materials

Market Reports and Overviews

CDR.fyi

October 2024 CDR.fyi Q3 Market Report
July 2024 CDR.fyi Q2 Market Report
February 2024 CDR.fyi Year in Review

Circular Carbon Network

Circular Carbon Network 2023 Market Report
Circular Carbon Network 2022 Market Report
Circular Carbon Network 2021 Market Report

IEA and IRENA

IEA 2023 Policies and Business Models for CCUS
IEA 2021 CCUS Project Review
IEA 2020 CCUS Report
IEA DAC Report
IEA DAC Overview and Relevant Policies
IRENA Capturing Carbon Report

EFI on 2024 DAC Landscape
DAC Overview and Market Scan
Expected CDR Demand and Policies to Accelerate Deployment
Durable CDR Projected Demand Curve and Insights
CDR and Net-Zero Strategies
CCUS Vital but Limited
Mind the Gap Report on CDR and 1.5°C
Large Emitters Already Need CDR for Carbon Budgets
Differentiating Between CCUS and CDR

2023 CDR Through 2030
McKinsey on CCUS
Philanthropy's Role in CDR
EU CCU Roadmap for 2050
EU and German Role in Catalyzing CDR Industry
EU Natural CDR Potential
Growth of Global and UK CDR Markets
SAPEA Review Reports of CCU
GCI CCU Market Report
Defossilizing the Chemical Industry
CO2 Recycling Limits and Opportunities
Decarbonizing Cement and Concrete Primer
RMI Concrete Solutions Guide

Scalability

Full DAC Scalability Report
DAC Scalability and Supporting Policies
Barriers to Scaling CDR
Framework for Scaling Corporate CDR Funding
Bridging CDR Finance Gap for Scale
BeZero Carbon CDR Scalability
CDR Scalability and Durability
CDR Scaling and Potential Allocation
CDR Scaling and Needed S-Curves
Land-Use Competition
Bioresources in a Net-Zero Economy
EU Biomass in a Net-Zero Economy
CCS Scaling from Lab-Scale to Commercial Demo
Scaling CCUS Industry
Climeworks 2022 Industry Snapshot on Scaling CDR

Costs

DACCS Costs, Scale, Funding, and Policy
CDR Supply Cost Curves
CCUS Cost Analysis Report
Levelized Cost of Carbon Abatement
Captura on DOC Cost Reduction Strategy
February 2024 Oxy Investor Slides and DAC Costs
December 2023 CDR is Costly

DOE and NREL

DOE April 2023 Carbon Management Status

DOE FECM Strategic Vision
DOE SAF Liftoff Report
AI Needs Across Carbon Management Areas
Carbon Capture Supply Chain
National Labs on CDR Innovation Opportunities
Accelerating Innovation in CCUS Report
Reactive Capture Workshop Slides and Summary

Global CCS Institute

2024 Global CCS Status
2023 Global CCS Status
2022 Global CCS Status
Global CCS Status Reports
TRL and Cost of CCS Value Chain

Region-Specific

Comparing CDR in U.S. vs. China
DACCS vs. E-fuels in Europe
CDR and CCUS Finland Perspective
CDR Development in Norway
UK CCUS Cost Challenge Report
GGR in Australia
CCS in California
NET Options in California
CCUS in New York State
GCI Voluntary Offsets in Great Lakes Region

Corporate Buyers

CDR Credit Assessment Framework
Microsoft CDR Buying Observations
Carbon Direct and Microsoft High-Quality CDR Criteria
Business Guide to CDR Including TRLs and Ratings
WEF CDR Buying Guidance
Buyer's Guide to Carbon Credit Data Quality
FECM CDR Credit Primer
Unlocking Carbon Market Demand
Building Blocks for Promoting Corporate Demand
CDR Corporate Engagement Guide
Corporate Reflections on CDR Plans
MaRS Discovery CDR Pre-Purchase Lessons
Buyer's Guide to ERW
Buyer's Guide to CDR Policy

Expanded Corporate WTP for CDR
Carbon Gap Company WTP for CDR
Profit per Ton CO2 for Major Companies
Corporate Emissions and Revenue
In-Value Chain Use of CDR
Private Sector Levers to Support CDR
Case for Investing in CDR
CDR Corporate Buyer Behaviors and Trends
Canadian CDR Buyer Analysis

SAF and E-Fuels

Carbon-Free Transport Overview
SAF Overview
Maritime Fuels Overview
SAF Projections and Data
SAF Guide
Decarbonizing Aviation Report
Biogenic CO2 Availability for E-Fuels
UK Jet Zero
DOE SAF Roadmap
DOE Review of Technical SAF Pathways
Technical Review of Aviation Fuels
Carbon Direct SAF CI and Cost Report
SkyNRG 2023 SAF Market Outlook
Sexy vs. Practical Aviation Quadrants

Chemicals

Chemicals in Plastics Report
Syngas Overview Chapter
Decarbonized Chemicals Report
Refining and Petrochemical Emissions
ecoinvent Chemical Report w/ In-Depth Descriptions

Job Creation and Economic Benefits

CDRjobs 2024 Salary Report
DAC Job Creation
Deep Dive on DAC Job Creation
DAC Job Creation by State
CCS Workforce Development by State
Economic Benefits of Carbon Capture

mCDR, ERW, and BiCRS

Marine CDR Code of Conduct
Ocean CDR Decision-Making Landscape
Marine CDR Issue Brief
ERW Roadblocks and Solutions
Overview of CDR Using Biomass (BiCRS)
Sustainable Biomass Overview
Guide to Sustainable Biomass Sourcing for CDR
Frontier Sustainable Biomass Sourcing Principles
Sourcing Sustainable Biomass for CDR
Roadmap for Sustainable Biomass Sourcing
Sustainable Biomass Principles for BiCRS
2023 Biochar Market Report

Roads to Removal: U.S. CDR Potential
RMI CDR Innovation Roadmap w/ RD&D Tracking
Bezos Fund CDR Roadmap
Bezos Fund CDR Workshop Report
XPRIZE Getting to Gigatonne Team Data Summary
CCS and DAC Ladder and 2030 and 2050 Prioritization
Penn CCS Ladder
Case for Negative Emissions
Stages of DAC Commercialization
Advancing CDR Beyond the Hype Cycle
remove CDR Startup Business Models
FOAK Framework for Carbon Management
Mission Zero Early FEED Report
CDR Electrochemistry Overview
Industry Guidelines for CCUS CO2 Specifications
CDR and Utilities Nexus
CarbonCapture Clean Energy RFI
Reducing Risks of Climate Overshoot
Significant Scale of Carbon Credit Insurance
Digital Infrastructure for CDR

Organizations

Trade Groups

DAC Coalition
Carbon Business Council
Carbon Removal Alliance

Carbon Removal India Alliance
Coalition for Negative Emissions
Rethinking Removals Doers Club
Negative Emissions Platform
Global CCS Institute
CCS Association
Decarbonized Cement and Concrete Alliance

Policy Groups

Carbon180
Great Plains Institute
Carbon Capture Coalition
Carbon Gap
Carbon Removal Canada
Bellona
French Association for Negative Emissions (AFEN)
Deutscher Verband für negative Emissionen

System Testing

International Test Center Network Partners
NETL DAC Test Center
National Carbon Capture Center
Wyoming Integrated Test Center
NIST DAC Testing System
Technology Centre Mongstad
Alberta Carbon Conversion Technology Centre
Shand Carbon Capture Test Facility
SINTEF Tiller CO2 Laboratory

Carbon Removal XPRIZE
Carbon Utilization XPRIZE
NextGen
First Movers Coalition
AirMiners
The OpenAir Collective
OpenAir Discord
Pacific Coast Legacy Emissions Action Network
Reearthers CDR Community
Mission Innovation CDR Mission
Carbon Management Canada
CanCO2Re Initiative Canadian CDR Organization
CO2RE UK CDR Research

Group of Negative Emitters (GONE)
EU RESCUE Consortium
Swiss Carbon Removal Platform
Climate Overshoot Commission
Rethinking Removals
Global CDR Action Network
CarbonPlan
Ocean Visions
Carbon to Sea Initiative
Hourglass Climate OAE Research
Foundation For Climate Restoration
U-M Global CO2 Initiative
Columbia Carbontech Development Initiative
Book and Claim Community

Companies

DAC

DAC Company List
Expanded DAC Company List
Early DAC Company List
DAC Project Deployment Map
DAC Project Deployment List

Point-Source Capture

2023 State-of-the-Art CCS Providers
Svante
Carbon America
Carbon Clean
Aker Carbon Capture
RTI
Ion Clean Energy
Entropy
Baker Hughes
Northern Lights CCS Infrastructure

Investors and Accelerators

CDR Investor List
FECM DAC EPIC Semifinalists
AirMiners Launchpad
Counteract
Carbon Removal Partners

Lowercarbon Capital
Alchemist Climate Ventures
Carbon Direct
Flowcarbon Project Finance and Development
remove Carbon Removal Accelerator
Carbon Removal Booster Switzerland
Brinc
Tencent CarbonX Program
CEEZER Carbon Coalition
gener8tor CDR Accelerator
TerraDAC Laboratory
Breakthrough Energy Catalyst
YCombinator Carbon Removal

Frontier, Stripe, and Shopify

Frontier
Frontier Climate Apps
Frontier Funding Progress
Frontier Criteria
Frontier CO280 and CREW Offtakes
Frontier Terradot Offtake
Frontier CarbonRun Offtake
Frontier Exergi BECCS Offtake
Frontier Lithos ERW Offtake
Frontier Fall 2024 Purchases
Frontier Fall 2023 Offtakes
Frontier Fall 2023 Purchases
Frontier Fall 2022 Purchases
Frontier Spring 2022 Purchases
Stripe Negative Emissions Apps
Stripe Fall 2021 Purchases
Stripe Spring 2021 Purchases
Stripe 2020 Purchases
Stripe Negative Emissions AMA
Shopify CDR Deck
Shopify CDR Procurement Explainer
Shopify CDR Investments

Insurance

Kita
Oka

CarbonPool
Howden
Marsh
Arbol
Aon
Canopius

Carbon Removers Index
AlliedOffsets CDR Company Database
CDR Company List
Circular Carbon Network - Company Database
150+ CDR Startups
IEA CCUS Projects Database
Global CCS Institute CCS Facility Database
NETL PSC and CDR Compendium
Climate Tech VC Carbon to Value Companies
Climate Tech VC Capture Companies
Snapshot of EU CDR Companies
mCDR Companies and Overview

Offsets

Articles and Reports

Guidance

Oxford Net-Zero Offsetting Principles
Like-for-Like to Strengthen Net-Zero Claims
Corporate Net-Zero Emissions Guidance
Six Questions for Better Offsets
Shift Carbon Offsetting to CDR
VCM and Novel CDR
National Claims and Additionality
Beyond Value Chain Mitigation Over Offsets
Scope 3 Workshop Findings and CDR Credit Recommendations
More Transparency Needed for SBTi
Four Ways to Fix Offsets
Reduction Offsets Possibly Still Valuable at Net Zero
Horizontal and Vertical Offset Stacking
Pricing Carbon Offsets Considering Permanence
Carbon Market Recommendations
Building Trusted VCM
Separating Net Zero and CDR Goals

Market Overviews

World Bank State and Trends of Carbon Pricing Reports
May 2024 VCM and Compliance Market Status
2024 CDR.fyi Market Outlook Summary
AlliedOffsets 2023 CDR Market Report
2024 Puro CDR Offtake Report
2024 State of VCM
2023 State of VCM
2020 Offset Analysis
Credits and Claims: State of VCM

Influence of SBTi BVCM on CDR
EU Greenwashing Law Files
EU Parliament Bans Greenwashing
EU Ban on Greenwashing, Carbon Neutrality, Etc.
RMI on Book and Claim/Insetting
Book and Claim for Steel and Concrete
Types of Additionality
ClimeFi Commitment to Not Engage in Speculative CDR Trading
Offset Buffers and Insurance

Offset Trackers

CDR.fyi Offset Tracker
Known CDR Purchases
AlliedOffsets Offset Price Tracker
Carbo Alliance VCM Tracker
Carbo Alliance CDR Offset Tracker
Carbon180 Carbon Offset Registry and Project Directory
Voluntary Registry Offsets Database
CarbonPlan Offset Database
Open Offsets Directory

Standards and Ratings Bodies and VVBs

ANSI Accredited GHG Validation and Verification Bodies
Verra-Certified VVBs
LCFS Accredited Verification Bodies
ICROA Endorsed VCM Standards
IETA
Integrity Council for the VCM Core Carbon Principles
Integrity Council for the VCM
VCM Integrity Initiative
Science-Based Targets Initiative

GHG Protocol
Verra
Gold Standard
Climate Action Reserve
American Carbon Registry
BeZero Credit Ratings
Sylvera Credit Ratings

Marketplaces and Platforms

2023 Carbon Removal Marketplaces
Carbonfuture
Persefoni
Thanks A Ton
Puro
Patch
CUR8 Removals Platform
Supercritical
Planboo
CEEZER
Watershed
Milkywire
Carbonplace
Carbon Removed
Xpansiv
Klimate
Wren
Senken
Zopeful
ClimeFi
Rubicon Carbon
Covalent Forward Crediting Platform
Accend
Bigfoot

Criticism

Reduction Offsets as Unscalable
VCM Headed for a Crisis
Offsets as Incompatible with Paris
Less Than 16% of Reduction Offsets Real
Low-Quality Offsets Threatening Climate Integrity
Offsetting Undermining Climate Targets

South Pole Shady Practices and Junk Offsets
Verra Replacing Rainforest Offset Scheme
Worthless Verra Forestry Offsets
Further Offset Issues
Top Offset Projects Worthless
South Pole Junk Offsets
South Pole Kariba Junk Offsets
Over-Crediting of Forest Offsets
21 Ways Forest Projects Cheat
Issues w/ Low-Quality Forest Credits
Forest Preservation Carbon Credit Harm
Hundreds of Millions of Tons of Emissions from Wildfires
Downsides of Trillion Tree Projects
Junk Offsets Rampant
ICVCM Approving Non-Additional Credits
ICVCM Excluding RE-Based Offsets Due to Non-Additionality
EU Carbon Credit VAT Scam Story
Tracking Offsets to Demonstrate Issues
Carbon Offset Market Issues
Fake Offsets from Shell

Puro VCM Market Map
Energy Impact Partners VCM Market Map
Patch Framework w/ Carbon Offset Certifier Overview
Carbon Offset Buyer List
Frontier Offtake Contract Template
Sample CDR Contracts
Shopify Sample CDR Contract Clauses

MRV

Articles and Reports

Carbon Gap CDR Certification Principles
MRV in U.S. Federal Policy Recommendations
MRV Policy Roadmap
C180 MRV Principles
C180 MRV Matrix
Frontier on MRV
Market Shaping and MRV
CDR Market Vision and MRV
MRV Costs and UK Policy Recommendations
Cascade ERW MRV Cost Calculator

Cascade Climate ERW MRV Plans
Rethinking Carbon Removal Accounting
Open Questions in CDR Certification
Carbon Gap Guide to Certifying CDR
CDR MRV Progress

MRV Landscape Mapping

CDR.fyi MRV Methodology List
TRACEcdr MRV Protocol Map
MRV for CDR Overview and Recommendations
Review of MRV Methodologies for EU CRCF
Review of Engineered GGR Standards
CDR Certification Landscape
CDR Certification Ecosystem Visualization

MRV Organizations

Isometric
Cascade Climate Open Systems CDR
Carbon Removal Standards Initiative
NIST CDR Standards Consortium
350Solutions
CCS+ Initiative
Absolute Climate
EcoEngineers
Offstream Advisory
CarbonPilot
[C]Worthy
Submarine
atdepth MRV
Subtidal
Oceanid
Coastal Carbon
EarthXCG Digital MRV
Crystal Trade Biochar dMRV
Fix6
Renoster NBS
Chloris Geospatial
Open Forest Protocol NBS

General Methodologies

Biochar

European Biochar Certificate

European Biochar Certificate/CSI
CAR Biochar Protocol
Verra Biochar Protocol
Puro Biochar Methodology

CarbonPlan CDR Verification Framework
Verra Methodologies
Puro MRV Standards
Isometric Protocols
Isometric General Standard
Isometric DAC Protocol
Isometric OAE Protocol
Isometric Biomass Feedstock Accounting Module
Isometric Energy Use MRV Module
Verra DAC Module
CCS+ Initiative Carbon Management Accounting Framework
CCS+ Initiative Methodology Approach
CCS+ Initiative Methodologies
Absolute Climate Standards
ERW MRV Quantification
ERW MRV Methods
ERW MRV Measurements
Methodology for Fermentation BECCS as CDR

Specific Company Methodologies

Climeworks DAC Certification Report
Climeworks and Carbfix Storage Certification Report
Planetary MRV
Planetary OAE Environmental Audit
Ebb Carbon MRV
Equatic MRV Protocol
Captura MRV
Equatic MRV
Brilliant Planet Methodology
Rewind Marine Biomass MRV Protocol
CarbonCure Verra MRV Methodology
Drax BECCS Methodology
Charm and Bio-oil MRV Protocol
Review of Cropland ERW MRV

Storage

Class VI Wells

EPA Class VI Permit Tracker
Class VI Guidance Documents
NETL CO2-Locate Well Database
Congressional Research Service on Class VI
Class VI Well Background
Class VI Wells and Incentives
Next-Gen Class VI Wells
Class VI Primacy for Louisiana
Remaining Class VI Project Risks After Primacy
Storage Obstacles

Functionally Stable Carbon Storage
Permanent Removal vs. Temporary
Geologic CO2 Storage Overview
Terminology for Carbon Storage
Temporary and Permanent Storage
High Confidence in Geologic Storage
Overview of Storage and Need for It
Geologic Storage Overview
Geologic Storage Incentives
Carbon Storage Podcast

AirMiners Videos

AirMiners MRV for ERW
AirMiners MRV for DAC + Mineralization
AirMiners MRV for Soil Carbon
AirMiners MRV for CDR
AirMiners MRV for OAE
AirMiners MRV for Land-Based CDR
AirMiners MRV for Biomass Storage
AirMiners MRV for Ocean Biomass
AirMiners MRV and Environmental Justice

Isometric MRV Principles
MMRV CDR Standards Initiative Call
Integrated U.S. GHG Monitoring Strategy
Absolute Climate Classifications for CDR Credits to Support Innovation
Towards Unified MMRV Frameworks
LCFS on CCS

Carbon Credit MRV Cost Calculator
DOE-Funded CDR MRV Programs

Policy

CDR Policy Options and Recommendations

C180 Federal Policies for Net Zero
Federal Policy Options for CDR in U.S.
New U.S. CDR Tax Credit Considerations
Rhodium U.S. Policies to Scale CDR
CATF CDR Recommendations
CDR Policy Agenda
Policy Incentives to Scale CDR
U.S. CDR Overview and Policies to Scale
Carbon180 Biden Transition Handbook
RE Policies for CDR
Policy Recs Based on Off-Track NDCs
BECCS Reverse Auction Design Considerations
Considerations for Combining State Support and VCM for BECCS
Climate Restoration as a Policy Goal
Fungibility of CDR Credits in Compliance Markets
Possibilities for Intersection of ETSs and CDR
Trade Policy/CBAM for CDR
Governing Permanence of CDR
CCUS Policymaker Handbook
Policymaker Guidance on Carbon Credits
Policy Design to Finance CCUS in Power Sector
Regulating Safety for CDR and CCUS
Avoiding Mitigation Deterrence/Moral Hazard of CDR
Separate Targets and Mitigation Deterrence
Call for Reduction and Removal Distinction
Open Letter on Separate CDR and Reduction Targets
Principles for CDR Policies

Government CDR Procurement

EFI National Carbon Removal Authority Proposal
U.S. CDR Federal Procurement
Carbon Removal Canada Government Procurement Summary
U.S. Progress on CDR Procurement
FECM and Industry Voluntary CDR Purchasing Program
Promise of Government CDR Procurement Standards
Congress Should Wait on Procurement

Government CDR Financing Typology
Carbon Business Council on Demand-Side Support
Procurement Overview and Pillars
Public–Private Co-Ownership for CDR

Trackers and Specific Bills

CDR/CCUS Law Database
Carbon Gap CDR Policy Tracker
World Bank Carbon Pricing Dashboard
C180 Policy Tracker
C180 Federal CDR Funding Tracker
Carbon Gap EU Policy Tracker
Data for Progress CDR Leadership Act Polling
CDR Policy Map
Federal CDR Leadership Act
2024 CDR Investment Act at $250/t
2024 Proposed REMOVE Act
2023 Proposed CREST Act
2022 Proposed REMOVE Act
2021 Proposed CREATE Act
2020 Proposed CREATE Act
FY23 CDR Federal Funding
ESIC Act for DAC Investment Tax Credit
November 2024 Massachusetts Bill Supporting CDR
SB-308 Next Steps After Defeat
SB-308 California CDR Mandate
CDR Policy in U.S. States
CDR in National Climate Pledges

International Policy

EU-Wide

Carbon Gap EU CDR Strategy Recommendations
2024 EU CDR Policy Overview
How the EU Can Regulate CDR
Sequencing CDR into EU ETS
Integrating CDR into EU ETS
Linking CDR in EU ETS
January 2024 EU to Require 90% Cut and 10% CDR
EU Carbon Management Strategy
CDR Policy Across Europe
EU CRCF Regulation

EU CDR Certification Framework Progress
EU Proposed Regulation for CDR Certification
Industry Recommendations for EU CDR Certification
Issues with CDR in Carbon Markets and CRCF
Corporate Interests Influencing EU NBS CDR Policy
August 2024 Sweden BECCS Reverse Auction
August 2024 Sweden BECCS Reverse Auction Review
2024 EU CDR Policies Overview
EU CDR Policy Recommendations
EU Climate Law Revision Proposals
Commentary on EU Proposal

Canada

Planning Public CDR Procurement in Canada
Legal Framework for CDR in Canada
Ideas for CDR in Canadian Compliance Markets

IPCC CDR Inventory Accounting Workshop Materials
Recommendations for CDR International Governance
Microsoft Proposal on Reconciling International CDR Trading
International Politics and Global Governance of CDR
Germany Negative Emissions Plan
Germany 2060 Net-Negative Target
Swiss Policies to Support CDR
Article 6.4 Provisional CDR Rules
CDR Stakeholder Input to Article 6.4 Meeting
Japan Incorporation of CDR Into GX-ETS
Governance Principles for DAC in South Korea
CDR Policy in Brazil, China, and India
G7 CDR Policy Ideas
OECD CDR Policy Case Studies

Municipal Involvement

Role of Cities in CDR
Local Governments and CDR
Municipal CDR Projects in Minneapolis
Municipal CDR Support in Boulder and Flagstaff

45Q

NETL 45Q Guidance Toolkit
IRS 45Q Instructions
IRS 45Q Rule

45Q Text
Bad 45Q IRA Incentives
CATF 45Q Analysis
C180 45Q Recommendations
2024 45Q Congressional Letter to EPA and IRS
45Q Crediting Concerns
Insufficient MRV for 90% of 45Q Credits
Fraudulent 45Q Claims
IRS 45Q Investigation Response

DAC

C180 Strategies for DAC Hubs
Bipartisan Policy Center DAC Report
Policy Roadmap for DAC
Policy Insights for Scaling Up DAC
U.S. Policies to Advance DAC
Policy Options for DACCS
10 Policy Recommendations for DAC

ERW

ERW Policy Primer
Law of Enhanced Weathering for CDR Overview
Law of Enhanced Weathering for CDR Materials Sourcing

Marine CDR

U.S. mCDR Research Strategy - FTAC
U.S. Marine CDR Policy Overview
Model U.S. Marine CDR Legislation
NOAA CDR Strategy
2024 Marine CDR Policy Overview
Congressional Research Service mCDR Considerations
mCDR Governance Recommendations
Assessing mCDR Under London Protocol
Adapting London Convention and Protocol for mCDR
Next Steps on mCDR International Regulation
Marine CDR Policy Sequencing

U.S. Government VCM Principles and Statement
Overview of CDR Regulation and Policies
Government Intervention for Carbon Credits
Effect of IRA and CCUS and CDR
Grubert on DAC Hubs and CCS Policy Issues

CDR Predictions Under Trump 2.0
CDR Obligation as Indirect Carbon Tax
Legal Issues for Ocean CO2 Transport
2021 CCUS Policy Trends
CDR at COP24
CCS at COP24

Equity and FF Involvement

Overview Materials

AirMiners EJ Resource Repository
AirMiners EJ Vision Statement
JEDI for CDR Resources
Agenda for Progressive CDR
Progressive Platform for CDR
F4CR Equity Report
AGU Ethical Framework for Climate Intervention
CDR Industry Commitments Pledge
Responsible Carbon Management Initiative Principles
17 EJ Principles
Overview of Deployment Trade-Offs
CO2 Pipeline Safety Record
CO2 Pipelines Debate
CDR and Addressing Local Air Pollution

Academic Articles

EJ, Climate Justice, and CDR
CDR for a Just Transition
Issues w/ For-Profit CDR Deployment
Lessons for Just DAC Deployment
Equity for Carbon Removal Quotas
National Shares of GHG Reduction
Quantifying Responsibility for Climate Breakdown
Adaptation, Justice, and CDR
Avoiding Polarization of NETs
Germany CDR Stakeholder Deliberation
Holly Jean Buck Google Scholar
Review of Justice-Related Implications for DAC
Ethics of CDR at Scale
Dangers of Extractivism in CDR

Polling and Perceptions

DAC

U.S. Community DAC Support Surveys
Perceptions of DAC and OAE Across Sociotechnical Scenarios
DAC Polling and Moral Hazard Framing
Exploring Public DAC Acceptability
Data for Progress DAC Polling
Data for Progress DAC Hub Focus Groups
DAC Hub Opinion Polling
DAC Media Coverage Analysis

Regional Focus

Global North vs. South CDR/SRM Polling
Global CDR Perceptions
CDR Public Perceptions in U.S. and UK
CDR Perceptions in Three Asian Regions
German CCU Perceptions
Denmark BECCS Perceptions and WTP
Stakeholder CDR Perceptions and Ideas in Norway
Public Support Drivers for CDR in 30 Countries
Perceptions of CDR and Decarbonization Across States
Californians Want FFs to Pay for CDR
Data for Progress California Climate Infrastructure and CDR Polling

Public Engagement for Climate Intervention Governance
CDR Attention and Positive Sentiment Growing on Social Media
CCS Demand Varies w/ Information
Public Perception's Role in CDR at Scale
Public Views on CDR Methods
Demographic Effects on CDR and SRM Preferences
Climate Worry Predicting CDR Support
Indigenous Views on Climate Interventions
Driving CDR Awareness with Collective Intelligence
Communication Recommendations for CDR
Improving Online CDR Sentiment
Article on Framing Nature-Based Solutions
Comment on Framing Nature-Based Solutions
Cross-Border CO_2 Transport Decreases CCS Acceptance

Community Ownership and Engagement

Community Engagement for CDR Slides
Community Benefits from CDR Slides

Advances and Issues in Public Engagement
Need for Independent Public Engagement
Best Public Engagement Practices for OAE
Engagement Needed Before Methane Removal Testing
California DAC Hub Community Ownership and Refusal Right
Improving Comm. Engagement for CDR
Policymaker Lessons for CDR Community Engagement
Airhive Community Engagement
IRCR mCDR Washington Engagement
DOE Workshops Omitting Naysayers
Tensions Between DOE and White House EJ Council
Community Control of CDR
Issues with Community Engagement
Engaging Stakeholders for CDR Research

Specific Projects

Early Resistance to Louisiana DAC Hub
Project Cypress CBPs
December 2024 Climeworks Engagement in Louisiana
August 2024 Deep Sky DAC Opposition
Carbon Gap on Learning from Planetary Engagement
Planetary Protest
Community Pushback to CarbonCapture
July 2024 North Dakota DAC Moratorium in Response to Retract and Airhive
Retract and Airhive Materials for North Dakota DAC Facility
STRATOS Class VI Resistance
ADM Pausing Class VI Injection After Leak
April 2024 Louisiana Pipeline Leak
CO2 Pipeline Explosion in Mississippi
NPR on Satartia Incident
Lake Maurepas Blue Hydrogen Resistance
Illinois County Considering CCS Ban
May 2023 Fears About Carbon Permitting
Lake Nyos CO2 Disaster
Skepticism About Carbon Management Job Creation
Navigator CO2 Pipeline Canceled
May 2024 Pipeline Concerns and Issues
March 2024 Biochar Opposition
June 2023 Resistance to CCS in Louisiana

Leftism and CDR

Carbon Capture and EJ
XPRIZE and C180 EJ Report
Carbon Removal and Climate Justice
Left Should Focus on CCS Implementation
2023 EJ CCUS Platform
Wallace-Wells on Climate Reparations
Global North Paying for CDR, Reparations
Táíwò on CDR
African Case for CDR
CO2 Pipeline Moratorium Letter
Opposition to Carbon Capture
May 2023 EJ Opposition to CCUS/CDR
Socialist Argument for CDR
Leftist View of CDR as Public Good

Fossil Fuel Involvement

DAC as License for O&G
DAC as License for Coal and NG
Defense of EOR
EOR Nuance Podcast
Keith on Why CDR Can't Save Big Oil
Oxy CE Acquisition Strategy
Buck and Burns on Oxy CE Purchase
Issues w/ Fossil Embrace of DAC
Concerns About FF DAC Hub Involvement
DAC Reconsidering Oil Under Trump
Oil Company DAC Involvement
Oxy Foresees Trump DAC Support
Oxy CEO Lobbying Trump for DAC
Occidental and Stratos
Exxon Abandoning GT and Doing In-House DAC
8 Rivers/Calcite JX Nippon O&G Investment
RepAir Taking Oil Money
Oxy and SK Net-Zero Oil
Eneos Japan Net-Zero Oil
Carbon-Negative Oil?

Criticism

DAC

Romm DAC Critique
Reddit Response to Heirloom Plant
Overly Optimistic DAC Assumptions
Unrealistic DAC Energy and Material Needs
Thermodynamic Issues with DAC
High-Level DAC Issues
February 2024 Not Enough DAC for Industrial CO2
DAC as a Distraction
Stratos and Oxy Critique
CIEL DAC and Oil Critique
CIEL Geoengineering and CDR Risk Report
Data for Progress DAC Hubs Letter
Issues w/ Oil-Funded DAC
Global Thermostat Dysfunction
CO2Rail and Mobile DAC Criticism

Marine CDR

Issues w/ Ocean CDR
OAE Additionality Problems
Neglected Aspects in Marine CDR
Running Tide History and Failure
Running Tide Premise Responsible for Failure
Running Tide Post Mortem and Lessons
Running Tide Shuts Down
Issues w/ Seaweed Sinking and Running Tide

BiCRS

Biochar Business Issues
Biochar Scaling Issues
UK BECCS Criticism
Argument Against Ethanol CCS as CDR
Bio-Oil Acidic, Unstable, and Corrosive

Soil Carbon Sequestration

Issues w/ Soil Carbon as CDR
Soil Carbon Critique
Soil Carbon Critique Continued
Issues w/ Carbon-Storing Farms

CCS

Parody Ad Mocking CCS
CCS Criticism
CCS and 45Q Criticism
Oil Change International on CCS
ENGOs Urging EPA to Stop CO2 Injection
Letter to Govt. Criticizing Carbon Capture
Why Carbon Capture isn't a Climate Solution
Errors and Issues with DOE CCS LCA
Academic Letter Against Blue H2
Carbon Capture Is Not a Climate Savior
Failed Chevron CCS Project

CCU and Storage

CCU Won't Play Big Mitigation Role
Specific Issues w/ Geologic CO2 Sequestration
Issues with Temporary CDR
Critique of Ton-Year Accounting
Issues w/ CO2 Storage in Concrete
F–T Issues

CDR Controversy Discussion
February 2024 Growing CDR Sustainability Concerns
Too Much CDR Hype
Skepticism of Net-Zero Pledges
Issues w/ Net-Zero Pledges
Flowcarbon Shutting Down

Overviews and Resource Compilations

Articles

Vox

Vox on CCS/CCU
Vox on CCU Part 1
Vox on CCU Part 2
Vox on CCU Part 3
Vox on CCU Part 4

Quartz CCS/CCU Overview
Wired CDR Overview
Overview of NETs
Discussion of Synthetic Hydrocarbon Potential

NYTimes on Carbontech Revolution
Wallace-Wells on Necessity of Capture
CDR Helping with Climate Goals
CDR Overview and Potential
Types of Carbon Capture Materials

CDR Primer
CDR Knowledge Gaps
Carbon Gap CDR Research Gaps
Carbon Dioxide Removal
CDR Fact Sheets
Carbon180 Fact Sheets
Carbon180 Resources
NETL Annual Conference Decks
AirMiners Contact List
Wil Burns NET Outline and Deck
Scaling CDR Interactive Article
Systems Change Lab CDR Data
CDR Pathway Classification
Carbon Gap CDR 101
Uses of CDR
CDR's Carbon Cycle Interactions
DAC People List
CDR Resources
Frontier CDR Resource List
Carbon Removal Partners Resource List
Intro to CDR
CDR Overview
CO2removal.org - CDR Assessments
CDR Learning Resources
Carbon Removal Academy
Ocean Visions Ocean CDR Methods
OpenAir CDReality

Videos and Podcasts

Podcasts

Wilcox CDR Thoughts on MCJ Podcast
Friedmann on CCU, SAF, and Moonshots
CDR Analogies Podcast
Carbon Removal Show Podcast
CDR Procurement Guide Podcast

CDR Overviews

NOVA: Cooling the Planet
CO2 Recycling Report Presentation and Panel
Vox on CDR
CDR Overview
Joe Hezir CDR Overview
Hausfather CDR Overview
8 Rivers/Calcite DAC Overview
Höglund CDR Intro Webinar
Role of CDR in Achieving Net Zero
Role and Cost of DAC
Höglund 2023 CDR Overview
Ocean CDR Explanation
Discussion of CH4 Removal
Biomass Burial Overview
Climate and Crypto (Regenerative Finance)
Accelerated Geomineralization
SEA MATE Oceanic Alkalinity Enhancement

Playlists

AirMiners - YouTube
CDR Video Playlist
This is CDR Playlist
Institute for Responsible Carbon Removal Videos
Rethinking Removals Panels
Carbon Capture Colloquium Videos
Climate Sprints Videos

Events

AM LCA and TEA Event
AirMiners Carbon Storage Event
June 2023 Climeworks DAC Summit
The Carbys - 2020
Climeworks Orca Launch

2024 State of CDR Report Launch
2023 State of CDR Report Launch
Thermodynamics and DAC Explanation
Azarabadi on DAC Scaling
Lackner Interview on CDR
Eisenberger on CDR and Future of Energy

Nemet on Scaling CDR
Tuning Petroleum Refining Away from Combustion
IEAGHG CO2 Conditioning Workshop
Issues Impeding CCS Deployment
Kita CDR Insurance
COP26 Reimagining CDR
DAC Congressional Briefing
Senate Hearing on CDR
Utilities and CDR

Maps and Siting

DOE Maps

DOE Carbon Matchmaker Map
NETL Map Collection
NETL CONNECT Carbon Management Project Map
NETL Carbon Utilization Map
NETL CCS Map
NETL Carbon Storage Atlas
NETL Catalog of Prospective Storage Formations

CDR.fyi Map
Interactive Map of CCUS Projects in Development in the U.S.
Class VI Well Permitting Map
Class II and VI Well Map Tool
Carbfix Storage Map
Map of CCUS Projects
Potential CCUS Hub Locations and Analysis
Geoengineering and CDR Map
Negative Emissions Platform Atlas
Mission Innovation CDR Deployment Map
European CCS/CCU Projects
SAF FAST Grant Award Map
Low-Carbon Investment Database and Map
Cipher Cleantech Project Map
CCSNet AI-Based CO2 Storage Modeling
Transport Infrastructure for CCS
Atlas for DAC with Siting Considerations
Atlas of U.S. Carbon and Hydrogen Hubs
Atlas of State-Level CDR Support and Policy
Atlas of State-Level CDR Support and Policy Methodology
Carbon Capture Project Milestones

Carbon Capture Siting Tools
EJScreen
Climate and Economic Justice Screening Tool
EJ State by State Guide

Calculators, Databases, and Art

Road to 10 Gigatons of CDR Game
CDR.AI LLM
Calculator for Allocated Corporate CDR Responsibility
CarbonPlan DAC Cost Calculator
OAE Efficiency Mapping Tool
Parallel Carbon DAC Cost Calculator
ERW Open Database
Plastics Europe Eco-Profiles
Petrochemical Flowchart
ICIS Petrochemical Flow Chart
ChemAnalyst Chemical Prices
BusinessAnalytiq Chemical Prices
Enthalpy Calculator
Air Liquide Gas Encyclopedia
CDR Events Calendar
AI CDR Song
Carbon Management Visualizations
DOE LPO Posters
Aireal CCU Material Gallery

Carbon Herald
Carbon Pulse
Quantum Commodity Intelligence

Cleantech

Companies, Organizations, and Jobs

Investors and Accelerators

Climate Tech VC
Climate Tech VC List
Climate Tech Accelerators
Climate Tech Venture Studios
Startup Studio Analysis
Climate Tech Corporate VCs

Impact Investing Map
Signal NFX Investor Lists
Deep Tech Investors Mapping
Climate Investor Guide
Amasia: US Climate VCs
European Climate VCs
Climatescape Capital Database
Midwest Accelerators and Incubators

Company Lists

SOSV Climate Tech 100 2022
Climate Tech Unicorns
Cleantech Startup List
European Climate Tech Startups
Cool List Climate Startups
Diamond List of Clean Tech Startups
Climate and Crypto Companies
AI/ML Climate Startup Directory
Climate Tech Software Companies
BNEF Freight, Materials, and Sensing Startups

Jobs

Climate Jobs Resource
Climatebase Jobs
ClimateTechList Jobs
Climate Tech VC Job Board
Climate Pledge Fund Jobs
Climate People Jobs/Recruiting
Climate Recruit
Work on Climate Slack Community
Dayaway Renewable Energy Jobs
Jobs in Carbon
CDRjobs Jobs Board
DAC Coalition Jobs

Climatescape Organizations
Philanthropic Climate Funder Database
Climate Professional Directory
Thunder Said Energy Tools and Consultancy
Trailhead Cleantech Consulting
Mark1 Climate Tech Developer-as-a-Service
Climate Design Company

The Determined - Climate Designers/Branding

FOAK and Project Finance

Climate Capital Stack Explained
FOAK Financing Case Studies and Lessons
OCED FOAK Lessons
OCED Investment Strategy
Moving to FOAK and Beyond
FOAK Overview
FOAK Project Checklist
FOAK Financing Options
Executing Project Development
From FOAK to NOAK
FOAK-Focused Fund Proposal
Project Finance Overview
Cleantech Project Finance Overview
Cleantech Project Finance Template
Project Risk List
Cleantech Project Finance Lessons
12 Recommendations to Unlock Cheaper Capital
Project Finance Guide
Project Finance and Bridge to Bankability
VC vs. Project Finance
Generate Capital and Cleantech Project Finance
RE Project Finance Primer
Project Finance News

Articles

Climate Tech VC

September 2024 Cleantech Financing Status
2024 H1 Climate Tech VC Deals
2023 Climate Tech Funding
2023 H1 Climate Tech VC Deals
2022 Climate Tech Funding
2022 H1 Climate Tech VC Deals
2021 Climate Tech Funding
2021 H1 Climate Tech VC Deals
Climate Tech VC 2024 NY Climate Week Takeaways
Guide to DOE Funding
Climate Capital Stack

Canary
Cipher Newsletter
Practical vs. Marginal Abatement Cost Curve
Cleantech Innovation, TRLs, and the IEA
Public R&D for Climate Progress
Clean Energy Marshall Plan
Green Stimulus Plan
Importance of Learning By Doing and R&D for Cleantech
2023 Rapid EV Growth
Biden Climate Spending Status
Germany AfD vs. Heat Pumps
Clean Energy/EV Security Concerns Overblown
The Engine Climate Issue
Podcast on Socolow and Pacala Paths to Net-Zero Emissions
Changing Mr. Burns Test for Climate Tech
Need for Better Carbon Credit Markets
Carbon Tunnel Vision
Performance > Chemistry for Customers
Compostables' Role in Circular Economy
Issues w/ "Green" Products
EU Fighting Greenwashing
Land-Use Change Issues w/ New RFS
McKibben on Being a YIMBY
Issues w/ Rushing Risky Climate Solutions
Dark Side of Gates' Techno-Optimism
Articles on Climate, Systems, and Capital
Redesigning VC w/ Systems Thinking Entrepreneurship
Tips for Hosting Climate Events
Climate Tech 4 Valleys of Death
Vaclav Smil Critique of Rapid Innovation
Ideas for Software in Climate Tech

Reports

IEA

IEA 2024 Oil Supply Predictions
IEA 2023 Tracking Clean Energy Progress
IEA 2023 Net Zero 2050 Roadmap
IEA Clean Energy Tech Guide
IEA Energy Technology Perspectives
IEA Clean Energy Innovation Report
IEA 2023 World Energy Investment

IEA 2023 Global EV Outlook
IEA WEO 2023
IEA WEO 2021
IEA Roadmap for Carbon-Neutral China
IEA Cement Report

DOE

DOE Advanced Nuclear Liftoff Report
DOE Industrial Decarbonization Commercial Liftoff Reports
DOE Industrial Decarbonization Roadmap

RMI

June 2024 RMI Renewable Growth Summary
June 2023 RMI Renewable Growth Summary
Profitably Decarbonizing Toughest Sectors
Decarbonizing Heavy Transport and Industry

Mission Innovation Reports
Energy Transitions Commission Reports
Exponential Roadmap Initiative Reports
Jenkins Policy Impact Reports
2023 NASEM Report on U.S. Decarb. Recommendations
Princeton Net-Zero America Pathways - Socolow, Pacala
Rewiring America Field Manual - Saul Griffith
Various Cleantech Demand and Market Mechanisms
House Committee on Climate Crisis Action Plan
Clean Technology Supply Chain Overview
The Engine Tough Tech Report
Wildly Optimistic Decarbonization Report
Federal Funding for Scaling Climate Solutions
Energy Transitions Commission Report on Net Zero Pathways
Fusion Industry Association Reports
Nuclear Fusion Role and Costs
State of Climate and Decarbonization
Frontiers of Impact Tech
Tsung Xu's Clean Energy Transition Guide
Rhodium Emerging Climate Tech Modeling
JP Morgan 2021 Report Skeptical of Energy Transition
Goldman Carbonomics Equity Research
McKinsey: Farming Practices to Fight Climate Change
Patient Capital and Not VC for Cleantech
EPC Contracts for Climate Projects

SFI on Decarbonizing New Mexico
Stabilization Wedges - Carbon Mitigation Initiative

Startup Resources

Third Derivative Startup Resources
Accelerator-in-a-Box
Climate Tech Scaling Manual
Founder's Playbook - Cyclotron Road
Climate Lean Startup Canvas

Chemistry and Chemical Engineering

Crash Course Chemistry
Crash Course Organic Chemistry
Introduction to Chemical Engineering
Chemical Process Design
Introductory Chemical Engineering Videos
Chemical Engineering Resources

Energy

Academic Articles

RECs Threatening Integrity of Targets
LCOEs for Decentralized RE
Decarbonizing Last 10% of Electricity
Geophysical Constraints on Global Wind and Solar Reliability
Geophysical Constraints on U.S. Wind and Solar Reliability
Low-Carbon Power Demand Sink Modeling
Sources of RE Opposition
Jacobson on 100% RE
100% RE Challenges
Review of Net-Zero Emissions Energy Systems

Articles

Utility Dive
China Coal Plant Nuance
HBR Energy Strategy
Future Grid Architecture
Bad RECs Becoming More Popular
Fusion Advances

Financing

Tax Equity: Structures

Tax Equity: Partnership Flips in Detail
Clean Energy Finance Forum
University PPAs
Virtual PPAs
Solar PPAs
NREL PPAs
RMI BRC Renewables for Smaller Orgs
RE Project Financing Methods
Energy Financial Modeling

Wikipedia

Rebound Effect
Countries by Electricity Consumption
US Electricity Sector + Installed Capacity
Cost of Electricity by Source
Intermittent Energy Source
Energy Industry
Earth Overshoot Day

Lazard LCOEs
LBNL Utility Scale Solar Status w/ LCOEs, Capacity Factors, Etc.
Future of Renewable Energy: Quayle Hodek
Vox and Saul Griffith on Electrification
Energy Use by End Use
RMI Cities RE Accelerator Resources
Growth in Renewables Map 2000–2021
Google Project Sunroof
Google Environmental Insights Explorer
Google PPA Explanation
Issues w/ Green Power Purchasing
2023 Interconnection Woes
Interconnection Queue Overview
NREL Solar Cell Efficiencies
Energy Information Administration
EIA Annual Energy Outlook
FECM NG Imports and Exports Monthly
Wind Technologies Market Report
Wood Mackenzie/GTM Renewables Research
EPA Green Power Users
Solutions Project - Paths to 100% RE

24/7 Carbon-Free Energy

Google 24/7 CFE by 2030
Google 24/7 RE Explanation
Google Deploying Data Centers Alongside New Power
Google Quest for Clean Energy
Google Comments on GHG Protocol Scope 2 Update
24/7 CFE Summary
24/7 RE Becoming a Standard
Difficulties w/ 24/7 RE Sourcing
Modeling Proof for 24/7 CFE Benefits
Impact of Additionality and Time-Matching Requirements for H2
Temporal Regulation of RE Supply for H2
Ensuring Clean Energy Used for H2 Production
Hourly Matching and 45V Hydrogen Credit
24/7 CFE vs. Emissionality/Consequential Approaches
Average vs. Marginal Emissions Factors
RECs/GOs in LCA
24/7 RE w/ Granular Certificates: EnergyTag
Granular Energy 24/7 CFE
WattTime

Energy Storage

Energy Storage Overview and Market Map
Overview of Energy Storage Innovations
Discussion of TEA Application for Redox Flow Batteries
Building Better Batteries
Environmental Issues w/ Lithium Extraction

Hydrogen and Heat

Academic Articles

Integrated TEA and LCA for Green H2
National H2 Case Studies
High H2 Abatement Costs
Blue Hydrogen Not Beneficial
Climate Impacts of Blue Hydrogen
Decarbonizing Industrial Heating
Heat Decarbonization Strategies

Green H2 and Renewable Matching

Balancing H2 Renewable Supply and Scale-Up

December 2023 Strict 45V Power Rules
Treasury Should Dictate Green H2 Additionality
Developing EU Rules on Green Hydrogen
Hourly Matching and Green Hydrogen Production
Role of Hydrogen in a Low-Carbon Electric Power System

Clean Hydrogen Ladder
Liebreich Hydrogen Economy Criticism
Green Hydrogen Market Map
Hydrogen LCOH and Emissions Modeling (Code: SZY-846)
LCOH Tool
Green H2 Cost Calculator
IEA LCOH Map
IEA Hydrogen Projects Database
IEA H2 Production Map
DOE Hydrogen Program Plan
DOE Clean Hydrogen Commercial Liftoff Report
DOE H2 Shot Tech Assessment Thermal Conversion
Hydrogen as an Indirect GHG Offsetting CO2 Decrease
Issues w/ H2 Management
Issues Facing Green H2 Deployment
Renewable Hydrogen from Biogas
PEM Cost Analysis Report
Water Electrolyzer Cost Analysis Deck
Siemens Brochure on Electrolysis Efficiency
Electrothermal Energy Storage Opportunities
Hydrogen Opportunities Overview
PEM Challenges and Advancements

Metal

Steel

Net-Zero Steel Industry Reports
Plant-By-Plant Steel Decarbonization
Steel Decarbonization Pathways
McKinsey on Decarbonizing Steel
Design and Cost Analysis of H2 DRI
Hydrogen-Based Steel
SSAB Mill Conversion Lowering Swedish Emissions

Comprehensive Report on Metal Sourcing for Clean Tech
Issues w/ Metal Supply for Decarbonization

Challenges w/ Metal Supply for Transition
Minerals and the Transition
Minerals Used in Clean-Energy Technologies
IEA Role of Critical Minerals
Economic Viability of Unconventional REEs
Losses and Lifetimes of Metals
Demand-Side Strategies to Enhance Transition Material Sustainability
Metal Production Needs for PV Deployment
Projected Copper Needs
Precious Metal Prices and Charts
Heraeus 2022 Precious Metals Forecast
Precious Metals Reports

Cultivated Meat

Dismal Prospects for Cultivated Meat
Argument for Change in Cultured Meat Focus
LCA and TEA of Cultivated Meats
GFI Defense of Cultivated Meat
GFI Review of Critical TEA
Company Database
Relatively Critical Cultured Meat TEA
Another Cultivated Meat TEA
EA Forum TEA Comparison
Cost Calculator
Cultured Meat LCA
Review of Cultivated Meat Advances
Cultivated Meat Advances and Criticisms
Pathways and Emissions for Food Without Ag
Benefits of Cultivated Meat
Cultured Meat - Wikipedia

Systems Change Lab Climate Data
IEA Clean Energy Demonstration Projects Database
Global Low-Carbon Industrial Project Tracker
Climate Technology Primer
Industrial Zero Emissions Calculator
Climate Solutions Federal Funding Database
EDF Federal Climate Funding Tracker
Innovation Funding Opportunities
ARPA-E Webinars
CSS Factsheets

Climate Change

Articles

Fossil Fuel Industry

Exxon Lobbyist Admitting Company Deception
Shell and Bayer Climate Denial Funding
Exxon Funding Centrist Think Tanks
IRA Making O&G on Federal Lands Less Likely
Shell on Profiting from CC
Resisting Fossil Law
O&G Influencing K–12 Education
O&G Policy Influence
Elsevier and O&G Exploration
Fossil Fuel Interests and Academia
Report on Racism of Fossil Fuels
Carbon Footprints from BP to Shift Responsibility

Companies and Economics

Essays on Failure of ESG Investing
Economists Switching from Carbon Tax to Investment
Trouble w/ Carbon Pricing
JP Morgan Climate Warning
August 2023 Global Carbon Pricing
Climate Denial vs. Climate Hypocrisy
Blackrock Climate Hypocrisy
Better Corporate Net Zero Guidance

Justice

Liability Roadmap for Climate Responsibility
Indigenous Carbon Pricing Critique
IHRB on Just Transitions
Increasing Population Doesn't Matter for CC
Shortcomings of Focusing on Climate Disinformation
Last Exit to Socialism Before Climate Change
Climate Coalition in Jeopardy Over Permitting

Vox

Air Pollution > Climate Change
Need for More Radical Climate Movement
Why Property Destruction Won't Work for Climate Activism

How Individual Food Decisions Make a Difference
Reframing Individual Action on Climate
Ending Fossilflation
O&G Company Climate PR Tricks
Vox on Supran/Oreskes Exxon Analysis
Population and Climate Change
Overview of Overpopulation Problem
Environmental Destruction and Pandemics
Chinese EVs vs. American Automakers
Issues with Green Jobs Transition
Green Banks
Aerosols, Air Pollution, and Climate
Ocean Cleanup A Bad Idea?
Limits of Local Food Benefits
Vox on Extinction Rebellion

The Atlantic

Importance of Passing Build Back Better
2050 Closer than 1990 in 2021
Middling Climate Progress
Heat, Human Rights, and Inequality
Between Climate Denial and Despair
Railroads Funding Climate Denial

BBC

Future/Deep Civilisation Series
Road to Civilization Collapse?
Leaving Nature Behind?
Danger of Melting Permafrost
How Air Pollution Changes Behavior
Quest to Build Galactic Civilization
Greatest Long-Term Threats
Environmentalists Buying FF Mines/Rights

Inside Climate News
Latitude Media
Desmog Blog on Climate Disinformation
Hannah Ritchie Substack
Climate Change and Disease
How Climate Change Will Affect Each County
Oreskes on Divestment and "Hypocrisy" Arguments
Climate Hypocrisy and Individual vs. Systemic Change

Just Stop Oil Soup Throwing Backstory
Individual-Level Solutions at Expense of Systemic Solutions
Food Emissions Using Up Budget
Critique of Environmentalism
Pragmatism > Dogmatism for Climate Advocacy Under Trump
Climate Doomism as New Denialism
Natalism for Progressives
2024 Record-High Global Emissions
Possible Emissions Peak in 2023
2023 Record EU Emissions Reduction
COP28 Key Outcomes
COP28 Beginning of the End of Oil
September 2024 UK Backing Away from Oil
September 2024 UK Shuts Last Coal Plant
Right-Wing Climate Actions in EU
Possibility of 1.5 Degrees
Global Warming Melting Sense of Time
Bad Climate Scenario
Giving Green Critique
Meyer on Giving Green
10-Steps for Psychological Resilience to Climate Change
Talking About Climate Change

Academic Articles

Mortality, Social Costs, and Inequality

153 Million Deaths from CC
Mortality Consequences of CC
Social Cost Above $1,000/t
Climate Damages Outweighing Mitigation Costs
Incorporating Feedback into Social Cost of Carbon
Effect of IAM Discount Rate on Carbon Price and Overshoot
Kyle Whyte on Being Too Late to Stop Climate Injustice
Top 1% Cause 15% Emissions
Top 1% Emitted 23% Emissions
Millionaires Eating Up Carbon Budget
Estimating Fair National Shares of Carbon Budget
Inequality Predicts Support for Structural Change
National Contributions to CC
>50% Diseases Exacerbated by CC
Mortality Cost of Carbon
Higher SCC

Social Costs of Carbon Increasing
Alternative Approach to Social Cost of Carbon

Oil and Gas Companies

ExxonMobil's Internal CC Models
ExxonMobil Rhetoric and Propaganda Analysis
O&G Mismatch Between Discourse and Action
FF Company Alignment with 1.5°C Pathways
Aerially Measured U.S. Methane Leaks
Governance Activities of 10 Largest O&G
Review of FF and University Ties
O&G Funding of University Energy Centers
Early O&G Knowledge of Global Warming

GWP

GWP*: Updated GWP Definition
GWP* for Methane
GWP* Explanation
Various Emissions Metrics Explained
Ag Climate Neutrality and GWP*
Methane GWP Discussion
Methane Impacts

Systems

Green Spiral: Policy–Industry Feedback
Increased Warming from Reduced Aerosols
Co-Evolution of Technological Promises and Climate Targets
Climate Tipping Points
System Dynamics Climate Modeling

Solutions

Reporting of High-Impact Climate Solutions
Issues with Climate Solutionism and Divergent Values
Green Industrial Policy Strategies
Evaluation of 1,500 Climate Policies
Systematic Review of Ten Decarbonization Policy Instruments
Green Premiums and Public Policy
Cost of Reducing Greenhouse Gas Emissions
Need for More Ambitious Pledges
Psychological Work After Climate Change

Agriculture

Climate Responsibility of Meat and Dairy Companies
Achieving Net-Negative Food System
Dietary Shifts and Emissions
Ag Can Cause Up to 1°C Extra Warming
Net-Zero Ag

Why We Haven't Bent Emissions Curve
Research Agenda for Extreme Climate Change
Collapse, Environment, and Society
Rapidly Changing Human Climate Niche
Discussion of Climate Niche Paper
Unextractable FFs for 1.5°C World
Importance of Considering Additional and Total CC Risk
Continued Change After Net Zero
2023 Hansen Warming Faster Than Expected
2023 Ten New Climate Insights
Need for Projections Beyond 2100
IAM Criticism
Issues with Nordhaus-Style IAMs
Public Intellectuals and CC Framing
Effective Climate Messaging and Issues with Doomerism
Corporate Climate Principles for Investors
Climate Industrial Policy and Populism
Mapping U.S. Climate Denial
Low Carbon Competence due to GHG Misestimates
Globalization Tied w/ Less Environmental Support
Justice in Climate Research
Services Emit Less Than Goods
Historical LCA and IPAT Changes
Impact of Climate Lawsuits
Debating Climate Ethics Book Review
Critiquing War and Climate Metaphors
Structuring Climate Risk Management Decisions
Computer Classification of Climate Misinformation Claims

Emissions Modeling

Paris Agreement and Net Zero Progress

REPEAT 2024 U.S. Emissions Projections
2023 Remaining Carbon Budgets

UNEP 2024 Emissions Gap Report
UNEP 2023 Emissions Gap Report
2023 Paris Progress
65% U.S. Emissions Reduction by 2035
Low-Carbon Resources Initiative Net-Zero Scenarios

Electricity and Energy Emissions

Singularity Hourly U.S. Grid Emissions
Live and Recent Grid Mix and Costs
Live Global Electricity Emissions
EPA AVERT Avoided Emissions Calculator
Marginal Electricity Factor Database
Energy Systems Emissions Modeling
Global Energy Monitor
Global Registry of Fossil Fuels
Decreasing Emissions Intensity of O&G

Pledge and Action Trackers

Climate Action Tracker
Net-Zero Pledge Tracker
Carbon Removal Corporate Action Tracker
OpenClimate Pledge Tracker
Fortune Global 500 Climate Pledges
SBTi Company Target Dashboard
Corporate Sustainability Index

Rhodium

2023 U.S. GHG Estimates
2022 U.S. GHG Estimates
2021 U.S. GHG Estimates
2020 U.S. GHG Estimates
Rhodium Climate Outlook
Mid-2024 U.S. GHG Outlook
Mid-2023 U.S. GHG Outlook
Mid-2022 U.S. GHG Outlook

Our World in Data

Global CO2 Emissions
GHG Emissions by Sector Graphic
Emissions by Sector
Historical CO2 Contributors
Cumulative CO_2 Emissions by Fuel Type

Calculators and Tools

Ember Climate Tracking Tools
En-ROADS Climate Simulator
Carbon Price Calculator
Carbon Pricing CO2 Reduction Calculator
CRANE Emissions Reduction Modeling
CO2 Visualization Game
Emissions Reduction Simulator

Climate Trace Emissions Tracking
Carbon Mapper Satellite Tracking
EPA U.S. GHG Inventories
EPA Facility Level GHG Emissions Data
U.S. GHG Center
Climate Watch Data on Climate Progress
Emissions by Country and Sector
Warming and Emissions Visual Tracker
Climate Science Substack
Carbon Monitor Emissions Comparisons
Drawdown Roadmap
Climate Change Indicators and Other Open Data
Global Change Map with Climate Change
Visualizing CO2 Emissions
Asia Climate Action Map

IPCC

IPCC Models Close to Actual Observations
IPCC AR6
IPCC AR6 Synthesis Report
IPCC AR6 Explanation
Misalignment Between IPCC Temp Mentions and Probability
IPCC AR5
IPCC AR5 Synthesis Summary for Policymakers
IPCC AR5 Synthesis Report
IPCC 1.5°C Warming Report
IPCC Land Report

IRA

IRA Explainer
IRA Text
IRA Potential Implications

Projected IRA Impacts
Assessing IRA Impacts
July 2023 Modeled IIJA/IRA Impacts
Jenkins IRA Summary
Carbon Direct Summary of IRA Credits
CTVC IRA Tracker
IRA-Enabled Progress

Geoengineering

Academic Articles

Proposal for Responsible SRM Research Plan
Global South More in Favor of Geoengineering
Public Perceptions of Geoengineering
Governance and Deployment of Earth System Interventions
Governance for Small Geoengineering Experiments
Why Albedo Modification Won't Work

Alliance for Just Deliberation on SRM
Overview of SRM Actors
New Policy in Solar Geoengineering
Geoengineering Podcast
Geoengineering Discussion
2023 Call for Geoengineering
SRM Overview

Energy Geopolitics

CGEP YouTube Videos
Climate Work to Overcome Geopolitical Discord
Geopolitics of Energy Transition
Geopolitics Shaping Clean Energy Transition
Podcast on Climate Action and Great Power Competition
Yergin on 50th Anniversary of Embargo
February 2024 Yergin on NG and Energy Security
Energy Flatness and Geopolitics
A Primer on the Geopolitics of Oil
2023 Global Energy Market Turbulence
Series of Articles on the End of Oil
U.S. Energy Superpower Status
Oil Markets Introduction
Long-Run Harm of Shale Revolution

IAMs Explained
Climate Models Explained
IAM Skepticism
U.S. Net-Zero 2050 Strategy
Review of U.S. Net-Zero 2050 Strategy
U.S. Fifth National Climate Assessment
Speed & Scale Decarbonization Tracker
Speed and Scale Key Results Guide
Global Climate Finance Landscape
Climate Syllabus Bank
Global Tipping Points
Our Changing Climate Videos
Matter of Degrees Podcast
David Roberts on MCJ Podcast
David Roberts and Holly Buck on Net Zero

Tech Modeling

Scholars

Jessika Trancik
François Lafond
J. Doyne Farmer
Rupert Way
Gregory Nemet
Edward Rubin
James McNerney
James M. Utterback
W. Brian Arthur
Jason Crawford

Academic Articles

Climate Tech

Review of Cost Reduction Drivers and RE Case Studies
Statistical Technology Cost Forecasting and PV Case
Tech Forecasts and the Energy Transition
Review of Learning in Energy Systems
Learning Curves and Energy Tech Policy
Clean Tech Pathways
Granular Climate Technologies
Book: Tech Learning in Low Carbon Transition

Duration of Formative Phases of New Energy Tech
Book: Energy Technology Innovation History
Costs as Biggest Solar and Wind Drivers
Lithium-Ion Battery Cost Decline
Evaluating Causes of Li-Ion Battery Cost Reductions
Energy Storage Experience Curves and Projections
Trancik on Accelerating Climate Innovation
Evaluating Causes of PV Cost Reductions
Factors Influencing PV Cost Reductions
Linking Hard and Soft Costs of PV
Experience Curves for Carbon Capture at Power Plants
Utility-Scale Wind and Solar Learning
Extensive Review of LRs for Electricity Supply Tech
Learning Rates for Energy Technologies
Experience Curves for Energy Demand Technologies
Image Summarizing Learning Sources (From Energy Demand Article)
Importance of Customization and Design Complexity for Cleantech Policies
Podcast on Customization and Design Complexity Article
Sensitive Intervention Points in Carbon Transition
Approaches to Learning for Low-Carbon Tech
Experience Curves for Emissions Control Tech

TRLs, MRLs, and ARLs

Original TRL Report
DOE Technology Readiness Assessment Guide
Commercial Adoption Readiness Assessment Tool
Combining TRLs and Risk Assessments
Role of TRLs and MRLs
MRL Reference

Stat Basis for Predicting Tech Progress
Designing for Manufacturing Scalability
Testing Experience Curves on 51 Technologies
Doyne Farmer on Learning Curve Article
Stat Test of Experience Curves
Unit Size and LBD
Tech Improvement Rate Predictions from Patent Data
Tech Improvement from Mining Patent Data
Empirical Trends in Technical Performance
Systematic Historical Analogue Research
LBR Rapid Improvements w/ No Commercial Production

Comparing Expert Surveys and Model-Based Forecasts
Role of Design Complexity in Technology Improvement
Tech Performance Modeling w/ Design Theory
Testing and Improving Technology Forecasts
Perils of Learning Models
Combining Wright's and Goddard's Laws
Learning Curve Lit Review
Political Aspects of Experience Curves
Growth, Innovation, Scaling - Bettencourt
Superexponential Trends in IT
Review of Experience Curves and Associated Uncertainties
Review of Learning Effects in Prospective Tech Assessment
Arthur on Invention
Quantitative Base for Combinatorial Innovation
Factors Affecting the Cost of Airplanes (Wright)
Moore's and Wright's w/ WWII Innovation
Progress Functions as a Managerial Opportunity
Cybernetic Perspective on Tech Learning
Percolation Model of Innovation
Evidence for Organizational LBD
Technological Forecasting for Decision Making Book
Technology Evolution and Parasitism
Universal Technological Evolution
Uneven Evolution of Human Know-How

Articles and Podcasts

Trancik Podcast on Tech vs. Climate Change
W. Brian Arthur Podcast on Nature of Tech
Technology Red Flags
Busting Popular Myths About Innovation
Long Nose of Innovation
Critique of (Nikola) Tesla Syndrome
Academic vs. Practical Plants
Communicating with Process Flowsheets
Chemical Plant Layout Textbook
Experience Curve Effects: Wright's Law

TEA and Cost Resources

Technology Scaling for Renewables
Review of Learning Curve Usefulness
Cost Reduction Approach for Climate Tech Companies

Applying Scaling Laws in Process Engineering
Founder's Guide to TEAs
Guide to TEA

Futures Studies, Progress, and Science

Works in Progress
Institute for Progress
Cold Takes Karnofsky Blog
Metaculus Superforecasting
Interactive Brokers Forecast Betting
Long Bets
Futures Studies
Futures Studies Topics
Progress Studies Trends
Case for Innovation and Optimism
Life Cycle of Uncomfortable Tech
(Positive) Moral Consequences of Economic Growth
Scarcity Mindsets and American Stagnation
Statecraft Policy Lessons Substack
Prediction at IARPA
DARPA Origin and Operation
Promises and Challenges of ARPA Model
Fast Track Proposal for DOE
Jason Crawford Interview with Vox
February 2024 Updates on Superforecasting
Techno-Optimism for 2022
Emerging Technologies
List of Emerging Technologies
Small Experiments
Science Funding Lessons from mRNA Vaccines
Starting an Advance Market Commitment
Ideas to Improve Science
Changing IP and R&D for Public Good
Science is Getting Harder
Ongoing Replication Crisis and How to Fix It
Why Most Published Research Findings Are False
How Bad Data Becomes Research
Issues with Peer Review

Performance Curve Database
Visual Patent Search for DOE-Funded R&D

PatentsView Patent Data and Visualizations
DOE Patents
Tech Forecasting Company
Precision Bias