# EMISSION REDUCTION POTENTIAL REPORT

*Biomass carbon sequestration*

Category: Cdr

Report prepared by: ,

Report prepared on: 3-31-2024


*See disclaimer for additional details.*

*This output report uses the IEA ETP 2017 RTS model.*

In agreement with the National Academies of Sciences report, biomass carbon sequestration in this model includes “terrestrial carbon removal and sequestration... [i.e.] land use and management practices such as afforestation/reforestation, changes in forest management, or changes in agricultural practices that enhance soil carbon storage (“agricultural soils”)" and “coastal blue carbon [i.e.] land use and management practices that increase the carbon stored in living plants or sediments in mangroves, tidal marshlands, seagrass beds, and other tidal or salt-water wetlands." These approaches are ready for large-scale deployment, but are limited in scale by land availability and the potential to affect food availability, food prices, national security, and biodiversity. Furthermore, these options "are reversible if the carbon sequestering practices are not maintained... In contrast, BECCS, direct air capture, and carbon mineralization have comparatively minor issues of permanence." This model, the Direct air capture model, and the Ocean carbon sequestration model are special cases within CRANE. Specifically, the “incumbent technology” in these scenarios is a business-as-usual scenario where no CO2 capture is performed. This solution is therefore not targeted at improving, or mitigating the emissions from any particular technology, but rather all annual emissions that are available to be mitigated. Thus, the rate at which this technology is implemented, i.e. the shape of the market penetration curve, is the key consideration of the model. Many factors will influence this adoption rate and it is left to the user to modify the model’s default assumptions based on their best estimates of these factors.

## Report Key Assumptions

- The reference scenario (i.e. projections for a world in which the new technology has not been deployed) uses data from **IEA ETP 2017 RTS** model.
- Geographic scope of analysis and markets is **Global** and covers the years **2020** to **2050.**
- The new technology is expected to displace **100%** of the target market’s incumbent technology by year **2050.** This figure does reflects a market penetration rate which has been modified by the user.
- The new technology is similar enough to **Biomass carbon sequestration** in terms of its overall functionality and mechanism of emissions reduction that the analysis is valid.
- The target market and incumbent high-GHG technology currently serving it is **Segment of total primary energy demand market addressable by biomass carbon sequestration** and has a GHG intensity of **0.058 MMT $CO_2$e/PJ** in year **2020**, ending with a GHG intensity of **0.05 MMT $CO_2$e/PJ** in year **2050.**
- The new technology is expected to have a GHG intensity of **0 MMT $CO_2$e/PJ** beginning in year **2020** and **0 MMT $CO_2$e/PJ** by year **2050.** This value cannot be modified by the user at this time.
- As modeled, the new technology adoption cannot exceed the projected target market size, including in cases where the target market is expected to decline over time.
- New technology provides a 1:1 replacement for each **PJ** in the target market and, if applicable, the established market.

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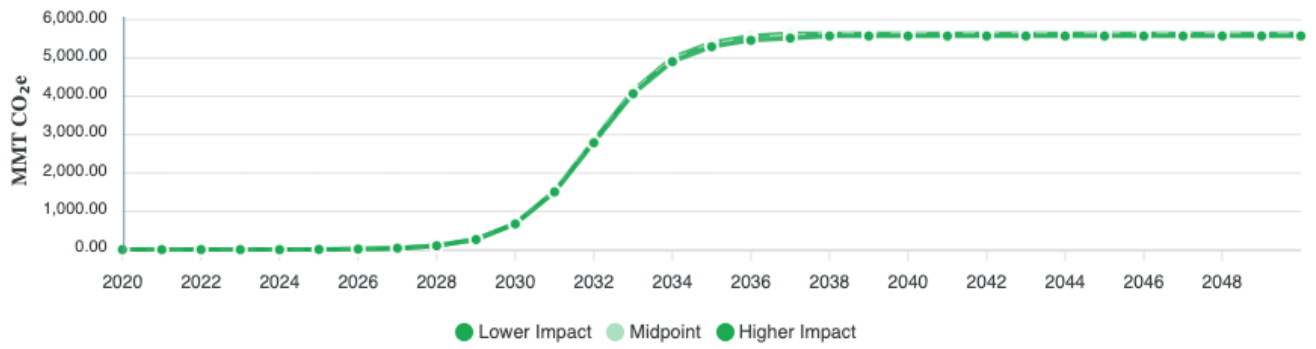
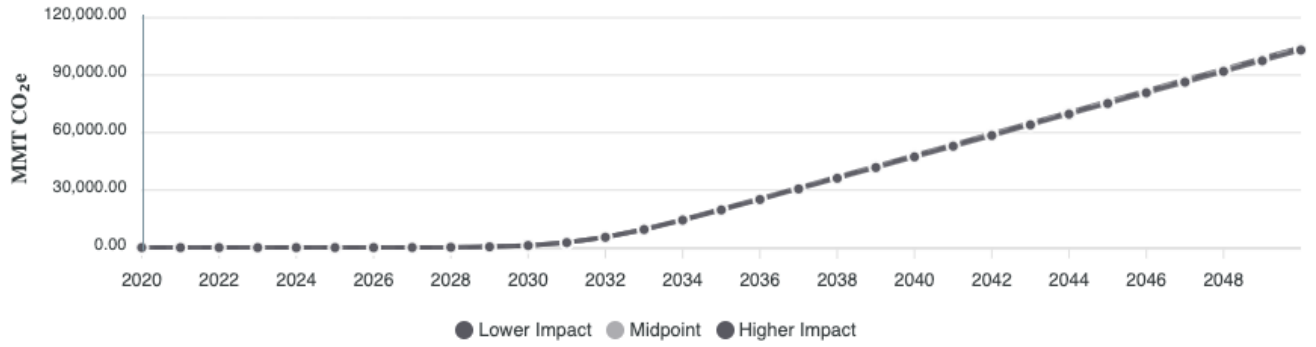
## Annual Emissions Reduction Potential




## Cumulative Emissions Reduction Potential




The Emissions Reduction Potential (ERP) is the annual difference in emissions, measured in Metric Ton CO2e, between a Reference Scenario in which the solution does not exist and a Solution Scenario in which the solution is deployed with the provided inputs. The figures below depict the ERP for each year of the analysis as well as the cumulative ERP (ERP for that year and all the previous years). The higher impact case and lower impact case represent variations (±1%) of market penetration and the GHG intensity of the solution. This demonstrates the ERP if the technology has a 1% higher and lower market penetration and a 1% higher and lower GHG Intensity than estimated.

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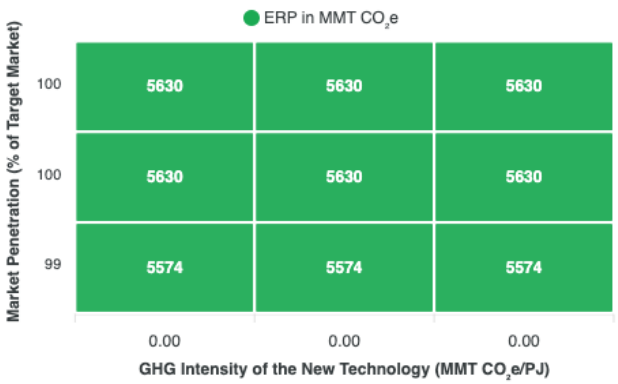
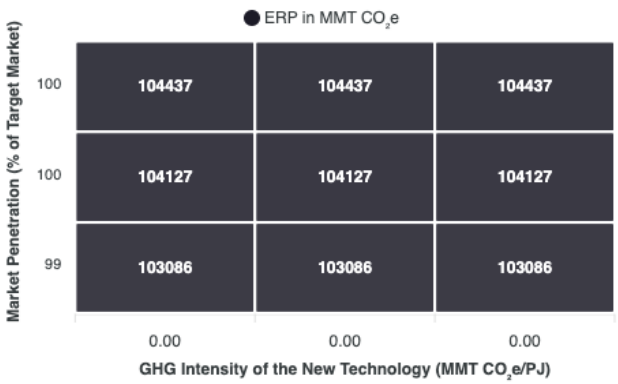
## Annual ERP Uncertainty in Year 2050

These values are for year 2050 only



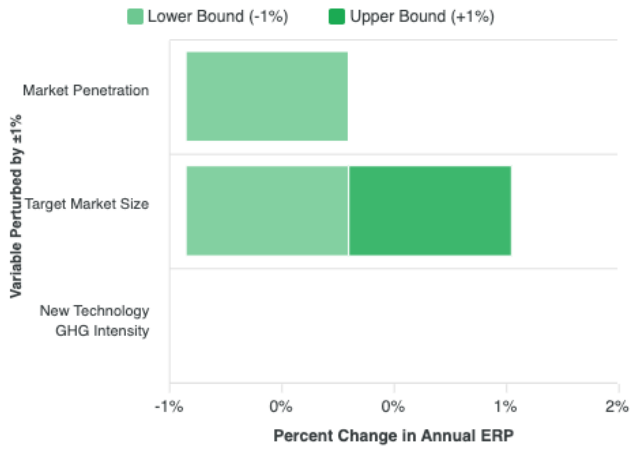

## Cumulative ERP Uncertainty in Year 2050

These values are for year 2050 only

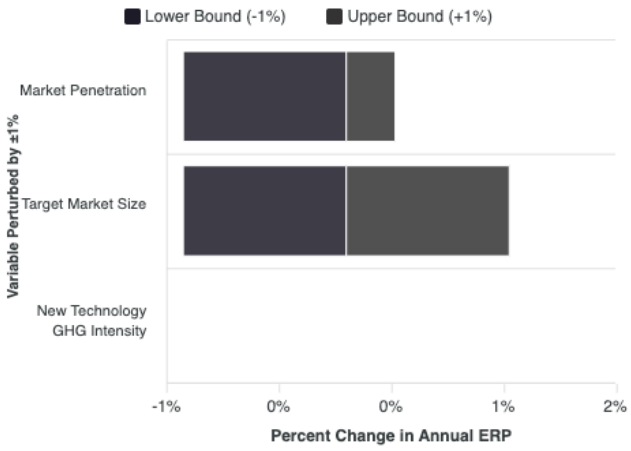



The heatmaps demonstrate how varying the market penetration and GHG Intensity of the New Technology by ±1% affects the Annual and Cumulative ERP. Note how the highest, midpoint, and lowest values match those in the final year for the ERP line graphs.

## Annual ERP Sensitivity to Input Variables




## Cumulative ERP Sensitivity to Input Variables




The tornado chart provides a sensitivity analysis. It highlights how the user-defined uncertainty (±1%), when applied to one variable at a time, impacts the final results.

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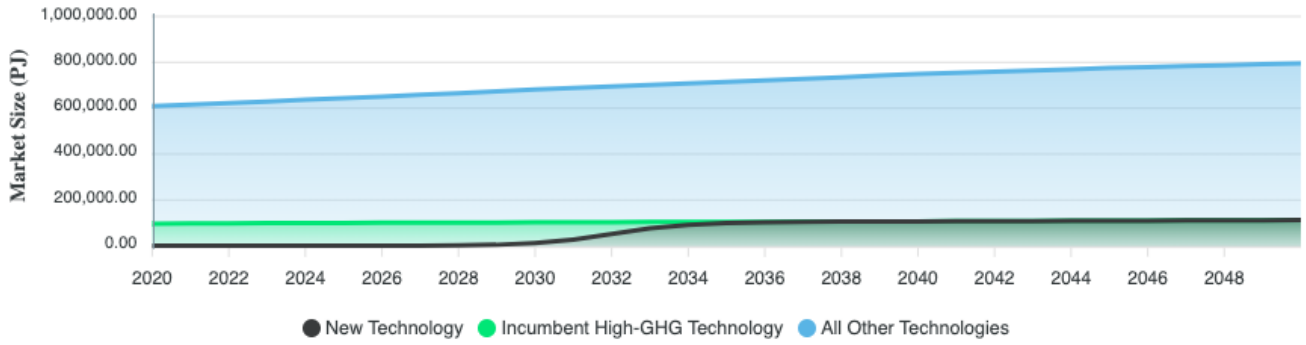
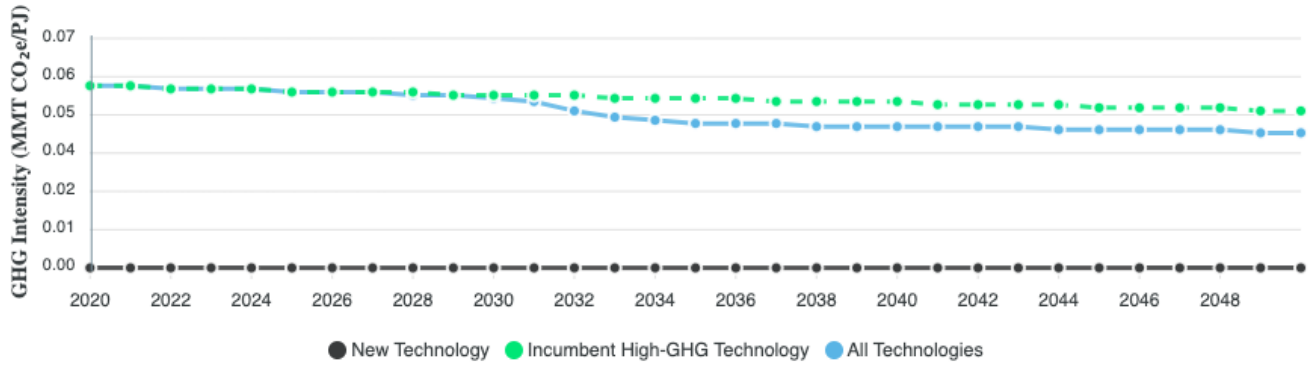
## Market Size




Market sizes in the solution scenario (future where the new technology is successful). Note how the new technology gains market share at the expense of other technologies.

## GHG Intensities of Technologies




Life cycle GHG intensities of technologies serving the market over time. Scroll over the chart to see how the new technology's intensity compares to others and how the market average changes over time.

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## References

[1] IEA. 2017. “Energy Technology Perspectives 2017”. https://www.iea.org/etp2017/summary/. Reference Technology Scenario.

[2] National Academies of Sciences, Engineering, and Medicine. 2018. “Negative Emissions Technologies and Reliable Sequestration: A Research Agenda.” Washington, D.C.: The National Academies Press. https://www.nap.edu/catalog/25259. (see p. 3, 7, 8)

[3] Baker, Sarah, Joshuah Stolaroff, George Peridas, Simon Pang, Hannah Goldstein, Felicia Lucci, Wenqin Li, et al. 2020. “Getting to Neutral: Options for Negative Carbon Emissions in California.” LLNL-TR-796100. Lawrence Livermore National Laboratory. https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf.

[4] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C12-K12)

[5] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario. (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C12-K12)

[6] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario. (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C142-K142)

[7] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario. (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C12-K12)

[8] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C142-K142)

[9] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario. (see ETP2017_scenario_summary.xlsx, “WORLD” tab, cells C142-K142)

[10] National Academies of Sciences, Engineering, and Medicine. 2018. “Negative Emissions Technologies and Reliable Sequestration: A Research Agenda.” Washington, D.C.: The National Academies Press. https://www.nap.edu/catalog/25259. (see p.61, table s.1)

[11] “Energy Technology Perspectives 2017.” 2017. Energy Technology Perspectives. IEA. https://www.iea.org/reports/energy-technology-perspectives-2017. Reference Technology Scenario. (see ETP2017_scenario_summary.xlsx, “WORLD” tab)

[12] National Academies of Sciences, Engineering, and Medicine. 2018. “Negative Emissions Technologies and Reliable Sequestration: A Research Agenda.” Washington, D.C.: The National Academies Press. https://www.nap.edu/catalog/25259. (see p. 6)

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