Analysis: Calculating Near-Term U.S. damages from U.S. greenhouse gas power sector emissions from 2025-2035

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Domestic damages that will be caused by U.S. power sector greenhouse gas emissions from 2025-2035 were calculated using the following methodology.

First, a quadratic relationship between historical cumulative power sector emissions since 1973 in billion metric tons (BMT) and annual percent damages to U.S. Gross Domestic Product (GDP) was developed using data provided by previous research, in consultation with the authors.[1] This data and quadratic fit are shown in Figure 1 below:

Figure 1

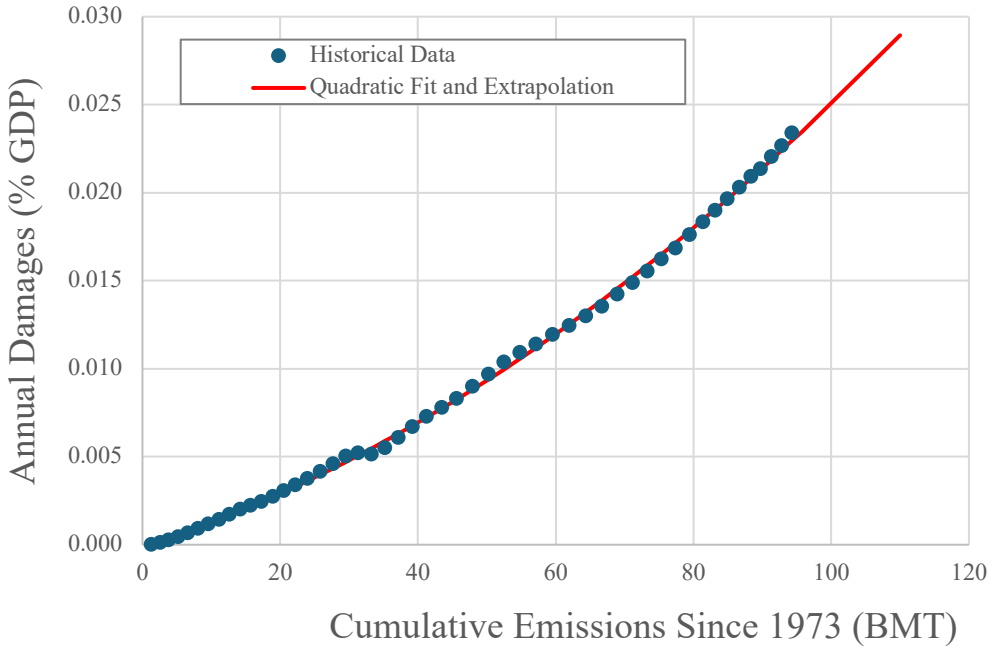

Figure 1: Relationship between damages in annual percent reduction in GDP and cumulative power sector emissions in billion metric tons since 1973 (blue dots), along with quadratic fit and extrapolation (red line).

[1] Justin S. Mankin, Alexander R. Gottlieb, and Christopher W. Callahan, *Climate damages to the U.S. economy from U.S. power sector emissions.* (June 2025), *available at* https://climateattribution.org/resources/climate-damages-to-the-u-s-economy-from-u-s-power-sector-emissions/.

The quadratic fit follows equation 1 as provided below:

$$\textbf{Eq. 1}: \quad \text{Damages (\% GDP)} = 1.26 \times 10^{-6}\left(\text{Cum. Em. (BMT)}\right)^2 + 1.26 \times 10^{-4}(\text{Cum. Em. (BMT)}) + -1.10 \times 10^{-4}$$

Future U.S. power sector emissions projections from two sources were used, as presented in Table 1.:

- **REPEAT Project**: projections assume the Carbon Pollution Standards are repealed and incorporate the current clean electricity tax credit phase out schedule as modified by HR1 enacted on July 4th, 2025.[2]

- **National Renewable Energy Laboratory (NREL) Standard Scenarios**: projections assume that all clean electricity tax credits were immediately terminated beginning in 2025 and the Carbon Pollution Standards are repealed (Mid-Case – No IRA, No 111d).[3]

Table 1: Projected future U.S. power sector emissions 2025 – 2035

Year	CO_2 Emissions (million metric tons)	
	REPEAT Project	**NREL Standard Scenarios**
2025	1,320	1,430
2026	1,320	1,390
2027	1,308	1,350
2028	1,296	1,323
2029	1,284	1,297
2030	1,306	1,270
2031	1,327	1,250
2032	1,349	1,230
2033	1,339	1,210
2034	1,330	1,175
2035	1,320	1,140

[2] Jenkins, J.D., Farbes, J., and Haley, B., "Impacts of the One Big Beautiful Bill on the US Energy Transition — Summary Report," REPEAT Project, Princeton, NJ (July 2025), *available at https://repeatproject.org/results.*
[3] Gagnon, Pieter, An Pham, Wesley Cole, Anne Hamilton, Sarah Awara, Anne Barlas, Maxwell Brown, et al. 2024. 2024 Standard Scenarios Report: A U.S. Electricity Sector Outlook. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-92256, *available at* https://www.nrel.gov/docs/fy25osti/92256.pdf.

Both sets of modeled annual future emissions were converted into cumulative emissions since 1973 by adding them to the historical dataset maintained by the U.S. Energy Information Administration (EIA).[4] Using equation 1, both sets of data were converted to % reductions in GDP, and then into actual damages using projected future GDP from EIA's Annual Energy Outlook 2025[5] converted into 2024 dollar-year using GDP data provided by the Bureau of Economic Analysis.[6] Annual damages from 2025 – 2035 were summed to calculate the total damages of $95.3 billion in both scenarios, as reported in Table 2.

Table 2: Projected future cumulative damages from 2025 – 2035 due to both historical and projected 2025-2035 U.S. power sector emissions

Scenario	Damages occurring in 2025-2035 (Billions $2024)	
	From historical and future emissions	Only from future emissions
No future emissions	$84.2	-
REPEAT Project	$95.3	$11.1
NREL Standard Scenarios	$95.3	$11.1

These damages include both damages occurring in 2025-2035 due to historical power sector emissions and projected power sector emissions from 2025-2035. To isolate only those 2025-2035 damages attributed to 2025-2035 power sector greenhouse gas emissions, a counterfactual no future emissions scenario was developed which held cumulative power sector greenhouse gas emissions constant at 2024 levels into the future. This resulted in 2025 – 2035 damages of $84.2 billion, solely attributed to historical emissions. Subtracting the historical $84.2 billion from the $95.3 billion calculated earlier results in $11.1 billion in damages attributable to 2025-2035 power sector greenhouse gas emissions under both emission projections, shown in Table 2. Future damages (beyond 2035) that will be caused by those emissions (some of which will remain in the atmosphere for thousands to hundreds of thousands of years)[7] are not included in this estimate. The estimate also does not include damages from

[4] U.S. Energy Information Administration, *Monthly Energy Review*. Table 11.6 – Carbon Dioxide Emissions from Energy Consumption: Electric Power Sector, *available at* https://www.eia.gov/totalenergy/data/monthly/pdf/sec11_9.pdf.
[5] U.S. Energy Information Administration, *Annual Energy Outlook 2025*. Reference Case. Table 20 – Macroeconomic Indicators, *available at* https://www.eia.gov/outlooks/aeo/tables_ref.php.
[6] Bureau of Economic Analysis, *National Income and Product Accounts*. Table 1.1.3 Real Gross Domestic Product, Quantity Indexes, *available at* https://www.bea.gov/itable/national-gdp-and-personal-income.
[7] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change at 2237 [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2391 pp. doi:10.1017/9781009157896.

U.S. power sector emissions beyond 2035, or damages from impacts (such as morbidity, wildfire smoke mortality, or macroeconomic effects) not included in the underlying damage analysis used in the original research.[8] As such, the $11.1 billion in damages is a severe underestimate of the damages that will accrue to the United States from unabated power sector greenhouse gas emissions.

[8] Solomon Hsiang et al., *Costing out the Effects of Climate Change*, 365 Science 1362 (2017), https://www.science.org/doi/10.1126/science.aal4369.