MIT Climate Policy Center

RESEARCH BRIEF

An Update on the Potential Impacts of Subsidizing Transmission in the United States

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Introduction

Transmission expansion is widely recognized as a critical piece of the energy transition. It allows regions to access lower cost generation, improve reliability, and accommodate rapidly growing electricity demand [1, 2, 3, 4, 5, 6]. Despite this, transmission investment in the United States has consistently lagged behind the pace needed to support reliability goals [7]. This is in part because of the long timelines, cost allocation issues, and regulatory hurdles involved in siting new lines [8, 9, 10, 11]. Transmission investment tax credits (Transmission ITCs) have been proposed as a policy tool to accelerate transmission build-out by directly lowering its effective capital cost and encourage more development.

This question has taken on renewed urgency amid rapid, geographically concentrated load growth driven by data centers, which is believed to further strain transmission and generation capacity in the United States [12, 13, 14, 15]. Whether a transmission ITC is an effective policy response to this kind of load growth, or whether its benefits are contingent on the presence of binding capacity constraints, is an open empirical question with direct relevance to ongoing policy debates.

In this research brief, we summarize results of ongoing work that aims to analyze the systemwide impact of transmission ITCs. We use the GenX capacity expansion model [16, 17, 18] to simulate a 2035 grid and evaluate the system cost, emissions, and transmission siting impacts of a transmission ITC under two contrasting load growth scenarios: (1) a high growth scenario reflecting significant data center-driven demand, and (2) a low growth scenario reflecting more modest, historically typical load growth. Our analysis does not include the Inflation Reduction Act (IRA) renewable tax credits, which were repealed following the passage of the One Big Beautiful Bill (OBBB) Act in July 2025 [19].

We vary the transmission ITC level from 0% to 40% and also compare our results to Knittel et al. (2024) [20], who evaluate a transmission ITC assuming low load growth alongside the renewable Production Tax Credits (PTC) and a generation ITC that were still in effect under the IRA at the time of that analysis [1]. This comparison further allows us to isolate and compare the impact of the transmission ITCs on its own alongside other policy instruments [2].

We now proceed with our results, focusing some analyses on the 30% transmission ITC and reporting other ITC levels where relevant [3].

Where do we see transmission being built with transmission ITCs?

The scale and location of new transmission differ substantially across load growth scenarios (Fig. 1, Table 1). In the high growth scenario, total new transmission capacity (53.2 GW combined intraregional and interregional) is more than 40 times larger than in the low growth scenario (1.3 GW) and roughly twice as large as in the Knittel et al. (2024) analysis (25.6 GW). This new capacity is heavily concentrated in and around the Mid-Atlantic where the largest data center load forecasts are.

The low growth scenario shows sparser deployment of transmission as a result of ITCs with new builds concentrated in just a few corridors: the Northwest-Southwest interregional line (0.5 GW), the Midwest-Southeast interregional line (0.7 GW), and an intraregional build in the Central region. The absence of any meaningful Mid-Atlantic build in this scenario is the start of evidence to show that transmission ITCs have minimal effect on regional generation adequacy when load growth does not create binding capacity constraints (as we will show in later sections).

The Knittel et al. (2024) analysis shows a more geographically dispersed pattern of transmission investment than either of the load growth scenarios, with substantial builds spanning the Central, Southwest, Midwest, and Mid-Atlantic regions rather than concentrating in a single constrained region. The largest individual builds in the Midwest-Southeast (3.5 GW), Mid-Atlantic intraregional (6.3 GW), and Midwest intraregional (3.6 GW) are distributed across the network in a way that supports the broad renewable capacity buildout shown in Fig. S1c,f in the Appendix.

[1] Knittel et al. (2024) [20] also assumed offshore wind mandates which we removed in our load growth scenarios following the OBBB Act.

[2] As part of the setup of this model, we note that capacity expansion models will increase transmission by a significant amount if there are no constraints on transmission builds. We amend this by calculating what we call "Non-Engineering" costs, which are unobserved costs that make it more difficult to build transmission. The calculation of Non-Engineering costs starts with the inputs (i.e. the "Engineering Costs") in a capacity expansion model for transmission, but progressively increasing these costs by 0.1 times in each iteration for all lines that have a positive build quantity. We stop increasing the cost when there are no new builds observed. The transmission ITC is only applied to the Engineering cost, and can only be obtained if the increase in transmission capacity is greater than 500MW.

[3] The focus on 30% ITC is due to proposed legislation including a 30% Transmission ITC

Figure 1: Maps of Transmission Deployment at 30% Transmission ITC.

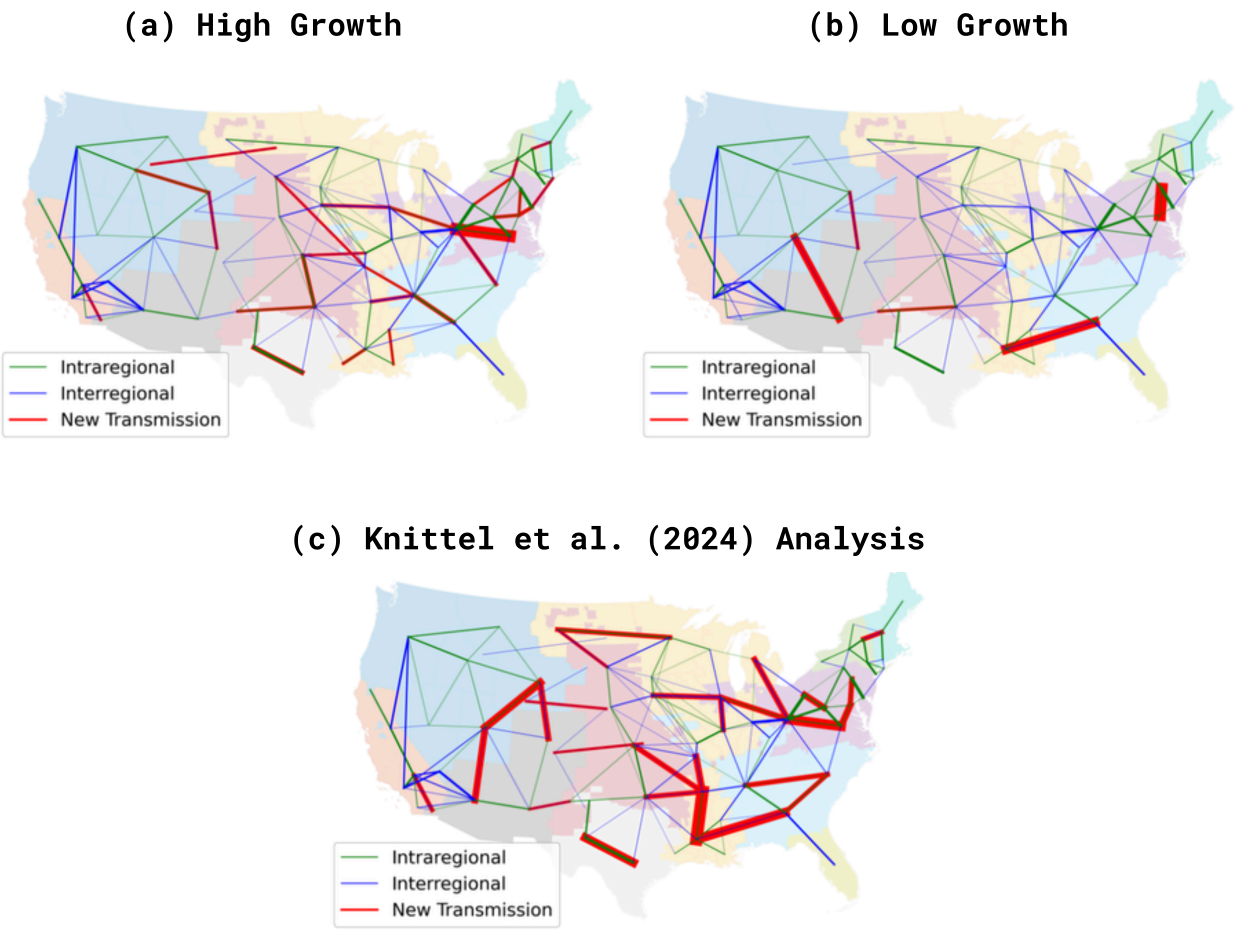

Table 1: Regional Transmission Deployment (in MW) at 30% Transmission ITC.

	Intraregional Transmission		
	High Growth	Low Growth	Knittel et al. (2024)
California	-	-	-
Central	537	13	-
Florida	-	-	-
Mid-Atlantic	40,101	985	6,322
Midwest	1,000	-	3,596
New York	-	-	-
Northeast	-	-	-
Northwest	500	-	1,577
Southeast	2,145	-	1,341
Southwest	-	-	-
Texas	974	-	1,334

		Interregional Transmission		
		High Growth	Low Growth	Knittel et al. (2024)
California	Northwest	-	-	-
California	Southwest	500	-	572
Central	Southwest	-	-	83
Central	Texas	-	-	2
Florida	Southeast	-	-	-
Mid-Atlantic	Southeast	2,760	-	-
Midwest	Central	500	-	1,945
Midwest	Mid-Atlantic	551	-	2,137
Midwest	Northwest	500	-	-
Midwest	Southeast	500	749	3,467
New York	Mid-Atlantic	1,372	-	-
Northeast	New York	500	-	732
Northwest	Central	-	-	77
Northwest	Southwest	526	542	2,433
Southeast	Central	763	-	-

What is the system cost impact of transmission ITCs?

Fig. 2a to 2c which show the cost impacts of transmission ITCs for the different growth scenarios and at varying transmission ITC levels[4] . We find that providing transmission ITCs leads to system cost reductions of $660 million to $1.17 billion dollars annually in a high load growth scenario while spending $20 million to $552 million in transmission ITCs. The impact of ITCs plateaus at 30%, where any additional system cost reductions are offset by additional spending on ITCs. The cost impact is more muted in a low load growth scenario, with cost reductions of $40 million to $50 million annually, while spending $7 million to $40 million annually in transmission ITCs.

This cost reduction asymmetry between high and low growth scenarios provides evidence that transmission ITCs unlock value primarily by relieving binding capacity and congestion constraints. Under high load growth, the system is more likely to be capacity or congestion constrained absent additional transmission[5]. Transmission ITC-induced investment then substitutes for more expensive generation capacity and dispatch, producing large fuel and investment cost savings. Under low load growth, the system has more slack to begin with, so the same transmission investment has little effect on which generators run or how much new capacity is needed, and the ITC mainly redistributes costs across categories (i.e. investment costs go down, interregional and variable O&M costs go up) rather than reducing total system cost. We see this further in the decomposition of these cost reductions. In the high growth scenario (see Fig. 2d), the reduction in total system cost at the 30% ITC level is driven almost entirely by lower fuel costs (i.e. more expensive generation) which is offset by investment in transmission (which in turn was enabled by the transmission ITC). In the low growth case (see Fig. 2e), investment costs in generation fall, but this is largely offset by higher interregional and variable O&M costs, leaving a much smaller net effect on total system cost.

These results contrast with the previous analysis conducted by Knittel et al. (2024) [20], which considers transmission ITCs alongside renewable generation incentives in the PTC and ITC[6]. The component-level pattern also differs where investment costs rise with the transmission ITC while fuel costs still decline since renewable incentives help drive additional investment in wind and solar when there is more transmission (see Fig. 2f).

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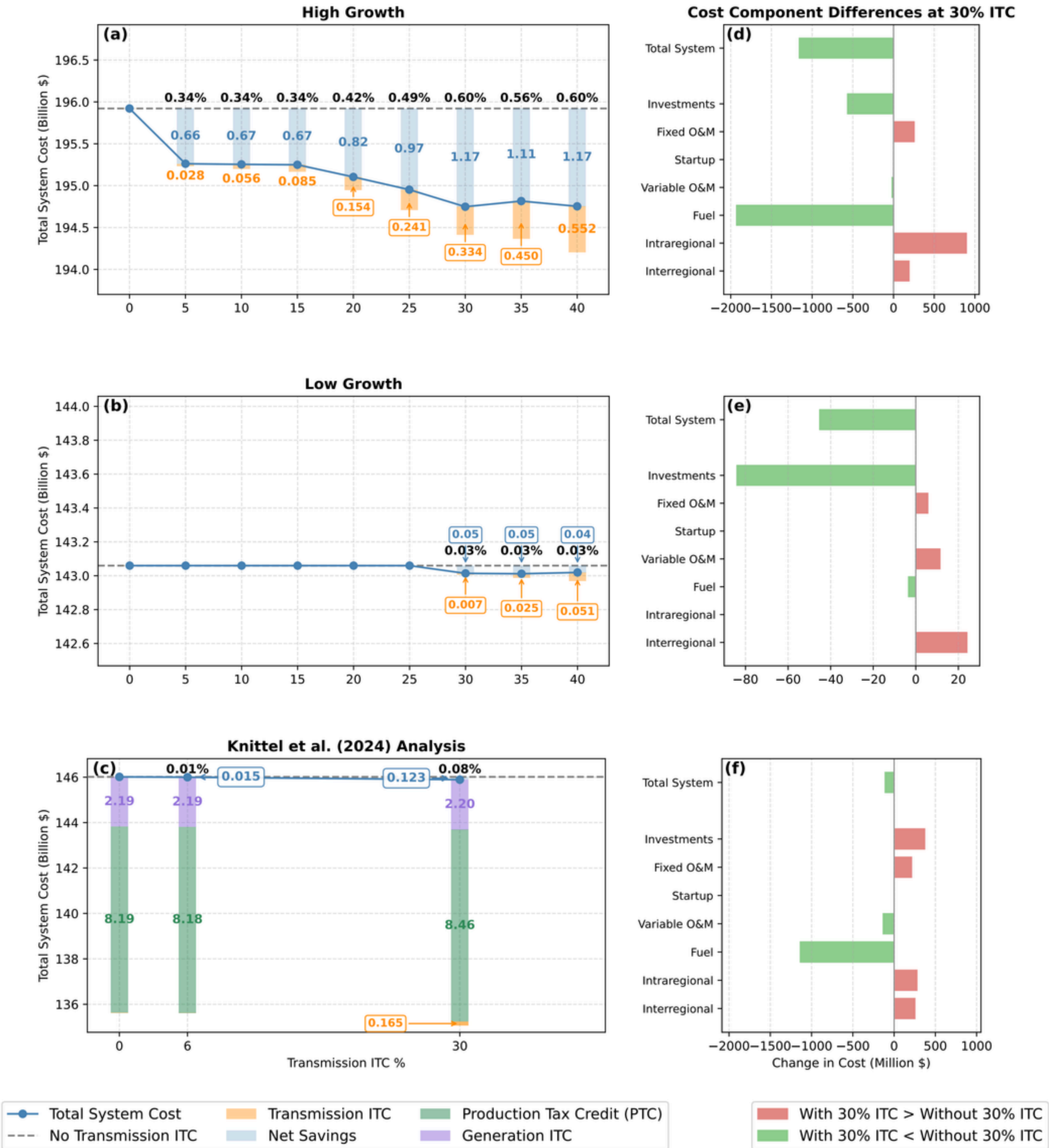
[4] It is important to note that a high growth scenario substantially increases the annual system cost relative to a low growth scenario.

[5] For example, in the Mid-Atlantic where load forecasts are extremely high given data center load projections in the region.

[6] Looking at Knittel et al. (2024) [20], they report $562 million in savings, which includes the changes in the PTC and ITC. We disaggregate that and consider PTCs and ITCs as not part of realized savings, given that the Federal government will have to subsidize it.

Figure 2: Annual System Cost per Transmission ITC %.



What is the emissions impact of transmission ITCs?

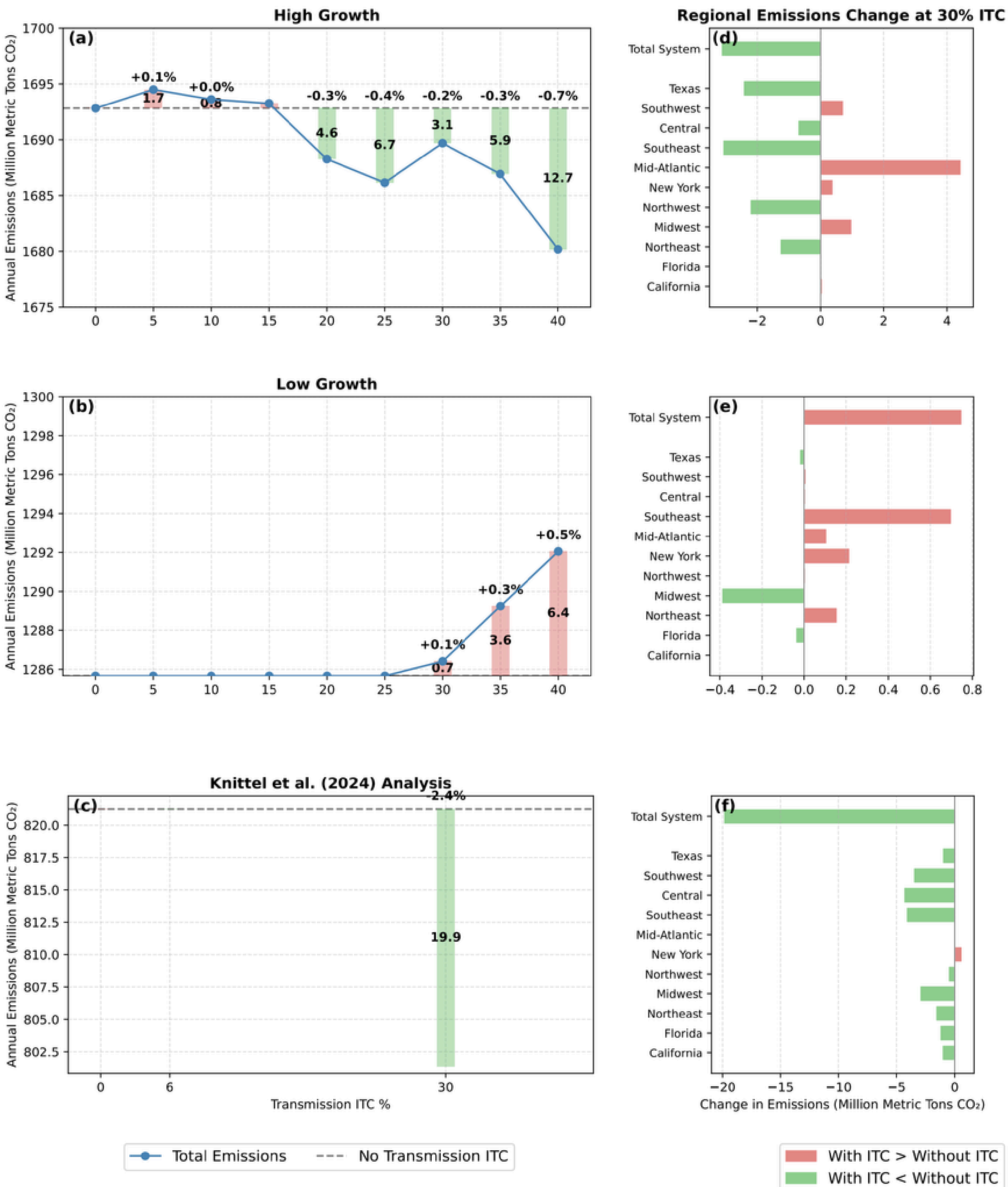
Fig. 3a to 3c show the emissions impacts of transmission ITCs across growth scenarios and ITC levels. In the high growth scenario, low ITC levels (5–15%) lead to emissions that are essentially unchanged or slightly higher than the no-ITC baseline, while emissions fall at 20% and above, reaching a maximum reduction of 12.7 million metric tons at 40% transmission ITC. This continued emissions improvement occurs in the transmission ITC range (30–40%) where the system cost savings identified in the previous section plateau, indicating that pushing the transmission ITC beyond the level where cost savings level off still yields meaningful additional emissions benefits.

The regional decomposition (Fig. 3d) shows that the high growth scenario's total emissions reduction at 30% ITC has regional heterogeneity. Texas, the Southeast, and the Northwest see the largest emissions reductions due to a reduction in Natural Gas generation (see Fig. S1a in the Appendix), while the Mid-Atlantic sees the largest emissions increase of any region [7]. In the low growth scenario (Fig. 3e), the regional pattern is smaller in magnitude and mixed in sign, with the Southeast driving most of the modest system-wide increase due to an increase in coal generation (see Fig. S1b in the Appendix) and the Midwest the only region with a meaningful decrease.

These results again contrast with the Knittel et al. (2024) [20] analysis, which finds a much larger emissions reduction of 19.9 million metric tons at 30% ITC. The regional pattern also differs (Fig. 3f) with nearly every region sees an emissions reduction, with Texas, Central, and the Southeast contributing the largest declines, and only New York showing a (small) increase. This near-uniform regional reduction, in contrast to the mixed regional pattern in Fig. 3d, is consistent with the generation-side incentives that drive renewable build-out across regions (see Fig. S1c, f in the Appendix). This shows that transmission ITCs are more effective in reducing emissions when there are policies in place that make renewables more economically attractive.

[7] This is consistent with the Mid-Atlantic being capacity-constrained under high load growth where additional transmission may allow the region to rely more on natural gas (see Fig. S1a in the Appendix))

Figure 3: Annual System Emissions per Transmission ITC %.



Conclusion

In this research brief, we present the results of an evaluation of transmission investment tax credits (ITCs), a policy mechanism that would lower the effective capital cost of new transmission investment. Using the capacity expansion model GenX, we compared systems with transmission ITCs ranging from 0% to 40% under two contrasting load growth scenarios: a high growth scenario reflecting significant data center-driven demand, and a low growth scenario reflecting more modest, historically typical load growth. We also compared our results to Knittel et al. (2024) [20], who evaluate a transmission ITC alongside the generation-side tax credits included in the Inflation Reduction Act. Our main findings are:

- New transmission investment under a transmission ITC concentrates heavily in regions facing the most acute capacity constraints, particularly the Mid-Atlantic under high load growth, in contrast to the more geographically dispersed build-out that results when a transmission ITC is paired with generation-side tax credits, as in Knittel et al. (2024) [20].
- Transmission ITCs would reduce annual system costs by $660 million to $1.17 billion annually under high load growth, and by $40 million to $50 million annually under low load growth, relative to the status quo.
- The emissions impact of a transmission ITC is highly sensitive to the pace of load growth. Under high load growth, transmission ITCs can reduce emissions by up to 12.7 million metric tons annually, as transmission-enabled reallocation of generation shifts dispatch away from higher-emitting regions. Under low load growth, the same subsidy can modestly increase emissions, by up to 6.4 million metric tons annually, as the induced transmission investment reallocates generation toward cheaper but more emissions-intensive sources.

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Appendix for An Update on the Potential Impacts of Subsidizing Transmission in the United States

Figure S1: Generation and Capacity Differences at a 30% Transmission ITC relative to having no ITC.

A negative (positive) value indicates less (more) generation in a system with 30% ITC.

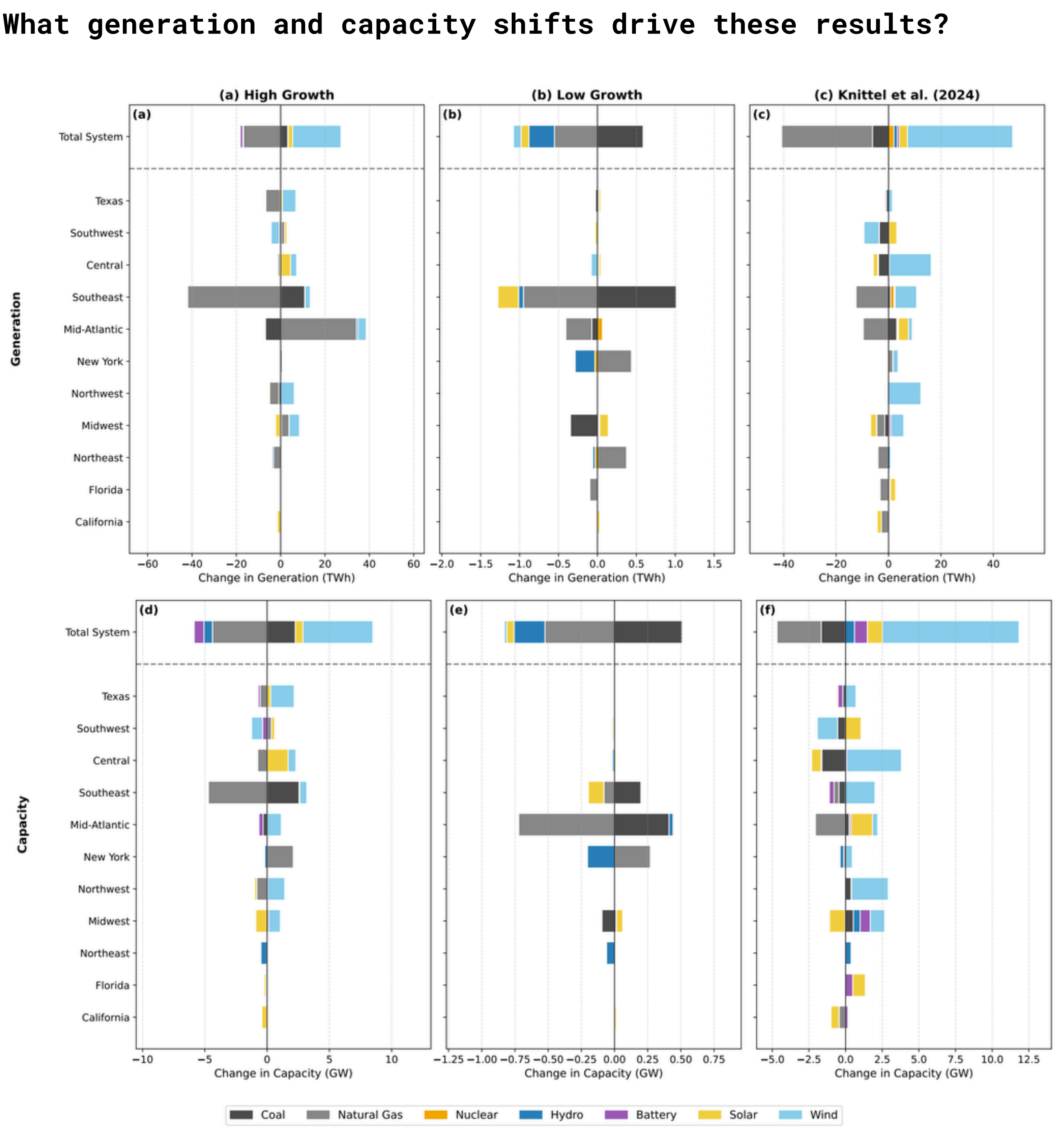

Fig. S1 shows the change in generation (a–c) and capacity (d–f) by technology and region at the 30% transmission ITC and helps explain the cost and emissions patterns described in the main text. In the high growth scenario (Fig. S1a,d), the transmission ITC leads to a reallocation of natural gas generation away from the Southeast and toward the Mid-Atlantic, accompanied by a nationwide increase in wind generation.

Additional transmission allows Mid-Atlantic Atlantic demand to be served by a mix that leans more heavily on natural gas generation. In the low growth scenario (Fig. S1b,e), the shifts involve a different pair of technologies. Natural gas capacity retires in the Mid-Atlantic, while coal generation and capacity increase modestly in the Southeast. Because coal is more emissions-intensive than the natural gas and solar generation it displaces, this shift explains the small emissions increase identified in the low growth scenario, even as it produces a small system cost reduction. The transmission ITC is enabling a shift toward cheaper but dirtier generation.

The Knittel et al. (2024) [20] analysis (Fig. S1c,f) shows a different mechanism with a large buildout of wind and solar capacity across most regions, alongside a substantial reduction in natural gas generation concentrated in the Southeast and Mid-Atlantic. This is brought by the combination of generation-side renewable tax credits and the transmission ITC.