MIT Climate Policy Center

Potential Impacts of Subsidizing Transmission

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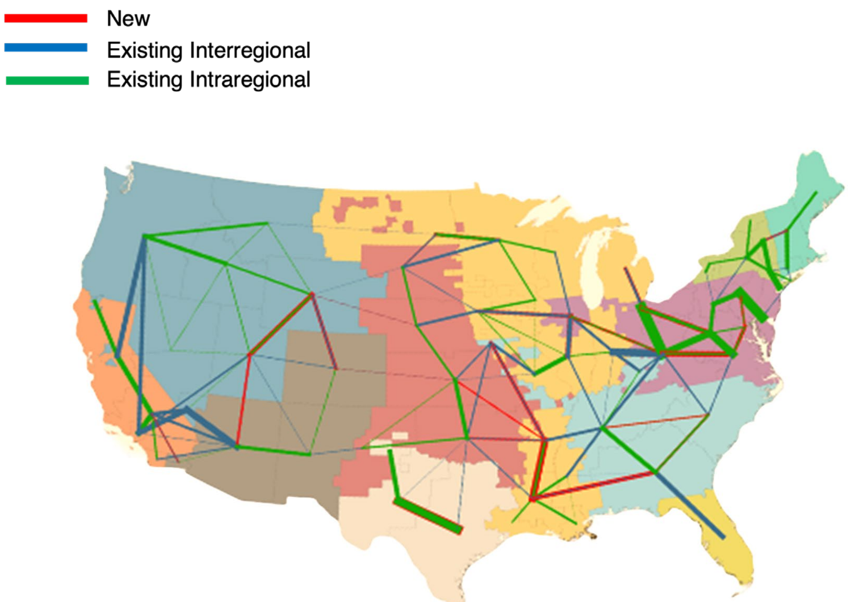
Policy Brief
December 2024

Researchers at MIT modeled the potential impacts of subsidizing transmission projects with investment tax credits (ITCs). The analysis reveals that transmission ITCs can reduce system costs, keep the lights on for millions of households during extreme weather events, and reduce the greenhouse gas emissions of the US power system.

1. What impacts could transmission investment tax credits have on transmission capacity?

A transmission investment tax credit of 30% could result in the building of 11GW of interregional transmission and 14GW of intraregional transmission across the US. A 6% transmission ITC is not enough incentive to spur transmission projects anywhere in the US except for a small amount (0.5GW) between California and the Southwest.

Projected Change in Interregional and Intraregional Transmission as a Result of a 30% Transmission ITC



2. What impacts could transmission investment tax credits have on electricity system costs?

A 30% transmission ITC could reduce annual system cost by $562M. This system cost reduction would come primarily from avoided fuel costs ($1.15B). New investments in transmission and generation would be offset by $165M in transmission ITCs and $267M in existing clean energy production tax credits. Total tax credit expenditure is $432M. A 6% transmission ITC could reduce annual system cost by $2M.

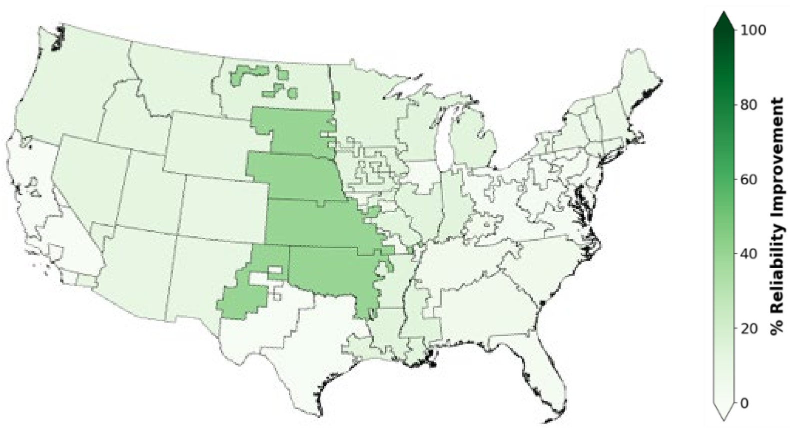
3. How do these costs vary by region?

In response to a 30% transmission ITC, some regions, like the Mid-Atlantic, would be expected to invest greatly in building transmission and then retire or defer construction of some generation facilities, therefore becoming power importers, resulting in reduced system costs. Other regions, like the Midwest, the Central, and the Northwest regions, would be expected to invest greatly in transmission *and* new generation, therefore becoming power exporters, and see an increase in system cost that yields additional revenue. The Southeast region would be expected to invest in transmission and generation, but offset so much fuel cost that the region would see net savings. A 6% transmission ITC could yield marginal cost differences in California and the Southwest region. Additional regional details are available in Appendix A.

4. What are the reliability benefits of interregional transmission during extreme weather?

A 30% transmission ITC could provide modest improvements in reliability for most regions during extreme weather events such as Winter Storm Uri, the polar vortex that struck Texas in 2021. The Central region could see reliability improvements of up to 39%, measured as a percentage of household electricity outages that could have been avoided under such conditions. However, if California made purely system cost-optimal decisions in response to the 30% transmission ITC, the region could actually experience 3% *more* outages in an extreme weather event. This is likely due to the generation retirements that would occur under a cost-optimized scenario with additional transmission capacity. Additional regional details are available in Appendix B.

Change in Grid Reliability During Extreme Weather as a Result of a 30% Transmission ITC



5. What are the climate benefits of increasing interregional transmission?

A 30% transmission ITC is projected to avoid 20 million metric tons of CO_2-equivalents in the year 2035. This is roughly 2.4% of anticipated annual system emissions. A 6% transmission ITC has virtually no impact on emissions, with a projected reduction of 29 thousand metric tons of CO_2-eq.

The analysis was conducted using GenX, a least-cost power systems optimization model developed at MIT with contributions from the MIT Center for Energy and Environmental Policy Research and the MIT Energy Initiative. Input data such as existing generators, load, and technology cost projections come from publicly available sources. We focus on intraregional and interregional transmission and do not explicitly model local distribution lines. In the analysis, the transmission investment tax credits are available to projects that increase transmission of an existing line by 500MW or build a new line with at least 750MW of capacity. Lower-bound non-engineering costs reflect uncaptured electricity price differences between zones. We assume a moderate implementation of the Inflation Reduction Act.

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Appendix A.

Regional Differences in Component Costs Resulting from a 30% Transmission Investment Tax Credit (in Million $)

		California	Central	Florida	Mid-Atlantic	Midwest	New York	Northeast	Northwest	Southeast	Southwest	Texas	Total US
Transmission	Interregional Transmission	17	33	0	23	56	2	14	15	67	39	0	267
	Intraregional Transmission	0	0	0	137	75	0	0	36	26	0	17	291
	Transmission ITC	-5	-9	0	-48	-39	-1	-4	-15	-28	-11	-5	-165
Generation	Investment Cost	-34	248	61	-71	25	55	0	213	146	-98	-186	359
	Fixed O&M	-23	23	16	-2	72	1	17	119	33	-67	29	218
	Fuel	-81	-76	-98	-209	-116	41	-118	-20	-395	-49	-31	-1151
	Variable O&M	-9	-31	-11	9	-23	6	-15	-5	-31	-28	-9	-146
	Startup Cost	-1	1	3	0	0	-1	0	0	-5	-1	10	6
	PTC	14	-121	-16	-43	-18	-15	0	-101	-67	36	64	-267
	ITC	0	0	-2	0	-2	0	0	0	1	0	1	-3
	CCS Incentive	0	0	0	0	0	0	0	0	0	0	0	0
Storage	Investment Cost	0	2	16	2	25	0	0	0	-10	0	-8	27
	Fixed O&M	0	1	5	1	8	0	0	0	-3	0	-3	8
	Variable O&M	0	0	0	0	0	0	0	0	0	0	0	0
	ITC	0	0	-3	0	-4	0	0	0	2	0	1	-4
	System Cost	-122	70	-28	-202	59	88	-106	243	-264	-180	-120	-562
	Revenue	-124	143	-62	-189	-138	116	-130	110	-379	-194	-115	-962
	Revenue - System Cost	-2	73	-34	14	-197	28	-24	-133	-115	-14	5	-400

Regional Differences in Component Costs Resulting from a 6% Transmission Investment Tax Credit (in Million $)

		California	Central	Florida	Mid-Atlantic	Midwest	New York	Northeast	Northwest	Southeast	Southwest	Texas	Total US
Transmission	Interregional Transmission	-15	0	0	0	0	0	0	0	0	0	0	-15
	Intraregional Transmission	0	0	0	0	0	0	0	0	0	0	0	0
	Transmission ITC	1	0	0	0	0	0	0	0	0	0	0	1
Generation	Investment Cost	36	0	0	0	0	0	0	-1	0	-1	0	35
	Fixed O&M	9	0	0	0	0	0	0	0	0	-14	0	-6
	Fuel	1	0	0	0	0	0	0	0	0	0	0	1
	Variable O&M	0	0	0	0	0	0	0	0	0	0	0	0
	Startup Cost	0	0	0	0	0	0	0	0	0	0	0	0
	PTC	-15	0	0	0	0	0	0	0	0	0	0	-14
	ITC	0	0	0	0	0	0	0	0	0	0	0	0
	CCS Incentive	0	0	0	0	0	0	0	0	0	0	0	0
Storage	Investment Cost	0	0	0	0	0	0	0	0	0	0	0	0
	Fixed O&M	0	0	0	0	0	0	0	0	0	0	0	0
	Variable O&M	0	0	0	0	0	0	0	0	0	0	0	0
	ITC	0	0	0	0	0	0	0	0	0	0	0	0
	System Cost	-17	0	0	0	0	0	0	0	0	14	0	-2
	Revenue	-29	0	0	0	0	0	0	0	0	20	0	-9
	Revenue - System Cost	-13	0	0	0	0	0	0	0	0	6	0	-7

Appendix B.

Regional Improvements in Grid Reliability During Extreme Weather Resulting from a 30% Transmission Investment Tax Credit

	Outages Before 30% Transmission ITC	Outages After 30% Transmission ITC	Outages Avoided	Reliability Improvement (%)
Mid-Atlantic	9,054,404	8,867,535	186,869	2%
Southeast	5,572,408	5,284,719	287,689	5%
Midwest	2,774,839	2,406,006	368,833	13%
Florida	1,181,389	1,151,036	30,354	3%
New York	1,718,986	1,565,955	153,030	9%
Northeast	1,658,486	1,515,713	142,773	9%
California	654,657	673,472	(18,815)	-3%
Texas	1,751,915	1,741,317	10,598	1%
Southwest	769,137	687,693	81,444	11%
Northwest	3,090,285	2,709,454	380,830	12%
Central	327,109	200,935	126,175	39%