

**From:** [Wufoo](#)  
**To:** [Staff, CAO \(PUC\)](#)  
**Subject:** Submitted Public Comment Form  
**Date:** Friday, November 21, 2025 1:20:11 PM

---

**This message may be from an external email source.**

Do not select links or open attachments unless verified. Report all suspicious emails to Minnesota IT Services Security Operations Center.

Name *	Durgésh Manjuré
Phone Number	(704) 595-2718
Email	<a href="mailto:dmanjure@epri.com">dmanjure@epri.com</a>
Provide the docket's number.	E999/CI-07-1199; G008,G002,G011/CI-23-117; G999/CI-21-565
Leave a comment on the docket. *	Please see attached file for comments.

Attach a File



[epri\\_mn\\_cost\\_of\\_ghg\\_public\\_comments\\_final\\_20251121.pdf](#)  
253.70 KB · PDF



## **Comments in response to the Minnesota Public Utilities Commission Request for Public Comment on the Regulatory Cost of Greenhouse Gas Emissions for Gas Integrated Resource Plans**

Docket Number: E999/CI-07-1199; G008,G002,G011/CI-23-117; G999/CI-21-565

November 21, 2025

Dear Commissioners,

EPRI submits the enclosed comments to the Minnesota Public Utilities Commission ('The Commission') regarding the request for public comment on the regulatory cost of greenhouse gas emissions for gas integrated resource plans (Docket Number E999/CI-07-1199; G008,G002,G011/CI-23-117; G999/CI-21-565). EPRI thanks The Commission for the opportunity to comment.

EPRI is an independent, nonprofit organization for public-interest energy and environmental research. EPRI was established in 1972 and has principal offices and laboratories located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; and Lenox, Mass. EPRI conducts research and development related to future energy supply and demand, economies, and climate change, bringing together its scientists and engineers as well as experts from academia and industry to help address challenges, including reliability, efficiency, health, safety, and the environment. EPRI has a public benefit mission and makes its research results widely available.

EPRI has been studying topics related to the issue at hand for nearly twenty years and has over fifty years of research experience in the underlying science related to this topic, including participation on the National Academies of Sciences, Engineering, and Medicine's (NASEM) Social Cost of Carbon Committee as a committee member. With relevant expertise and resources, EPRI is technically well-positioned to provide comments. Among other things, EPRI has recognized scientific expertise in estimating the value of carbon and other GHGs, corporate climate target setting and risk management, climate scenarios, socioeconomic and energy system transformations and modeling, GHG abatement technologies, and climate policy evaluation, as well as a long history of research community leadership and participation in the Intergovernmental Panel on Climate Change, U.S. EPA's Science Advisory Board, the U.S. National Climate Assessment, and, as noted, the NASEM.

### **Our comments below identify the following technical considerations when applying the costs of GHGs in gas resource planning:**

1. Communicating the distinction between the cost of GHGs and the social cost of GHGs.
2. Designing a study to estimate ranges of costs of GHG values for Minnesota to capture local emissions transition opportunities.
3. Accounting for natural gas emissions abatement policies to avoid additional costs in reducing GHG emissions.
4. Clarification on whether non-CO<sub>2</sub> GHGs are being considered and subsequent public input.
5. Technology portfolios when applying regulatory costs in gas planning.
6. Clarification on the types of emissions being considered and subsequent public input.

7. Emissions leakage when applying regulatory costs in gas planning.
8. Evaluation of natural gas price implications.

EPRI is pleased to present these comments and technical considerations based upon its research and scientific engagement activities on estimating GHG values and analyzing and informing the application of GHG values in policy and corporate decision-making. The enclosed comments reflect only EPRI's expertise and do not necessarily reflect the opinions of those supporting and working with EPRI to conduct collaborative research and development. EPRI would welcome the opportunity to discuss our technical insights and comments, as well as future research opportunities, with The Commission. The technical point of contact is Dr. Steven Rose ([srose@epri.com](mailto:srose@epri.com)). Please let us know if this would be of interest.

Sincerely,



Durgesh Manjuré  
VP, Integrated Grid and Energy Systems  
[dmanjure@epri.com](mailto:dmanjure@epri.com)  
Office: 704-595-2718  
Cell: 980-461-1354  
EPRI

## Detailed comments related to each technical consideration

### 1. Communicating the distinction between the cost of GHGs and the social cost of GHGs

Conceptually, the cost of carbon (or other GHGs) is a “regulatory cost” that represents the marginal cost of CO<sub>2</sub> (or other GHG) abatement given assumptions regarding climate policy stringency and design, available technologies, and market conditions. It is a conceptually appropriate metric for internalizing the cost of potential future GHG emissions reduction policies (Rose, 2010). The cost of carbon (or other GHG) is not the social cost of carbon (or social cost of another GHG). The latter is an “environmental cost” estimate that represents the marginal societal damage from CO<sub>2</sub> and is appropriate for pricing CO<sub>2</sub> externalities in resource planning and estimating of the marginal benefit of abating CO<sub>2</sub> emissions. Note that regulatory and environmental costs should not be used together. Using them together would be economically inefficient due to multiple pricing of the GHG (see discussion in technical consideration #3 below). In particular, the regulatory cost estimates represent policies that already consider the benefits of abating emissions. With many stakeholders not familiar with this distinction and its importance, it would be helpful to take this opportunity to educate stakeholders.

### 2. Designing a study to estimate ranges of costs of GHG values for Minnesota to capture local emissions transition opportunities

Carbon cost (and other GHG) values are uncertain because they depend on estimates of future conditions, such as: policy stringency and design, available technologies, and market conditions. Thus, there are a range of regulatory cost estimates associated with the range of futures. In addition, the values relevant to gas utilities operating in Minnesota should reflect the marginal costs of abating natural gas-related emissions in Minnesota. Research has shown notable variation in GHG emissions reduction opportunities and challenges among U.S. regions (e.g., Rose and Molar-Cruz, 2023). The existing literature, unfortunately, does not provide the range of Minnesota GHG cost estimates required for this application. As such, The Commission may wish to consider requesting a study designed to estimate the range of values needed. Ideally, this study would want to consider a range of plausible potential climate policy, technology, and market futures. EPRI’s previous research has shown that a wide range of potential natural gas market transitions (size and composition) can be consistent with a fully decarbonized economy (e.g., Rose and Molar-Cruz, 2023; Taber and Rose, 2022; Blanford et al, 2022).

The current range of values being considered (\$5 - \$75/short ton CO<sub>2</sub>) was not designed for this application. We understand that the \$75 upper bound is based on a pair of International Monetary Fund (IMF) research papers<sup>1</sup>. We have reviewed the IMF papers and found that they are global analyses with limited insights for this Minnesota-specific application. For instance, the studies are not deriving marginal carbon costs; but, instead, assuming a \$75 carbon price for wealthy countries and evaluating abatement responses. The studies also do not evaluate alternative policy and non-policy conditions and their implications for global and regional regulatory costs. In addition, the modeling does not consider non-CO<sub>2</sub> abatement; thus, the \$75 per short ton CO<sub>2</sub> value would not be suitable for non-CO<sub>2</sub> or CO<sub>2</sub>-equivalent (CO<sub>2</sub>eq) application. Furthermore, the modeling does not capture integrated energy system dynamics, markets, or general

---

<sup>1</sup> IMF Blog: <https://www.imf.org/en/Blogs/Articles/2022/05/19/blog-why-countries-must-cooperate-on-carbon-prices>. Chateau et al (2022): <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2022/03/16/Economic-and-Environmental-Benefits-from-International-Cooperation-on-Climate-Policies-511562>. Parry et al (2021): <https://www.imf.org/en/Publications/staff-climate-notes/Issues/2021/06/15/Proposal-for-an-International-Carbon-Price-Floor-Among-Large-Emitters-460468>.

equilibrium effects on energy supply and demand. Due to the nature of the IMF modeling, the IMF estimate does not reflect the regulatory CO<sub>2</sub> cost, potential non-CO<sub>2</sub> costs, and the cost uncertainty Minnesota gas utilities will likely face. See below for additional non-CO<sub>2</sub> discussion.

### **3. Accounting for natural gas emissions abatement policies to avoid additional costs in reducing GHG emissions**

Across policies and jurisdictions, there is a risk of explicitly or implicitly pricing/valuing/costing CO<sub>2</sub> or other GHGs more than once. Pricing emissions more than once results in excess costs to society and leads to an inefficient allocation of resources (Rose and Young, 2021; Hytowitz et al, 2021; EPRI, 2021; EPRI, 2020; Rose and Bistline, 2016).

Figure 1 illustrates how multiple GHG pricing is economically inefficient. In the figure, CO<sub>2</sub> pricing on top of an emissions cap increases the cost of compliance with the cap. The marginal cost curve in Figure 1 represents the increasing cost of reducing emissions, with the lowest cost emissions reduction options deployed to comply with the emissions cap. The cap constrains emissions and creates an implied price on CO<sub>2</sub> that is internalized into compliance decisions. Adding an explicit CO<sub>2</sub> price (αCO<sub>2</sub> with α equal to a carbon value, such as a regulatory cost value) is shown to only increase the cost of compliance without further reductions in emissions (Rose and Young, 2021; Rose and Bistline, 2016).

Multiple pricing is already happening at and across federal and state levels. For instance, carbon costing in coal mine permitting, public utility commission externalities pricing, a federal clean energy standard, and low-carbon goods and services procurement policies all price the same molecule of CO<sub>2</sub> at different points along the value chain from extraction to goods consumption. Similarly, the same molecule could be priced multiple times within a state by a low-carbon technology subsidy, emissions constraint, clean energy or renewables standard, end-use carbon reduction related subsidies, and/or GHG regulatory cost in gas resource planning.

Note that some state-level proposals for wholesale CO<sub>2</sub> pricing of electricity have recognized the multiple pricing issue and suggested adjusting the carbon value for the GHG emissions allowance price (for instance, see EPRI, 2020, for discussion regarding New York). However, the economic efficiency problem persists. While smaller, the adjusted carbon value is still positive and increasing the cost of compliance.

To summarize, multiple pricing increases abatement cost without achieving higher emissions reductions. The multiple pricing results in sub-optimal decisions, inefficient allocation of resources, and lower societal welfare. The solution to this problem is recognizing when GHGs are already priced to ensure that a GHG is only valued once. To avoid this economic inefficiency, The Commission may consider avoiding applying a GHG regulatory cost to natural gas emissions when there are policies already addressing those gas-related emissions—directly (e.g., via a cap, price, or CES standard) or indirectly (e.g., via an RPS, subsidy, or low-emissions procurement). To elucidate the potential for multiple pricing, The Commission could document (a) the emissions covered by the proposed regulation, and (b) existing emissions policies. Tracking this information over time will allow The Commission to identify where an existing policy is managing emissions and the GHG regulatory cost should be removed.

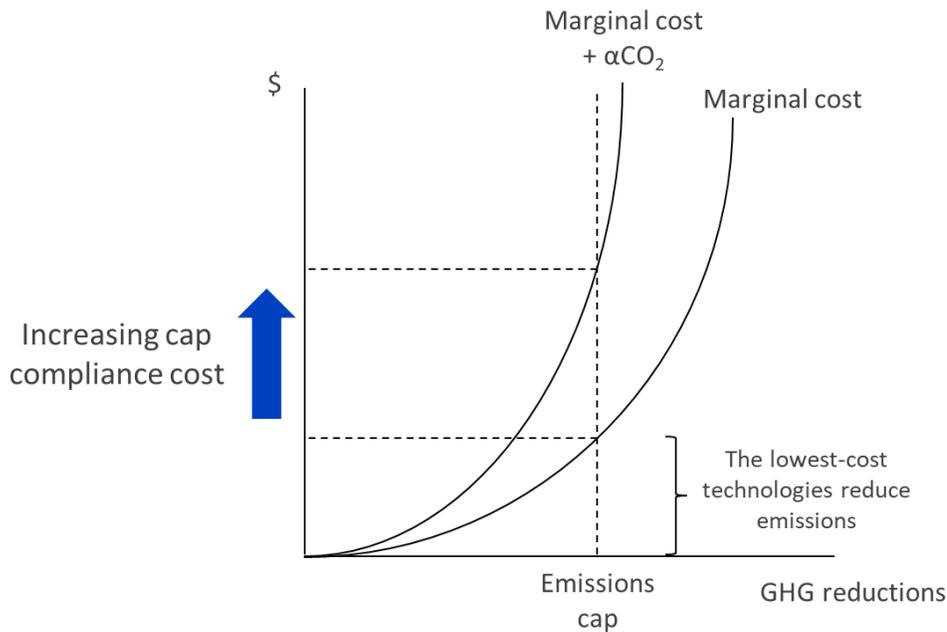


Figure 1. Illustration of how valuing a GHG more than once can be economically inefficient. Source: Rose and Young (2021). The figure portrays one potential instance of multiple pricing for CO<sub>2</sub>. In this case, it is showing CO<sub>2</sub> pricing on top of a CO<sub>2</sub> emissions cap constraint. The CO<sub>2</sub> pricing ( $\alpha\text{CO}_2$  with  $\alpha>0$ ) increases the marginal cost of emissions abatement with the net implication being an increase in the cost of achieving the emissions cap without additional emissions reduction benefits.

#### 4. Clarification on whether non-CO<sub>2</sub> GHGs are being considered and subsequent public input

The current notification refers to cost of GHGs, but we only found reference to estimates for CO<sub>2</sub>. It would be helpful to clarify if estimates for CH<sub>4</sub> or CO<sub>2</sub>eq are also of interest. Given the differences in emissions sources, abatement opportunities, uncertainties, and climate effects, there are different marginal abatement cost ranges associated with each GHG (e.g., Rose et al, 2016; Clarke et al, 2014; Rose et al, 2013; Fisher et al., 2007). If CO<sub>2</sub>eq cost ranges are of interest, the modeling source of the cost estimates should include evaluation of CO<sub>2</sub> and non-CO<sub>2</sub> abatement and uncertainties to capture the differences in opportunities between the GHGs, including with abatement of the relevant gas-related emissions sources.

#### 5. Technology portfolios when applying regulatory costs in gas planning

A cost of CO<sub>2</sub> (or other gas) ignores technology portfolio net emissions. For instance, gas related emissions may be offset by CO<sub>2</sub> removal (CDR) such as direct air capture, afforestation, or bioenergy with CCS, or emissions allowances or other types of offset credits such as avoided landfill CH<sub>4</sub> or agriculture N<sub>2</sub>O emissions. Research clearly indicates that the decarbonization transition role of natural gas is very sensitive to the availability of CDR technologies (e.g., Rose and Molar-Cruz, 2023; Blanford et al, 2022; Taber and Rose, 2022). For example, with CDR, regional gas consumption could cost-effectively increase or remain flat in a net-zero CO<sub>2</sub> future (e.g., Rose and Molar-Cruz, 2023). Given the overall goal of decarbonizing the Minnesota economy while managing societal costs and other trade-offs, The Commission could consider the net emissions of transition portfolios. Not doing so runs the risk of precluding potentially cost-effective GHG abatement solutions.

## **6. Clarification on the types of emissions being considered and subsequent public input**

It is currently unclear which types of GHG emissions are proposed for gas resource planning consideration—direct, upstream, and/or downstream emissions. This matters a great deal in terms of practicality, analytical scope, abatement opportunities, and GHG cost estimates. Practically, compliance and emissions management are more challenging for upstream and downstream sources. Issues include emissions uncertainty, lack of abatement control, leakage, and potential economic inefficiency in terms of how to most cost-effectively manage sources and whether they are already being managed (Rose, 2022; EPRI, 2022a; EPRI, 2022b; Rose et al, 2016). The analytical requirements for compliance can also be impacted by the emissions scope, with it significantly more challenging the greater the required emissions scope. A larger emissions scope implies the need to evaluate a larger economic, energy system, and abatement technology scope, including potentially beyond the borders of Minnesota. The emissions scope can also affect the regulatory cost estimates themselves. Clarifying the emissions scope and seeking public input is essential for informed discussion regarding values and compliance.

## **7. Emissions leakage when applying regulatory costs in gas planning**

Emissions leakage occurs when GHG emissions beyond the compliance emissions sources are affected (Rose and Bistline, 2016; Bistline and Rose, 2018; EPRI, 2021; Rose and Young, 2021; EPRI, 2020). Market linkages make leakage a potential issue for The Commission. Applying a GHG regulatory cost may affect fuel markets (individual and relative fuel prices) within Minnesota and with neighboring states. Thus, there is the possibility of emissions changes in the broader Minnesota economy and neighboring economies due to fuel substitution and economic activity changes in response to The Commission's policy. See, for instance, Figure 2 from Bistline and Rose (2018) for an illustration of emissions leakage in response to regional power sector carbon pricing in the U.S. Similar energy market responses are possible from applying a GHG regulatory cost to natural gas emissions. Emissions beyond the natural gas emissions source activities could increase or decrease (within or outside the Minnesota state borders), which impacts the net emissions implications of the policy. The Commission, therefore, could consider the possibility of emissions leakage and pursue a study to evaluate leakage potential. This study could be combined with the earlier proposed study for estimating ranges of Minnesota GHG cost values.

## **8. Evaluation of natural gas price implications**

Incorporating GHG regulatory costs into natural gas planning has the potential to impact natural gas fuel prices. As a result, it has potential affordability implications. EPRI research evaluating regional carbon pricing of U.S. electricity generation emissions has robustly found electricity price change implications regardless of the region (Bistline and Rose, 2018). Similar results are likely for natural gas markets from a GHG regulatory cost on gas. For instance, Blanford et al (2022) estimated higher future natural gas prices in response to a net-zero by 2050 economy-wide U.S. policy. As a result, The Commission may want to evaluate potential natural gas price and affordability implications for Minnesota citizens and businesses.

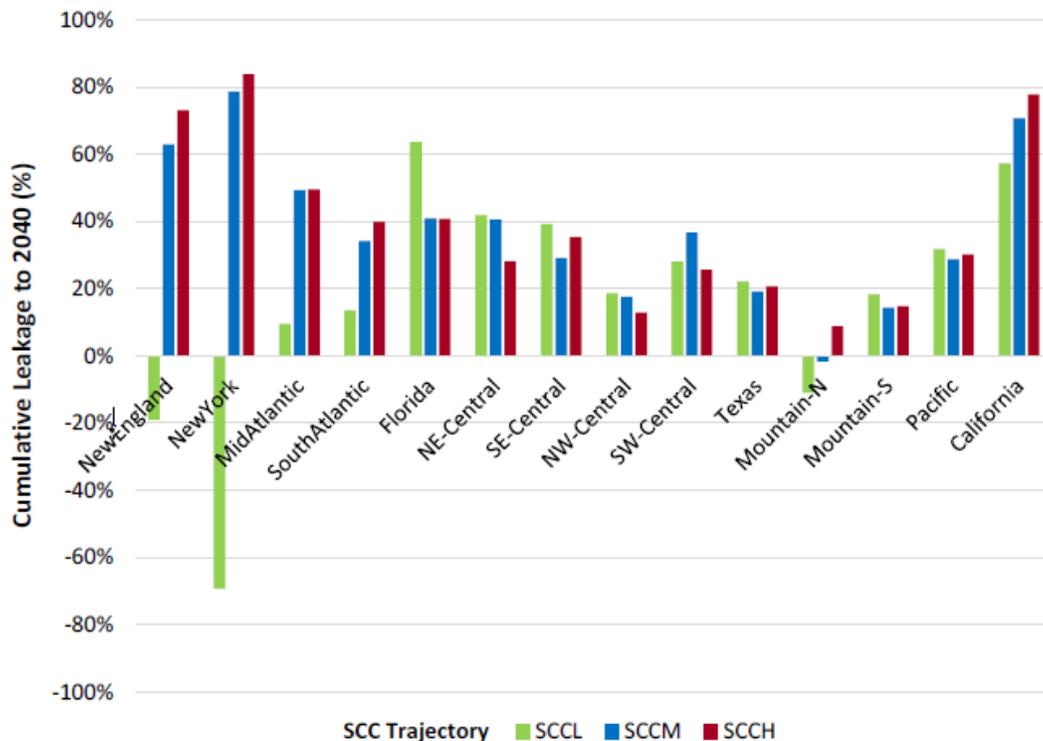


Figure 1: Cumulative CO<sub>2</sub> leakage through 2040 by U.S. region in response to a CO<sub>2</sub> price on regional electricity generation emissions. Source: Bistline and Rose (2018). The figure estimates leakage in percentage terms from reference conditions when a CO<sub>2</sub> price is applied independently to each region's power generation emissions. Positive (negative) results indicate an increase (decrease) in emissions. The analysis used low, medium, and high CO<sub>2</sub> price scenarios based on social cost of carbon (SCC) externalities pricing estimates. Regulatory GHG costs would have similar implications depending on their magnitude.

## References

Bistline, J and S Rose, 2018. [Social Cost of Carbon Pricing of Power Sector CO<sub>2</sub>: Accounting for Leakage and Other Social Implications from Subnational Policies](#), *Environmental Research Letters* 13 014027. EPRI – #3002014809.

Blanford, G, N Kern, S Rose, N Johnson, C Roney, S Goteti, J Bistline, D Young, C Trueblood, T Lejedal, D Wissmiller, A Nasta, S Siddique, F de la Chesnaye, D McCollum, 2022. *LCRI Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis*. EPRI, Palo Alto, CA: 2022. #3002024993, <https://lcri-netzero.epri.com/>.

Clarke L, K Jiang, K Akimoto, M Babiker, G Blanford, K Fisher-Vanden, J-C Hourcade, V Krey, E Kriegler, A Löschel, D McCollum, S Paltsev, S Rose, PR Shukla, M Tavoni, BCC van der Zwaan, DP van Vuuren, 2014: Assessing Transformation Pathways. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the IPCC* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. <https://www.ipcc.ch/report/ar5/wg3/>.

EPRI, 2022a. [EPRI Public Comments on the SEC's Proposed Climate Risk Disclosure Rule: The Enhancement and Standardization of Climate-Related Disclosures for Investors](#). EPRI, Palo Alto, CA: 2022. #3002025101.

EPRI, 2022b. [\*EPRI Public Comments on Federal Acquisition Regulation ANOPR: Minimizing the Risk of Climate Change in Federal Acquisitions\*](#). EPRI, Palo Alto, CA: 2022. #3002023465.

EPRI, 2021. [\*EPRI Public Comments on the Biden Administration's Interim Social Cost of Carbon, Methane, and Nitrous Oxide Estimates and Technical Document\*](#). #3002022316.

EPRI, 2020. [\*EPRI Public Comments on New York State Department of Environmental Conservation's Proposal "Establishing a Value of Carbon: Guidelines for Use by State Agencies."\*](#) EPRI, Palo Alto, CA: 2020. #3002020249.

Fisher, BS, N Nakicenovic, K Alfsen, J Corfee Morlot, F de la Chesnaye, J-C Hourcade, K Jiang, M Kainuma, E La Rovere, A Matysek, A Rana, K Riahi, R Richels, S Rose, D van Vuuren, R Warren, 2007: Issues related to mitigation in the long term context, In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Inter-governmental Panel on Climate Change* [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. <https://www.ipcc.ch/report/ar4/wg3/>.

Hytowitz, RB, E Ela, S Rose, T Wilson, 2021. [\*What does carbon pricing mean for electricity markets?\*](#) EPRI, Palo Alto, CA. #3002021815.

Taber, J and S Rose, 2022. [\*Opportunities for Decarbonizing Minnesota's Economy: Energy System Supply and Demand Assessment\*](#). EPRI, Palo Alto, CA. #3002019333.

Rose, S, 2022. [\*Technical Considerations for Climate-Related Risk Disclosure Rules\*](#). EPRI, Palo Alto, CA. #3002024244.

Rose, S, 2010. "Federal decision-making on the uncertain impacts of climate change: incremental vs. non-incremental climate decisions," [\*Assessing the Benefits of Avoided Climate Change: Cost-Benefit Analysis and Beyond\*](#), Pew Center on Global Climate Change.

Rose SK and J Bistline, 2016. [\*Applying the Social Cost of Carbon: Technical Considerations\*](#). EPRI, Palo Alto, CA. #3002004659.

Rose, S, J Petrusa, L Davis, 2016. *Regional Non-CO<sub>2</sub> Greenhouse Gas Abatement Potential in the United States to 2030*. EPRI, Palo Alto, CA. #3002009609.

Rose, S and A Molar-Cruz, 2023. [\*Differences in Regional Decarbonization Opportunities, Uncertainties, and Risks\*](#). EPRI, Palo Alto, CA. #3002028181.

Rose, SK, R Richels, S Smith, K Riahi, J Strefler, D van Vuuren, 2013. Non-Kyoto Radiative Forcing in Long-Run Greenhouse Gas Emissions and The Role of Non-Kyoto Gas Forcing in GHG Stabilization Scenarios. *Climatic Change* 123: 511–525. doi: 10.1007/s10584-013-0955-5.

Rose SK and D Young, 2021. [\*Repairing the Social Cost of Carbon: Immediate Steps for Scientifically Reliable Estimates and Use\*](#). #3002020523.