

Innovation

Illuminating the Black Box

EPRI, National Academy of Sciences Provide Greater Scientific Scrutiny of “Social Cost of Carbon” Analyses

By Brent Barker

Imagine trying to estimate the monetary damage of one additional ton of carbon dioxide (CO₂) emitted into the atmosphere in the year 2020, 2030, or 2040. The modeling must be global, look hundreds of years into the future, and account for damages that encompass potential effects on health, agriculture, forestry, sea level rise, extreme weather, water resources, energy consumption, and human migration. It would be necessary to build and run models backed by comprehensive, sophisticated thinking. As impossible as this endeavor might seem, it describes models addressing the Social Cost of Carbon (SCC), which is becoming more integral to development of environmental regulations. To date, more than 60 federal and state rulemakings applied SCC modeling to estimate the costs and benefits of reducing CO₂ emissions.

Despite the widespread use of SCC numbers, the models behind them remain for most people a black box. Most of the nation’s scientists, regulators, and policymakers do not know how they are constructed, how they work, or how they differ. In 2015, the National Academy of Sciences (NAS) established a committee to evaluate SCC modeling approaches. Early in 2017, NAS plans to publish a major report with recommendations for improvements, and to reflect certain scientific guidance which has, to date, been lacking.

Origins of the Social Cost of Carbon

How did the SCC emerge? EPRI Technical Executive Steve Rose was there at the beginning. “In 2007, the Ninth U.S. Circuit Court ruled in an environmental lawsuit that the U.S. Department of Transportation (DOT) was arbitrary and capricious in assuming a value of zero for the benefits of reducing CO₂ in its passenger vehicle efficiency standards,” said Rose, who at the time was at the U.S. Environmental Protection Agency (EPA) and the only federal employee working on SCC modeling. “The government had to come up with numbers, and three agencies—DOT, EPA, and the U.S. Department of Energy—began working on the problem independently.” Rose moved to EPRI in 2008.

In 2010, a new Interagency Group produced the first official U.S. government SCC numbers, which were revised upward by 50–100% in 2013. Since then, minor revisions also used the 2010 methodology. For example, current estimates used in rulemakings value a CO₂ reduction today of one metric ton at \$36. Alternative values range from \$11 to \$105 per metric ton, depending on factors such as discount rates. Expected CO₂ reductions in subsequent years are assigned even higher values.

“The revisions garnered a lot of attention in policy circles, including Congress,” said Rose. “Congressional hearings ensued. The White House Office of Management and Budget requested public comments, and this led to a request to the National Academy of Sciences to establish the SCC Committee in 2015.” Rose is one of its 13 members.

Three Models, Three Approaches

To calculate the SCC numbers, the Interagency Group integrated results from three models—FUND, PAGE, and DICE—that use distinct analytical approaches to climate change–related damages.

Research by Rose and other EPRI researchers has yielded important insights regarding the three models. With FUND, the major source of damage comes from cooling loads in the developing world as global temperatures rise, particularly air conditioning in China. With PAGE, the greatest damages initially emerge in the developed world, particularly non-economic damages associated with effects such as those on human health and ecosystems. DICE, on the other hand, organizes damage into only two categories—sea level rise and “other.”

“DICE covers some of the same types of damage as the other models, but unlike the others they are not explicitly separated into categories,” said Rose. “This makes them less transparent and hard to interpret and evaluate.”

All three models isolate sea level rise damages providing one point of comparison. “But they differ dramatically in how they approach it,” said Rose. “FUND estimates almost no net sea level damages because it assumes that nations mitigate the risk with adaptation measures such as sea wall construction.”

The three models come from the academic world. “A handful of prominent researchers at universities such as Yale and Cambridge synthesized all things climate, from emissions to projected temperature responses to induced damages,” said Rose. “It is a substantial challenge to build a model that simulates all the world’s physical and economic systems for 300 years into the future. You can imagine the uncertainty that somehow needs to be considered.”

EPRI’s Role

Rose serves on the NAS committee for several reasons—his pioneering SCC work while at EPA, his standing among specialists and leaders in modeling, and his more recent EPRI work dissecting the SCC models and evaluating how they operate.

“To date, EPRI has been the only organization to bore down into each of the models to examine and directly compare their components,” said Rose. “Others have looked at the models as a whole, added features, or varied parameters. Based on our work, we brought a fine-grained understanding of the models’ inner workings to the NAS committee to inform its thinking. For instance, our insights regarding the differences in the climate system modeling of the three models—and their implications for projected temperatures—were key inputs into the NAS Phase 1 report that came out in 2016. Our insights regarding socioeconomic projections and the modeling of damages are also proving valuable to the committee.”

Beyond the committee, Rose has taken the message about the need for greater understanding and scientific engagement on the road. “I’ve given more than 25 presentations to stakeholders of all types, including EPRI utility members, trade associations, government agencies, policymakers, environmental groups, academics, and climate scientists. They are all very appreciative of the work, objectivity, and novel insights. EPRI’s role is to contribute to the SCC scientific and technical knowledge for more informed discussion and decisions.”

Key EPRI Technical Experts

Steve Rose