Synapse
Energy Economics, Inc.

Climate Costs and the "Value of E"

Prepared for SEIA

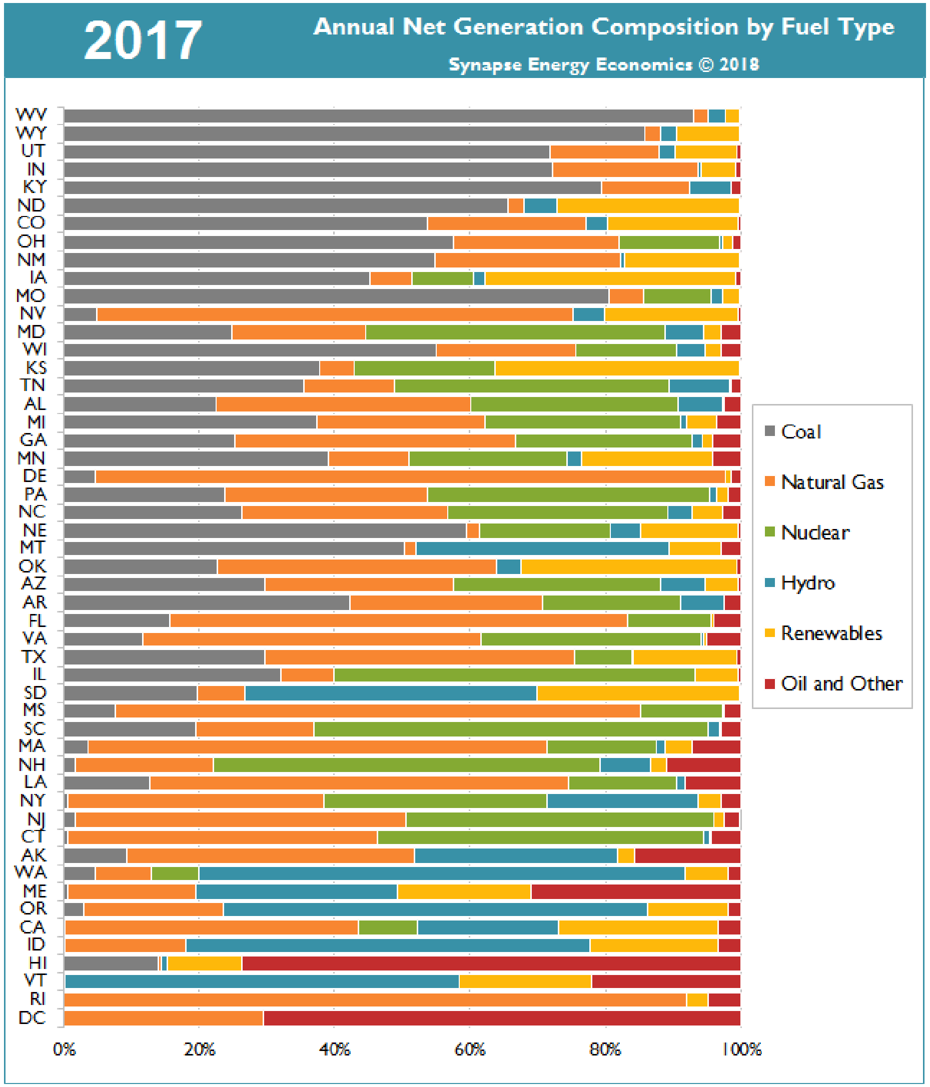
Albany, NY

October 2, 2018

Dr. Frank Ackerman

Synapse Energy Economics

- Founded in 1996 by CEO Bruce Biewald
- Leader for public interest and government clients in providing rigorous analysis of the electric power sector
- Staff of 30 includes experts in energy and environmental economics and environmental compliance
- Numerous reports on energy and environmental issues (see illustration – and our website)



Outline: How Should GHG Costs be Calculated?

- Damage cost calculations
  - Theoretical arguments for using damage costs
  - Challenges to meaningful valuation of climate damages
- The “social cost of carbon” (SCC)
  - Definition and calculation
  - Weaknesses of best-known estimates
  - Global vs. local damage estimates
- An alternative: marginal abatement cost valuation
- Recommendation: use either
  - A version of Obama administration’s SCC, or
  - Marginal abatement costs

Climate damage costs

Economic theory and damage costs

- Efficiency of markets depends on assumption that everything of value (good or bad) has a market price
- Negative externalities – costs imposed on third parties – must be priced and internalized to make market outcomes efficient, desirable
  - To be efficient, market prices must include costs of all resources (including pollution) used to make a product
- Originally due to Pigou (1920), not a new idea!
  - Pigou wrote about coal smoke; other externalities include traffic congestion, local air pollution – and climate change
- In a perfect textbook economy, marginal damage costs must equal marginal abatement costs
  - May not be true in messy real-world context

Valuation problems, 1: Priceless values

- Some climate damages have meaningful prices (property damage); many do not
- What is the value of an endangered species? Or human life and community? Or unique natural environments?
- Economists have invented prices for many such values, with mixed results
  - Surveys ask how much people would pay to preserve these values
- Immanuel Kant: some things have a price, others have a dignity
  - Artificial prices demean the dignity of human life and the natural world

Valuation problems, 2: Extreme, uncertain risks

- How fast is the climate changing? How bad will it get?
  - We know that we don't know precise answers
- Unknown time, temperature at which tipping points will be reached
  - Droughts destroying agriculture, collapse of ice sheets raising sea levels, many other risks
- These risks are not (yet) the most likely outcomes, but become less unlikely as temperatures rise
- For more on policymaking for extreme, uncertain risk, see Ackerman, *Worst-Case Economics* (2017)

Valuation problems, 3: What is the future worth?

- Climate damages spread over centuries after emissions
  - How much should future damages be discounted?
- Short-term private investments: discount at market interest rate
- Intergenerational public investments: different logic, discount at very low rate in order to value the future
- Stern Review (2007), many other sources support this approach

"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."

Social cost of carbon

The Obama administration's SCC

- Social cost of carbon (SCC) is the present value of present and future damages caused by emission of one more ton of CO_2 (damage costs)
- Calculated by running a climate economics model twice, once with and once without additional emissions; difference in results = SCC
- Obama administration's Interagency Working Group (IWG) ran three models – DICE, PAGE, and FUND – and averaged results
- Four sets of results published
  - Default "climate sensitivity" (speed, severity of climate change) and discount rates of 5%, 3% and 2.5%
  - Much worse climate sensitivity (95^{th} percentile) and 3% discount rate
- Default climate sensitivity and 3% discount rate is by far the most widely used
  - Sometimes called (for no good reason) the "central estimate"

SCC models: What's in and what's out

- SCC estimates depend on damage calculations in climate economics models.
  - **Market damages** can be included, although they are hard to measure and details are often omitted.
  - **Non-market damages**, e.g. loss of human life, endangered species, unique environments, can be artificially priced in some cases, with problematical results.
  - **Socially contingent damages**, e.g. increases in conflict and migration, are important but impossible to measure and price. Could become large; never included in models.
  - **Catastrophic damages** from tipping points with irreversible losses, are also important but almost impossible to predict in detail. Most models omit these risks.

Long before the days of climate economics models, the Oracle at Delphi provided cryptic guidance on an unknown future.

Inside the three SCC models

- **DICE**
  - Developed by William Nordhaus, Yale University
  - Designed for simplicity and transparency, not precision of details
  - Global damages estimated with a single function; surprisingly low
  - No explicit treatment of catastrophic risks, tipping points
- **PAGE**
  - Developed by Chris Hope, Cambridge University
  - A few aggregate categories of damages, initially calibrated to match DICE results
  - Includes possibility of moderate-sized catastrophic losses as temperature rises
- **FUND**
  - Developed by Richard Tol (Sussex University) and David Anthoff
  - Detailed but very conservative, dated estimates of many damages
  - Increased air conditioning costs are the largest cost of climate change in many FUND scenarios

Global or local impacts?

- For most pollutants, almost all impacts are local.
- Climate change is different: each country's emissions affect everyone.
- Trump administration recalculates SCC, including only domestic impacts. Result is 10 – 14% of global SCC.
- Why count global damages?
  - Almost all climate damages consist of impacts of one country's emissions on another country.
  - Damages abroad affect U.S.: droughts and crop failures lead to more refugees.
  - The Pentagon recognizes climate change as a national security threat.
  - Negotiations matter: countries have to act together to solve the problem.

Marginal abatement costs

Costs of meeting a climate target

- An alternative approach avoids problems of damage cost valuation.
  - Relies only on (better-defined) abatement costs and targets.
- Calculate least-cost scenario for meeting an established climate target.
  - Could be 80% or 100% emission reduction by a future target year.
- Arrange abatement measures in order of cost per ton of CO_2 abated.
- The highest cost per ton in the scenario is the marginal abatement cost.
  - In some analyses, marginal abatement cost is the cost of offshore wind.
- If society has decided to meet the climate target, all measures required to reach it must be worthwhile.
  - This includes the most expensive, or marginal, abatement measure in the least-cost compliance scenario.
- California PUC uses marginal abatement cost for planning purposes in setting requirements for IRPs.
  - Value rises rapidly to $150 per ton by 2030.

Recommendation: Pick a number

What value of carbon emissions should be used?

- No readily available measure comes close to capturing the full impacts of GHG emissions.
- The value of carbon damages (and of emission reduction) is much larger than values proposed by NY DPS to date.
- To create a better value, with a reasonable amount of effort, either of two approaches can be used:
  - Use the Obama administration's SCC with a 3% discount rate and 95th percentile climate sensitivity (reflecting greater speed of climate change and severity of risks); or
  - Calculate a least-cost abatement curve for meeting state goals and set a value based on marginal abatement costs, as was done recently by California PUC.

For more information

Dr. Frank Ackerman

Synapse Energy Economics

http://www.synapse-energy.com

http://frankackerman.com

"Perhaps I've said too much."