Economic Modeling and Environmental Policy Choice

James Bushnell

Dept. of Economics

UC Davis

UCDAVIS
UNIVERSITY OF CALIFORNIA

Which model is best? The different types of modeling

- Empirical economic models ("program evaluation")
  - Best for resolving questions, but backward looking
- Statistical Forecasting models
  - "top-down" projections of future outcomes based upon historic trends
  - Best for quantifying uncertainty but dependent upon history
- Equilibrium models
  - "top down" simulations of high level economic activity based upon historic relationships between sectors
- Techno-Economic models
  - "bottom-up" exercises that assemble and attempt to aggregate the component costs of all aspects of a policy.

Which model is best? The different types of modeling

- Empirical economic models ("program evaluation")
  - Best for resolving questions, but backward looking
- Statistical Forecasting models
  - "top-down" projections of future outcomes based upon historic trends
  - Best for quantifying uncertainty but dependent upon history
- Equilibrium models **(REMI)**
  - "top down" simulations of high level economic activity based upon historic relationships between sectors
- Techno-Economic models **(PATHWAYS)**
  - "bottom-up" exercises that assemble and attempt to aggregate the component costs of all aspects of a policy.

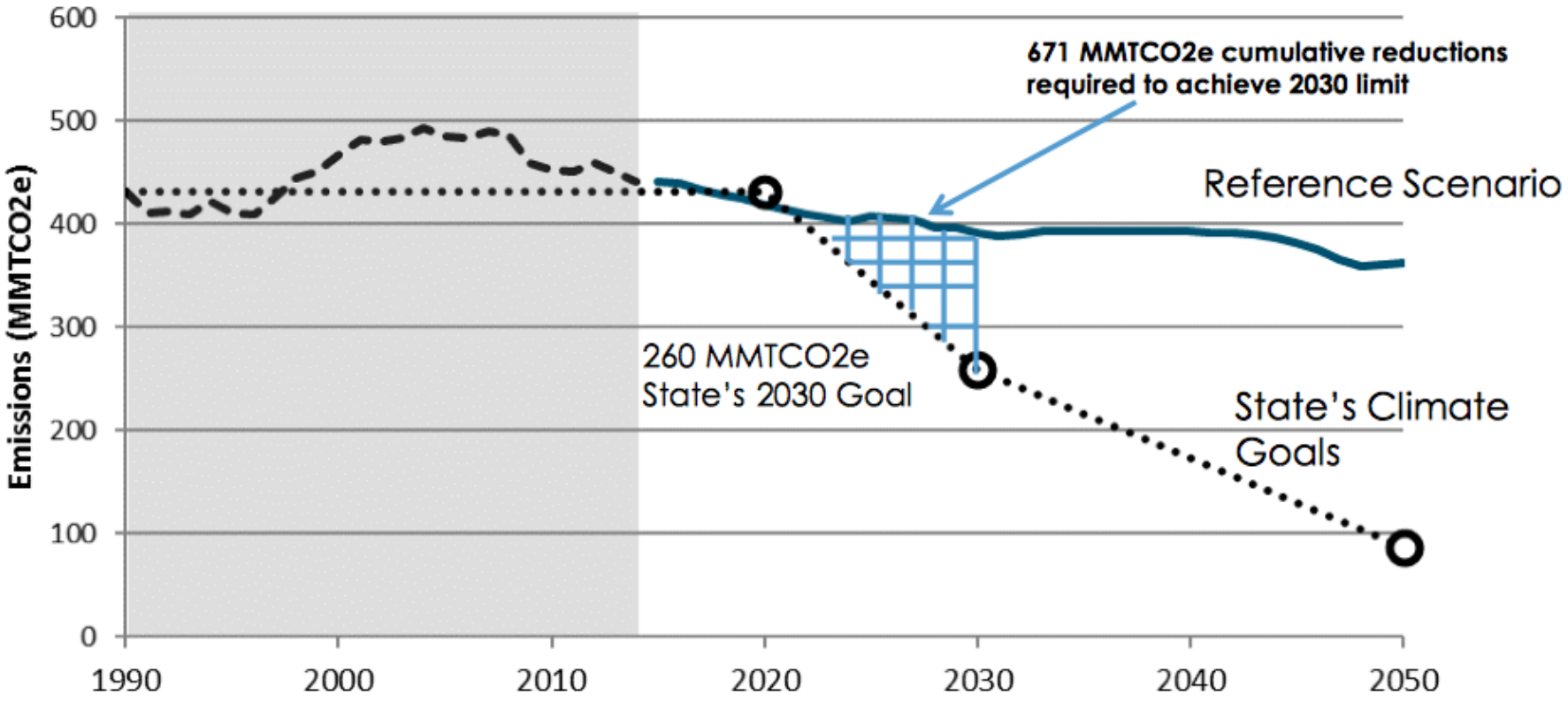
Techno-Economic Models

- Usually forward looking
- "Bottom-up" models that take cost numbers of inputs and processes from a variety of sources (often other TE models) and sums up the costs of all the pieces necessary to implement a policy.
- Highly assumption dependent.
  - Really what they do is aggregate and summarize large sets of assumptions that would otherwise be difficult to interpret
  - Only as good as the assumptions that go into them
- Sometimes the only thing we can do
- Not dependent upon historic trends (unless those are the basis for the assumptions.
- Useful for "ballparking" impacts
  - "How much could it cost for 1/10 of Californians to trade in the ICE vehicle for an EV this year?"

Techno-Economic Models (2)

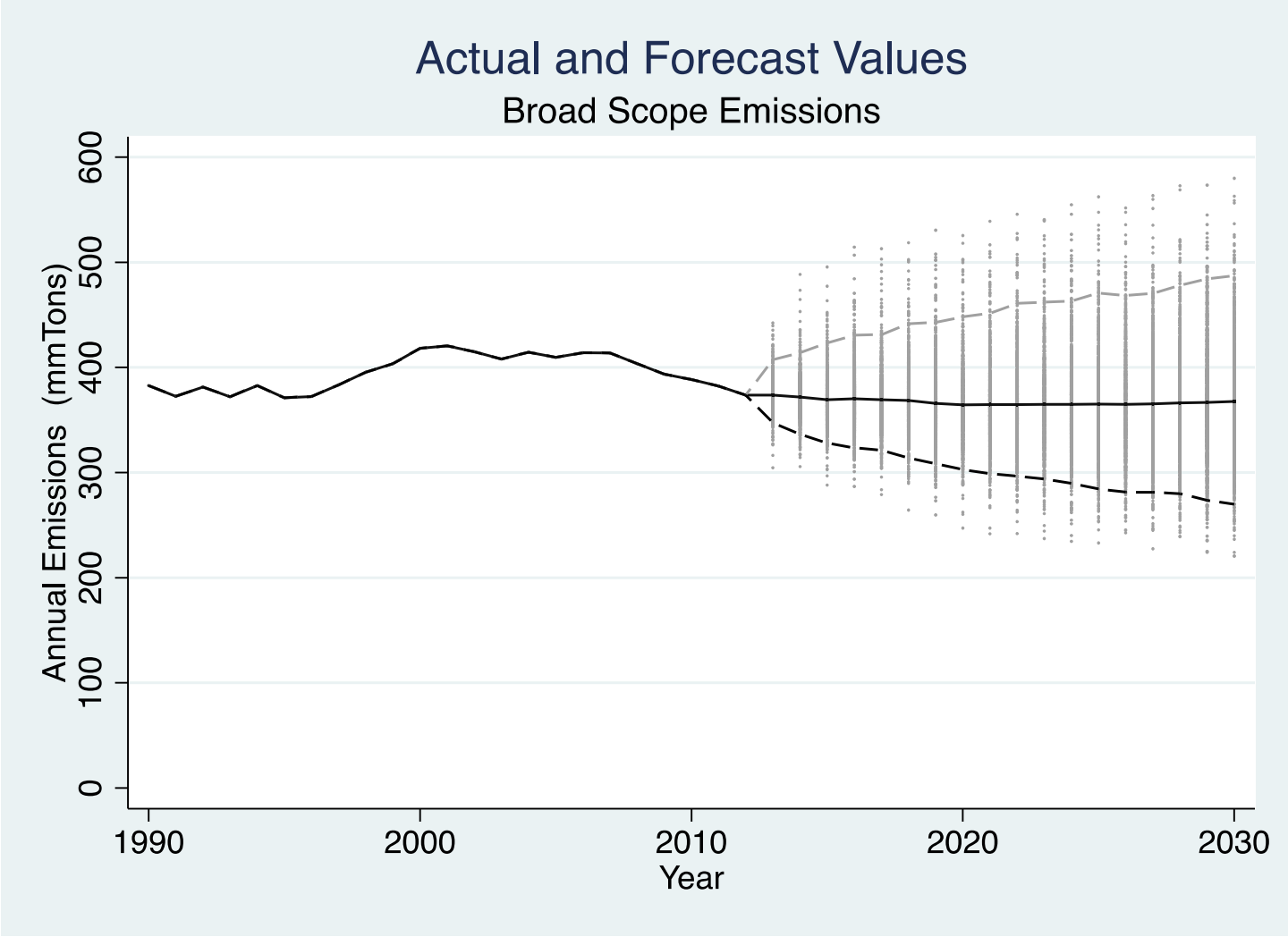
- Often focus exclusively on the technical “input” costs
  - It takes 500 bricks and 10 lbs of cement to build a brick car
    - Bricks cost $1.00 each and cement $2.00/lb, so replacing one regular car with a brick car costs $520
- Usually do not estimate costs of making policies a reality
  - “How much do we have to spend to get someone to buy a brick car”
  - Backward looking (program evaluation) is needed to iterate with models to better set these costs
- Not designed to measure convenience “utility”
  - “what if people hate brick cars?”
- Can examine uncertainty but not in a statistical sense.
  - Can test the sensitivity to certain assumptions but not set up to test how likely those different scenarios might be.

Reductions from an Assumed Reference Level



UCDAVIS
UNIVERSITY OF CALIFORNIA

One forecast of BAU Emissions



UCDAVIS
UNIVERSITY OF CALIFORNIA

Basic Points

- All the models will be wrong
  - But *how* much are they wrong (sizes of the errors).
  - *How* bad can it be? (consequences of the errors).
- Models are not forecasts
  - The tools and best practices of forecasting can be of use here.
  - What are the goals of the forecast?
- Policy needs to recognize that reality will not look like the model
  - Policy flexibility
  - Minimize economic losses? Maximize environmental integrity?

Models and Policy Choice

- Current TE models do *not* optimize choice of policies
  - They ballpark costs of a set of policies identified by other means
- They can try to represent the range of costs of *those specific* policies
  - But not do not really give probabilities of those ranges
- They do not capture the benefit of being able to switch to *other* policies or solutions if modeled options turn out to not be the least cost options.
  - Can give us a sense of the ballpark costs of a set of specific policies.
  - But not set up to compare the costs/benefits of choice of specific policies vs. taxes vs. caps.

Summary

- *All* policies have a degree of uncertainty associated with them
- Modeling may make directed policies appear to be more “certain” but that is due to the requirements of a model
  - Reductions from policies are uncertain
  - Levels we are reducing from is uncertain
  - Costs of reductions are uncertain
- Policy process needs to recognize uncertainties and work through acceptable trade-offs in light of them