Plan for the day

08:30 – 09:15	Overview of >25 years of HDGC, CDMC and CEDM – Granger Morgan
09:15 – 10:00	Uncertainty in energy efficiency, Part 1: technologies, strategies, behavior and policy – Inês Azevedo
10:00 – 10:30	Uncertainty in energy efficiency, Part 2: technologies, strategies, behavior and policy – Alex Davis
10:45 – 11:15	Coffee break
11:15 – 11:45	Decision support for implementing the EPA Clean Power Plan Proposed Rule – Jeff Anderson
11:45 – 12:30	Marginal emissions factors, health and climate change co-benefits and trade-offs - Inês Azevedo
12:30 – 13:30	Lunch break
13:30 – 13:55	Insights from twenty years of work on expert elicitation and projections – Granger Morgan
13:55 – 14:05	Transitioning to a low carbon economy, Part 1: Insights from the RenewElec Project – Granger Morgan
14:05 – 14:30	Transitioning to a low carbon economy, Part 2: Insights from ITC and BC's Climate Policy – Hadi Dowlatabadi
14:30 – 15:10	Strategies for supporting investment decisions about large energy infrastructure in the face of regulatory and other uncertainty – Dalia Patiño
15:10 – 15:40	Coffee break
15:40 – 16:00	Reflections on Research and Governance wrt Albedo Modification – Granger Morgan
16:00 – 16:45	Insights From Our Experience in Building and Using ICAMs – Hadi Dowlatabadi
17:45 – 17:00	Muddling through on climate policy: good, but not good enough to avoid the risk of dead ends – Granger Morgan
17:00 – 17:30	Discussion and round table on what investigators in CEDM might best work on in the next several years to be most useful to the IA and energy modeling communities.

Insights from work on expert elicitation and projections.

Prof. M. Granger Morgan
Department of Engineering
and Public Policy
Carnegie Mellon University
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In the next 15 minutes I will talk about three things:

1. Insights we've draw from a series of "expert elicitations" we have conducted in climate science, climate change impacts, and energy technologies.

2. Concerns we have about the use of scenarios as a way to think about the future.

3. Work we have been doing to to assess the performance of energy and other forecasts and better describe the associated uncertainties.

Over the past 20 years…

…we've performed a variety of expert elicitations:

On climate Science:

- M. Granger Morgan and David Keith, "Subjective Judgments by Climate Experts," *Environmental Science & Technology*, *29*(10), 468A-476A, October 1995.
- M. Granger Morgan, Peter Adams, and David W. Keith, "Elicitation of Expert Judgments of Aerosol Forcing," *Climatic Change*, *75*, 195-214, 2006.
- Kirsten Zickfeld, M. Granger Morgan, David Frame and David W. Keith, "Expert Judgments About Transient Climate Response to Alternative Future Trajectories of Radiative Forcing," *Proceedings of the National Academy of Science*, *107*, 12451-12456, July 13, 2010.

On Climate Impacts:

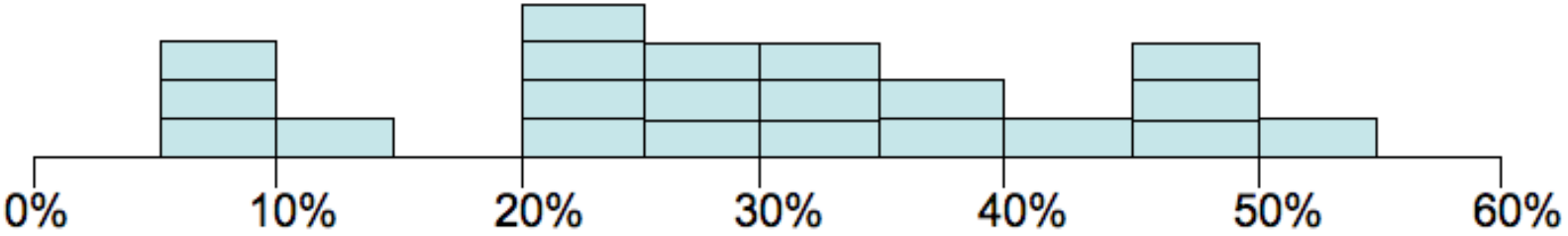
- M. Granger Morgan, Louis F. Pitelka and Elena Shevliakova, "Elicitation of Expert Judgments of Climate Change Impacts on Forest Ecosystems," *Climatic Change*, *49*, 279-307, 2001.
- Kirsten Zickfeld, Anders Levermann, Till Kuhlbrodt. Stefan Rahmstorf, M. Granger Morgan and David Keith, "Expert Judgements on the Response on the Atlantic Meridional Overturning Circulation to Climate Change," *Climatic Change*, *82*, 235-265, 2007.
- Jean-Pierre Gattuso, Katharine J. Mach and Granger Morgan, "Ocean Acidification and Its Impacts: An expert survey," Climatic Change, Climatic change 117(4), 2013, pp 725-738.

On Low Carbon Technologies:

- Aimee Curtright, M. Granger Morgan and David Keith, "Expert Assessment of Future Photovoltaic Technology, " *Environmental Science & Technology*, *42*(24), 2008.
- Ahmed Abdulla, Inês Azevedo and M. Granger Morgan, "Expert Assessments of the Cost of Light Water Small Modular Reactors," *PNAS*, *110*(24), 9686-9691, 2013.

Over confidence

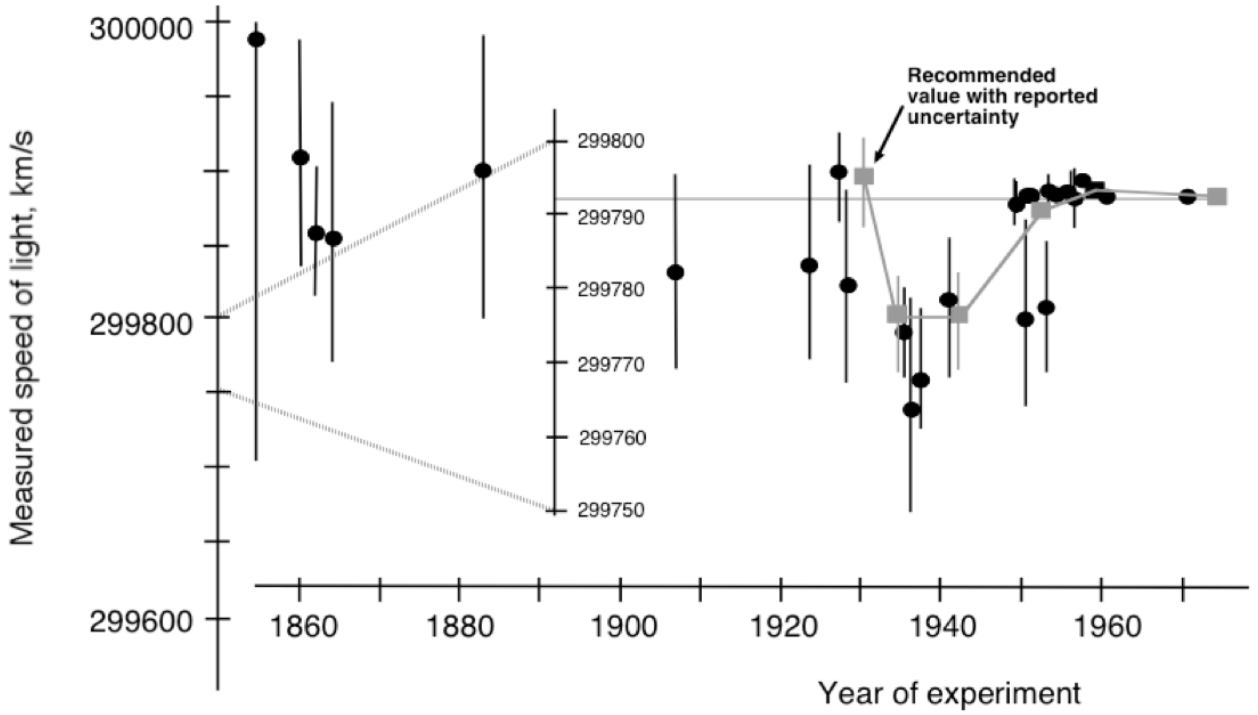
There is considerable evidence in the literature that people are overconfident when they make judgments in the face of uncertainty.



Percentage of estimates in which the true value lay outside of the respondent's assessed 98% confidence interval.

Summary of the value of the "surprise index" (ideal value = 2%) observed in 21 different studies involving over 10,000 assessment questions. These results indicate clearly the ubiquitous tendency to overconfidence (i.e., assessed probabilities that are too narrow). A more detailed summary is provided in Morgan and Henrion (1990).

Experts also are overconfident



Published estimates of the speed of light. The light gray boxes that start in 1930 are the recommended values from the particle physics group that presumably include an effort to consider uncertainty arising from systematic error. Note that for over two decades the reported confidence intervals on these recommended values did not include the present best-measured value. Henrion and Fischhoff (1986), from which this figure is combined and redrawn, report that the same overconfidence is observed in the recommended values of a number of other physical constants.

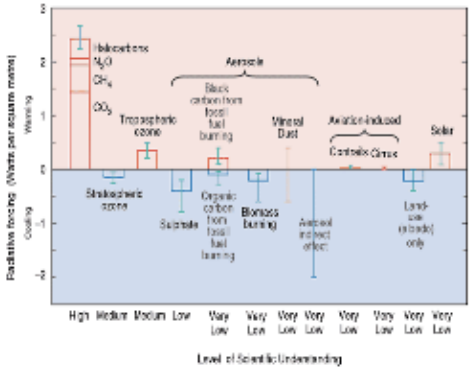
While this is a problem…

…in expert elicitation, and we take various steps to minimize overconfidence it is *also* a problem in any less formal setting, such as IPCC consensus panels.

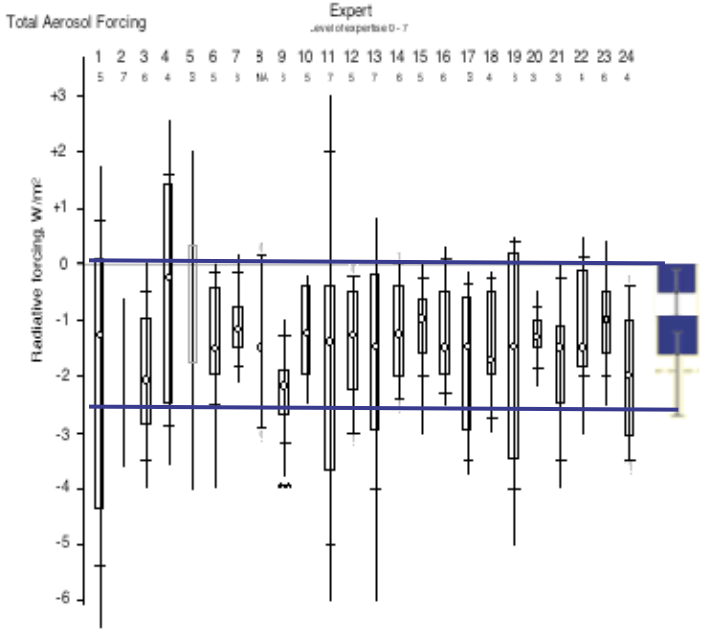
Our results suggest that IPCC consensus judgments may often produce tighter distributions than what one sees when talking with individual investigators.

Comparison with IPCC 4th assessment consensus results

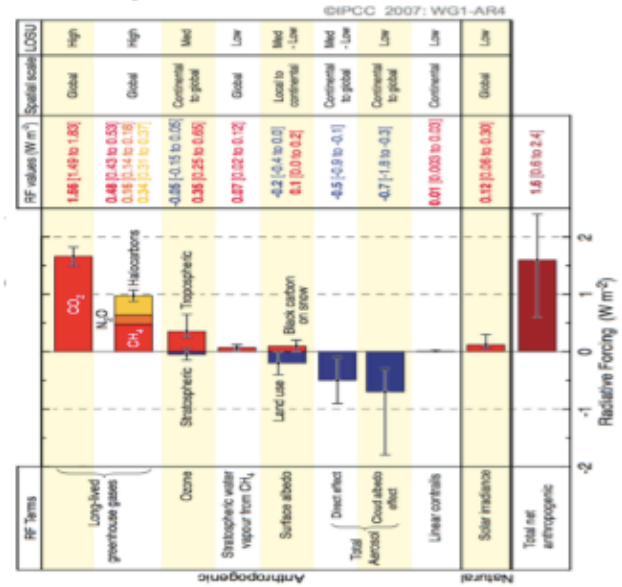
Summary from TAR



Total aerosol forcing from Morgan, Adams and Keith

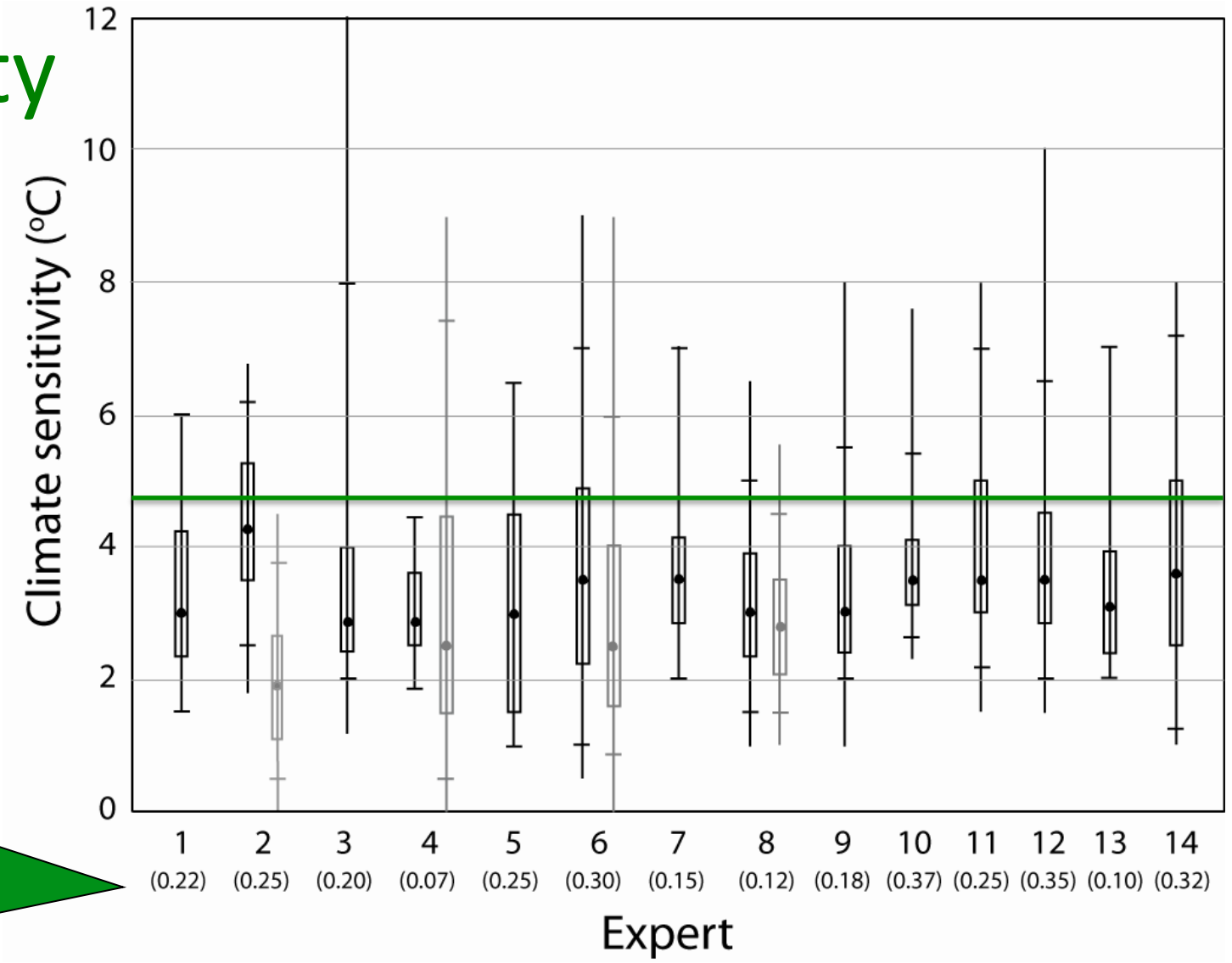


Summary from FR4



M. Granger Morgan, Peter Adams, and David W. Keith, "Elicitation of Expert Judgments of Aerosol Forcing," *Climatic Change*, *75*, 195-214, 2006.

Climate sensitivity



Probability allocated to values above 4.5°C

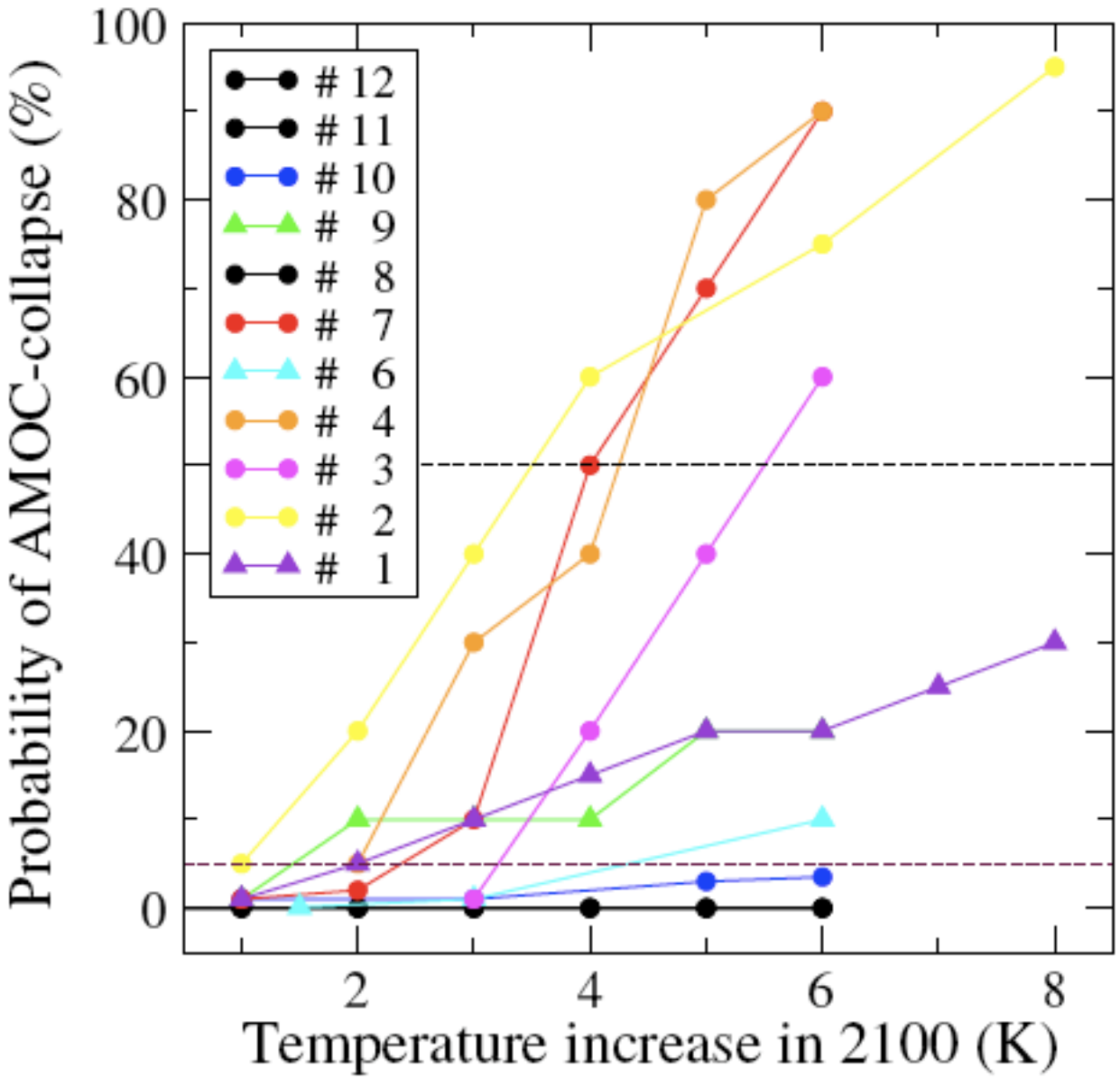
Kirsten Zickfeld, M. Granger Morgan, David Frame and David W. Keith, "Expert Judgments About Transient Climate Response to Alternative Future Trajectories of Radiative Forcing," *Proceedings of the National Academy of Science*, *107*, 12451-12456, July 13, 2010.

Displaying individual results…

…can also give a very different impression than is often conveyed in consensus statement.

An excellent example of this is provided by our study of the AMOC

Probability of AMOC collapse



From Kirsten Zickfeld, Anders Levermann, Till Kuhlbrodt. Stefan Rahmstorf, M. Granger Morgan and David Keith, "Expert Judgements on the Response on the Atlantic Meridional Overturning Circulation to Climate Change," *Climatic Change*, *82*, 235-265, 2007.

Advice for future IPCC assessments

Conduct individual assessments of the author teams before they start working together to produce a consensus judgment.

An editor at PNAS…

…who handled our most recent paper on expert elicitation (of SMRs), said they were getting too many questionable elicitation papers and asked me to prepare this commentary.

PERSPECTIVE

Use (and abuse) of expert elicitation in support of decision making for public policy

M. Granger Morgan[1]
Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA 15213

Edited by William C. Clark, Harvard University, Cambridge, MA, and approved March 18, 2014 (received for review October 22, 2013)

The elicitation of scientific and technical judgments from experts, in the form of subjective probability distributions, can be a valuable addition to other forms of evidence in support of public policy decision making. This paper explores when it is sensible to perform such elicitation and how that can best be done. A number of key issues are discussed, including: topics on which there are, and are not, experts who have knowledge that provides a basis for making informed predictive judgments; the inadequacy of only using qualitative uncertainty language; the role of cognitive heuristics and of overconfidence; the choice of experts; the development, refinement, and iterative testing of elicitation protocols that are designed to help experts to consider systematically all relevant knowledge when they make their judgments; the treatment of uncertainty about model functional form; diversity of expert opinion; and when it does or does not make sense to combine judgments from different experts. Although it may be tempting to view expert elicitation as a low-cost, low-effort alternative to conducting serious research and analysis, it is neither. Rather, expert elicitation should build on and use the best available research and analysis and be undertaken only when, given those, the state of knowledge will remain insufficient to support timely informed assessment and decision making.

Society often calls on experts for advice that requires judgments that go beyond well-established knowledge. In providing such judgments, it is common practice to use simulation models, engineering-economic assessment, and similar tools. Although such analytical strategies can provide valuable insight, they can never hope to include all relevant factors. In such situations, the community of applied decision analysis has long used quantitative expert judgments in the form of subjective probability distributions that have been elicited from relevant experts. Most such applications have been undertaken in support of decisions being made by private parties (1–4). Sometimes the resulting distributions are used directly, and sometimes they are fitted to formal functions and used in various Bayesian decision models (2, 5).

The use of expert elicitation in public sector decision making has been less common. Several studies have explored issues such as the health impacts of fine particle air pollution (6–12) and of lead pollution (13), the likely nature and extent of climate change (14–16), the various impacts that may result from climate change (17, 18), herbicide-tolerant oilseed crops (19), and the likely cost and performance of various energy technologies (20–24). The Environmental Protection Agency (EPA) has begun to make use of elicitation methods to address uncertain issues in environmental science (25), and those who work in both the Department of Energy and the Food and Drug Administration (FDA) have expressed interest in possibly using the method.

Done well, expert elicitation can make a valuable contribution to informed decision making. Done poorly it can lead to useless or even misleading results that lead decision makers astray, alienate experts, and wrongly discredit the entire approach. In what follows, I draw on relevant literature and 35 y of personal experience in designing and conducting substantively detailed expert elicitations, to suggest when it does and does not make sense to perform elicitations, how they should be designed and conducted, and how I believe the results should and should not be used. In contrast to much of the literature in Bayesian decision-making and applied decision analysis, my focus is on developing detailed descriptions of the state of understanding in some field of science or technology.

First, Are There Any Experts?

To conduct an expert elicitation, there must be experts whose knowledge can support informed judgment and prediction about the issues of interest. There are many topics about which people have extensive knowledge that provides little or no basis for making informed predictive judgments. For example, the further one moves away from questions whose answers involve matters of fact that are largely dependent on empirical natural or social science and well-validated models into realms in which individual and social behavior determine the outcomes of interest, the more one should ask whether expertise, with predictive capability, exists. For example, given a specified time series of future radiative forcing and other relevant physical variables, in my view, it is reasonable to ask climate scientists to make probabilistic judgments about average global temperature 150 y in the future. I am far less persuaded that it makes sense to ask "experts" questions that entail an assessment of how the stock market, or the price of natural gas will evolve over the next 25 y, or what the value of gross world product will be 150 y in the future.

The Interpretation of Probability

A subjectivist or Bayesian interpretation of probability (5, 26–28) is used when one makes subjective probabilistic assessments of the present or future value of uncertain quantities, the state of the world, or the nature of the processes that govern the world. In such situations, probability is viewed as a statement of an individual's belief, informed by all formal and informal evidence that he or she has available. Although subjective, such judgments cannot be arbitrary. They must conform to the laws of probability. Further, when large quantities of evidence are available on identical repeated events, one's subjective probability should converge to the classical frequentist interpretation of probability.

Partly as a result of their different training and professional cultures, different groups of experts display different views about the appropriateness of making subjective probabilistic judgments, and have different levels of willingness to make such judgments. Although every natural scientist and engineer I have ever interviewed seemed to think naturally in terms of subjective probabilities, others, such as some experts in the health sciences, have been far

Author contributions: M.G.M. designed research, performed research, and wrote the paper.
The author declares no conflict of interest.
This article is a PNAS Direct Submission.
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This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1319946111/-/DCSupplemental.

In the next 15 minutes I will talk about three things:

1. Insights we've draw from a series of "expert elicitations" we have conducted in climate science, climate change impacts, and energy technologies.

2. Concerns we have about the use of scenarios as a way to think about the future.

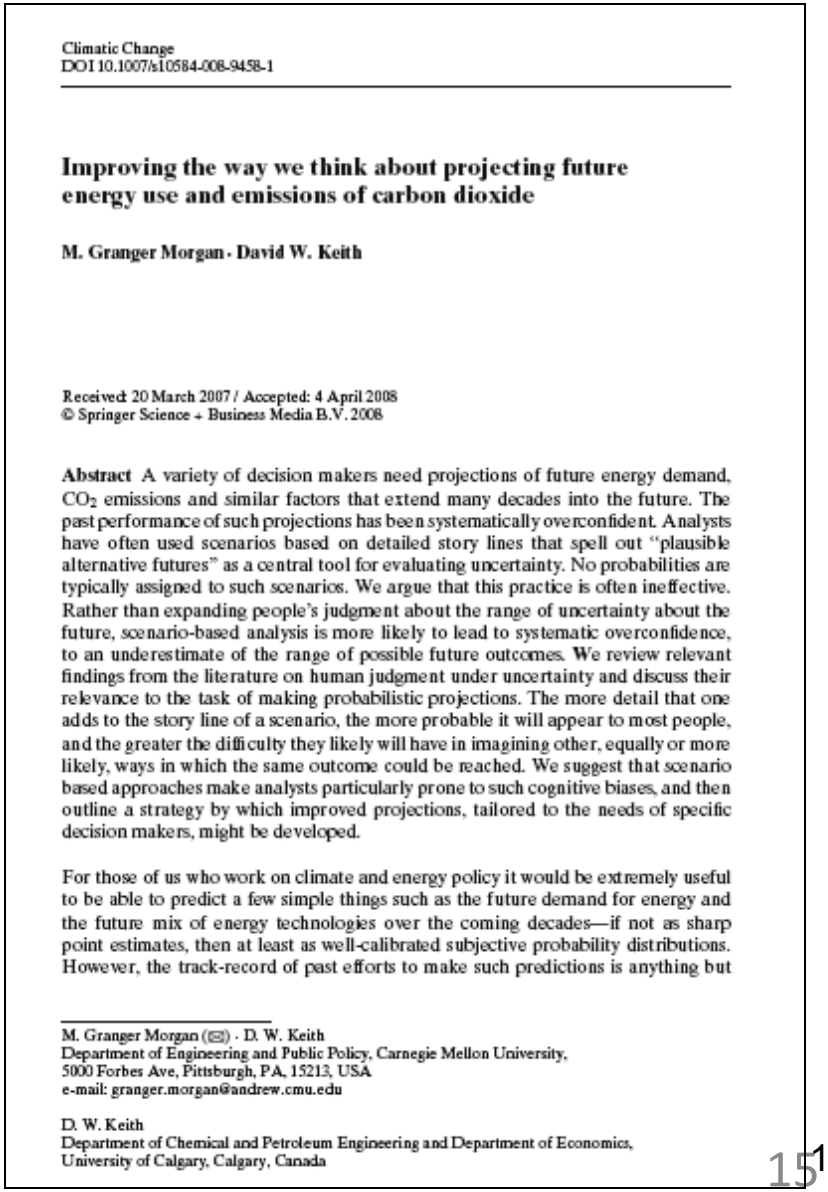
3. Work we have been doing to to assess the performance of energy and other forecasts and better describe the associated uncertainties.

Problems with conventional scenarios

Analysts often use scenarios based on detailed story lines that spell out "plausible alternative futures." Typically no probabilities are assigned.

Rather than expanding people's judgment about the range of uncertainty about the future, in my view such scenario-based analysis often leads to systematic overconfidence and an underestimate of the range of possible future outcomes.

Because of the cognitive heuristic of "availability" the more detail that one adds to the story line of a scenario, the more probable it is likely to appear, and the greater the difficulty people will have in imagining other, equally or more likely ways in which the same outcome could be reached.



Climatic Change
DOI 10.1007/s10584-008-9458-1

Improving the way we think about projecting future energy use and emissions of carbon dioxide

M. Granger Morgan · David W. Keith

Received: 20 March 2007 / Accepted: 4 April 2008

Abstract A variety of decision makers need projections of future energy demand, CO_2 emissions and similar factors that extend many decades into the future. The past performance of such projections has been systematically overconfident. Analysts have often used scenarios based on detailed story lines that spell out "plausible alternative futures" as a central tool for evaluating uncertainty. No probabilities are typically assigned to such scenarios. We argue that this practice is often ineffective. Rather than expanding people's judgment about the range of uncertainty about the future, scenario-based analysis is more likely to lead to systematic overconfidence, to an underestimate of the range of possible future outcomes. We review relevant findings from the literature on human judgment under uncertainty and discuss their relevance to the task of making probabilistic projections. The more detail that one adds to the story line of a scenario, the more probable it will appear to most people, and the greater the difficulty they likely will have in imagining other, equally or more likely, ways in which the same outcome could be reached. We suggest that scenario based approaches make analysts particularly prone to such cognitive biases, and then outline a strategy by which improved projections, tailored to the needs of specific decision makers, might be developed.

For those of us who work on climate and energy policy it would be extremely useful to be able to predict a few simple things such as the future demand for energy and the future mix of energy technologies over the coming decades—if not as sharp point estimates, then at least as well-calibrated subjective probability distributions. However, the track-record of past efforts to make such predictions is anything but

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Department of Chemical and Petroleum Engineering and Department of Economics,
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Indeed, in writing that paper…

…I found the following very troubling (and almost certainly true) assertion from one of the strong proponents of using scenarios:

> Practitioners can find several advantages in using scenarios. First, they can use scenarios to enhance a person's or group's expectancies that an event will occur. This can be useful for gaining acceptance of a forecast…Second, scenarios can be used as a means of decreasing existing expectancies…Third…scenarios can produce greater commitment in the clients to taking actions described in them.

Source: W. Larry Gregory, "Scenarios and Acceptance of Forecasts," 519-540, in *Principles of Forecasting: A handbook for researchers and practitioners*, J. Scott Armstrong (ed.), 849pp., Kluwer Academic, 2001.

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Probability and Scenarios

As most of you know, Steve Schneider, as well as others, argued that without probabilities, scenarios are of little value to climate scientists and impact assessors who are trying to understand how the climate is likely to evolve over the coming centuries.

> While acknowledging the logic of avoiding fruitless debate, I strongly argued…that policy analysts needed probability estimates to assess the seriousness of the implied impacts; otherwise they would be left to work out the implicit probability assignments for themselves… I urged the expert group to provide a subjective probability assessment for less expert users, but I was not persuasive enough, and the SRES authors expressed "no preference" for each scenario.

Source: Stephen H. Schneider, "What Is 'Dangerous' Climate Change?," *Nature*, *411*, 17-19, May 3, 2001.

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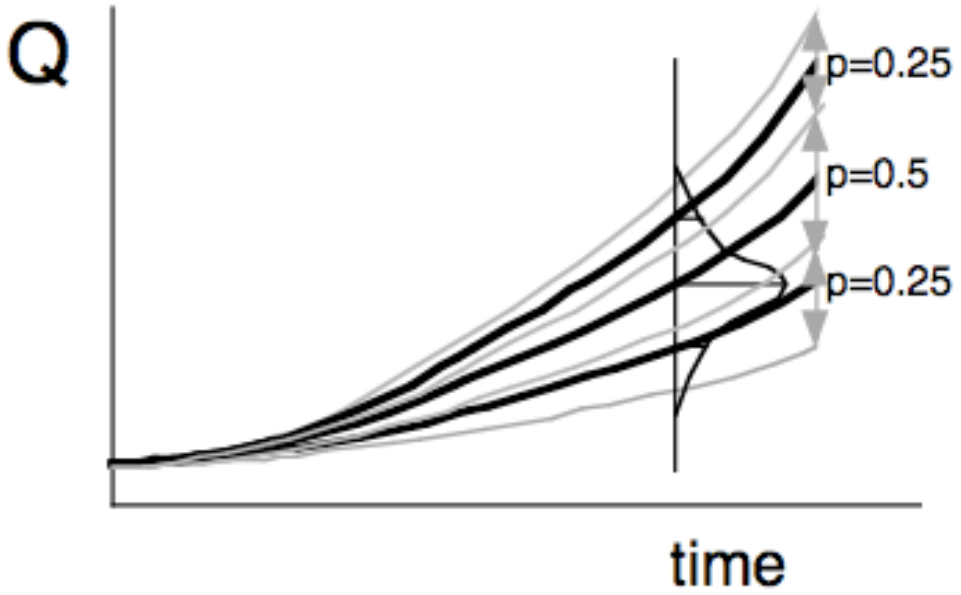
Of course…

…if we think of a scenario as describing a series of points over time through a multi-dimensional space of future possible socioeconomic conditions, scenarios cannot be assigned probabilities since, in any probability distribution over a continuous variable, the probability that attaches to any specific point value or line through that space is zero.

BUT…one *can* attach probabilities to intervals in such a space.



For more elaboration of these and related ideas see:

M. Granger Morgan and David Keith, "Improving the Way We Think About Projecting Future Energy Use and Emissions of Carbon Dioxide," *Climatic Change*, *90*(3),189-215, October 2008.

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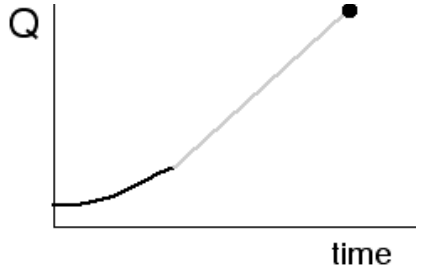
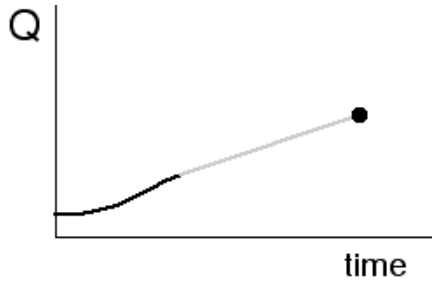
One alternative is bounding analysis

Given some quantity Q whose value you want to project in the future, rather than developing a few very detailed "story lines" instead work to build a list of:

All the developments that might lead to its having a high value



All the developments that might lead to its having a low value



Then, subject the resulting lists and analysis to repeated critical review and revision.

Again for details see: M. Granger Morgan and David Keith, "Improving the Way We Think About Projecting Future Energy Use and Emissions of Carbon Dioxide," *Climatic Change*, *90*(3), 189-215, October 2008.

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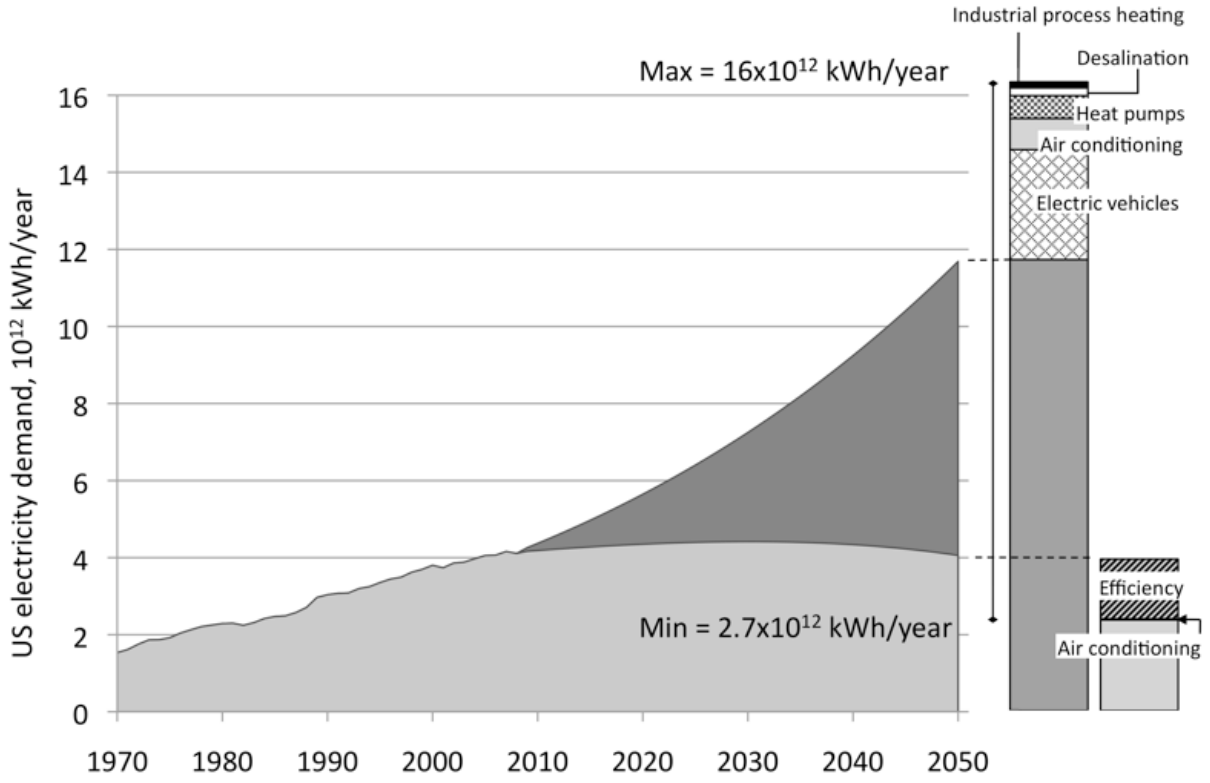
Without going through any details…

…here is the result of a bounding analysis of future US electricity demand produced by student Vanessa Schweizer.
(paper now in review at *Technological Forecasting and Social Change*)



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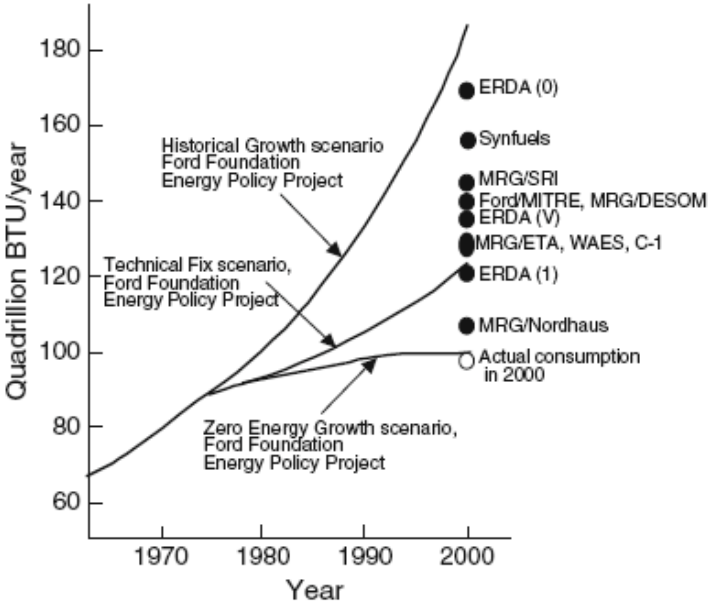
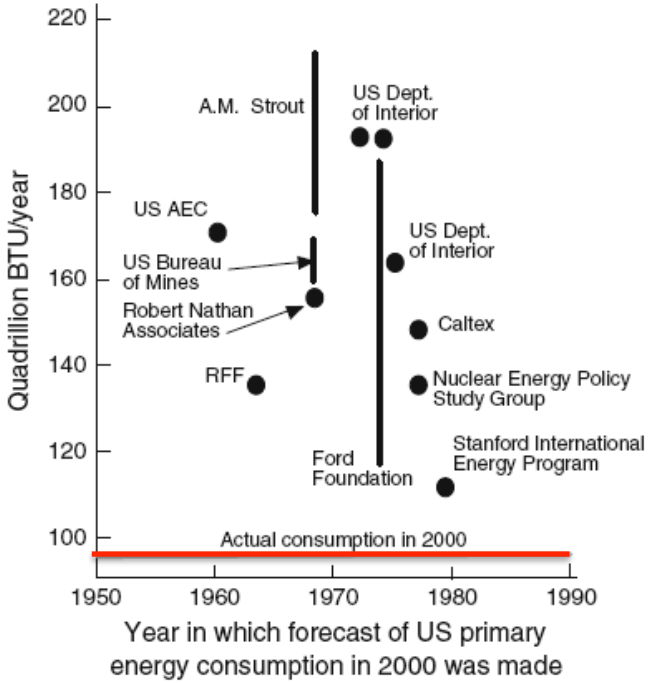
Predictions of US Energy Consumption

Summary of forecasts of U.S. primary energy consumption for the year 2000 compiled by Smil (2003) as a function of the date on which they were made.





Comparison of forecasts of U.S. primary energy consumption for the year 2000 compiled by Greenberger in the early 1980s compared with three scenarios developed by the Ford Foundation Energy Project.

Figures from Morgan and Keith, 2008

In the next 15 minutes I will talk about three things:

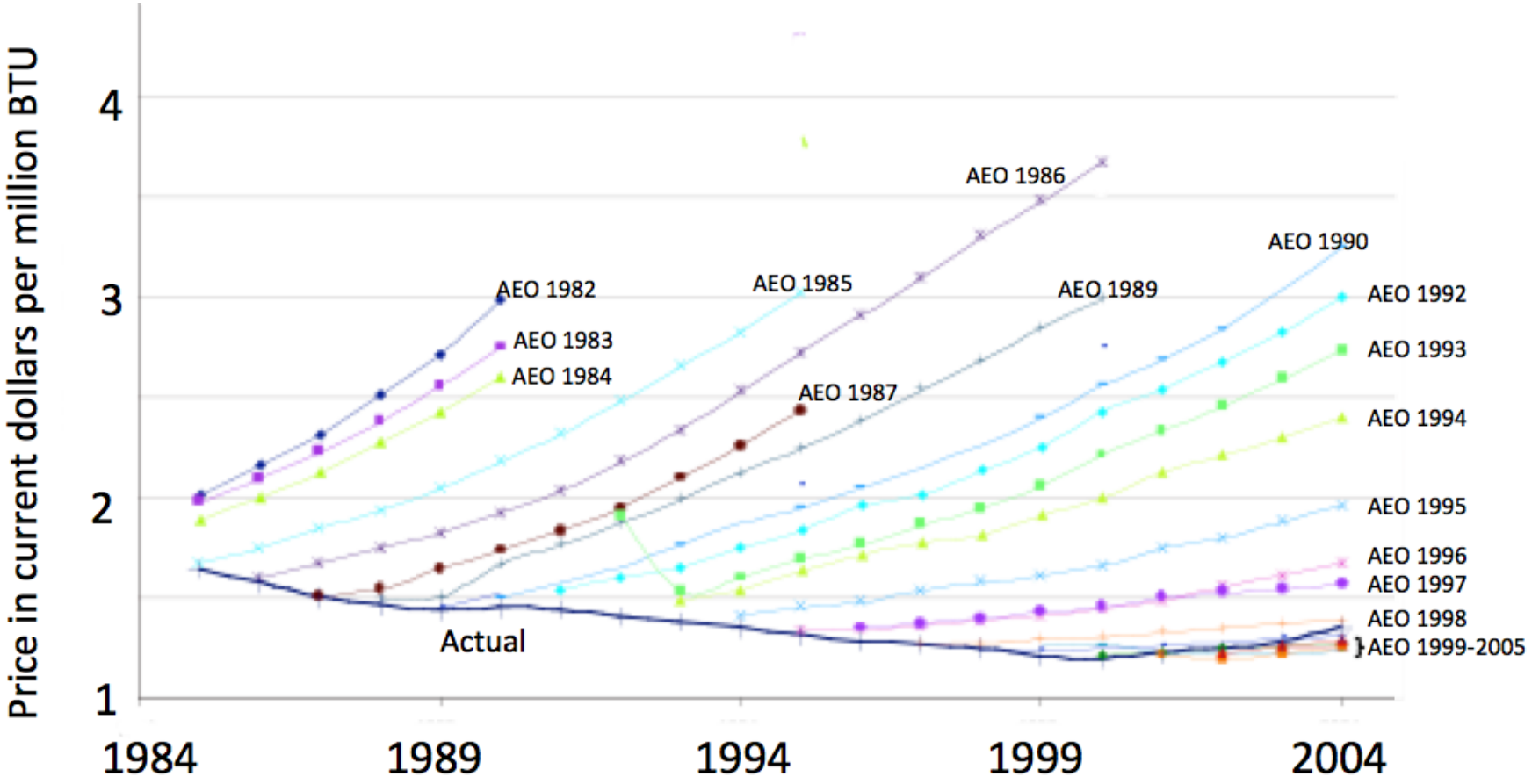
1. Insights we've draw from a series of "expert elicitations" we have conducted in climate science, climate change impacts, and energy technologies.

2. Concerns we have about the use of scenarios as a way to think about the future.

3. Work we have been doing to to assess the performance of energy and other forecasts and better describe the associated uncertainties.

EIA - AEO

Coal prices to electric generating plants. EIA-AEO 1984-2005.



Complied by Adam Newcomer, 2007

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2013 Theory and Methods Workshop

Workshop on methods to address uncertainty in forecasting future values of key social, economic and resource variables

Revelle Conference Room, 2nd floor, AAAS Building
1200 New York Avenue, NW
Washington, DC 20005
Dial-in information for those participating via telephone: *1-800-391-1709 (domestic)*
001-310-539-2229 (international)
312582 (Bridge number)

Monday, March 18

10:00 – 10:15 Welcome and introductions
10:15 – 10:30 Overview: Motivations and what we hope to accomplish – G. Morgan, CMU
10:30 – 10:40 Discussion
10:40 – 11:30 Assessing past performance:
- Energy forecasts –Paul Craig, UC Irvine
- Energy forecasts – H. Gruenspecht, EIA
- History of natural gas price forecasts – J. Snyder, Wood Mackenzie (via remote connection)
- The more believable the forecasts, the worse it will be – P. Fischbeck, CMU

11:30 – 12:00 Roundtable discussions of:
- Attributes of variables that can and cannot be reliably predicted.
- Could we sensibly include uncertainty even if we want to?
- If we could produce assessments with more complete descriptions of uncertainty, would many people continue to prefer single-value best-estimate forecasts of such variables?

12:00 – 12:15 Pick up box lunches
12:15 – 13:45 Thoughts on scenarios:
- IPCC experience – N. Nakicenovic, IIASA
- The RCP process and the U.S. National Assessment experience – R. Moss, PNNL
- Experience from the assessment community – J. Edmonds, PNNL
- Policy makers and assessors: What do they want and need? – H. Gruenspecht, EIA
- Scenario development with the cross-impact balance (CIB) method – V. Schweizer, NCAR

13:45 – 14:15 Roundtable discussions of:
- Is it feasible to be generating scenarios that are regions of a "function space" rather than a line through that space?
- If folks were to start doing that, what would be the issues with users?

14:15 – 14:35 A Bayesian approach to demographic forecasting – A. Raftery, UWash (via remote connection)
14:35 – 14:45 Q&A and discussion. How well might this approach extend to other variables of interest in the areas of climate and energy assessment?
14:45 – 15:00 A bounding analysis of future U.S. electricity demand - V. Schweizer, NCAR
Q&A and discussion. Are the bounds Vanessa has produced so broad that they are useless? If an assessment like this were made so that it was interactive, and people could apply their own assumptions, would that be useful?
Break for tea and coffee
MegaJoule – M. Henrion, Lumina Systems
Q&A and discussion. Assuming that a system like this becomes widely used, would the likely diversity of views and projections that it would contain help to promote greater and more systematic treatment of uncertainty in forecasting?
Incentives for scientists in describing and communicating uncertainty – B. Fischhoff, CMU
Q&A and discussion
View around the table:
- Are you guys from Carnegie Mellon nuts to be trying to promote greater attention to uncertainty in forecasting?
- If no, are there additional ideas for how this might be done that we have not talked about?
- Do you have suggestions for issues that we should be discussing tomorrow?

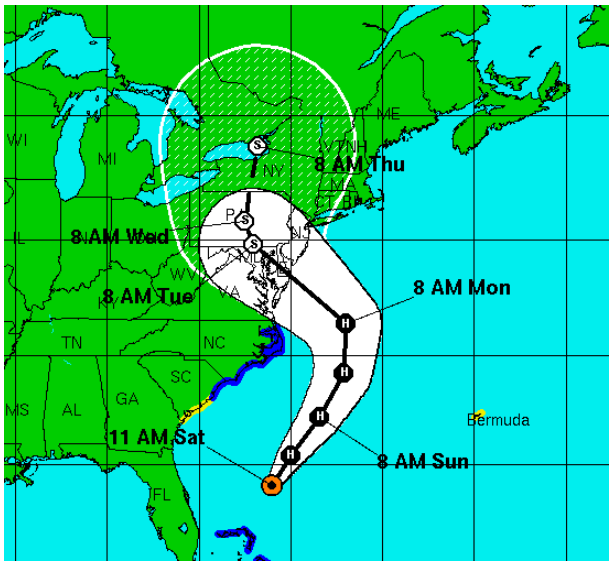
Group Dinner at the Tabard Inn, 1739 N Street, NW, Washington, DC (202-785-1277)

Continental breakfast
Roundtable: Suppose we could develop better methods for characterizing uncertainty in forecasts. What should such "improved" forecasts look like? Would anybody use them? If so, who would use them and how?
Ten minute comments by:
M. Henrion, Lumina
T. Janetos, PNNL
R. Lempert, RAND
H. Dowlatabadi, UBC
E. Rubin, CMU
G. Escher, EPFL
E. Paté-Cornell, Stanford
General discussion
Break for tea and coffee
Group discussion followed by reflections around the table from each participant:
- Do we need improved methods to describe uncertainty in forecasts of key social, economic and resource variables?
- If yes, what research or demonstration activities would be best to promote their development and use?

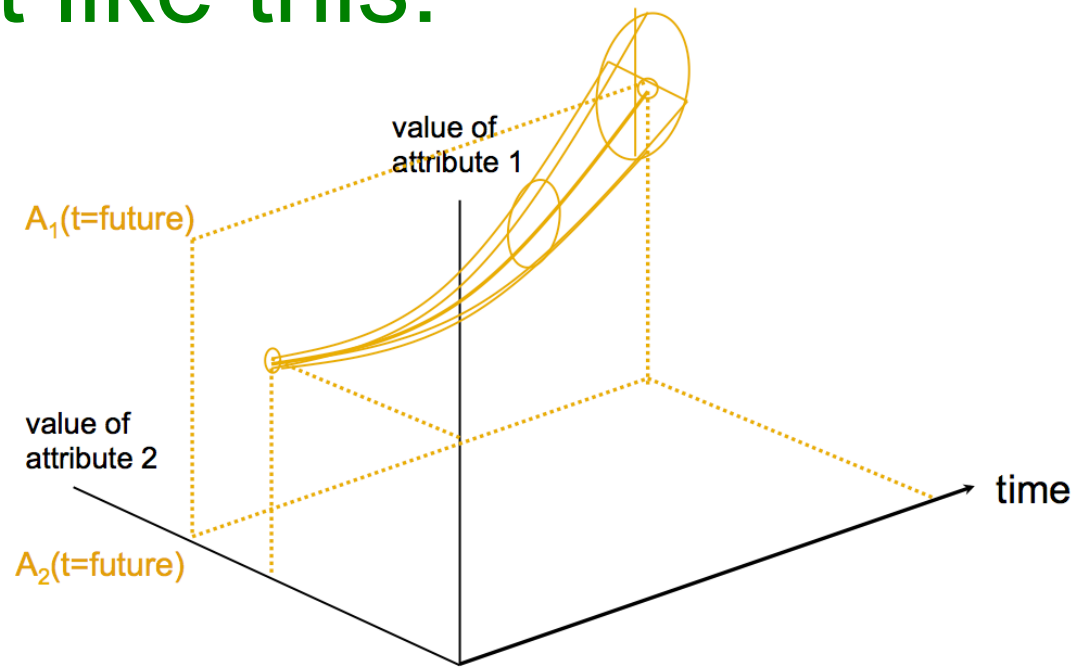
Lunch available – informal discussion around the table

This workshop is one in a series of "Theory and Methods Workshops" being organized by the center for Climate and Energy Decision Making (http://cedm.epp.cmu.edu/) which is supported through a cooperative agreement between the National Science Foundation and Carnegie Mellon University (SES-0949710).

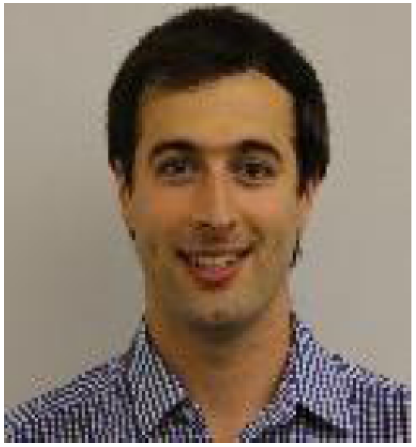
Just like we have hurricane forecasts like this:



We need energy forecast like this:



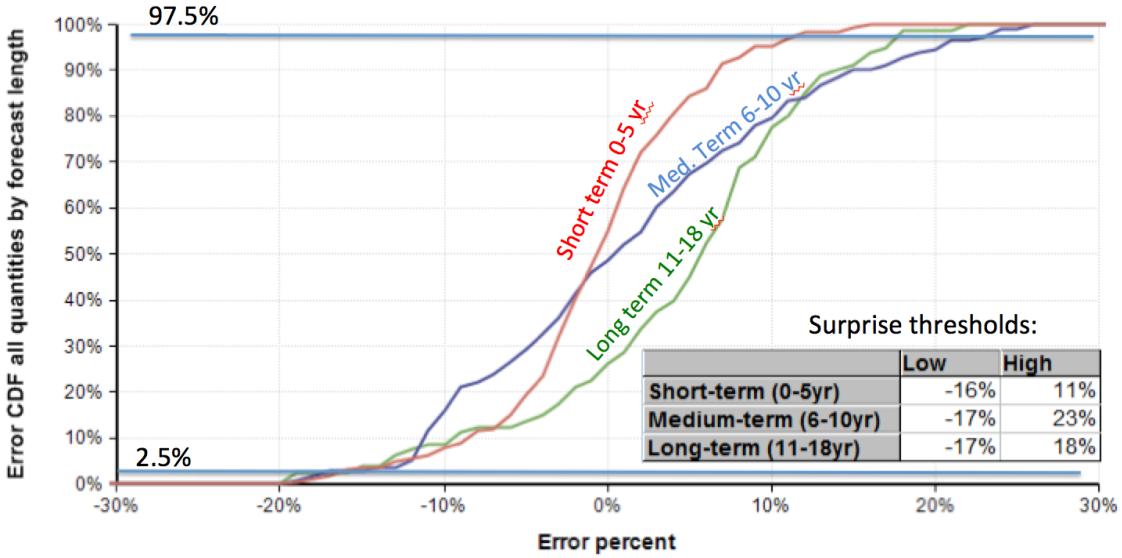
We now have two PhD students working to develop better methods to deal with uncertainty in forecasts

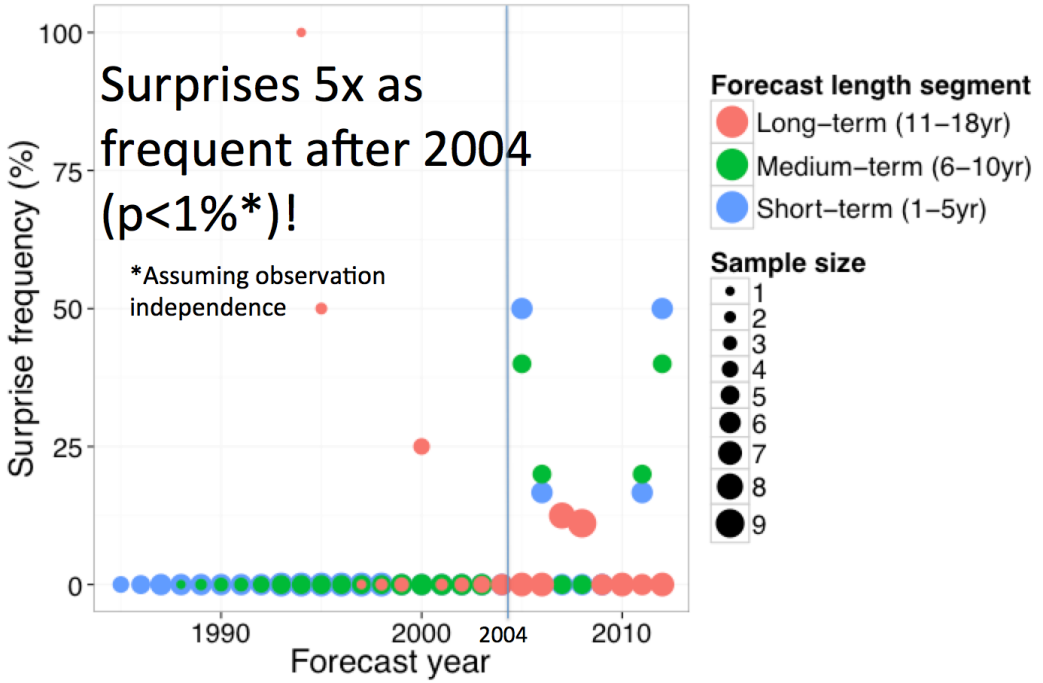


Evan Sherwin is working on defining and analyzing surprises in energy forecasts.

Lynn Kaack is working on introducing probability into energy forecasts.

Gas production forecast errors



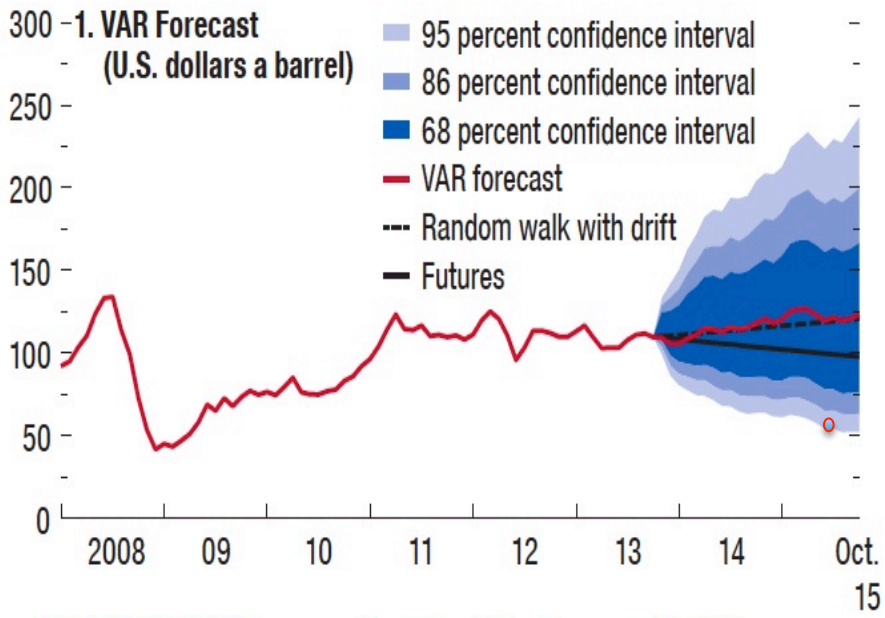


Examples from Economics

International Monetary Fund

- World Economic Outlook 2014: oil price forecast by vector autoregression (VAR)
- Use of fan chart since 2006 [WEO 2009] for global growth projections: incorporating uncertainty of input variables, survey-based measures and option prices

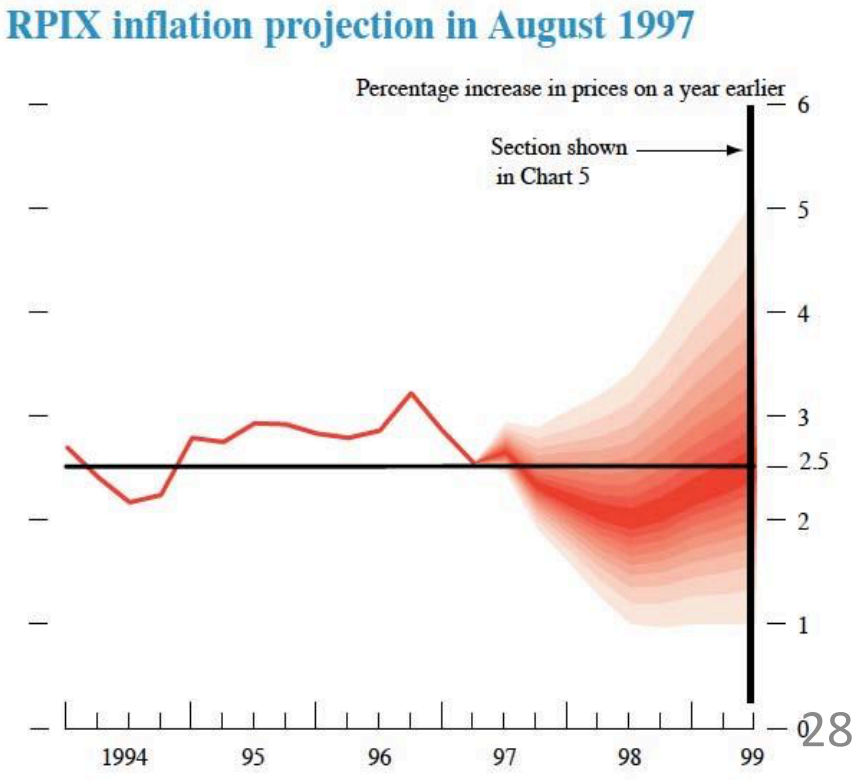
[IMF, WEO 2014]



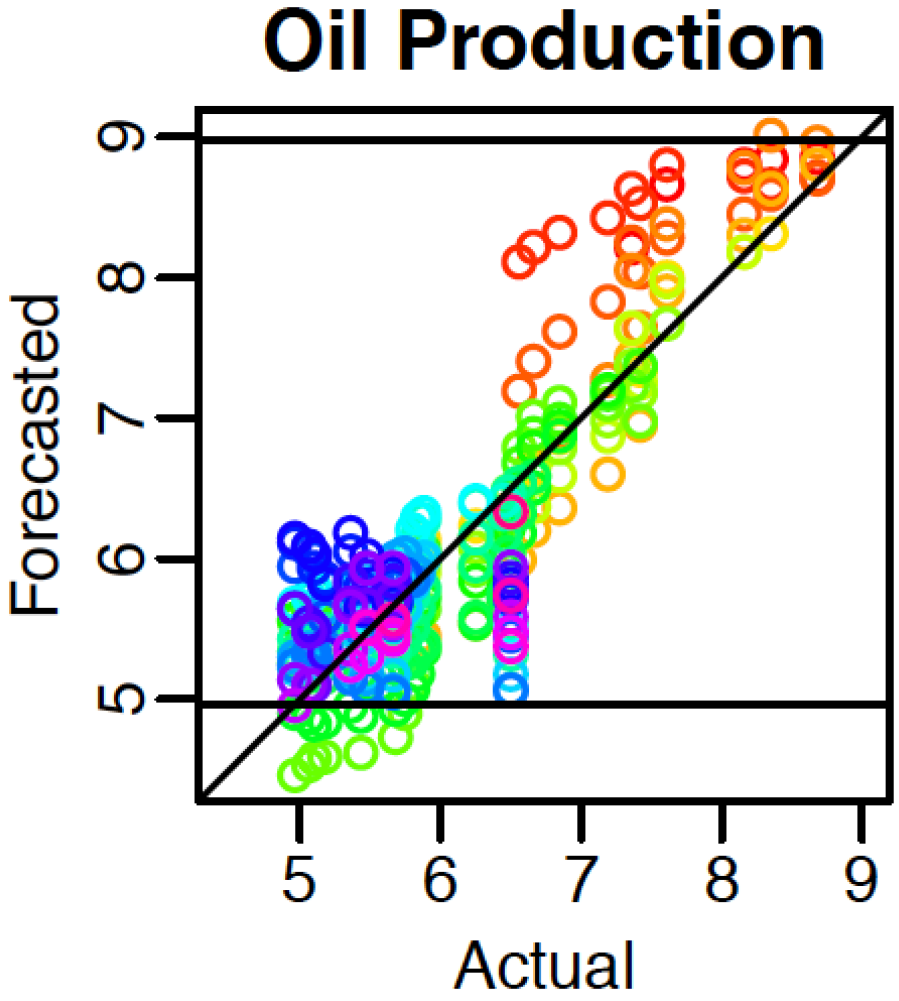
Inflation Forecasts

- Bank of England started 'fan chart' 1996 [Britton et al., 1998], many central banks adopted
- Banks differ in the way they combine judgement, retrospective analysis, use of multiple models and uncertainty of key input variables for find the uncertainty range [Julio, 2007, Blix and Sellin, 1998]

[Britton et al., 1998]



Comparing projected with actual

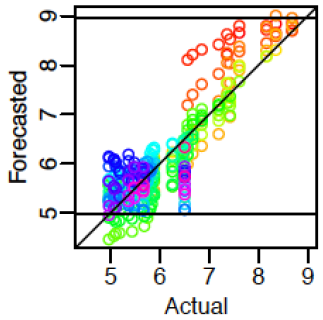


AE 1982

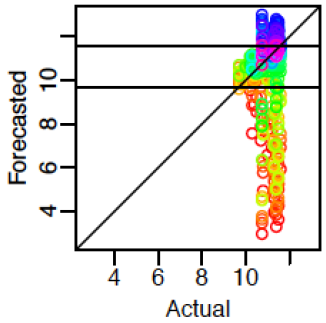
AE 2012

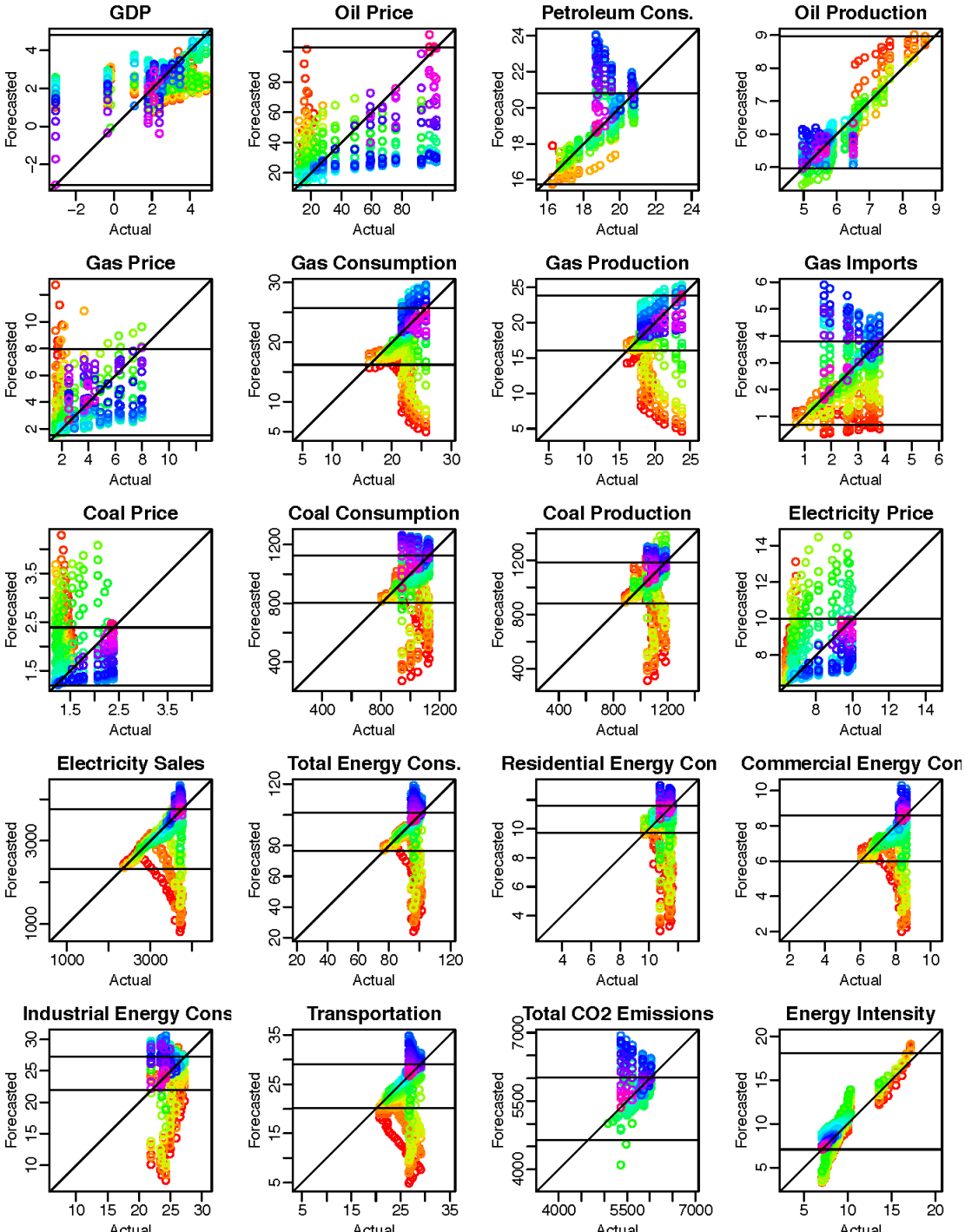
Comparing predicted with actual over time

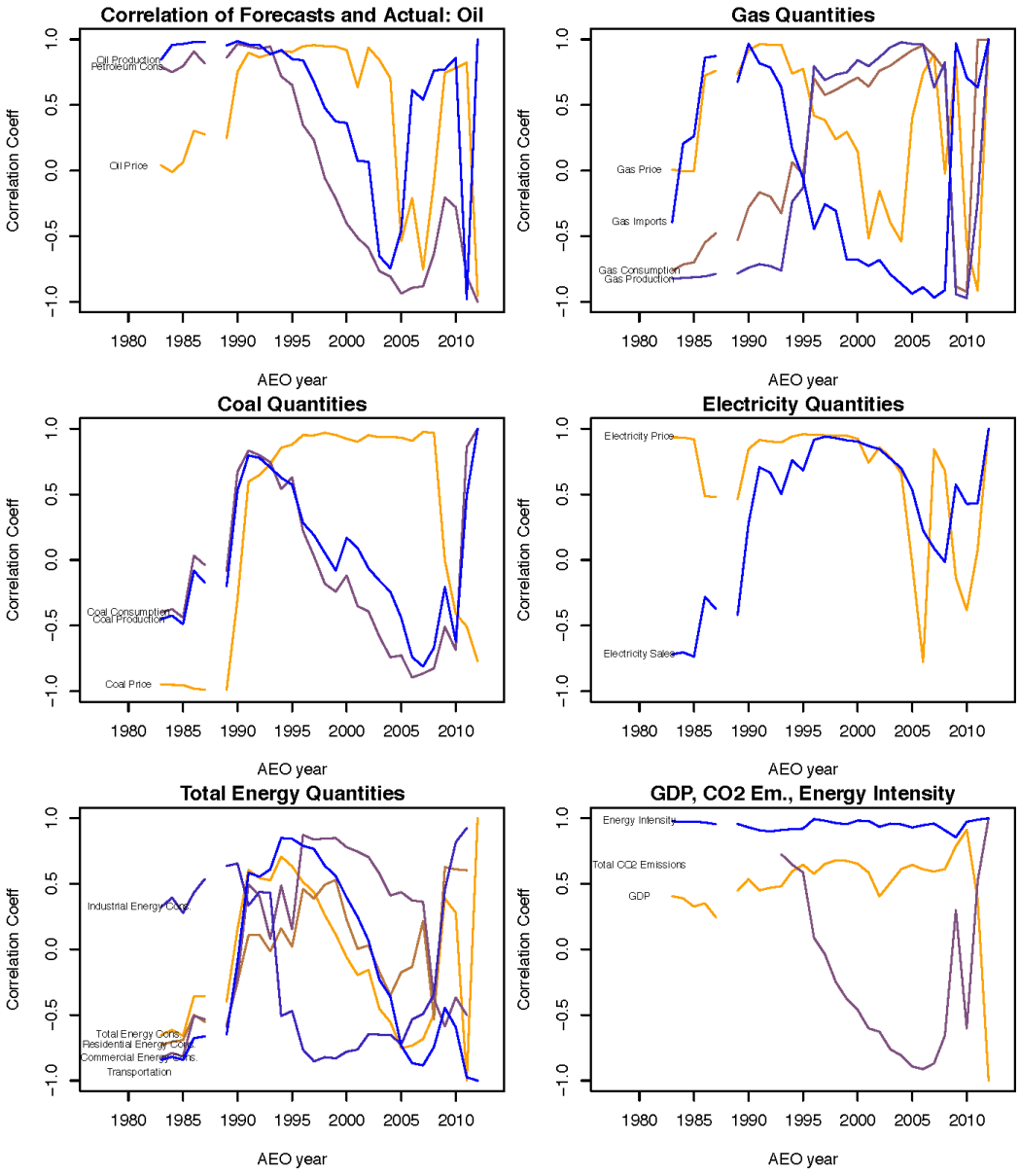
Asking why do some do quite well:



While others are very poor:







Also looking at correlation coefficients over time

Lynn is finding…

…that error distributions do not correspond to a single probability density function and require non-parametric quantile regression.

She expects that calibration and sharpness of prediction intervals will be improved by identifying non-stationarity with change point analysis.

The prediction intervals for the EIA coal forecasts span a considerably wider range than captured by EIA'sscenario analysis. She expects similar results for other quantities and for IEA projections.

So far she is challenging the assertion by some that forecasts are systematically biased.

Bottom Line

It is our plan to develop specific guidance for institutions on how to construct and incorporate sound prediction intervals in future energy outlooks.

We expect our findings to also be applicable to projections made in other fields.

Plan for the day

08:30 – 09:15	Overview of >25 years of HDGC, CDMC and CEDM – Granger Morgan
09:15 – 10:00	Uncertainty in energy efficiency, Part 1: technologies, strategies, behavior and policy – Inês Azevedo
10:00 – 10:30	Uncertainty in energy efficiency, Part 2: technologies, strategies, behavior and policy – Alex Davis
10:45 – 11:15	Coffee break
11:15 – 11:45	Decision support for implementing the EPA Clean Power Plan Proposed Rule – Jeff Anderson
11:45 – 12:30	Marginal emissions factors, health and climate change co-benefits and trade-offs - Inês Azevedo
12:30 – 13:30	Lunch break
13:30 – 13:55	Insights from twenty years of work on expert elicitation and projections – Granger Morgan
13:55 – 14:05	Transitioning to a low carbon economy, Part 1: Insights from the RenewElec Project – Granger Morgan
14:05 – 14:30	Transitioning to a low carbon economy, Part 2: Insights from ITC and BC's Climate Policy – Hadi Dowlatabadi
14:30 – 15:10	Strategies for supporting investment decisions about large energy infrastructure in the face of regulatory and other uncertainty – Dalia Patiño
15:10 – 15:40	Coffee break
15:40 – 16:00	Reflections on Research and Governance wrt Albedo Modification – Granger Morgan
16:00 – 16:45	Insights From Our Experience in Building and Using ICAMs – Hadi Dowlatabadi
17:45 – 17:00	Muddling through on climate policy: good, but not good enough to avoid the risk of dead ends – Granger Morgan
17:00 – 17:30	Discussion and round table on what investigators in CEDM might best work on in the next several years to be most useful to the IA and energy modeling communities.