

# MIND THE GAP: EVALUATING THE ACCURACY OF EIA'S ELECTRICITY PRICE FORECASTS AMID RISING UTILITY COSTS

*Charles Hanks, Evergreen Economics, Portland OR*

## Introduction

This poster presents a comparison of forecasted and historical national electricity prices from 1997 to 2022, examining how well forecasts by the Energy Information Administration (EIA) have aligned with national average residential electricity costs. As the energy sector undergoes significant transformation driven by renewable energy, increasing consumer electricity demand, and rising electricity rates, understanding the reliability of these forecasts is important for implementers and evaluators of energy efficiency programs.

Each year, EIA publishes long-term forecasts of electricity prices for the residential, commercial, and industrial sectors in its *Annual Energy Outlook* (AEO). These forecasts serve as crucial inputs for federal and state, as well as independent evaluators in regulatory decision-making. For example, the Environmental Protection Agency (EPA) used AEO forecasts to support the 2019 Affordable Clean Energy ruling and repeal of the Clean Power Plan. Similarly, the Department of Energy relies on AEO energy price data for impact analyses of building energy codes, projecting energy cost savings through 2040. Our objective was to assess the accuracy of EIA's electricity price forecasts specifically for the residential sector. The accuracy of these forecasts determines their utility in cost-effectiveness testing and the program evaluations they inform.

## Methodology

We compiled a dataset of EIA's historical and forecasted (reference case) national electricity prices from 1997–2022, totaling 647 observations across the residential, commercial, and industrial sectors. This poster focuses on the residential sector, comparing actual national average prices (\$/kWh) to AEO forecasts. Key variables and metrics of this analysis include:

- Forecast year – the year the forecast was published.
- Forecast horizon – the number of years into the future projected (1–22 years).
- Absolute Percentage Error (APE) – the absolute difference between forecasted and actual prices, divided by the actual price, expressed as a percentage.

We applied this framework to quantify the magnitude and direction of forecast errors across horizons and publication years.

## Findings

The Annual Energy Outlook forecasts have consistently underestimated residential electricity price increases over the past two decades. Between 2005 and 2021, the average forecasted price was \$0.03 per kWh lower than the actual price of electricity. However, the gap between forecasted and actual prices is shrinking as forecast accuracy has substantially improved since 2005. Forecasting accuracy was poorest during 2002–2007, with longer-term forecasts showing substantial errors. For example, the 10-year forecast made in 2007 for 2017 was 30% below the actual 2017 electricity price. All forecast horizons demonstrated substantial improvement after 2005, achieving much lower error rates in recent years.

Mean absolute percentage error (MAPE) for EIA residential electricity price forecasts increases systematically with forecast horizon, from 7.9 percent for 1-year forecasts to 29.2 percent for 10-year forecasts, demonstrating the fundamental limitations of long-term energy price forecasting. For every one-year increase in

the forecast horizon, the average error of the forecast increases by 2 percent. When examining forecasts made five years apart, forecasts remained flat or declining through 2005, with the first upward price projections not appearing until 2010.

## **Conclusion**

Unadjusted use of AEO forecasts in cost-effectiveness tests of energy efficiency programs can undervalue customer bill savings. If evaluators rely on EIA forecasts without adjustment, they may underestimate the value of energy savings over a measure's lifetime, which could reduce the apparent cost-effectiveness of certain programs or measures. We recommend limiting reliance on EIA electricity price forecasts to a seven-year threshold. Forecasts beyond ten years risk errors exceeding 30 percent.

The substantial improvements in EIA's forecasting methodology, evidenced by reduced error rates in recent years, coincide with updates to the National Energy Modeling System. With EIA's significant updates to this system in 2024, future research opportunities exist to assess whether these changes further improve electricity price forecasting accuracy for residential sector applications.