Comparing model accuracy before and after applying hyperparameter tuning can help determine the impact of fine-tuning on the performance of a reliable energy consumption analysis system for energy-efficient appliances. Here are the steps to compare the model accuracy:

1. Initial Model: Train an initial model using default hyperparameters or initial parameter values. This serves as a baseline model with no hyperparameter tuning.
2. Evaluation Metrics: Evaluate the initial model's performance using appropriate evaluation metrics such as MSE, RMSE, MAE, R-squared, or any other relevant metrics. Note down the values of these metrics as a baseline for comparison.
3. Identify Hyperparameters: Identify the hyperparameters that are relevant to your chosen algorithm. These are the parameters that can be tuned to potentially improve the model's performance. For example, in a decision tree algorithm, hyperparameters may include the maximum depth, minimum samples required to split a node, or the number of features to consider.
4. Define Parameter Search Space: Determine a range of values or options for each hyperparameter. This search space defines the possible values that will be explored during the hyperparameter tuning process.
5. Hyperparameter Tuning: Apply a hyperparameter tuning technique such as grid search, random search, or Bayesian optimization to systematically search through the parameter search space and find the optimal combination of hyperparameters. This process involves training and evaluating multiple models with different hyperparameter settings.
6. Train Tuned Model: Train the final model using the hyperparameters found during the tuning process.
7. Evaluate Tuned Model: Evaluate the performance of the tuned model using the same evaluation metrics used for the initial model. Compare the values of these metrics with the baseline metrics obtained from the initial model.
8. Performance Comparison: Compare the accuracy metrics of the initial model with the tuned model. Analyze how the hyperparameter tuning has affected the model's performance. Look for improvements in metrics such as reduced MSE or RMSE, increased R-squared, or any other relevant improvements.
9. Statistical Significance: If the accuracy improvements are observed, consider evaluating the statistical significance of the improvement. Statistical tests such as paired t-tests or cross-validation paired t-tests can be used to assess whether the improvements are statistically significant.