OSCEF: Open Source CIM-EARTH Framework

Contribution
The CIM-EARTH (Community Integrated Model for Energy and Resource Trajectories for Humankind) Framework [3] offers an environment for economic modeling and simulation. Its early version was written in AMPL [2]. To facilitate adoption of CIM-EARTH and integrate data processing and analysis services, we have been moving the implementation from AMPL to C++ and standardizing input and output formats to produce the OSCEF (Open-Source CIM-EARTH Framework) [1]. The core of this framework is a methodology for formulating and solving large-scale computable general equilibrium (CGE) models.

OSCEF currently offers C++ APIs for
- reading and modifying SAMs (social accounting matrices) and production functions
- simulating and solving CGE models.

Architecture

Case Studies
CIM-EARTH has been used internally for:
- understanding carbon leakage due to emissions policies or border-tax adjustments
- analyzing biofuels policies
- perturbation of model parameters.

Funding
This work was supported by grants from the National Science Foundation under grant SES-0951576, the University of Chicago Energy Initiative, and the Office of Advanced Scientific Computing Research, Office of Science, U.S. Department of Energy, under contract DE-AC02-06CH11357.

Standardized SAMs

C++ Classes in OSCEF

Sample Interfaces
- Read and write description of regions and sectors:
  Regions regions("regions.csv");
  Sectors sectors("sectors.csv");
- Read and write SAMs from a directory:
  SAMS sams("sams7.1");
- Transforming SAMs:
  Aggregating regions:
  sams.regionAggregate("map.txt");
  Aggregating sectors:
  sams.sectorAggregate("map.txt");

Code Documentation

Release and Support Website

Future Work
In the future, we plan to support entire reproducible workflows that include
- simulating dynamic models on high-performance computing resources
- automating parametric sensitivity analyses
- providing analysis and visualization services for the results.

References