

ENERGY 2100

What is ENERGY 2100?

ENERGY 2100 is an integrated multi-region energy model that provides a complete and detailed simulation of supply and demand sectors for all types of fuels. With every aspect of the energy market modeled in detail, ENERGY 2100 has become an industry leader in analyzing and forecasting the impacts of a variety of policy considerations on the energy market and resulting emissions. When integrated with a macroeconomic model, ENERGY 2100 becomes a powerful tool for estimating the impacts of energy policy on the economy as a whole.

ENERGY 2100 is populated with local data for each region, state, or province as well as all the associated energy suppliers it simulates. This allows the model to capture the unique characteristics (physical, institutional, and cultural) that affect how people make choices and use energy. Model inputs and assumptions can be customized by the client in order to scale the model to their desired level of analysis.

How does ENERGY 2100 work?

ENERGY 2100 is a system dynamics model that simulates the feedback effects between supply and demand for over twenty specific types of fuel and the resulting effects on greenhouse gas emissions and criteria air contaminants. The model uses an extensive economic database to examine historical usage patterns to simulate consumers' selection process for each fuel type,

capturing the feedback among energy consumers, energy suppliers, and the economy using Qualitative Choice Theory and cointegration. For example, a change in price impacts demand which in turn impacts future supply and price. Increased economic



activity increases demand, increased demand increases investment in new supplies, and new investment has impacts on both the economy and energy prices.

ENERGY 2100 is designed to model the economy at the level of detail needed to realistically analyze energy and emissions policies. The default model simulates three residential categories (single family, multi-family, and other family), over sixty NAICS commercial and industrial categories, and eight transportation services. There are approximately six end-uses per category and six technology/mode families per end-use. Currently the technology families correspond to six fuels groups (oil, gas, coal, electric, solar and biomass) and thirty detailed fuel products. The transportation sector contains forty-five modes including various types of automobile, truck, off-road, bus, train, plane, marine, and alternative-fuel vehicles. More end-uses, technologies, and modes can be added as data allows.

ENERGY 2100 performs detailed modeling of supply sectors, including a detailed endogenous electric supply simulation of capacity expansion and construction; rates and prices; load shape variation due; and changes in regulation.

A sophisticated dispatch routine selects critical hours along seasonal load curves to provide an accurate determination of system generation.



The ENERGY 2100 model includes pollution accounting for energy and non-energy (by economic activity) for Sulphur Oxides and Hexafluoride, Nitrogen and Nitrous Oxides, Carbon Monoxide and Dioxide, Methane, Particulate Matter of various types, Volatile Organic Compounds, Perfluorocarbon and Hydrofluorocarbon, Mercury, Ozone, and Ammonia. Each pollutant is calculated at the state and provincial level by economic sector, including allowance trading at the national and international levels.

What can ENERGY 2100 do?

ENERGY 2100 has been utilized by clients for a broad spectrum of analytical work related to energy usage and emissions

Examples of what ENERGY 2100 is designed to examine include, but are not limited to, the following:

- Impact of carbon taxes on energy prices, including variables for banking, offsets, allotment trading, and the economy when integrated with a macroeconomic model.
- Effects of emissions standards on energy prices and emission inventories, including CAFE equivalent standards for the transportation sector.
- Impacts of energy supply changes, including migration to cleaner energy sources and the effect of constructing new power plants on the electric market.

Who has used ENERGY 2100?

ENERGY 2100 has been used by a wide variety of groups, including federal agencies, state governments, and regional power administrations. Organizations that have used or are currently using ENERGY 2100 include the following:

- Environment and Climate Change Canada
- The Canada Energy Regulator
- The Northwest Power and Conservation Council
- State departments and energy commissions of Illinois, Michigan, Vermont, and Wisconsin
- U.S. Environmental Protection Agency (for the analysis of impacts of proposed Kyoto initiatives)
- The Western Climate Initiative
- California Air Resources Board
- Bonneville Power Administration

In addition, ENERGY 2100 has been used in Eastern Europe and in South America to analyze national energy markets.

Why use ENERGY 2100?

Forecasting the energy economy, ENERGY 2100 is designed around endogenous decision making, where the process of selecting fuels and devices is robustly calculated within the model. This allows the model to dynamically forecast the impacts of new technologies instead of relying on exogenous assumptions regarding technology adoption, making ENERGY 2100 a powerful tool for analyzing energy usage and emissions into the distant future.

ENERGY 2100 also adapts the decision making process for each economic actor to simulate real-world factors. For instance, a utility dispatches electricity



optimally, usually with the help of a linear program; ENERGY 2100 uses this same methodology when simulating the dispatch for plants into the future. However, a consumer choosing a new appliance or car generally does not act optimally but rather makes a decision based on the limited information available to him or her. ENERGY 2100 is designed to reproduce this decision making process, allowing it to capture the nuances of device selection that a standard optimization model is likely to miss by simulating actual, not assumed, responses.

Through decades of widespread use in the public sector, ENERGY 2100's methodology

has been rigorously tested both by its clients and the public at large. To date, the system dynamics approach used by ENERGY 2100 has withstood all scrutiny, allowing the client the security of depending on time-tested reliability of the model when releasing the results to the public.

**About
Systematic
Solutions, Inc.**



Based in Ohio, Systematic Solutions, Inc. has provided analytical work related to energy and emission policy for over thirty years. We are a small firm dedicated to being responsive to the needs of each client. As a result, SSI offers a variety of options for the use of ENERGY 2100 depending on the particular needs of each client. Previous contracts have ranged from in-house policy analysis to long-term consulting and support for the independent use of the model by utilities and government agencies.

For more information, please visit our website at www.energy2020.com or e-mail SSI@ENERGY2020.com.