

STEP Supply-Demand Integration Model and Methodology

STEP Assumptions and Scenario Cases

1. Energy Prices (EIA base case; higher prices to induce conservation, fuel switch)
2. Government Policies (business as usual; carbon reduction policies; R and D budgets)
3. Technology Assumptions (historical, current best, future best)
4. Pace of Capital Stock Turn-Over (autos - 10 years; homes -50 years; industry 75-100 years)
5. Energy Security/Carbon Reduction Cases (historical, current best technology, projected "best" technology)

STEP Methodology

For different scenario cases, determine energy demand by category, energy supply, and energy supply-demand integration

1. Determine energy consumption and carbon emissions for each category (ie. economic activity x energy efficiency).
 - A. Economic activity derived from macro-economic model (tons of steel) to ensure consistency of categories (ie. tons of steel consistent with autos produced) based on GNP
 - B. Each demand sector has energy efficiency or carbon intensity based on technology choice (historical, current, best) determined by price and technology availability
2. Determine fuel mix for each demand category (historical and based on price of fuels and government policy)
3. Add up final demand for key demand sectors
4. Determine energy transformation sector
 - A. Fuel mix for electrical generation (depends on price, government policy)
 - B. Efficiency of electricity generation process (historically 33%; current 37%; best future?)
5. Add up columns (across and down) and determine "primary energy demand"
6. Determine energy supply parameters (domestic, imports or exports)
 - A. Impact of price and policy on fuel choices in demand sectors
 - B. Impact of price and policy on electricity
7. Determine most effective government R&D
8. Feasibility of scenarios in real-world business applications

STEP Results

1. Each demand line item would afford opportunity to showcase key technologies (transport, commercial, residential, industrial)
2. Integration would occur as fuel choices for each sector are made (oil, coal, renewables, electricity)
3. Renewables can be both direct (remote power) or part of electrical transformation (large-scale)
4. Total energy (energy efficiency) and total carbon output is thus determined by demand sectors, supply options and energy transformation
5. Alternative Scenarios chosen would bracket
 - A. Base EIA case—no change in policy
 - B. 450 ppm reduction case—what set of assumptions would be required to achieve this case (economic growth, energy prices, technology success).
6. Leads to the conclusion that 450 ppm case can be achieved if . . .
7. What are the costs and benefits of this? Key issue is to quantify the externalities of not achieving this 450 ppm case (and lower oil imports)
8. A key factor is the discount rate used for the future. A high interest rate devalues the future and makes adjustments very expensive.
9. Translate model results into practice in the presentation

STEP Goals

1. STEP endeavors to seek efficiency in energy and carbon in every cell of this matrix
2. STEP seeks to ensure consistency of forecast (economic, policy)
3. STEP seeks to showcase key technologies in each cell
4. STEP seeks to determine what sets of assumptions achieve 450 ppm and the costs/benefits
5. STEP approach allows for framework to discuss government-business partnership
6. STEP methodology enables comparison of US with other nations, a framework for bilateral/IPCC/IEA discussions

	Natural				Renewable		TOTAL
	Petroleum	Gas	Electricity	Coal	Sources*	Nuclear	
Major Sectors							
Transportation							
Light-duty vehicles							
Commercial light trucks							
Bus Transportation							
Freight Trucks							
Passenger Rail							
Freight Rail							
Domestic Shipping							
International Shipping							
Recreational Boats							
Air							
Military Use							
Lubricants							
Pipeline Fuel							
Other							
Industrial							
Manufacturing							
Aluminum							
Cement							
Chemicals							
Computers, Electronics, Appliances, Electrical Equipment							
Fabricated Metals							
Food and Beverage							
Forest Products							
Foundries							
Glass and Fiber Glass							
Heavy Machinery							
Mining							
Petroleum Refining							
Plastics and Rubber							
Products							
Steel							
Textiles							
Transportation Equipment							
Other							
Commercial							
Space Heating							
Space Cooling							
Water Heating							
Ventilation							
Cooking							
Lighting							
Refrigeration							
Office Equipment (PC)							
Office Equipment (non-PC)							
Other							
Residential							
Space Heating							
Space Cooling							
Water Heating							
Refrigeration							
Cooking							
Clothes Dryers							
Freezers							
Lighting							
Clothes Washers							
Dishwashers							
Color Televisions and Set-Top Boxes							
Personal Computers and Related Equipment							
Furnace Fans and Boiler							
Circulation Pumps							
Other							
Primary Energy Demand							
Energy Transformation							
Electricity							
Synthetic Gas							
Synthetic Liquids							
Heat							
Energy Sector							
Total Energy Demand							
Domestic Supply							
Imports							
Exports							

*Renewable Sources currently include hydropower, solar, wind, geothermal, biomass, and ethanol.