

# SAGE: Strengths and Weaknesses Depend on Modeling Purpose

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# Overview of SAGE

- 16 Regional models linked by trade in energy markets and carbon
- Time-stepped MARKAL formulation
- Forecast through 2030 in 5-year increments
- SAGE is used to produce forecasts for EIA's *International Energy Outlook* and as it is refined to focus more on policy analysis

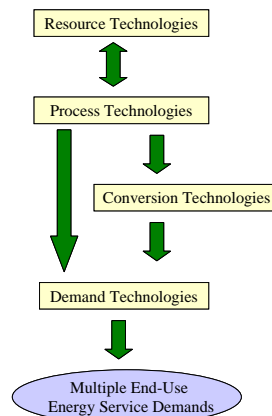
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# SAGE Overview, Cont.

## RES Building Blocks

- 1. Energy Carriers** →  
e.g. crude oil  
liquefied petroleum gas  
gasoline  
distillate  
jet fuel
- 2. Technologies** ▭  
e.g. extraction  
import  
refining  
electricity generation  
light duty vehicles  
airplanes  
cookstoves  
home heating furnaces
- 3. End-Use Energy Service Demands categorized by sector** ○



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# SAGE Service Demands

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## Residential Sector (11)

Space Heating  
 Space Cooling  
 Refrigeration  
 Water Heating  
 Cooking  
 Lighting  
 Clothes Washing  
 Clothes Drying  
 Dishwashing  
 Residential Electric Appliances  
 Other Residential Energy Services

## Commercial Sector (8)

Space Heating  
 Space Cooling  
 Refrigeration  
 Water Heating  
 Cooking  
 Lighting  
 Electric Office Equipment  
 Other Commercial Energy Services

## Industrial Sector (6)

Iron & Steel  
 Non-Ferrous Metals  
 Chemicals  
 Non-Metallic Minerals  
 Pulp & Paper  
 Other Industries

## Transportation Sector (13)

Personal Automobiles  
 Personal Light Duty Trucks  
 Buses  
 Commercial Heavy Trucks  
 Commercial Medium Trucks  
 Commercial Light Trucks  
 Two & Three Wheeled Vehicles  
 Domestic Aviation  
 International Aviation  
 Passenger Rail  
 Freight Rail  
 Internal Navigation  
 International Water Shipping

## Agriculture Sector (1)

Total Agriculture Energy Demand



# SAGE AND Standard MARKAL

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- **Standard MARKAL**
  - What is the most efficient energy system possible? How *should* investors behave knowing all future events—including future energy and technology policies. Provides insight to policy makers on the maximum impact of policies.
- **SAGE (Time-stepped)**
  - EIA bases analysis on current laws and regulations. Forecasts must reflect our best judgments of what *will* happen *over time* in the absence of any policy changes. For forecasting we must deal with non-economic aspects of energy markets.
- **Effective policy analysis requires both**



## What SAGE Does

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- Organizes data and assumptions to support forecasting and analysis.
  - Comments like ‘coal consumption is too high’ progress to ‘steel production is too high,’ and, ‘efficiency gains are too low.’
- Analysts’ using SAGE provide:
  - Reference case energy forecasts to 2030 by fuel, sector and region
    - Energy consumption evolves over time based on energy prices and other factors.
    - Current policies evolve over time.
  - Alternative forecasts based on non-reference case assumptions for:
    - Energy and technology policies
    - World oil price paths
    - Economic growth paths

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## Strengths and Weaknesses

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- Strength
  - Consistent framework for thinking about energy markets across regions
    - Each region has potentially the same RES differences reflect regional data and assumptions
  - Consistent naming conventions for processes and technologies
- Weakness
  - SAGE organizes data and assumptions but it doesn’t provide either.

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