

# **Macroeconomic Activity Module**

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The Macroeconomic Activity Module (MAM) represents the interaction between the U.S. economy as a whole and energy markets. The rate of growth of the economy, measured by the growth in gross domestic product (GDP) is a key determinant of the growth in demand for energy. Associated economic factors, such as interest rates and disposable income, strongly influence various elements of the supply and demand for energy. At the same time, reactions to energy markets by the aggregate economy, such as a slowdown in economic growth resulting from increasing energy prices, are also reflected in this module. A detailed description of the MAM is provided in the EIA publication, Model Documentation Report: Macroeconomic Activity Module (MAM) of the National Energy Modeling System, DOE/EIA-M065(2011), (Washington, DC, June 2011).

## Key assumptions

The output of the U.S. economy, measured by GDP, is expected to increase by 2.7 percent between 2009 and 2035 in the Reference case. Two key factors help explain the growth in GDP: the growth rate of nonfarm employment and the rate of productivity change associated with employment. As Table 2.1 indicates, real GDP growth slows during the first three years of the forecast, reflecting a slower near term recovery from the 2008 recession. Over the next ten years the economy recovers, and then returns to its long-run growth path. In the Reference case, real GDP grows by 2.4 percent for the first two years, and then attains 2.9 percent growth for the recovery period and 2.6 percent growth for the final fifteen years. Both the high and low macroeconomic growth cases show similar patterns of early lower growth, recovery and settling back into their respective long-run growth trends. In the near term from 2009 through 2011, the growth in nonfarm employment is low at 0.9 percent compared with 2.4 percent in the second half of the 1990s, while the economy is expected to experience productivity growth of 2.1 percent. Over the projection period, nonfarm employment is expected to grow by 1.0 percent per year. Nonfarm employment, a measure of demand for nonfarm labor, is generally more volatile than the labor force, a measure of labor supply. The latter depends upon the projection of population and labor force participation rate. The Census Bureau's middle series population projection is used as a basis for population growth for the *AEO2011*. Total population is expected to grow by 0.9 percent per year between 2009 and 2035, and the share of population over 65 is expected to increase over time. However, the share of the labor force in the population over 65 is also projected to increase in the projection period.

To achieve the Reference case's long-run 2.7 percent economic growth, there is an anticipated steady growth in labor productivity. The improvement in labor productivity reflects the positive effects of a growing capital stock as well as technological change over time. Nonfarm labor productivity is expected to remain between 2.0 and 2.1 percent for the remainder of the projection period from 2009 through 2035. Business fixed investment as a share of nominal GDP is expected to grow over the last 10 years of the projection. The resulting growth in the capital stock and the technology base of that capital stock helps to sustain productivity growth of 2.0 percent from the 2009 to 2035.

**Table 2.1. Growth in gross domestic product, nonfarm employment and productivity**

Assumptions	2009-2011	2011-2020	2020-2035	2009-2035
<b>Real GDP (Billion Chain-Weighted \$2005)</b>				
High Growth	2.4%	3.6%	3.1%	3.2%
Reference	2.4%	2.9%	2.6%	2.7%
Low Growth	2.4%	2.1%	2.1%	2.1%
<b>Nonfarm Employment</b>				
High Growth	0.9%	2.0%	1.1%	1.4%
Reference	0.9%	1.2%	0.9%	1.0%
Low Growth	0.9%	0.4%	0.9%	0.7%
<b>Productivity</b>				
High Growth	2.1%	2.2%	2.5%	2.4%
Reference	2.1%	1.7%	2.1%	2.0%
Low Growth	2.1%	1.3%	1.6%	1.6%

Source: U.S. Energy Information Administration, *AEO2010* National Energy Modeling system runs: AEO2011.d020911A, LM2010.d020911A, and HM2010.d020911A.

To reflect the uncertainty in projection of U.S. economic growth, the *AEO2011* uses High and Low Economic Growth cases along with the Reference case to project the possible impacts on energy markets. The High Economic Growth case incorporates higher population, labor force and productivity growth rates than the Reference case. Due to the higher productivity gains, inflation and interest rates are lower compared to the Reference case. Investment, disposable income, and industrial production are increased. Economic output is projected to increase by 3.2 percent per year between 2009 and 2035. The Low Economic Growth case assumes lower population, labor force, and productivity gains, with resulting higher prices and interest rates and lower industrial output growth. In the Low Economic Growth case, economic output is expected to increase by 2.1 percent per year over the projection horizon.