

## Chapter 2. Macroeconomic Activity Module

The Macroeconomic Activity Module (MAM) represents interactions between the U.S. economy and energy markets. How fast the economy grows, as measured by either growth in gross domestic product or industrial shipments, is a key determinant of growth in the 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 publications, [Model Documentation Report: Macroeconomic Activity Module \(MAM\) of the National Energy Modeling System](#) (Washington, DC, May 2014) and [Update to Industrial drivers in the AEO2015 as a result of new input-output data](#) (Washington, DC, May 2015).

### Key assumptions

The output of the U.S. economy, measured by GDP, is expected to increase by 2.2% per year between 2015 and 2040 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, in the Reference case, real GDP grows by 2.6% per year from 2015-20, 2.2% from 2020-30, and 2.1% from 2030 to 2040. Both the High and Low Economic Growth cases differ by 0.6 percentage points compared with the Reference case from 2015 to 2040. Non-farm employment shows higher growth from 2015-20 in the Reference case and then returns to its long-run trend growth of 0.7% from 2015-40. In the High Economic Growth case, nonfarm employment growth differs by 0.3 percentage points compared with the Reference case growth of 0.7% from 2015 to 2040, while the Low Economic Growth case differs by only 0.1%, reaching 1.0% and 0.6% in the High Economic Growth and Low Economic Growth cases, respectively. In the Reference case, productivity (measured as output per hour in nonfarm business) grows by 1.7% from 2015 to 2040, showing slower growth as compared to the 1.9% growth experienced from 1980 to 2015. Nominal business fixed investment as a share of nominal GDP is expected to grow over the projection. The resulting growth in the capital stock and the technology base of that capital stock helps sustain productivity growth of 1.7% from 2015 to 2040.

The U.S. Census Bureau's middle series population projection is used as a basis for population growth in AEO2016. Total population is expected to grow by 0.7% per year between 2015 and 2040, 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 2.2% GDP 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 growth is expected to remain between 0.8 and 2.0% throughout the projection period of 2015 to 2040.

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

Assumptions	2015-2020	2020-2030	2030-2040	2015-2040
Real GDP (Billion Chain-weighted \$2009)				
High Economic Growth	3.6%	2.8%	2.6%	2.8%
Reference	2.6%	2.2%	2.1%	2.2%
Low Economic Growth	1.5%	1.7%	1.7%	1.6%
Nonfarm Employment				
High Economic Growth	1.6%	0.9%	0.7%	1.0%
Reference	1.2%	0.7%	0.6%	0.7%
Low Economic Growth	0.6%	0.5%	0.6%	0.6%
Productivity				
High Economic Growth	2.1%	2.0%	2.0%	2.0%
Reference	1.6%	1.8%	1.7%	1.7%
Low Economic Growth	1.0%	1.4%	1.3%	1.3%

Source: U.S. Energy Information Administration, AEO2016 National Energy Modeling system runs: AEO2016.d032416A, LM2016.d032516A, and HM2016.d032516A.

To reflect uncertainty in the projection of U.S. economic growth, the AEO2016 uses High and Low Economic Growth cases to project the possible impacts of alternative economic growth assumptions 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 than the Reference case. Investment, disposable income and industrial production are greater. Economic output is projected to increase by 2.8% per year between 2015 and 2040. 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 1.6% per year over the projection horizon.