

# Nightlights of North America: Showing Energy Use

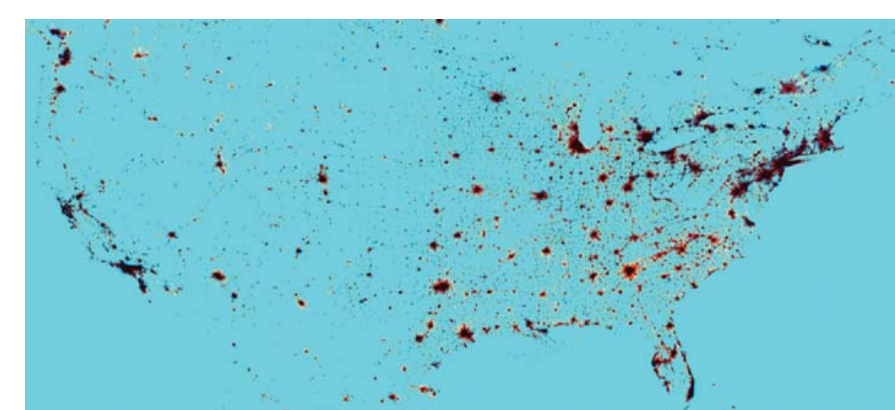


## Nightlights

Lighting consumes one fourth of all energy expended worldwide and is misspent when lighting fixtures allow light to go up instead of downward, where it is generally preferred. The images to the right not only show escaping light from cities, but also gas flares off the coasts of southern California and Louisiana.

The night light images were created by the National Geophysical Data Center (NGDC). By the middle of 1995, NGDC began filtering out noise and short-term events such as fires and lightning to produce a "stable lights" dataset. NGDC was able to create the stable lights dataset of the lower USA and Canada using 236 orbits of night-time Defense Meteorological Satellites Program (DMSP) data. The DMSP data was taken during the dark half of the lunar cycle over a six month time period.

Sources: NGDC/DMSP October 1994 - March 1995; Wikipedia 2006

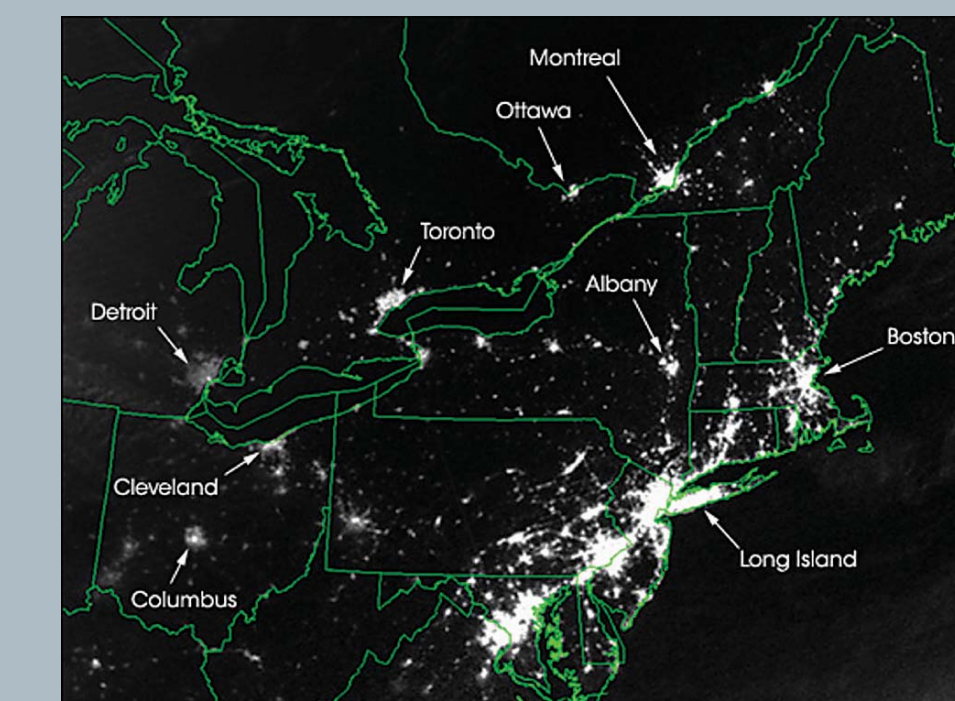


- Black = Lights saturated in both time periods.
- Red = Lights brighter in 2000.
- Yellow = Lights only present in 2000.
- Blue = Lights only present in 1992-93.
- Gray = Dim lighting detected in both time periods, but little change in brightness.

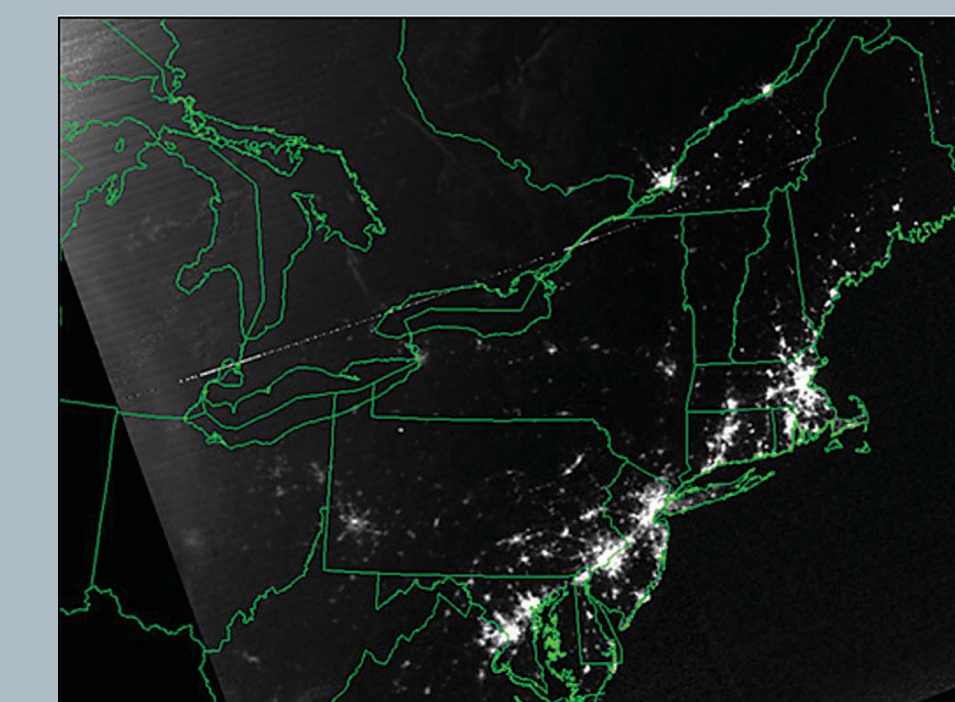
## The Power of Blackouts

On 14 August 2003, parts of the northeastern United States and southeastern Canada experienced widespread power blackouts. Among the major urban agglomerations affected by the electrical power outage were the cities of New York City, Albany, and Buffalo in New York, Cleveland and Columbus in Ohio, Detroit in Michigan, and Ottawa and Toronto in Ontario, Canada. Other U.S. states, including New Jersey, Vermont, Pennsylvania, Connecticut, and Massachusetts, were also affected. The blackout resulted in the shutting down of nuclear power plants in New York and Ohio, and air traffic was slowed as flights into affected airports were halted. Approximately 50 million people were affected by the outage.

The change in the nighttime city lights is apparent in this pair of Defense Meteorological Satellite Program (DMSP) satellite images. The top image was acquired on 14 August, about 20 hours before the blackout, and the bottom image shows the same area on 15 August, roughly seven hours after the blackout. In the bottom scene, notice how the lights in Detroit, Cleveland, Columbus, Toronto, and Ottawa are either missing or visibly reduced. Previous major blackouts include the 9 November 1965 outage caused by a faulty relay at a power plant in Ontario, which affected a large swath of land stretching from Toronto to New York. Another one followed on 14 July 1977, the result of a lightning strike, affecting New York City. The power supply in nine western states was also affected in August 1996 as a result of a high demand for electricity, a heat wave, and sagging electrical power lines.



14 August 2003 before power failure



15 August 2003 after power failure

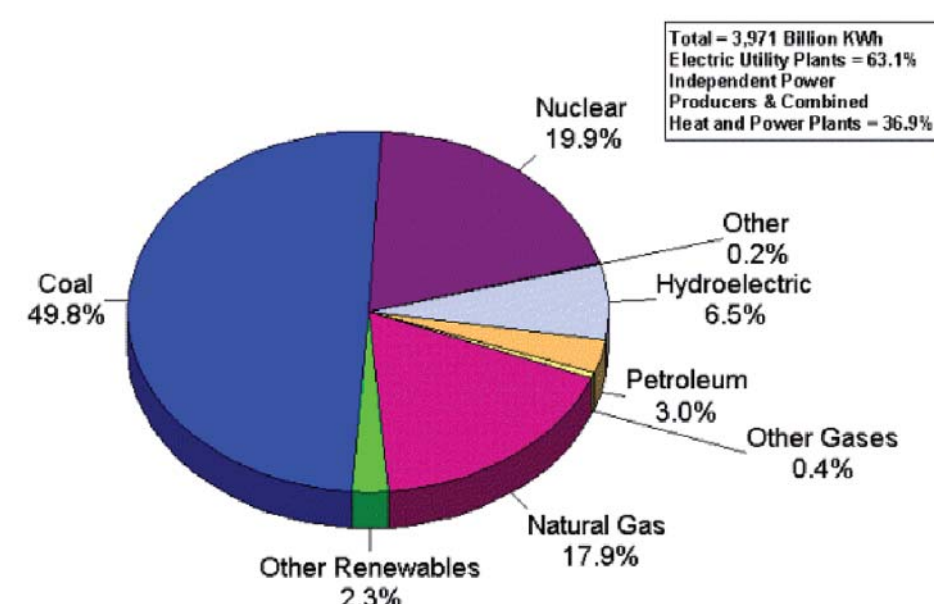
Courtesy of Earth Observatory/NASA

## Energy Consumption

Between 1850 and 1970, the number of people living on Earth more than tripled—yet the energy they consumed rose 12-fold. Primary energy consumption increased globally by 4.3 per cent in 2004. Asia Pacific saw the highest rise, up by 8.9 per cent, while North America recorded the weakest growth at 1.6 per cent. Coal remained the fastest growing fuel, rising 6.3 per cent globally. Oil consumption grew by 3.4 per cent, the most rapid rate since 1986. Natural gas use rose by 3.3 per cent. Hydroelectric and nuclear generation also experienced strong growth, rising 5 per cent and 4.4 per cent, respectively.

Energy consumption is rising fastest in the developing world, where petroleum use alone has quadrupled since 1970. Transportation is the world's fastest-growing form of energy use and accounts for nearly 30 per cent of world energy use and 95 per cent of global oil consumption. Worldwide, people use about a third of all energy in buildings—for heating, cooling, cooking, lighting, and running appliances. Just over 75 per cent of the world's current primary energy supplies come from the fossil fuels (and only 2 per cent from new renewables other than large hydro). Over 60 per cent of primary energy is, in effect, wasted—and over 60% of that in end uses.

Sources: BP Statistical Review of World Energy June 2005; CIA World Factbook 2005; EIA 2005



Note: Conventional hydroelectric power and hydroelectric pumped storage facility production minus energy used for pumping



## Oil Consumption

Saudi Arabia has 25.5 per cent of the world's oil reserves and produces 11.6 per cent oil per day but consumes only 1.9 per cent per day. The United States has 2.2 per cent oil reserves and is the second largest oil producer, producing 10.7 per cent per day, however, consuming 25.9 per cent per day. The industrialized countries are the largest consumers of oil but until 1998 had not been the most important growth markets for some years. The countries of the Organization for Economic Cooperation and Development (OECD), for instance, account for almost 2/3 of worldwide daily oil consumption. In 2004, growth was a global phenomenon, with oil consumption growth being the largest in volume terms since 1976. Consumption grew more than double the 10-year average rate. Chinese oil consumption rose by just under 16 per cent, with consumption in all regions rising above the 10-year average rate on the back of a strong world economy.

World demand for crude oil is expected to grow from 78 million barrels per day in 2002 to 103 million barrels per day in 2015 and to just over 119 million barrels per day in 2025. Much of the growth in oil consumption is projected for the emerging Asian nations (including China and India), expected to account for 45 per cent of the total world increase in oil use, where strong economic growth results in a robust increase in oil demand. Producers in the Organization of Petroleum Exporting Countries (OPEC) are expected to be the major source of production increases.

Sources: BP Statistical Review of World Energy June 2005; CIA World Factbook 2005; EIA 2005

### Consumption - United States vs. World (1998)

	U.S.	World	% U.S. Total <sup>1</sup>
Oil	18.92 million barrels/day	73.6 million barrels/day	40 %
Natural Gas	21.34 tcf/year	82.2 tcf/year	23 %
Coal	1.04 billion tons/year	5.01 billion tons/year	23 %

<sup>1</sup> Calculated on a Btu basis

