

# Energetic Limits to Economic Growth

[Get access >](#)

James H. Brown, William R. Burnside, Ana D. Davidson, John P. DeLong, William C. Dunn, Marcus J. Hamilton, Norman Mercado-Silva, Jeffrey C. Nekola, Jordan G. Okie, William H. Woodruff ... [Show more](#)

*BioScience*, Volume 61, Issue 1, January 2011, Pages 19–26,

<https://doi.org/10.1525/bio.2011.61.1.7>

**Published:** 01 January 2011

## Abstract

The human population and economy have grown exponentially and now have impacts on climate, ecosystem processes, and biodiversity far exceeding those of any other species. Like all organisms, humans are subject to natural laws and are limited by energy and other resources. In this article, we use a macroecological approach to integrate perspectives of physics, ecology, and economics with an analysis of extensive global data to show how energy imposes fundamental constraints on economic growth and development. We demonstrate a positive scaling relationship between per capita energy use and per capita gross domestic product (GDP) both across nations and within nations over time. Other indicators of socioeconomic status and ecological impact are correlated with energy use and GDP. We estimate global energy consumption for alternative future scenarios of population growth and standards of living. Large amounts of energy will be required to fuel economic growth, increase standards of living, and lift developing nations out of poverty.

© 2011 by American Institute of Biological Sciences

**Issue Section:** [Overview Articles](#)

You do not currently have access to this article.

**Sign in**

 [Get help with access](#)

**Personal account**

**Institutional access**

- Sign in with email/username & password
- Get email alerts
- Save searches
- Purchase content
- Activate your purchase/trial code
- Add your ORCID iD

Sign in >

Register



Sign in through your institution



Sign in through your institution >

[Sign in with a library card](#)

[Sign in with username/password](#)

[Recommend to your librarian](#)

### **Institutional account management**

[Sign in as administrator](#)

## Purchase

[Subscription prices and ordering for this journal](#)

[Purchasing options for books and journals across Oxford Academic](#)

## Short-term Access

To purchase short-term access, please sign in to your personal account above.

Don't already have a personal account? [Register](#)

Energetic Limits to Economic Growth - 24 Hours access

EUR €39.00

GBP £33.00

USD \$43.00

## Rental



This article is also available for rental through DeepDyve.