

## **Energy, the Great Acceleration, and the Future of Technology**

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The understanding of energy continues to lag behind its rapidly expanding consumption. The Laws of Thermodynamics, finalized in the later 1800s, were written a full century after the mass production of Watt's steam engine, still the most important invention for all humankind. Only after global energy consumption exploded exponentially—from 80 EJ/yr to 570 EJ/yr since 1940—have we begun to look back, albeit dazed, to recognize this more recent event as an exponential forcing function unique in evolutionary time. A retrospective of the history of energy on Earth, and the still developing science of thermodynamics, clarifies the age of acceleration and the technological grip prescribed by Jevons' paradox. Where continued increases in energy consumption to support a population of 9 billion by 2050 depends on an extraordinarily complex socioeconomic and biophysical system, the biology of our past rather easily clarifies the technology needs, goals, and constraints of this near future.