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## The Global Energy Transition: Fundamental Matters

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The world of energy can be opaque and confusing. Are oil and natural gas really running out? Is coal “bad” and if so, why do we keep using it? Is switching to renewable energy just a matter of political will? Are renewable forms of energy more expensive, or more sustainable? Are fossil and nuclear energies environmentally “dirty” and renewable energy “clean”? Can we store energy, and why would that matter? In order to demystify, and hopefully depoliticize, the world of energy, it is important to step back and examine fundamentals. [1] [2]

- The enormous scale of global energy demand is difficult to comprehend.
- Energy, the economy, and the environment are intimately linked.
- Energy education is poor but improving.
- Energy security—affordability, availability, reliability, and sustainability—determines the global energy mix.
- Fuels used for 20th century transportation and electricity—oil and coal—are available, affordable, and reliable and thus reasonably secure and difficult to replace.
- Renewable sources of energy supplement regional demand but require major advances in affordability and reliability to replace fossil fuels at scale.
- Solving energy storage will improve the reliability and affordability of renewables.
- Natural gas and nuclear are becoming the foundational global energies of the 21st century; they are affordable, available, reliable, and more sustainable than oil and coal.
- The pace of the energy transition is controlled by infrastructure, economics, materials, thermodynamics, kinetics, policy, and more; the transition will not happen overnight.
- Energy security should be the goal of energy policy; one size does not fit all.
- Energy efficiency is underappreciated and has the potential for major impact; individual behavior matters.
- Access to secure energy bolsters economies and lifts nations from poverty.

### *References:*

[1] Tinker S, Lynch H, Carpenter M, and Hoover M (2013) Geological Society of America Special Paper 501: 21–51

[2] Tinker S and Lynch H (2012) *Switch*: <http://www.switchenergyproject.com/>

