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### Energy technologies united

The shortage of energy will be one of the main societal challenges for our future. While renewable energy sources exist (sun, wind, tides) in addition and as alternatives to fossil fuels, we are still learning how to harvest this energy and to economically and viably transform it into useful power. For this, the role of materials researchers is crucial for improving materials performance for enabling renewable and sustainable energy technologies. Unified strategies are needed for making our efforts successful.

The sun, for example, has great potential as an enormous energy reservoir, if only we could exploit it properly. But sun exposure is discontinuous and site-dependent, which results in an intermittent and unpredictable power availability. The same applies to wind, the other major source of renewable energy besides hydro.

Energy saving achieved by more efficiently utilizing conventional fuels should also be considered. Fuel cells provide a highly efficient method for producing power, and solid-oxide fuel cells can, in principle, operate at higher temperatures with a wide range of fuels, including hydrocarbons. The attainable increase in efficiency may guarantee a significant cut in greenhouse emissions in the medium term, while we wait for the infrastructure of hydrogen storage and distribution to be in place. However, fuel cells supply power continuously, while demand can vary over time.

The problems of intermittent or continuous supply and variable demand need to be addressed and solved by leveraging continuous energy supply, which has to be achieved by the integration of different energy-storage systems (batteries, supercapacitors, electrolyzers), either by compensating for the lack of power from renewable sources or for excess power produced by fuel cells when not needed.

We as materials researchers cannot solve the energy problems by developing a single technology. Rather, various technologies have to be integrated into the grid. Only by smartly integrating different energy technologies can we think of providing sufficient power for the future.

Enrico Traversa

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Energy Sector Analysis image: Cross-section of a wellbore.  
Credit: US Department of Energy's National Energy Technology Laboratory.

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