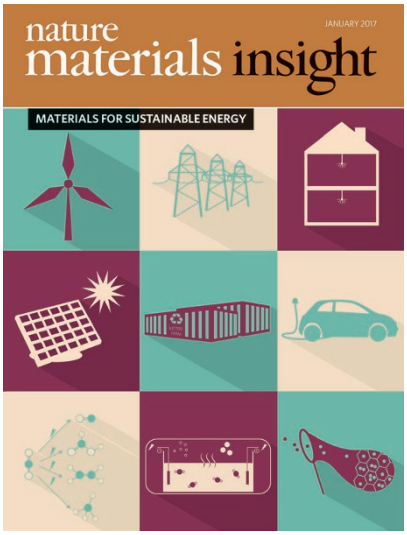

COVER IMAGE

Advances in materials science are leading to more efficient technologies for electricity generation from renewable sources, energy use and storage, and the capture and conversion of carbon dioxide.

IMAGE: PALOMA LIU

SPRINGER NATURE LONDON
The Campus, 4 Crinan Street,
London N1 9XW
T: +44 207 833 4000
F: +44 207 843 4563
materials@nature.com

CHIEF EDITOR
VINCENT DUSASTRE

INSIGHT EDITORS
VINCENT DUSASTRE
LUIGI MARTIRADONNA

SENIOR COPY EDITOR
KEVIN SHERIDAN

COPY EDITOR
TIM BODICOAT

SENIOR PRODUCTION EDITOR
ALISON HOPKINS

ART EDITOR
TULSI VORALIA

EDITORIAL ASSISTANT
STEPHEN DUNNELL

MARKETING MANAGER
REBECCA BUCKLEY

EXECUTIVE EDITOR
ALISON WRIGHT

EDITOR-IN-CHIEF,
NATURE PUBLICATIONS
PHILIP CAMPBELL

SPRINGER NATURE

Materials for sustainable energy

Available and affordable energy has so far led to spectacular industrialization and development, but with growth accelerating in developing countries, demands on non-renewable energy sources are reaching their limits. Moreover, the recent confirmation that global warming is due to the increase of greenhouse gases in the atmosphere, together with the uneven global distribution of energy sources, urgently requires drastic changes in the way we generate and supply energy.

To deal with these rapid changes we need to simultaneously develop innovative strategies to regulate the price of carbon emissions, reduce the costs of generating energy from renewable sources, and develop greener, cheaper and scalable technologies for energy production and storage. Overall, these technologies must rely on earth-abundant and recyclable materials selected according to their entire life-cycle impact, as well as on clean and affordable processes, to ensure long-term sustainability. This principle should also be applied to other technologies such as nuclear power, carbon capture and storage, and biofuels.

The aim of this Insight is therefore to focus on what materials-based solutions can offer and to show how the rational design and improvement of materials properties can lead to energy alternatives that can compete with existing technologies. In terms of alternative means of electricity generation, dramatic fundamental and practical breakthroughs are taking place in the realization of solar cells with high energy-conversion efficiency. The improvement of batteries for electric vehicles and the grid is also a major challenge. Key advances in sustainable approaches beyond Li-ion batteries and progress towards *operando* techniques for *in situ* monitoring and control of redox processes are greatly needed. The conversion of sunlight into fuels and chemicals is also an attractive prospect for energy storage, and major efforts to develop efficient catalysts for both water splitting and CO_2 reduction are under way.

Many difficulties remain, and researchers are working hard to overcome outstanding hurdles by designing improved materials and devices. Yet, this is not a road scientists should walk alone — the impact that wiser energy management can have on global warming and human health is huge, and requires ongoing attention from policy-makers. The recent Paris climate agreement demonstrates that strategies to ensure both economic growth and climate protection can be successful if coordinated internationally. However, such long-term support must be sustained globally, as the challenge is not just to preserve our environment, but how to save our planet.

Vincent Dusastre, Chief Editor
Luigi Martiradonna, Senior Editor

CONTENTS