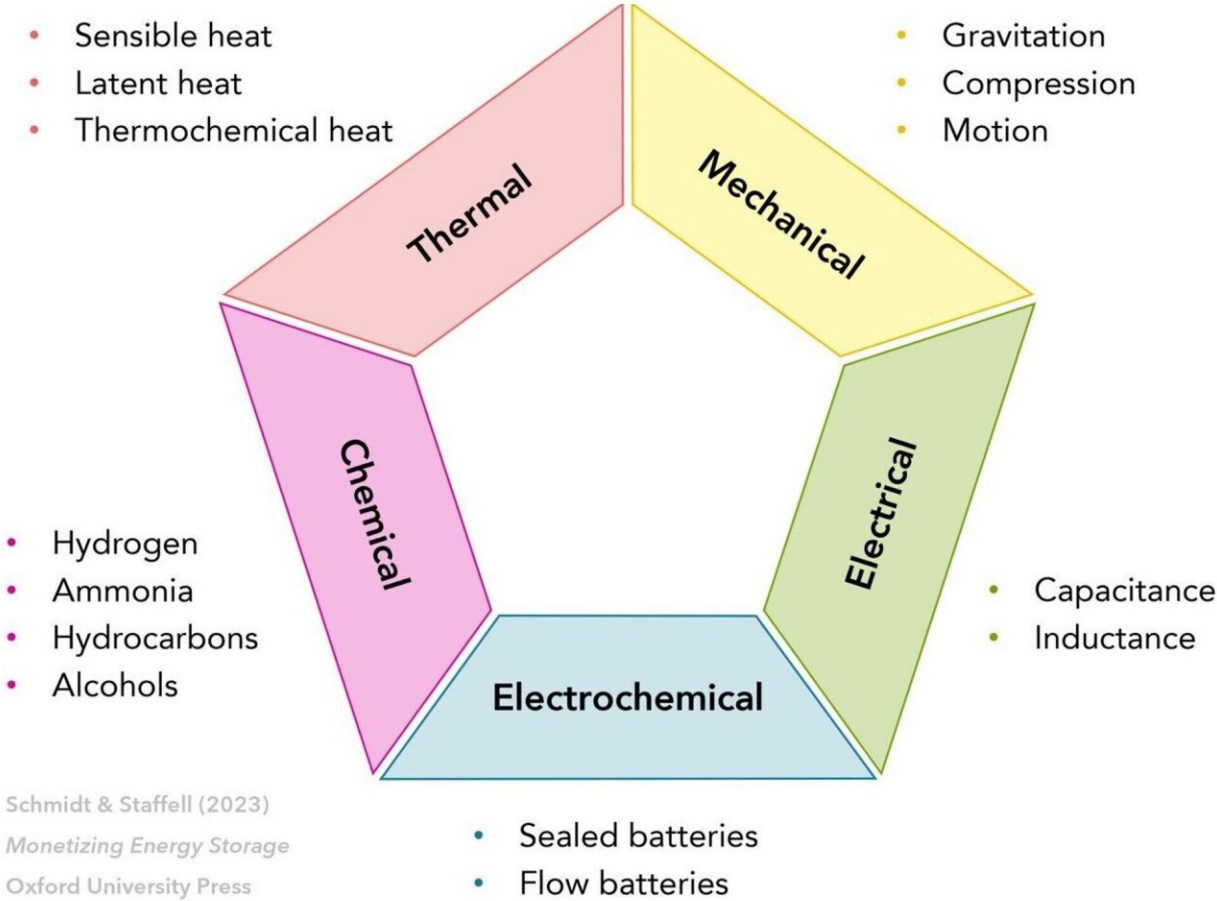


Q&A: Exploring the future of energy storage

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The five categories of energy Credit: Imperial College London

Imperial energy experts have penned a new book exploring the fast-growing field of energy storage.

In today's world, the shift towards cleaner and [sustainable energy](#) sources is more important than ever. Effective and adaptable energy storage solutions have become increasingly crucial as renewable energy sources like solar and wind fluctuate. With clean energy solutions taking priority, it is urgent to understand the complex landscape of energy storage.

Dr. Oliver Schmidt, a visiting researcher, and Dr. Iain Staffell, a Senior Lecturer in Sustainable Energy at Imperial's Center for Environmental Policy, are addressing the complexities of this fast-growing industry. They have authored a book titled "[Monetizing Energy Storage: A Toolkit to Assess Future Cost and Value](#)," which offers valuable perspectives, data and tools for businesses, policymakers and researchers to evaluate the economic potential of energy storage.

We interviewed the authors, delving into the significance of energy storage, the challenges confronted by the energy sector, and their mission to empower diverse audiences using their comprehensive toolkit.

What is energy storage, and why is it crucial?

Dr. Iain Staffell: Energy storage is one solution to integrate weather-dependent renewables like solar and wind into power systems. Storage is easy to deploy and can be built quickly. It is a small, modular technology with the potential for extraordinarily fast growth rates. If storage allows us to achieve a higher share of renewables, it will be a key factor in helping us reach net-zero emissions, not just in the U.K. but worldwide.

Dr. Oliver Schmidt: The world has an abundance of [renewable energy sources](#) that are currently being developed. However, we require a flexible energy system to integrate this variable renewable energy effectively. Energy storage is emerging as one of the most prominent forms of flexibility. Alternatives, like building more electric wires or making end-user appliances smarter, appear more challenging to

implement, particularly at the pace and scale needed. What are the core principles of energy storage?

There are [five main principles](#) for storing electricity, involving converting it into another form of energy that can be stored. These include mechanical storage, electrical storage, electrochemical storage, chemical storage, and thermal storage. These principles have similar advantages and disadvantages and can be useful when considering new storage technologies.

How do energy storage technologies contribute to a low-carbon energy system and global net-zero aspirations?

Staffell: One example is transportation, which is a significant sector for reducing emissions, accounting for about one-quarter of U.K. emissions. Electric vehicles are the most viable option for reducing emissions in this sector—making energy storage crucial for facilitating this transition.

Schmidt: In the [energy sector](#), storage can also provide various services that ensure the "lights stay on." Our book helps to clearly differentiate these services by economic value, location in the power system, and relation to renewables. This is like a dictionary for readers to understand the markets for energy storage, which have different names and structures in each country, but fundamentally provide the same value and have the same requirements.

What were your motivations for writing the book?

Staffell: My motivation is to accelerate the transition to clean energy. As a parent, I want my children to inherit a biodiverse world. I want to help people understand the clean energy transition by making fundamental

knowledge and tools widely available. This book serves as a vehicle for achieving this goal, reaching a wider audience than academic publications.

Schmidt: My motivation is to make academic research more accessible. Therefore, the digital version of this book is free. This allows anyone to read it and make fact-based decisions on investments needed for the energy transition. It is also the reason why the book is accompanied by the website www.EnergyStorage.ninja. Here, readers can interact with the models we have developed and conduct their custom analyses.

How does your book bridge knowledge gaps in energy storage?

Schmidt: One of the main challenges in energy storage is transparency. The various technologies, applications, and performance characteristics, coupled with rapidly falling technology cost can lead to uncertainties regarding the commercial viability of storage, which prevent policy and investment decisions. Besides insights, data and tools, we aim to create transparency by providing a clear structure and a common language for academics and industry professionals to communicate.

Staffell: There are many good books on the engineering and physics of energy storage but little on economics and business. These aspects are crucial for mainstreaming energy storage and impactful for the clean energy transition. The book covers how to go from a prototype to a mass-produced product that sells millions of units a year.

How did you navigate the challenge of balancing technical depth with accessibility?

Staffell: We have completed science communications training at

Imperial, which helped us communicate complex ideas effectively. We also identified common areas of confusion from our experience supervising students. We sought feedback from numerous peer reviewers, including colleagues and experts in the field, to refine our book. Our goal was to make the terms and explanations clear and understandable.

Schmidt: We also structured the book to present general concepts in the beginning, economic insights in the middle and complex methods at the end. This lets readers decide to read the whole book, or go straight to economic insights or, if they choose, to access the methodological details. By going through the summary page at the beginning of each chapter, you can even grasp the book's key messages if you only have an hour to spare!

How does your book bridge the gap between theory and real-world implementation?

Schmidt: As touched upon by Iain, we conducted our own review process by asking more than 20 industry stakeholders to review a draft of the book. These investors, consultants, strategists, project developers and policymakers provided real-world feedback that helped us validate our methods and findings and provide real-world examples. The book also features a range of "Frequently Asked Questions" that relate our conceptual insights to real-world application. We also provided a common language and structure for discussing key concepts, such as revenue stacking.

What key insights do you aim to convey to readers, including future policymakers, investors, and researchers, through this book?

Schmidt: We want readers to learn how to analyze [energy storage](#) technologies in terms of their costs, applications, and revenues. This will help them decide which technologies are best for transitioning our energy systems. Our book provides knowledge and interactive tools, such as the Energy Storage Ninja, for readers to do these analyses, bridging knowledge gaps and advancing a cleaner, more sustainable energy future.

Provided by Imperial College London

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