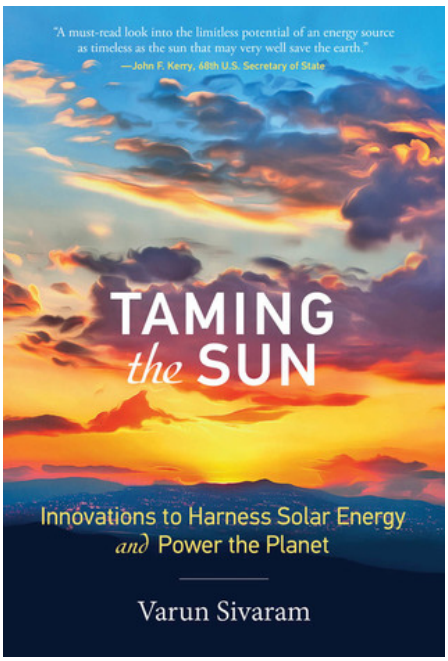

Taming the Sun: Innovations to Harness Solar Energy and Power the Planet

Varun Sivaram

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How solar could spark a clean-energy transition through transformative innovation--creative financing, revolutionary technologies, and flexible energy systems.

Solar energy, once a niche application for a limited market, has become the cheapest and fastest-growing power source on earth. What's more, its potential is nearly limitless--every hour the sun beams down more energy than the world uses in a year. But in *Taming the Sun*, energy expert Varun Sivaram warns that the world is not yet equipped to harness erratic sunshine to meet most of its energy needs. And if solar's current surge peters out, prospects for replacing fossil fuels and averting catastrophic climate change will dim.

Innovation can brighten those prospects, Sivaram explains, drawing on firsthand experience and original research spanning science, business, and government**.** Financial innovation is already enticing deep-pocketed investors to fund solar projects around the world, from the sunniest deserts to the poorest villages. Technological innovation could replace today's solar panels with coatings as cheap as paint and employ artificial photosynthesis to store intermittent sunshine as convenient fuels. And systemic innovation could add flexibility to the world's power grids and other energy systems so they can dependably channel the sun's unreliable energy.

Unleashing all this innovation will require visionary public policy: funding researchers developing next-generation solar technologies, refashioning energy systems and economic markets, and putting together a diverse clean energy portfolio. Although solar can't power the planet by itself, it can be the centerpiece of a global clean energy revolution.

A Council on Foreign Relations Book

Taming the Sun: Innovations to Harness Solar Energy and Power the Planet Details

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From Reader Review Taming the Sun: Innovations to Harness Solar Energy and Power the Planet for online ebook

Omar says

An excellent book with great insights into the state and possible futures of the solar industry. Very well researched with around 60 papers/references per chapter.

The book is accessible to both industry insiders and novices as it introduces concepts clearly before elaborating. It starts by imagining different future outcomes then describes the current context and history of the solar industry. I have appreciated, in particular, the analysis given of the silicon valley clean-tech boom and bust of the late 2000's.

The author does a great job of clarifying why it will take a 3-axis approach to innovation (business model, technological, and systemic innovation) to achieve solar's true potential.

The arguments are facts and data-based and the author's viewpoints are justified, balanced, and ideologically neutral.

Bill C says

Energy, how to envision a different future.

We can not live as we do without reliable and affordable energy. Thinking the problem through and looking at alternatives to what has gotten us to our current state is what this book does well. We all need to work the problem and be part of the solution. Carin has done a service to all in laying out the scientific challenge. We need to work towards the solution.

Enrico says

A true Masterpiece on "what it would take for solar to power a third of global consumption", carefully explaining what's missing in the current solar landscape and why innovation is required to overcome value deflation of silicon PV.
Recommended to everyone - from solar gurus to solar enthusiasts

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Kathleen says

Taming the Sun's singular purpose is to convince you of the necessity of investing in early-stage solar energy technologies, but in the process, Varun Sivaram delivers a simply-stated and comprehensive summary of the intertwined issues solar faces in scaling to a level that will deliver global carbon benefits. The second chapter - which sets out the stakes for a solar plateau mid-century - is a must-read for everyone in the energy industry; even oil & gas analysts will find their concerns fairly considered and addressed. Subsequent

chapters you can probably pick & choose depending on your relative level of expertise. I enjoyed learning about the history of PV cell development, design & deployment of high voltage transmission lines, and networked energy storage strategies. But I found that even the chapters on solar business model development, financing, and rural solar mini-grids - where I have more direct experience - covered the key issues succinctly. At his best, Sivaram clearly links the need to push the envelope in technology, financial, and systemic energy innovation all at once so that solar can deliver on the goals we've implicitly set for it in demanding a low-carbon future. In other places, the primacy that he places on increased investment for academic R&D projects (Sivaram started out as a solar materials researcher) can seem repetitive and self-serving. I'd judge the weakest chapter to be the last one on policy solutions, which isn't framed so much as an area for potential innovation as one where we just need to put down more money (easier said than done). But this assessment could also be due to the fact that after 11 hours of listening, I was very ready for the book to be over! All in all, I'd recommend - correction, I already have recommended - this book as required skim reading for those working in energy issues, as it's a great primer on today's most relevant solar energy topics across a range of disciplines.

Prash says

very important book to learn from and address the energy needs of the world for tomorrow.

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bibliotekker Holman says

An important book for anyone interested in the functional present realities and future potential of solar beyond fluffy pronunciations about its being the right thing. Solar is definately the future and its potential is limitless if we can get from where we are now. I admit I skipped thorugh a few chapters. This is a technical guide that misses nothing so that policymakers and the public can move forward toward the most important energy transistion since the Industrial Revolution.

Mark Schisler says

This book paints a very bleak picture of the future, and I found myself walking away from it doubtful that the nations of the world would be able to make their commitments to the Paris Accord.

Namely the deficiencies to the current status quo are as follows:
- Nuclear power investment and research are floundering. Paradoxically, Fukushima has made most nations and companies involved in pushing the envelope on newer safer reactor designs retreat and disinvest. Nuclear power is the only base power that is carbon neutral. Natural gas, oil, and coal all contribute carbon to the atmosphere.
- In the absence of some type of base load technology to cover nuclear's gap, insane amounts of investment need to be made in power storage technology and/or Solar technology generally.
- Solar technology is the only renewable energy source capable of meeting earth's needs given how much potential the sun gives us --right now, very efficient PV panels let us capture only 20% of the suns energy.
- Nevertheless, while power companies and nation states are doubling down on silicon PV and incentivizing installs, very little to no money is going toward research on critical solar technology that would allow us to harvest more of that energy at off-peak hours --e.g., concentrated solar arrays.

- Every day we delay this critical research, we are one day closer to irreparable harm to the planet
- Absent US leadership on this front, the world will likely miss its targets, or China will fill in the vacuum and profit immensely from whatever it discovers along the way.

I think that about sums it up. But basically the main take-away is this: while PV is the new hotness, it can't solve the climate crisis in its present form. Looking at the California energy market gives us a taste of the future, where so much PV has been installed that new peak hours emerge in the evening when the sun has set and people continue to use electric. Google "CAISO Duck Curve" to see this graphically. As long as humans continue to use and demand electric at all hours, without the ability to scale up clean power to meet that evening demand, the ice caps are toast.

By the way, the author repeatedly states that decarbonizing the electric grid is the easiest task humans face with climate change. Other areas such as transportation policy are even more baffling --e.g., how do you manufacture and replace all the forms of transit with electric and battery technology without releasing still more carbon? (Nevermind the technology for electric trucks, planes, and buses aren't even fully baked.) If we fail this basic test, how much more will we fail the others.

Mary says

Illuminating. No one is better suited to shine a light on the current state of solar energy and the need for the US to be a global beacon for technological, financial, and systemic innovation than Dr. Varun Sivaram.

Nathan Christopher says

Unbelievably good. My vision of the solar market and the different paths into a renewable energy future has been sharply defined by this book.

Chris Fleischman says

I have been reading a lot about renewable energy recently, and this is by far the best book I have read to understand the entire solar energy landscape and limitations. Thank you!
