

Strategies for a Low-Carbon Electricity Grid With Full Use of Nuclear, Wind and Solar Capacity to Minimize Total Costs

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With climate and clean air objectives in mind, decarbonization and emission reduction will undoubtedly continue to be a major factor in shaping the future of energy infrastructures. The article presents solar, wind, and nuclear as the three most likely carbon-free energy sources to dominate a low-carbon energy future. These three sources alone, however, do not provide the flexibility that consumers demand. All three introduce varying degrees of price collapse, as they are capital intensive and operationally inexpensive. When energy supply is high, these energies will bid low to recover capital costs. To avoid price collapse, the article explores five potential classes of systems to match the electric production and distribution to demand. These classes are electric devices (such as batteries), heated firebrick for industrial applications, reactor thermal heat storage, nuclear topped off peak electricity, and hybrid systems where a second product is produced when energy prices are low. In the article, the advantages, disadvantages, and distinct characteristics of each of these classes is discussed as they pertain to a low-carbon grid. For instance, electric battery type technologies must be operated for many cycles-per-year to reduce their levelized costs. While this makes them an appealing matching technology for solar, which has routine daily cycles, they are perhaps less lucrative for wind installations. Wind farms follow less routine, often weekly wind patterns where hybrid systems may be a more economic alternative.

In general I thought this article did successfully portray the economic situation facing low-carbon energies. My main criticisms arise due to the structure and readability of the study. While it is structured first with an abstract, executive summary and then a full in-depth discussion, many of the discussions, figures, and tables are repeated verbatim throughout the document. Additionally, I found that the clarity of the writing improves as a reader progresses through the document. I believe the article would be well served by reducing repetition and improving clarity, even if that requires a substantial reduction of the executive summary. Limiting the lengthy—and at times somewhat unclear—executive summary, in favor of a more concise document in total, would encourage me to read through the entire paper. On top of this, even with a reduction in length, high clarity is essential in the executive summary. This is where readers will start (and many will end), and it is the most important place to convey information effectively.