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**Energy's Digital Future: Harvesting Innovation for American Resilience and National Security** by Amy Myers Jaffe, Columbia University Press, 2021. ISBN 9780231196826, Photographs. Notes. Sources cited. Index. Pp., 246. \$35.00

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Review by Dr. Mark T. Peters II, USAF, Retired

The upcoming Fourth Industrial revolution will require abundant cheap, preferably clean, energy sources to support massive data centers, nation-wide automated vehicle services, and on-demand manufacturing. In *Energy's Digital Future: Harvesting Innovation for American Resilience and National Security*, Amy Myers Jaffe explores historical perspectives behind the global oil preference and suggests environmentally cleaner alternatives without sacrificing national security. The book's first section examines the historical aspects of national energy solution choices. The author highlights Chinese programs like the Belt and Road Initiative, as a strategic means to control key resources. Next, Jaffe suggests several disruptive urban transportation technologies before examining how U.S. structural energy transformations can improve national security. Overall, an interesting strategic look at how alternative energy sources fuel national security options, recommended for new readers, or those wanting to catch up on recent developments.

The overall thesis suggests U.S. national security policies can be maintained and enhanced only if the country can adopt digital and green energy sources which negate any harmful environmental impacts. A key miss appears here as the work never defines the core term, "digital energy." Traditional changes between analog and digital suggest moving from a continuously variable signal to one measured as multi-levels. The central arguments discuss how alternative electric sources may be more capable of sustaining the U.S. strategic vision than a petroleum base. Three areas contribute to this hypothesis; historical use, future models, and U.S. security goals. Historical anecdotal evidence begins with World War I's impact on Ford Motor company choosing gasoline power as electric, urban mass transportation's inability to compete, and how China plans to monopolize scarce global resources.

The historical section begins in the early 1900s with how World War I drove a shift from electric power to fossil fuels. Jaffe underlies these assumptions with the understanding that historical technology winners adopted the best, cheapest, and most available energy. These assumptions then underpin arguments suggesting long-term, fossil fuel detrimental effects may cause greater cost than initially apparent. Strong arguments support the efficacy of alternative sources during early mass-transit experiments. These examples tie to broader economic impacts to convert existing infrastructure and difficulties in storing renewable energy effectively versus scalable produce on demand with petroleum. The area concludes in suggesting power increases required to support robotics, artificial intelligence, cybersecurity and on-demand manufacturing may experience social nudges towards renewable energy sources rather cheap and available. Green strategies are a common, corporate concern as companies have adopt environmentally responsive strategies at higher cost by advocating long-term benefits rather than short-term needs.

The book's middle sections includes an excellent Chinese government initiatives chapter highlighting forthcoming monopolies in solar energy production, rare-earth resources, and other options supporting expanding Pacific military strategies.. These Chinese goals are supported by the Belt and Road Initiative to establish world-wide presence coupled with secure, nationally-independent, supply chains. While advocating for globalization, the text mentions Chinese investments are driven by a desire for independent accessibility in all areas rather than environmental benefits. The section includes a well-researched discussion about impacts if wide-spread transport automation such as mass ride-sharing becomes more popular than today's individual vehicle ownership. Those transport discussions are followed by an equally exhaustive chapter detailing modeled impacts when manufacturers shift to three-dimensional printing solutions. Several other innovations such as biodiesel and decentralizing energy infrastructure to individual management also appear. Each solution in this section suggests future applications benefitting from shifting energy applications.

During my military career, I deployed in 2005 to Bahrain and paid less than 50 cents per gallon for gas when the price in Germany was close to 10 dollars per gallon. Jaffe raises concerns not about the oil price differences but suggesting rapid oil market pricing shifts might politically destabilize

multiple countries. Integral here are some excellent discussions about peak oil demand potential versus production capabilities including recent cost changes due to COVID-19. Specific instances include humanitarian crises in Venezuela, Russia's continued European and Middle East aggression, as well as Saudi Arabia's challenges in economic development without oil profits. Collaborative national agreements such as the Lofoten Declaration for a Managed Decline of Fossil Fuel Production will likely exacerbate the problem in suggesting the highest income, petro fuel consuming countries should support renewable transitions for lower income and developing countries. However, Norway, while using over half of its proven oil reserves with an over 50% conversion to electric vehicles was suggested to lead change and their political structure resisted strongly. Particularly interesting was analyzing how long might be required to shift to all renewable sources even if cooperative governments mandated. Jaffe explores the connection between petro chemicals and plastic production, an area frequently overlooked. Each regional area is analyzed to suggest how implementations transitioning away from fossil fuels will likely face serious challenges. Some short-term transition techniques are discussed including carbon taxes, social costs, and negative emission incentives.

While the book presented some interesting anecdotes, my first concern, as mentioned above, is the lack of a digital energy core definition. Accepting energy supports digital transformation makes a sound argument but remains insufficient within the text. An alternative might be discussing how energy usage could be efficiently monitored or regulated through digital means, or mirroring manufacturing on demand with energy production on demand to reduce climate impacts. The second logical argument arises that without studies of massive use of clean energy, eventual impacts are uncertain. Jaffe mentions coronavirus impact oil pricing impacts without considering the associated decline in private transportation and shipping (p. 137) while those same shifts would impact ride-sharing or mass transit systems even if using alternative electrical power. Reducing waste associated with petrochemical products remains an excellent idea, further changes will require additional study. The costs associated with transition to other energy sources are not clearly balanced against economic gains other than the hypothetical assumptions linking fossil fuel usage to detrimental climate changes without comparative studies. One remaining gap was the discussing other non-renewable but

potentially beneficial energy sources such as nuclear fission and fusion options.

Overall, *Energy's Digital Future: Harvesting Innovation for American Resilience and National Security*, gathers some excellent research and arguments about several different topics under a single cover. My overwhelming impression, was in order to maintain a global leadership position, the U.S. needs to work to ensure power accesses, whether oil or renewable, to secure and maintain security similar to what China has accomplished. The links between expanding technologies and alternative power sources is not explored as substantially as I might have hoped but the associated research is excellent. The final conclusion provides some excellent recommendations for how the U.S., if it so decides, might advance its own participation in non-oil energy development. Anyone interested in the energy field, from either a corporate or a policy perspective, could likely benefit from reading this work.