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A Multi-physics Approach to Energy and Demonstration Facility

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Abstract:

A methodology to investigate the generation, transport and storage of energy based on a multi-physics approach, tied to the end use application, is presented. Often little or no consideration is given to the end use or desired product of the energy used. Current energy generation, transport and storage are dominated heavily by a few large sectors, notably electricity and hydrocarbons. This is not surprising as they are incredibly effective but rely on a centralized model. Small scale generation in microgrids tends to continue this model with energy storage being a mix of hydrocarbons and battery storage.

A paradigm shift in the thinking and design of energy systems based on the required end use or product is needed. The philosophy and motivation that lead to the consideration of this new approach are outlined in this article. Following this a summary of a methodical approach to developing the most energy and cost-effective solution to general processes by considering their end-use physics is presented. Examples of innovative energy generation, storage, and transport solutions based on the multi-physics approach are then outlined. Finally, a brief description of the Multi-physics Renewable Energy Lab (MPREL), a demonstration facility based on the approach and currently under construction at the Naval Postgraduate School, is given.

Biography:

Assistant Professor in Mechanical and Aerospace Department at the Naval Postgraduate School with area of research in renewable energy, solar thermal cycles, heat transfer, gas turbines, and turbomachines. Bachelor degree in Mechanical engineering from Education from University of Natal, Durban, South Africa ; Master degree and PhD in Mechanical Engineering from University of Stellenbosch, Western Cape, South Africa. Member of the American Society of Mechanical Engineers (ASME).