Abstract: Despite ever-improving computing efficiency, information technology (IT) represents the fastest growing energy consumer and will have significant implications for U.S. energy consumption. This impending cliff threatens the nation's ability to solve important problems across science, technology, national security, and energy. Without improvements in computing efficiency, the explosion of the Internet of Things (IoT) and artificial intelligence (AI) applications will exponentially increase energy consumption. A complete rethinking of how computing is performed today is needed to develop the next-generation of beyond-CMOS microelectronics. Our scientific mission is built on a core guiding principle that a significant opportunity exists for use-inspired basic science to enable highly energy efficient computing by exploiting correlated phenomena and consequently lowering the operating voltage. Orders of magnitude improvement in energy efficiency are possible by exploiting correlations (electronic charge/spin and dipolar). We aim to design and manipulate this energy barrier to specifically reduce the operating voltage substantially below what is achievable by today's CMOS technology. This fundamental physics approach to solving systems-level techno-economic problems can lead to dramatically lower energy consumption, in addition to a completely new hierarchy of logic-in-memory information technology building blocks.

Bio: Ramesh pursues key materials physics and technological problems in complex multifunctional oxides. Using conducting oxides, he solved the 30-year enigma of polarization fatigue in ferroelectrics. He pioneered research into manganites coining the term, Colossal Magnetoresistive (CMR) Oxides. His work on multiferroics demonstrated electric field control of ferromagnetism, a critical step towards ultralow power memory and logic elements. His extensive publications on the synthesis and materials physics of complex oxides are highly cited (over 100,000 citations, H-factor =150). He is a fellow of APS, AAAS & MRS and an elected member of the U.S. National Academy of Engineering, a Foreign member of the Royal Society of London, the Indian National Science Academy and a Fellow of the American Academy for Arts and Sciences. His awards include the Humboldt Senior Scientist Prize, the APS Adler Lectureship and McGroddy New Materials Prize, the TMS Bardeen Prize and the IUPAP Magnetism Prize and Neel Medal and the Europhysics Prize in 2022. He was recognized as a Thomson-Reuters Citation Laureate in Physics for his work on multiferroics. He served as the Founding Director of the successful Department of Energy SunShot Initiative in the Obama administration, envisioning and coordinating the R&D funding of the U.S. Solar Program, spearheading the reduction in the cost of Solar Energy. He also served as the Deputy Director of Oak Ridge National Laboratory and the Associate Lab Director at LBNL. Most recently, he served on the Biden-Harris Transition Team for Energy. He is also a co-founder of Kepler Computing, which is focused on low power computing using ferroelectrics. Since 15 August, he is the Vice President for Research at Rice University