Job Description for Research Assistantships in *Sustainability as a Strategy*
(*Stanford University*: Graduate School of Business, Materials Science & Engineering)

Stanford University and SLAC National Laboratory are developing research leadership focused on Sustainability in Microelectronics, in terms of assessing energy and resource usage for processing, manufacturing, computing, and reusing. SLAC and Stanford actively participate in several initiatives related to the Department of Energy. Microelectronics form the basis of all digital products in all sectors of the economy, including consumer goods, finance, transportation, and manufacturing. Innovations in microelectronics, also known as conventional semiconductors, are critical for global competitiveness as well as economic, national, and climate security. Advances in modeling, simulation, sensing and control, machine learning, automation, and other important processes reliant on microelectronics are driving innovations in manufacturing, reducing energy consumption, and limiting GHG emissions. On February 24, 2022, as part of the White House announcement on its 1-year Supply Chain Reports, DOE, in its Supply Chain Review for The Energy Sector Industrial Base and Semiconductor Sector Report, gave specific recommendations for investments in conventional semiconductor energy efficiency.

Because of its importance to the economy, all the countries in the world are expanding to using digital computing whose building block consists of various components manufactured using very large-scale integration processes in microelectronics. The digital economy is growing rapidly as evidenced by artificial intelligence and machine learning. Its large swath of applications, a few of which are growing exponentially, include automated manufacturing, driverless cars, internet of things, crypto mining, increased use of sensing to create all aspects of the modern economy. By 2030, semiconductors could consume nearly 10%- 25% of human planetary energy production, and possibly a higher percentage of the total electricity consumed. The problem of energy efficiency in computing is compounded further by the slowing of Moore's law in the last decade, and by global warming which further puts constraints on data centers. This has been the case already in the UK during the 2023 summer and during deployment and use of high-end supercomputers.

Position Overview:

As part of a new effort in Stanford between Engineering and Business schools, we propose to carry out a joint research effort between the Engineering and Business Schools for a field study of how major semiconductor companies are currently pursuing research and solutions towards a path to sustainability by increasing the energy efficiency in computing. The research will have two different thrusts: *One*, on technical challenges and how different companies are addressing them; *Second,* on strategic advantage for companies in pursuing sustainability via energy efficiency, co-design, and other innovations. This may need tie-in with the current efforts that the US federal government and industry are initiating in sustainability and for on-shoring semiconductor manufacturing. Correspondingly, there are openings for two Research Assistants (RAs), one from the engineering school and another from the business school, who shall work together

During research, the RAs will examine how by adopting sustainability goals specifically related to energy efficiency in computing and semiconductor manufacturing, the US is likely to be able to regain and maintain leadership over the longer term. Another key question to address is how sustainability could provide an advantage that can overcome the current challenges given the ubiquity of computing on all aspects of modern life. The research should address specific solution paths in the new world where the ecosystem has changed drastically since the last time as mentioned above. The research assistants will work with specific faculty from the engineering and the business schools who can guide and mentor the research. The outcome of the research would be to address the topics discussed above and show how sustainability can be a strategic advantage from both the technological and business perspectives. The end of the research project will be a written report, followed by an oral presentation to the faculty members, with background data, references, and analysis for addressing the key problems mentioned above.

Specific responsibilities (include but are not limited to):

- specific research thrust2 consistent between Engineering & Business
- Try to address the four questions:
    - How to mitigate unsustainable trends in energy of computing caused due to a variety of factors (e.g., AI growth)?
    - What can be done to make VLSI manufacturing sustainable in terms of energy?
    - How to bring sustainability into resources (Materials, Water) supply chain and usage during manufacturing?
    - What can be done to improve sustainability in the post usage of computing devices (e.g., landfills, recycling)?
- Based on literature research and discussions develop the basic aspects of the specific thrusts from supplier chain perspectives
- Using examples or specific cases

Opportunities and Benefits

- Growth and mentorship from engineers and scientists from SLAC and Stanford University.
- A mission-driven, stable, collaborative, highly multidisciplinary and supportive work environment.
- Opportunity to experience a multidisciplinary research and study environments, integrating knowledge from many subject areas spanning computer engineering, physical sciences, applied mathematics, and software applications.

Note: This is an hourly, non-benefits eligible temporary-nonexempt, research assistant (RA) positions (work at 50% full-time equivalent or more), not to exceed 980 hours in six consecutive months. Eligible applicants must be at least undergraduates/co-term engineering students, currently enrolled in or recently graduated from Stanford, and have US work authorization. The on-site internship program is for a period of eight weeks and takes place between May and Mid-August, with the start date being contingent on the convenience of the candidate.

To be successful in this position, candidates should:

- Be pursuing a degree (undergraduate and graduate) in a science, engineering or equivalent discipline.
- Have demonstrated strong communication skills.

- Have demonstrated ability to work in a collaborative environment.
- Are passionate about innovative solutions for Science & Engineering problems.
- Have some prior experience at Python programming and ability to process data

(*Please contact Sadas.Shankar@Stanford.edu if you are interested).*

Physical requirements and working conditions:

- Consistent with its obligations under the law, the University will provide reasonable accommodation to any employee with a disability who requires accommodation to perform the essential functions of the job.

WORK STANDARDS:

- Interpersonal Skills: Demonstrates the ability to work well with Stanford colleagues and clients and with external organizations.
- Promote Culture of Safety: Demonstrates commitment to personal responsibility and value for environment, safety and security; communicates related concerns; uses and promotes safe behaviors based on training and lessons learned. Meets the applicable roles and responsibilities as described in the ESH Manual, Chapter 1—General Policy and Responsibilities: http://www-group.slac.stanford.edu/esh/eshmanual/pdfs/ESHch01.pdf
- Subject to and expected to comply with all applicable University policies and procedures, including but not limited to the personnel policies and other policies found in the University's Administrative Guide,http://adminguide.stanford.edu.