NASEM – BECS Workshop

Developing and Assessing Ideas for Social and Behavioral Research to Speed Efficient and Equitable Industrial Decarbonization

Panel: Firm- and Industrial-Level Response to Decarbonization Goals

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Overview

- Questions
  - What is known from the social science literature about the factors, and conditions that influence different types of firms' decisions about transitioning from one type of business to another?
  - How do firms respond to financial incentives for decarbonization? Is there an understanding of situations in which carrots or sticks work better?
  - How do you measure the impact of the green premium on firm-level behavior?
- Example(s) of studies using social/behavioural science techniques
- Research Agenda – Areas to Prioritize

Q1. Social science (management & ESG) literature about factors & conditions influencing firm decisions about transitioning from one type of business to another?

- New technologies may be economically and technically viable, but adoption and success uncertain, influenced by many different mechanisms, viz. changing social norms, development of a market and market feedback loops, and government incentives (Hess 2005).
- **Barriers.** Adoption of new technologies blocked by: lack of legitimacy and pre-existing inhibitive institutional approaches and opposing behavior of established suppliers as seen in consumer behavior (Reddy & Painuly 2004).
- Social factors may prove more important than technological or economic factors similar to consumer behavior (Caird et al, 2008; Arkesteijn & Oerlemans, 2005) especially looking at market adoption.
- **Factors and conditions** include: level of technological acceptability of group and individuals, characteristics of group making decision (size, location, management), technology attributes (technical, economic, environmental), technology's acceptability due to industrial community's context – social context (thought leader influences, individual influences, social networks & communication, awareness & education; institutional and geographic context. (Wolfe et al 2002)
- **New Theory of the firm**: Redefining the business model for corporations as a socio-economic system, to create social and economic value across a firm's boundaries. (Alvarez 2020 and Business Roundtable 2019)
- Deep decarbonization is seen as a risk management challenge by firms (Lempert and Trujillo 2018)
- **Socio-technical Imaginaries. Carbon handprint** (based on LCA and sLCA) -- a framework to make decisions around decarbonization by firms – how positive actions by firms are valued – useful when an industry has to produce societal goods but can create value elsewhere in the social system (MIT SHINE 2021, VTT LUT Finland 2021)

Ex. Qualitative Study : Behavioral study of a paradigm shift to a green technology.

Factors and conditions influencing different types of firms' decisions about transitioning from one type of business to another?

Adoption of Renewable Energy Innovations (a novel electrochemical decarbonization technology) in the Cement Industry. (*Failey, Srinivasan, McCormick 2014, ASA*)

- **Methods:** used ethnographic, case study approaches, interviews
  - (a) cement companies (US, Canada, EU, China) roles in R&D, env compliance, QA/QC, engineering, management
  - (b) Industry trade associations
  - (c) Engineering design firms working on cement plant infrastructure (new product design)
  - (d) Government agencies involved in standards development, energy efficiency programs; and NGOs
  - (e) Research institutions studying how to reduce the cement industry's environmental footprint.

- **Findings**: **social**, technical, environmental, economic and regulatory (STEER) factors -- explain adoption of new technologies by industrial companies. Factors rooted in Socio-technic theories (Social Practice Theory, PACT Framework) **and** diffusion of Innovation theories.

- **Social factors:** company's attitudes towards change, environmental impacts, corporate image, management approaches (attitudes, knowledge, thought leadership), actions of individuals internal and external to the firm; and social network to advance new tech adoption, influence attitudes/management, build partnerships – they exist at the transfirm, intrafirm, and interfirm level. (Bossink 2004) and an essential tension between homophily and heterophily in the network or group plays a role in decisions.

- Expected roles of **economic and technical factors,** institutional factors (**regulations, policies and standards**)

This study was supported by a grant from the National Science Foundation under its Sustainable Energy Pathways (SEP) Initiative which looked at the sustainable co-synthesis of cement and fuels

Q2. How do firms respond to financial incentives for decarbonization? Is there an understanding of situations in which carrots or sticks work better?

- Firms appear to respond well to financial incentives for decarbonization e.g., IRA Funding Opportunity Announcements through DOE have elicited substantial interest and a large number of proposals.
- Provides an anchor in uncertain decision-making scenarios and appears to elicit equivalent/greater private equity/investment. Can motivate more firms but perhaps not all firms esp. those unwilling to deal with the potential sticks. E.g., cement
- Japan's Ministry of Economy, Trade and Industry (METI) has released a Transition Finance Roadmap for Industrial Decarbonization starting with the iron/steel industry. Their approach uses a combination of carrots and sticks. How it plays out remains to be evaluated. (METI 2023)

Q3. How do you measure the impact of the green premium on firm-level behavior?

- Uncertainty puts pressure on sustainable behavior change (Deloitte 2023)

- Recent research at Brookings appears to show similar findings at the firm level
  - Previous research has offered **conflicting conclusions**, documenting either a "carbon premium" with brown stocks yielding higher returns, or the opposite, with green stocks outperforming brown.
  - A new analysis provides international evidence using CO2 emissions to measure a firm's "greenness" (across a range of methodologies)
  - Findings show that green stocks across the G7 generally provided higher returns than brown stocks for much of the past decade. ***But in early 2022 brown stocks outperformed green ones during the energy crisis***. (Bauer et al 2023)

Research Areas to Prioritize and Data Needs

- How to enable firms to make decisions under deep uncertainty, high-risk, non-linear scenarios – e.g., probabilistic modelling, integrate quantitative and qualitative research.
- How firms can evaluate tradeoffs and what incentives work – focus on small to medium sized manufacturers since this is the bulk of the industrial supply chain. These firms are widely distributed so collecting data is challenging but necessary.
- Social Networks are powerful, how can pivot points be leveraged to advance decision-making for small, medium and large firms

About ACEEE:

The American Council for an Energy-Efficient Economy (ACEEE), is a nonprofit research organization that develops policies to reduce energy waste and combat climate change. Its independent analysis advances investments, programs, and behaviors that use energy more effectively and help build an equitable clean energy future.

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Presenter

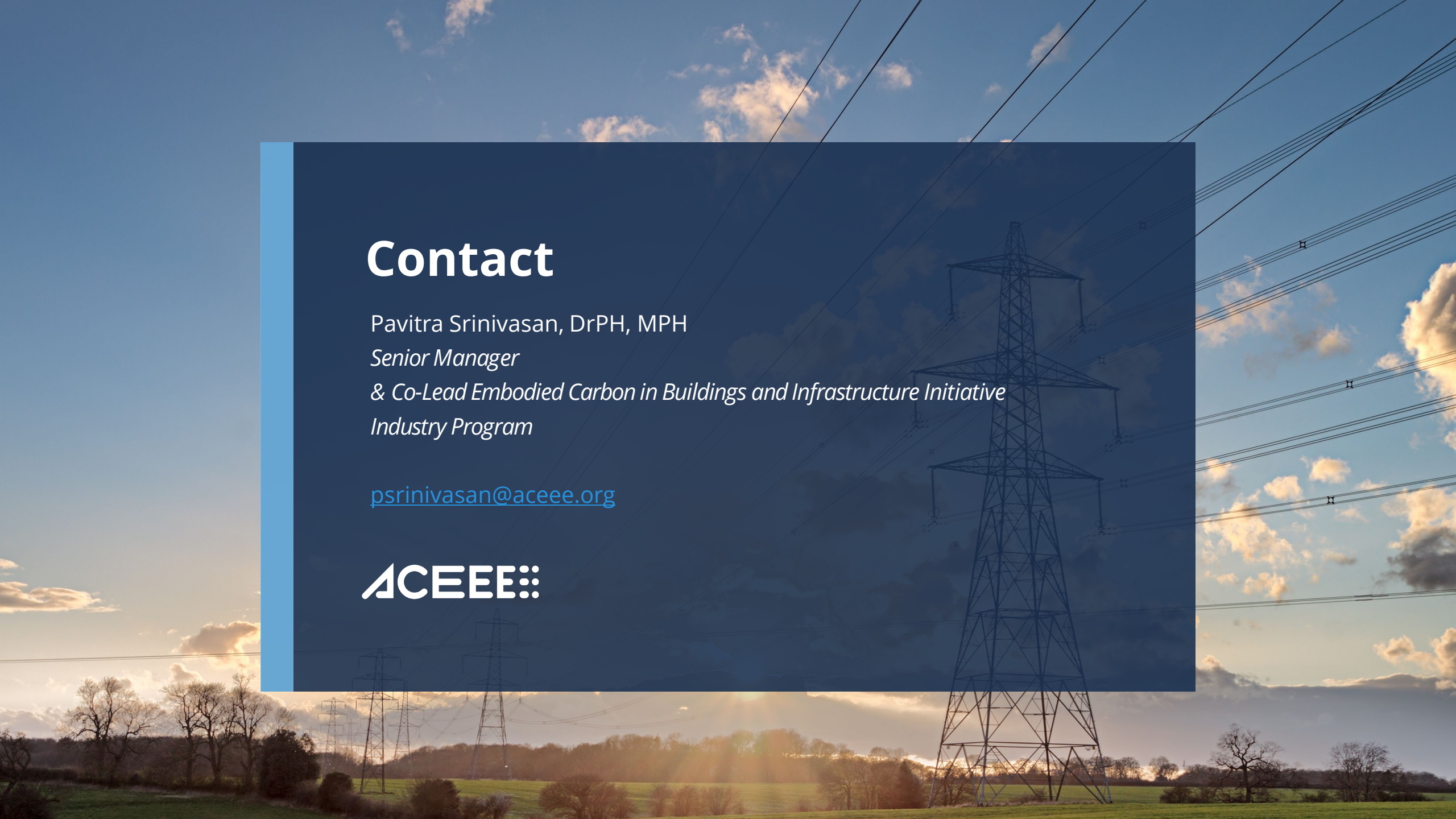
Pavitra Srinivasan, Sr. Researcher, Industry, ACEEE

Dr. Srinivasan is a Senior Manager in the Industry Program and Co-Leads the Embodied Carbon Initiative at ACEEE. She conducts research and analysis on technologies, programs and policies that facilitate industrial decarbonization and works with firms across the market spectrum from supply to demand.

Prior to ACEEE, Dr. Srinivasan was a public health scientist assessing and addressing environmental health, occupational risks and industrial hygiene across several industries, business and community settings. She has supported U.S. federal agencies in rule-making efforts, is experienced in interacting with and collecting input from stakeholders and has provided scientific litigation support to industrial firms.

During her doctoral research, she worked on an interdisciplinary team to conduct lifecycle assessments and better understand the technical, economic and behavioral aspects involved in decision-making around the adoption of a novel green chemistry technology, electrification and renewable energy by the cement industry in the US, India and China to mitigate carbon emissions.

Dr. Srinivasan has served as a guest lecturer on state industrial policy and building sector decarbonization at Georgetown University. She holds a Dr.P.H and M.P.H in Environmental and Occupational Health from The George Washington University, Washington, D.C., and a B.Sc. in Microbiology and Immunology from McGill University, Montreal, Canada. She is an elected member of the Delta Omega Public Health Honor Society.



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