

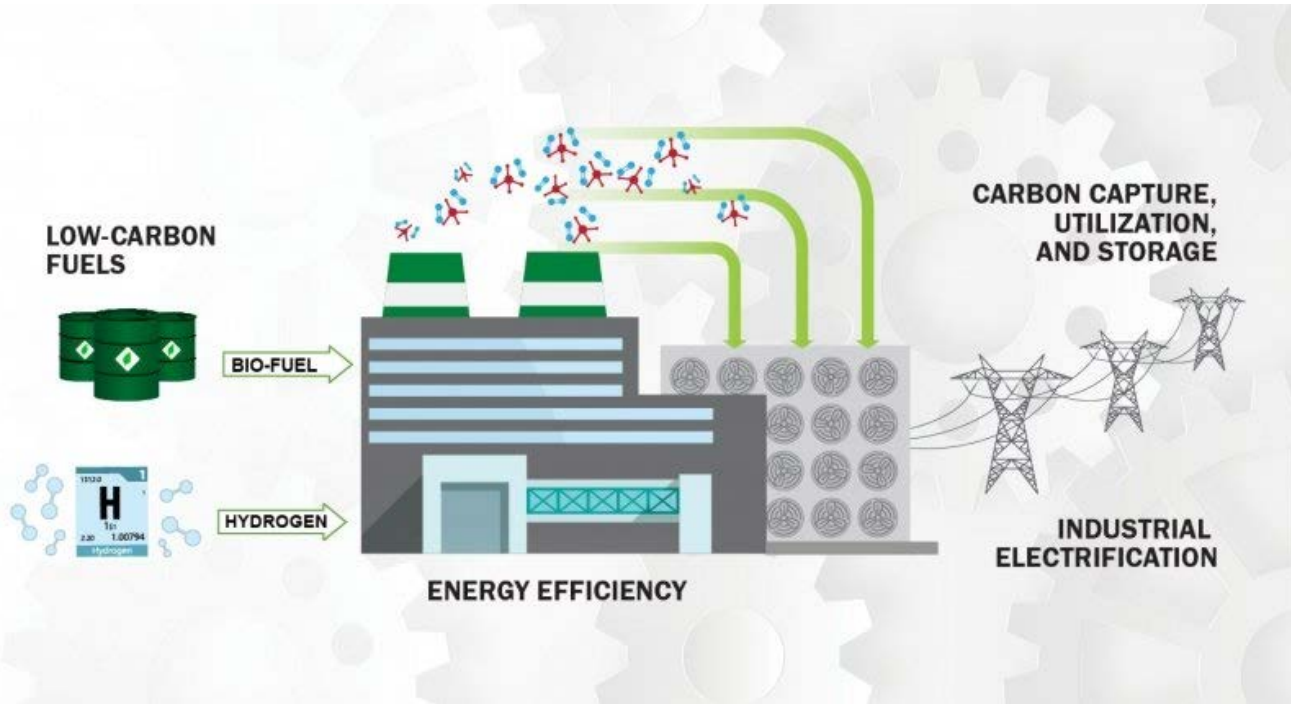
A Tool to Incorporate Non-Energy Impacts in Energy Efficiency Investment Decision Making for Firms

Liz Wachs

International Symposium on Sustainable Systems and Technology

June 18, 2024

Pillars of Industrial Decarbonization



2020 – Industry
30% of primary
energy-related CO₂
emissions in United
States

U.S. Department of Energy, 2022. <https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap#:~:text=The%20crosscutting%20decarbonization%20pillars%20are,capture%2C%20utilization%2C%20and%20storage.>

Preliminary Work: Framework of Technological Innovation Systems

| Dimension | Category |
|----------------|---|
| Actors | <ul style="list-style-type: none">• Companies, institutes of learning, government, NGOs, other stakeholders |
| Institutions | <ul style="list-style-type: none">• Hard: laws and regulations• Soft: Customs, norms, routines |
| Interactions | <ul style="list-style-type: none">• Networks• Between individuals |
| Infrastructure | <ul style="list-style-type: none">• Physical• Knowledge• Financial |

Functions

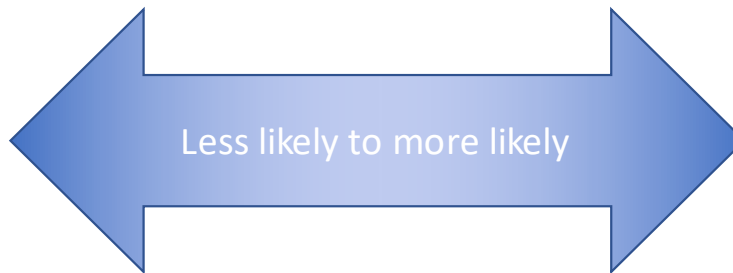
- F1: Entrepreneurship
- F2: Knowledge development
- F3: Knowledge diffusion
- F4: Guidance of the search
- F5: Market formation
- F6: Resources Available
- F7: Creation of legitimacy
- F8: Positive Externalities

(Hekkert et al. 2007; Bergek et al. 2008; Markard and Truffer 2008)

A structural-functional approach to detect barriers and opportunities for innovation

Prior Work: Process Heat/Scope 1 Decarbonization

High thermal load
Process-specific heating needs,
e.g., furnaces, reactors
High temperature (> 600 C)
Retrofits



Low to moderate thermal load
Generic heating needs, e.g.,
boiler, dryer
Low temperature
New build

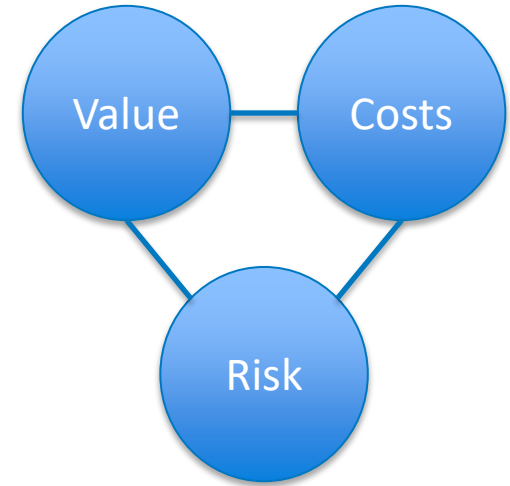
- Exploratory
- 13 interviews
- Sustainability and Operations
- Fortune 500+

McMillan and Wachs, 2024

Energy Efficiency Landscape and Initiatives



Adoption Gap

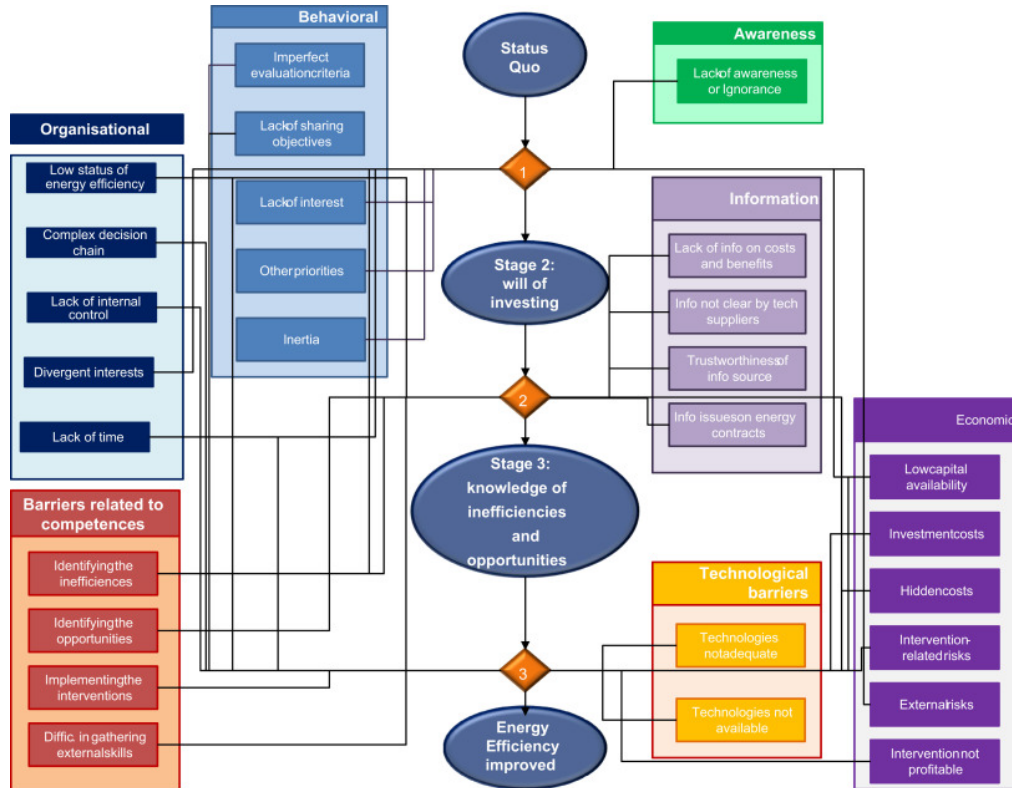


Cooremans, 2011



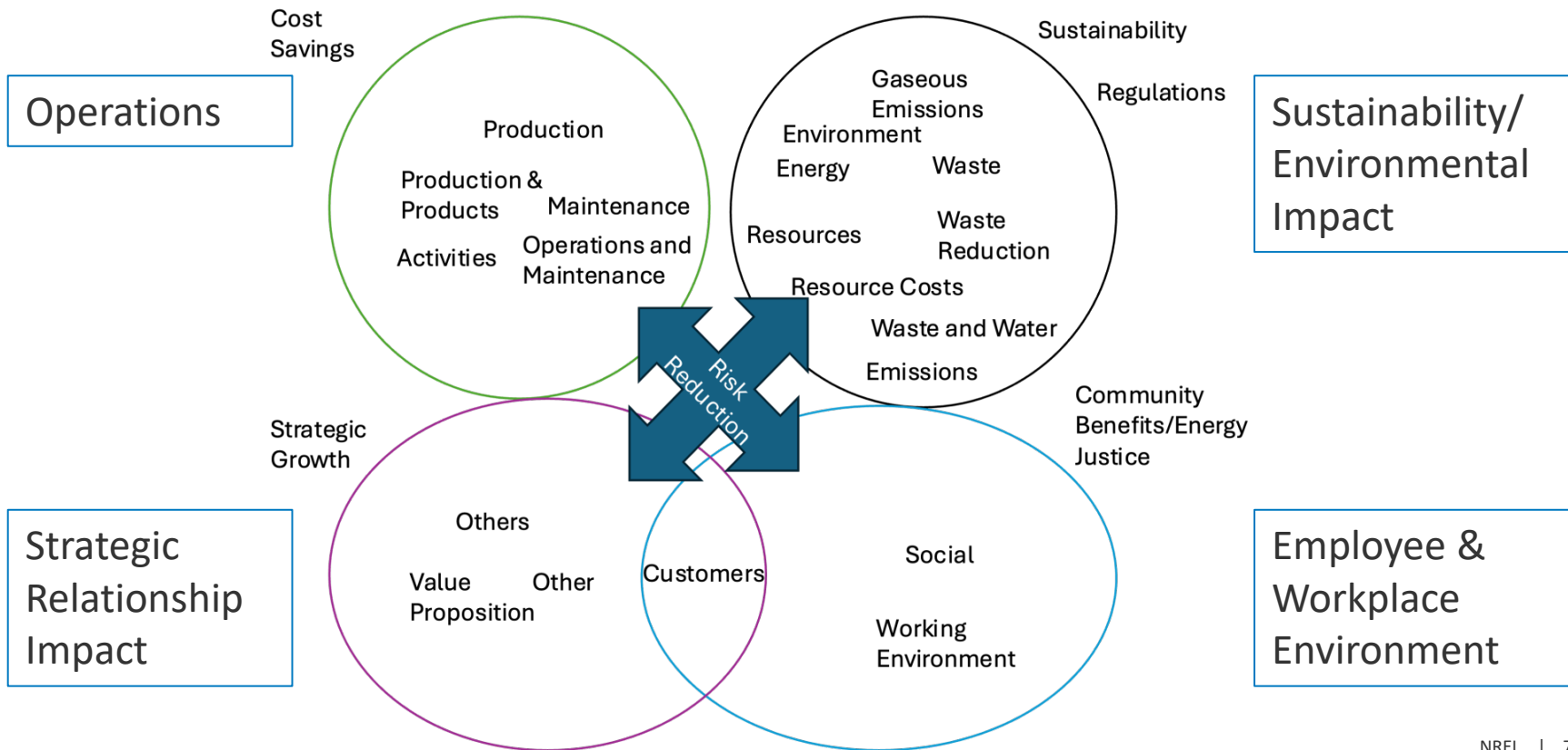
National schemes for energy efficiency in SMEs

MBENEFITS

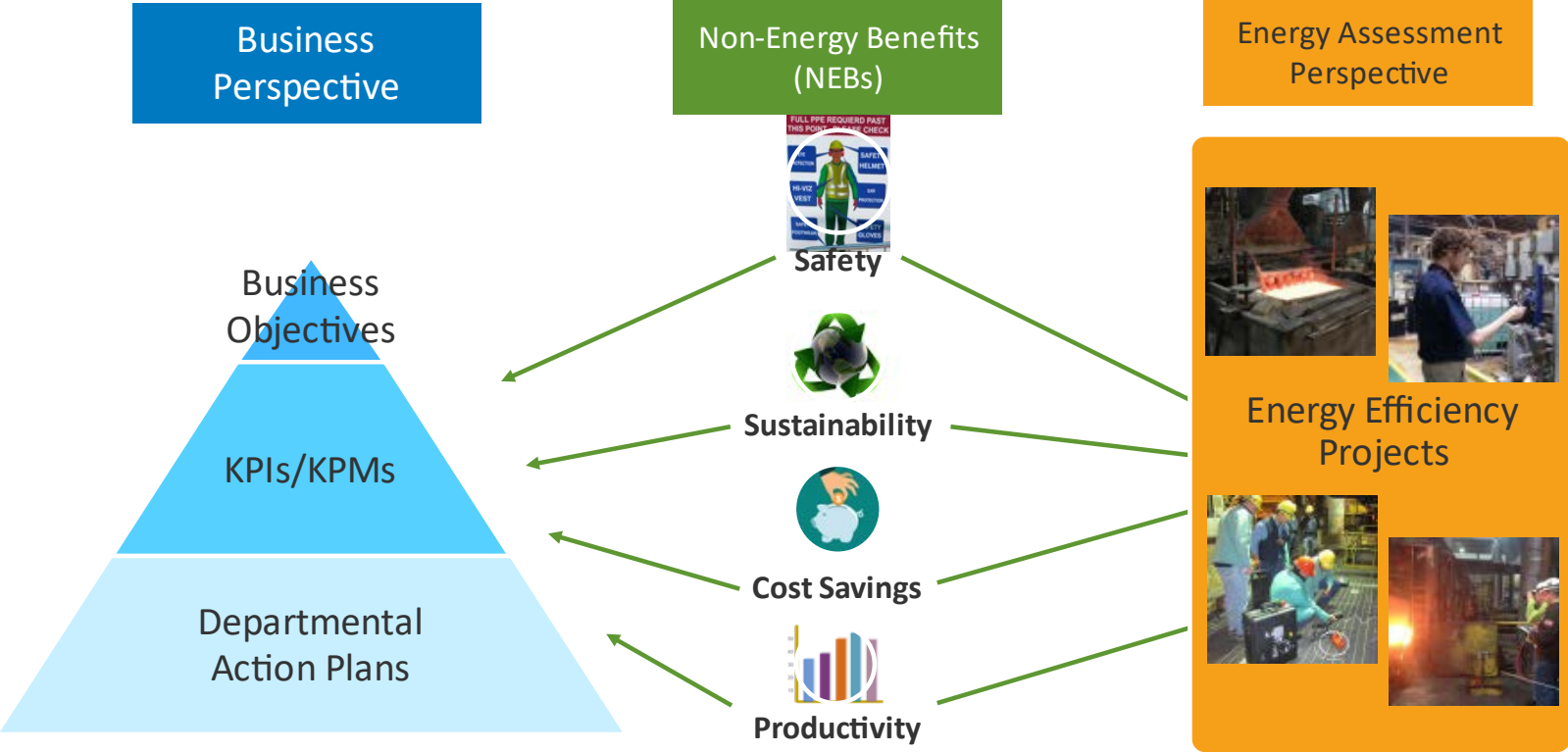


Cagno et al., 2013

Non-Energy Benefits



Bridging Gap between Industry and Government



Successful Initiatives: Scope 1

- 5% carve out for sustainability (A-3)
 - Sustainability metrics justify capital investment (A-3)
- Sustainability bond (A-3)
- Include sustainability goals in capital process (carbon price)
- Water and energy treasure hunts (A-3)
- Rebates from utilities for difference between highest efficiency project (A-6)
- Governmental programs reduce payback period (A-7)
- Risk assessments drove decarbonization goals (A-8)
- Senior stakeholders compensation linked to KPIs (A-8)
- Reduce technology risk by paying for service (A-12)

McMillan
and Wachs,
2024

Goals for Stakeholder Engagement

1. *How Energy-Efficiency Projects are Evaluated in U.S. Manufacturing*

- Who are decision makers on energy projects in manufacturing companies and what are their roles?
- How do sustainability goals influence decisions around energy efficiency?
- How does company or facility size influence decisions surrounding energy efficiency?

2. *How Non-Energy Benefits Can be Included in Decision Making*

- Which categories of key performance indicators are most useful for evaluating energy efficiency projects?
- Which indicators are most useful for evaluating energy efficiency projects, and how should they be evaluated?

Stakeholder Engagement Plan

- Methods:

1. Exploratory – interviews

- 2. Questionnaire**

- US manufacturers

- National Manufacturing Industry Database

- Summer 2024

3. Expert Elicitation

- Summer/fall 2024

The Alchemer logo is displayed in a bold, orange, sans-serif font. The letter 'A' is stylized with a triangular shape on its left side.

Questionnaire

Respondents

Energy
Efficiency
Decisions

Sustainability

Non-Energy
Benefits

Implemented/
Non-
Implemented
Projects

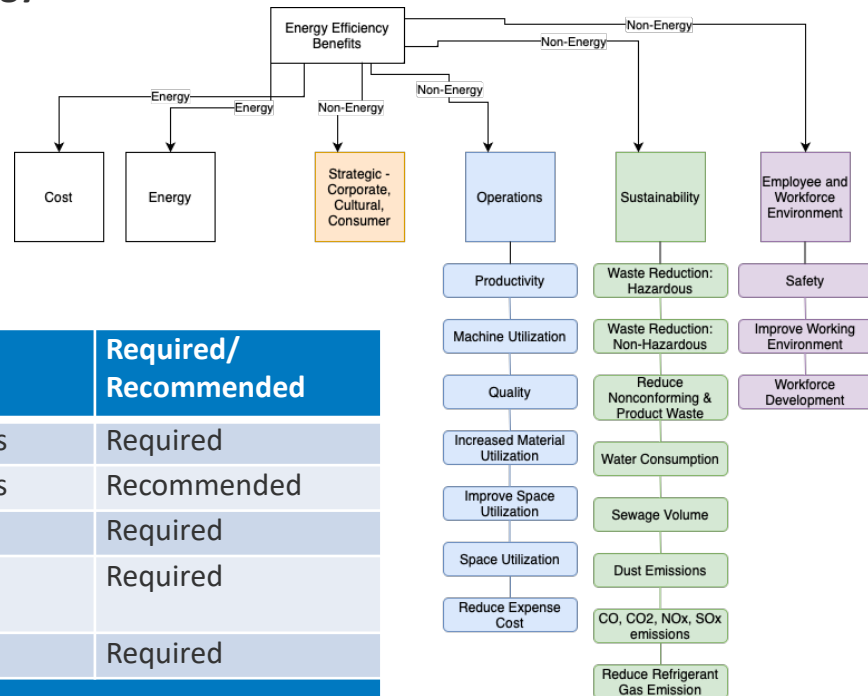
Expert Elicitation

Goal: Build Grouped List of Non-Energy Benefits to Be Used in Software

Question Type 1: Classification Scheme

Question Type 2: Category Definitions

Question Type 3: Categorize, rank NEBs; qualitative or quantitative; fit of KPM



| Task | Time | Required/ Recommended |
|--|------------|--------------------------|
| Short form on demographics and consent | 15 minutes | Required |
| Introductory Teams call - study instructions | 45 minutes | Recommended |
| Round 1: Provide initial assessment of NEBs | 1-2 hours | Required |
| Review assessments; Teams meeting to discuss results | 1 hour | Required |
| Round 2: Revise initial assessment | 1 hour | Required |
| Survey close | | |

IDEA Protocol

Conclusions

- Follow us as we move through the stakeholder engagement process!
- Anticipate pilot software early 2025



**U.S. DEPARTMENT OF
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Q&A

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This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by [U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Industrial Efficiency and Decarbonization Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

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