Welcome

Clean Energy Technology Adoption within Michigan's Manufacturing Sector

Webinar will begin shortly

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Housekeeping

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Submit your questions using the "**Question/Chat**" box in your Go To Webinar tool bar.

We are recording this webinar

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MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

ENERGY SERVICES

Lisa Thomas, Project Manager

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800-662-9278 | Michigan.gov/EGLE

Clean Energy Technology Adoption within Michigan's Manufacturing Sector

- Manufacturers' adoption in energy production and energy efficiency
- MI Healthy Climate Plan

Today's Speakers

University of Michigan
Economic Growth Institute

Dr. Sarah Crane, Research Manager

Clean Energy Technology Adoption within Michigan's Manufacturing Sector

March 2, 2023

Sarah Crane, PhD
sarahrcr@umich.edu
Research Manager
Economic Growth Institute

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UNIVERSITY OF MICHIGAN

About the Economic Growth Institute

Companies

Programs and funding relevant and proven resources

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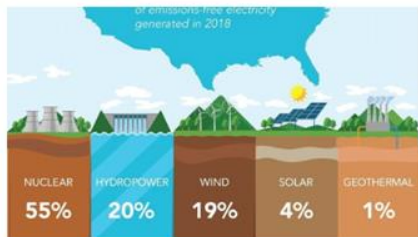Opportunities and technical assistance

Research & Classes

Applied research and learning opportunities

MI Healthy Climate Plan

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Clean Energy Technology Adoption Roadmap

This report identifies the clean energy technology adoption (CETA) roadmap and value chain related to energy and process efficiencies.

Clean Energy Technology Adoption Roadmap ›

Geothermal Roadmap

This report focuses on identifying the supply-side assets/gaps and demand-side impediments of Michigan's commercial and industrial (C&I) geothermal markets.

Download the geothermal roadmap ›

Solar Roadmap

This report focuses on identifying the supply-side assets/gaps and demand-side impediments of Michigan's commercial and industrial (C&I) solar PV markets.

Download the solar roadmap ›

Wind Roadmap

This report focuses on key supply-side assets/gaps and demand-side impediments of Michigan's commercial and industrial (C&I) wind market.

Download the wind roadmap ›

CENTREPOLIS
Accelerator
at Lawrence Technological University

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"Clean Energy Technology"

↓

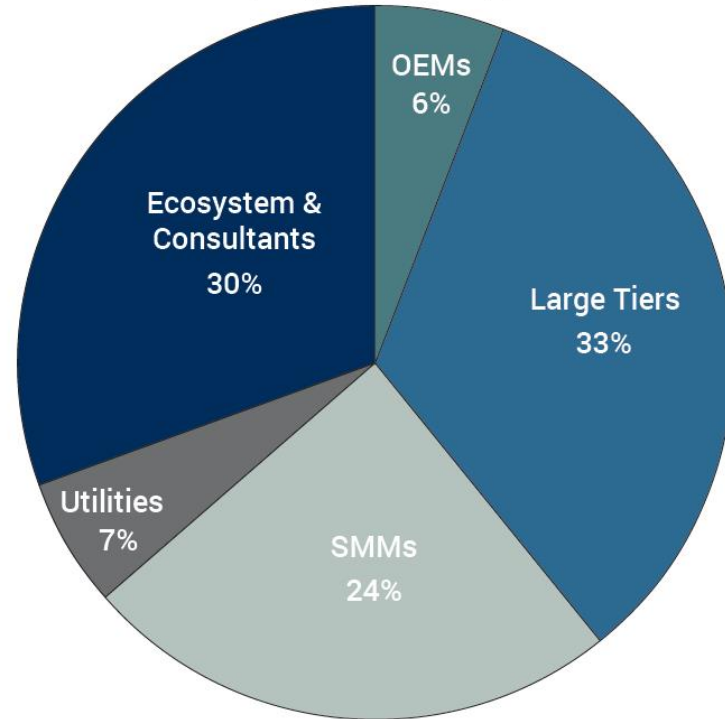# Clean Energy Technology Adoption Roadmap

Methodology

- 40 semi-structured interviews from 33 different organizations during 2022
- Qualitative thematic coding and analysis
- Focus: process efficiencies and fuel switching
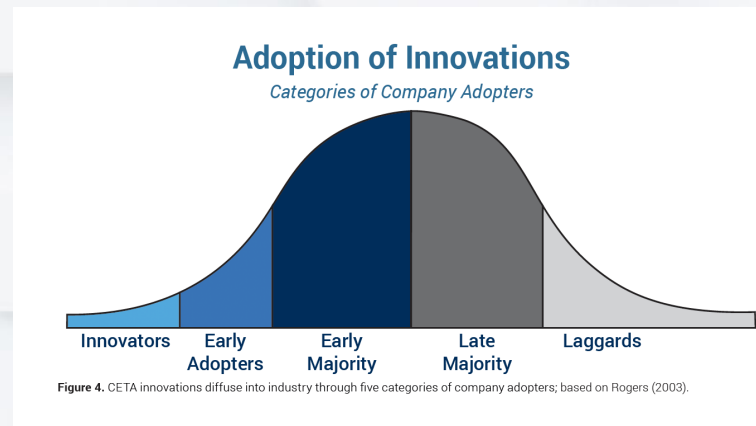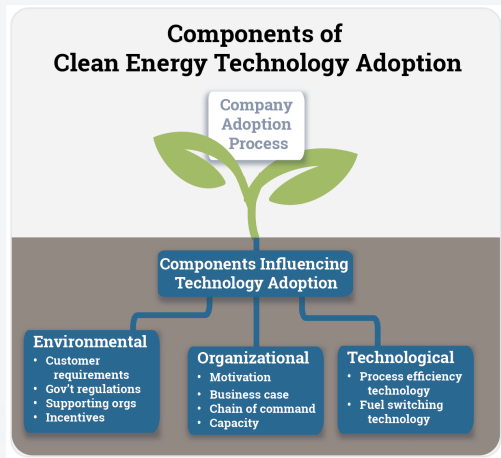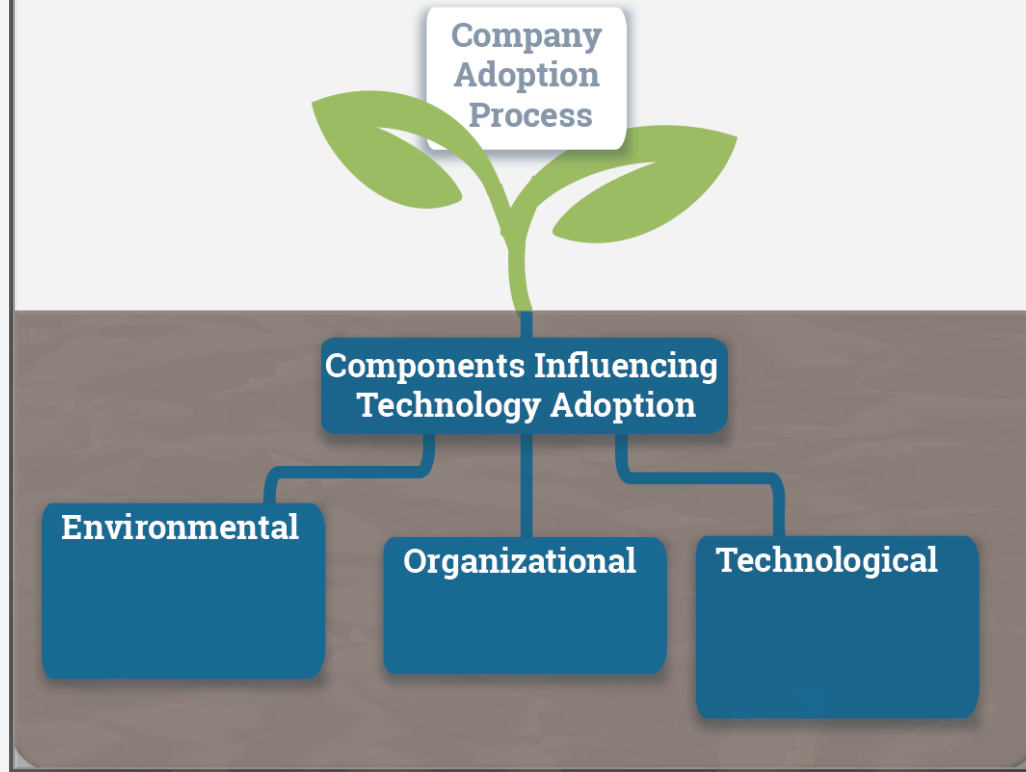- Interview Team: EGI and Centrepolis

STUDY PARTICIPANTS
by Organization Type

- OEMs 6%
- Large Tiers 33%
- SMMs 24%
- Utilities 7%
- Ecosystem & Consultants 30%

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Clean Energy Technology Adoption Roadmap & Value Chain
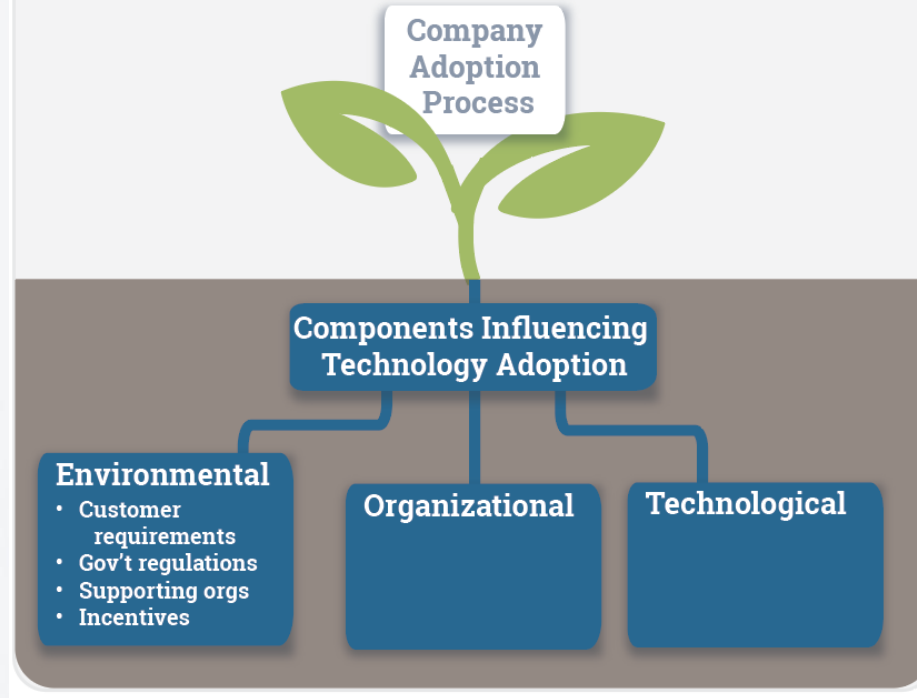
Source: Model based on Tornatzky and Fleischer's (1990) model of technology adoption and integrated with participant interview data.

Components of
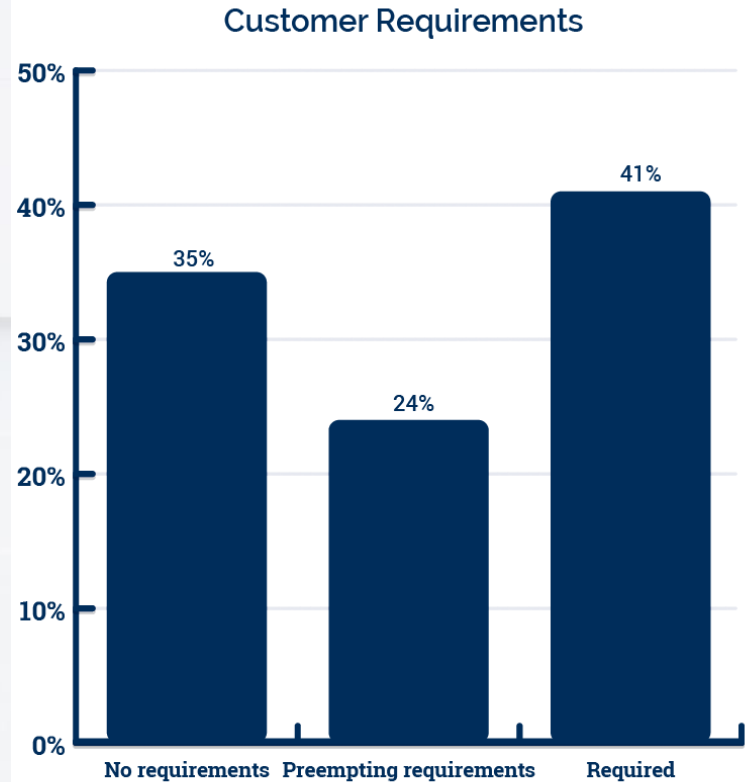Clean Energy Technology Adoption

Environmental Component

- **Customer Requirements**

Customer Requirements

No requirements	Preempting requirements	Required
35%	24%	41%

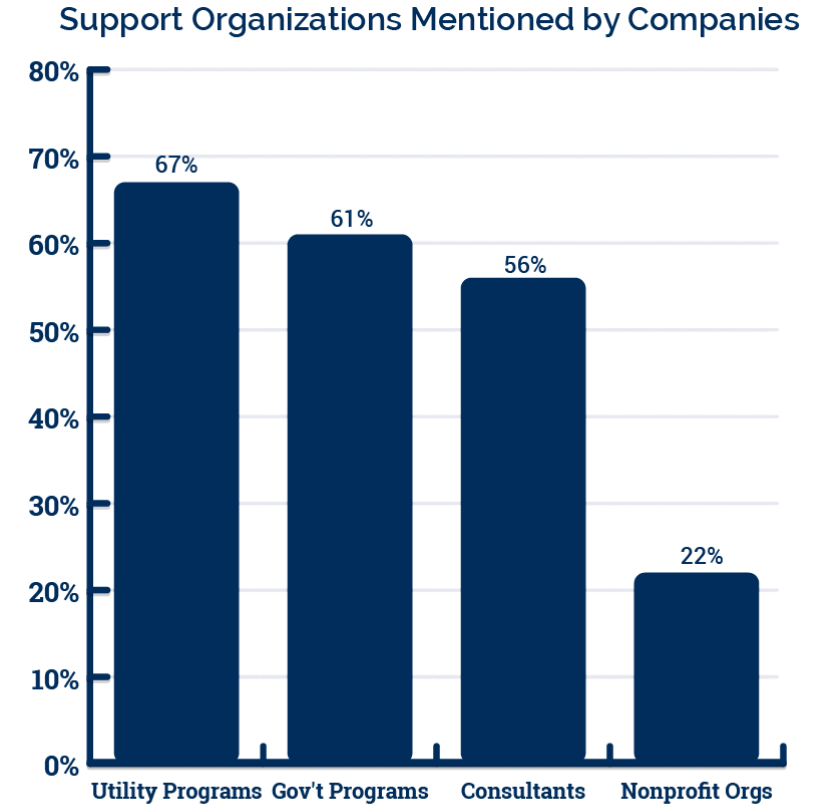**Graph 1.** Customer requirements for decarbonization.

Environmental Component

- **Customer Requirements**
- **Government Regulations:**
  - *14% mentioning these*
  - *Another 14% of participants hoping for more regulations to increase their competitiveness*

Environmental Component

- **Customer Requirements**
- **Government Regulations**
- **Support organizations**
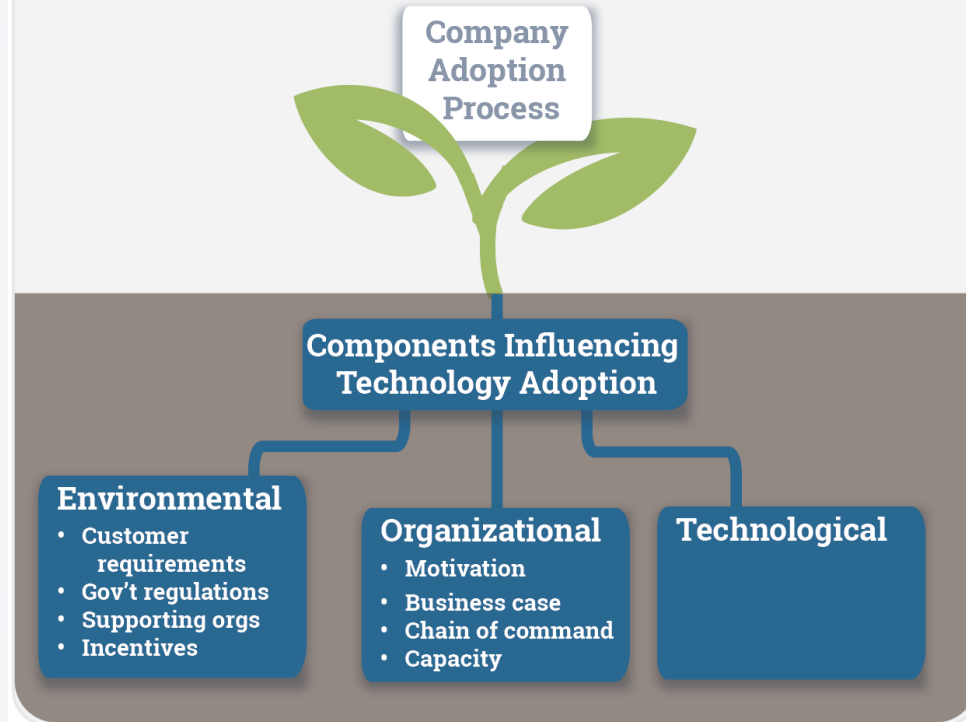

Support Organizations Mentioned by Companies

Graph 2. Support organizations mentioned by companies

Environmental Component
- **Customer Requirements**
- **Government Regulations**
- **Support organizations**
- **Incentives: Direct mention by 43% for implemented projects, with others discussed the need for incentives or lack of incentives.**
  - **Large supplier participant shared, "*When I say I need this capital expense for this project, [management's] first question is 'what is your rebate? What can the energy companies do for you? What are the incentives?'*"**

Components of
Clean Energy Technology Adoption

Company Adoption Process

Components Influencing Technology Adoption

Environmental
- Customer requirements
- Gov't regulations
- Supporting orgs
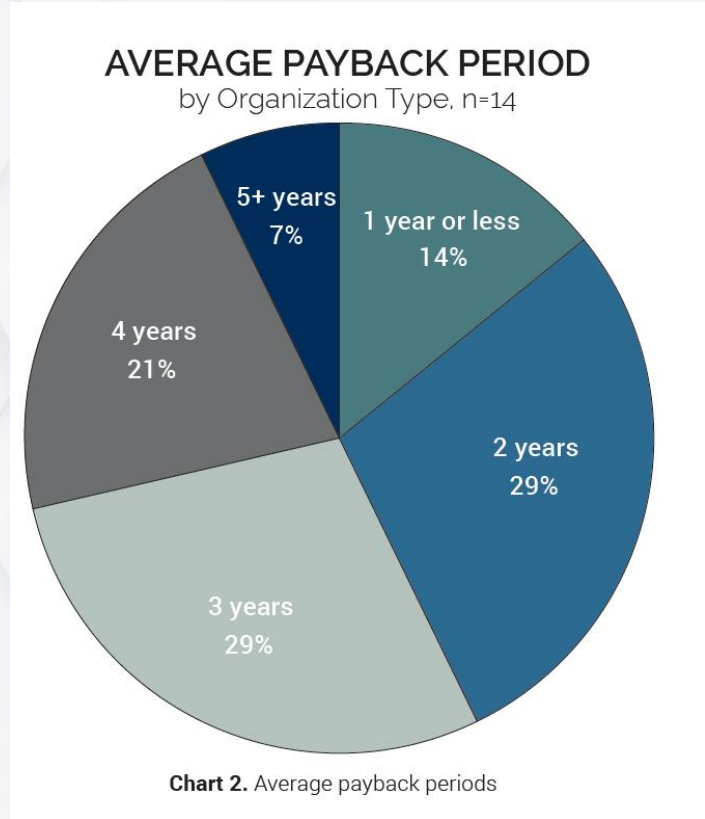- Incentives
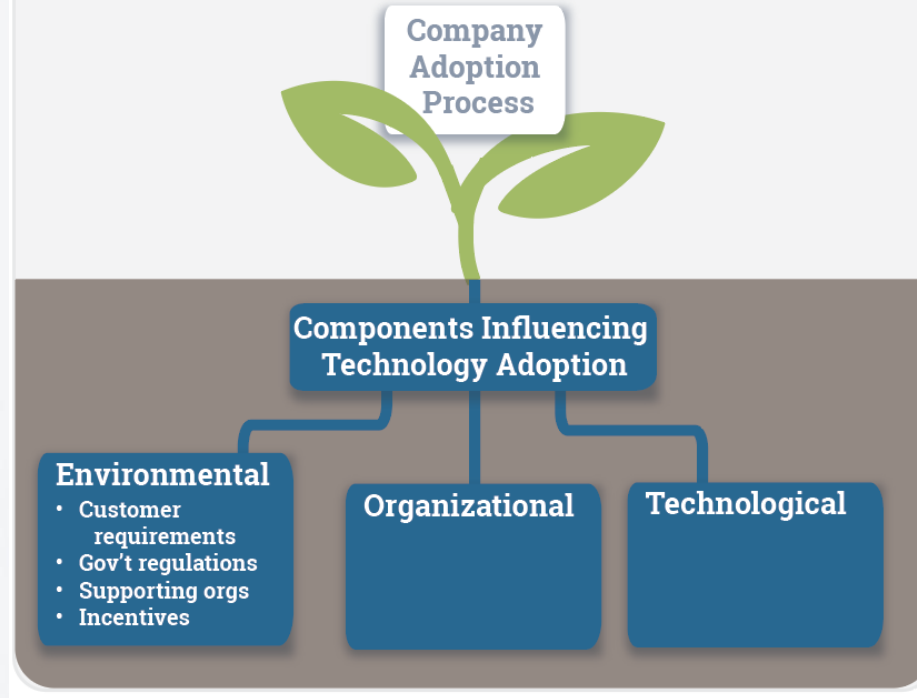
Organizational

Technological

Organizational Component

- **Motivation**:
  - **48% of company participants listed public commitments to sustainability or decarbonization on website**
  - **52% did not publicly list commitments**
  - **By organization size/type:**
    - **OEMs: 100%**
    - **Large suppliers: 63%**
    - **SMMs: 12%**

Organizational Component

- Motivation
- **Business Case**

AVERAGE PAYBACK PERIOD
by Organization Type, n=14

- 5+ years 7%
- 1 year or less 14%
- 2 years 29%
- 3 years 29%
- 4 years 21%

Chart 2. Average payback periods

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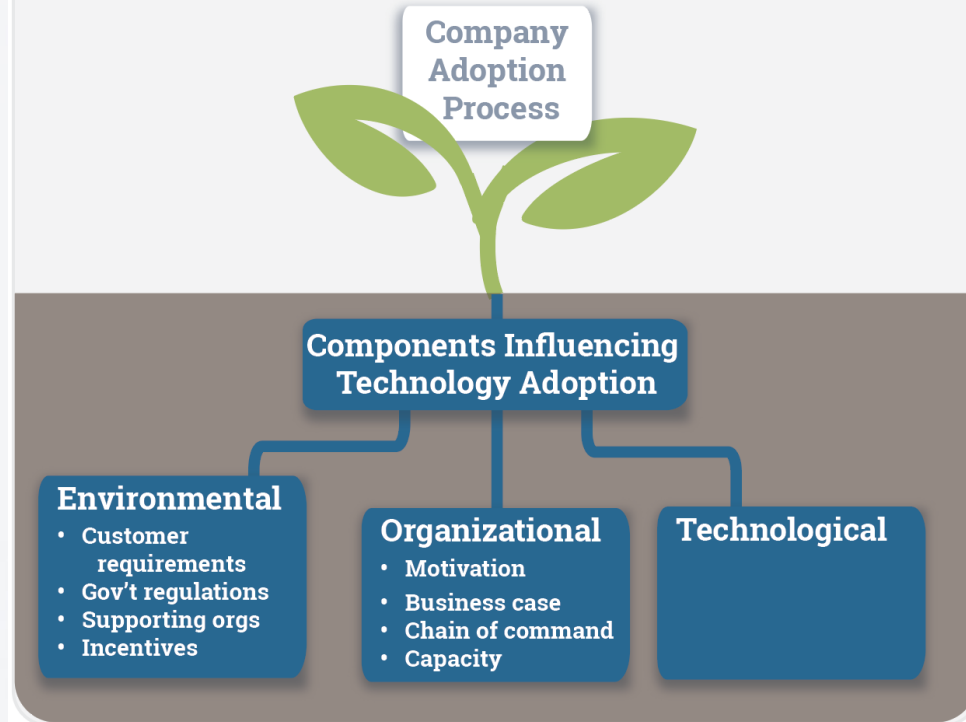
Organizational Component

- Motivation
- Business Case
- **Chain of Command**
    - *"I can quickly tell you how serious an organization takes sustainability – if you talk to the sustainability person and understand who they report to….the ones that report to the C-suite or directly to the CEO, those are the organizations where (sustainability personnel) have a lot more teeth"*
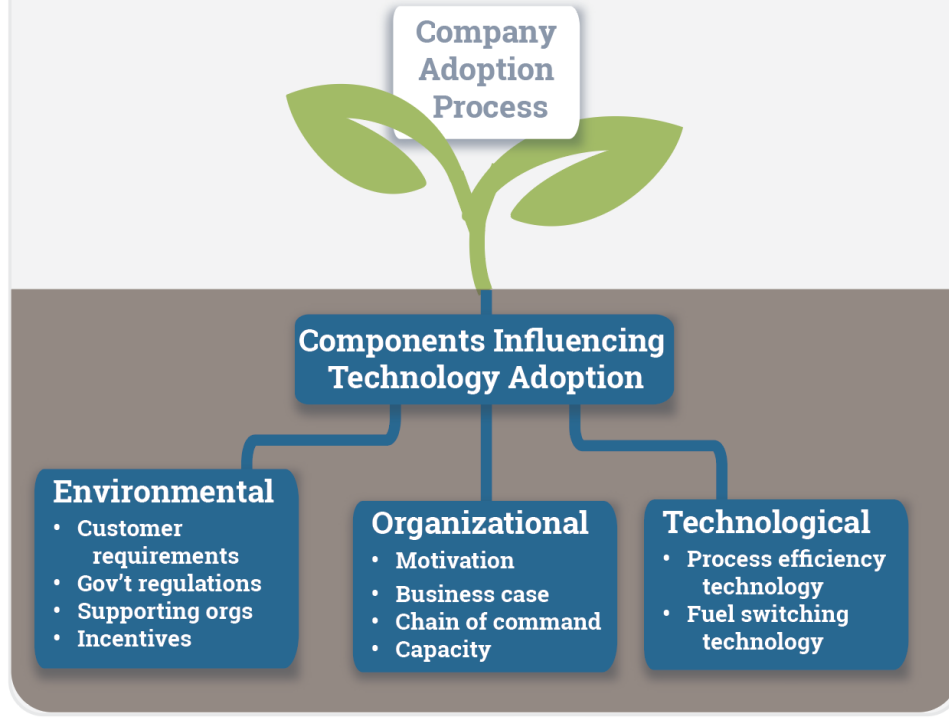
Organizational Component

- Motivation
- Business Case
- Chain of Command
- **Capacity**
  - *"I have negative 15% of my time to devote to this. I really need another employee in my department because it is just me and one other person right now, and we already had full-time jobs before [sustainability efforts] were added"*

Components of
Clean Energy Technology Adoption

Company Adoption Process

Components Influencing Technology Adoption

Environmental
- Customer requirements
- Gov't regulations
- Supporting orgs
- Incentives

Organizational
- Motivation
- Business case
- Chain of command
- Capacity

Technological

Components of
Clean Energy Technology Adoption

Company Adoption Process

Components Influencing Technology Adoption

Environmental
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- Incentives

Organizational
- Motivation
- Business case
- Chain of command
- Capacity

Technological
- Process efficiency technology
- Fuel switching technology

MSU Industrial Assessment Center

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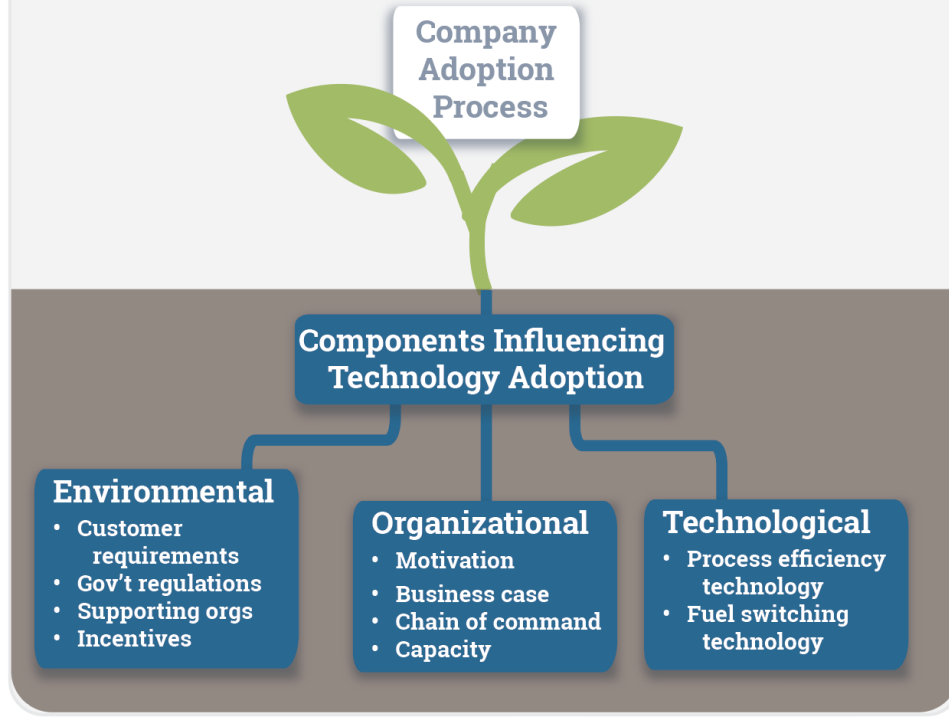
Process Efficiencies:
- 71% had implemented projects
- However, still significant room for additional implementation (MSU IAC data: 48% of top process efficiency projects implemented)

Assessment Recommendation Code (ARC)	Manufacturing Process Efficiency	Assessment Recommendation Description	# Times Recommended since 2010	Average Savings	Average Cost	Average Payback	Implementation Rate
2.4236	Y	Eliminate leaks in inert gas and compressed air lines/ valves	21	$7,878	$1,914	0.3	91%
2.6218	Y	Turn off equipment when not in use	20	$1,718	$133	0.4	67%
2.7142		Utilize higher efficiency lamps and/or ballasts	89	$14,773	$31,507	2.3	57%
2.4221	Y	Install compressor air intakes in coolest locations	88	$3,303	$2,810	1.4	53%
2.7135		Install occupancy sensors	57	$3,109	$3,126	1.4	52%
2.2511	Y	Insulate bare equipment	23	$5,927	$3,754	1.1	50%
2.2437	Y	Recover waste heat from equipment	58	$31,038	$39,671	1	47%
2.4231	Y	Reduce the pressure of compressed air to the minimum required	66	$4,678	$1,176	0.3	43%
2.6211		Conserve energy by efficient use of vending machines	27	$990	$182	0.2	41%
2.4146	Y	Use adjustable frequency drive or multiple speed motors on existing system	28	$11,060	$9,783	1.6	38%
2.2414	Y	Use waste heat from hot flue gases to preheat	44	$69,714	$92,284	2	32%

Chart 4. Most commonly implemented assessment recommendations in Michigan from 2010 to present by IAC assessments, data provided by MSU IAC, with EGI's research team determining which were related specifically to manufacturing process efficiencies as denoted by "Y".

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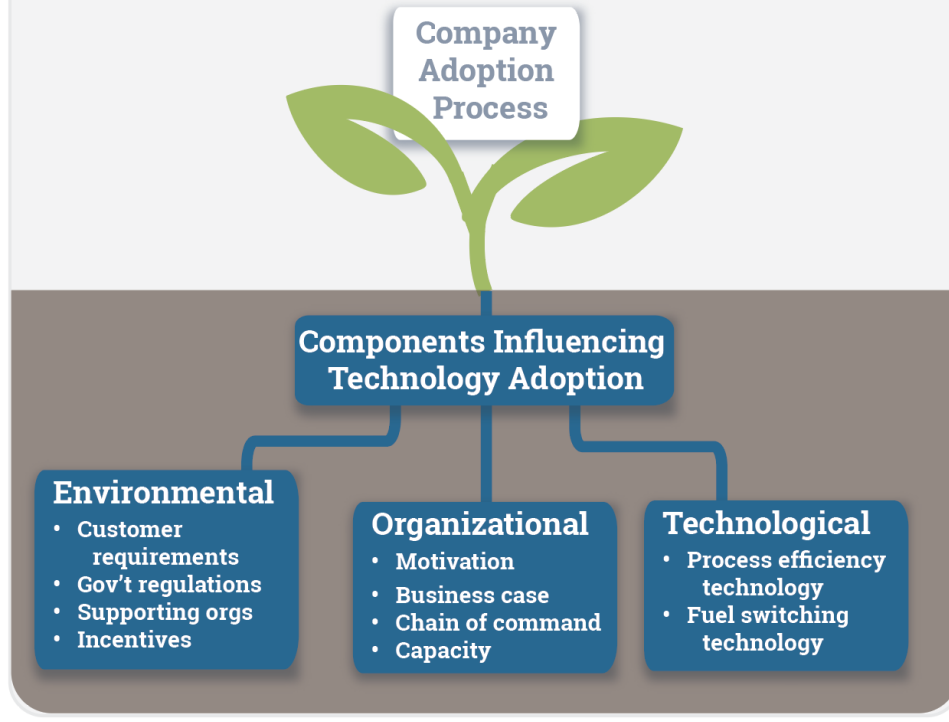
Fuel Switching
- Electricity → Natural Gas
- Low MRL for other technologies

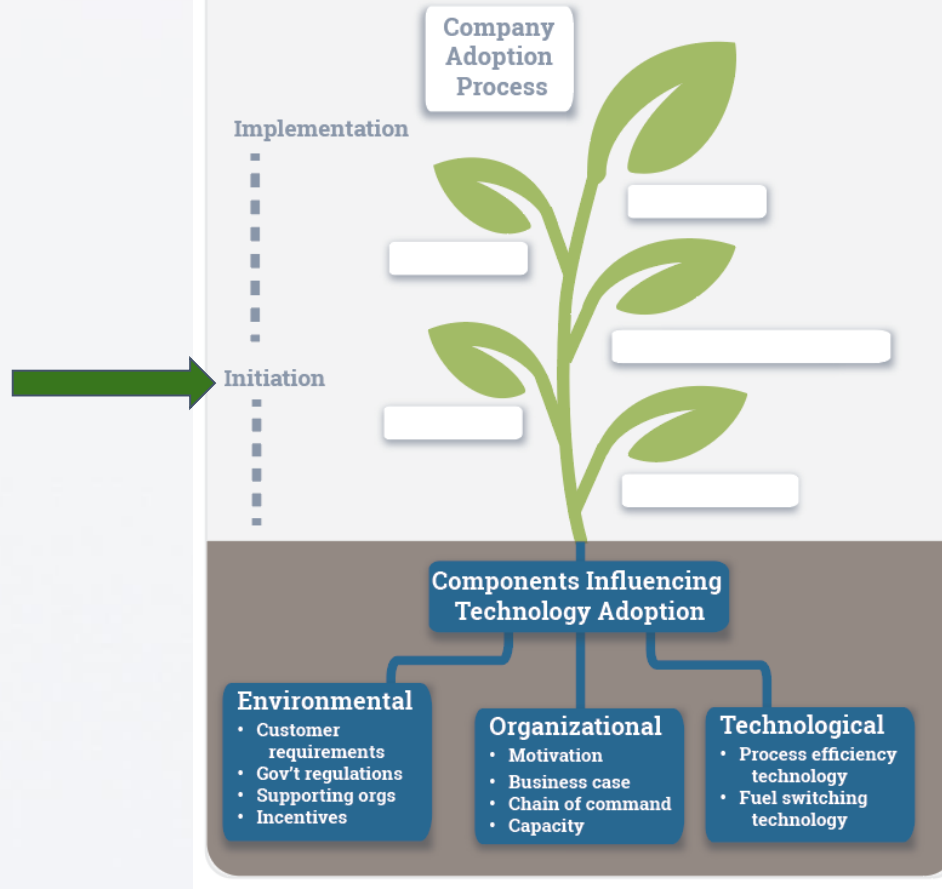Clean Energy Technology Adoption Process

Company Adoption Process

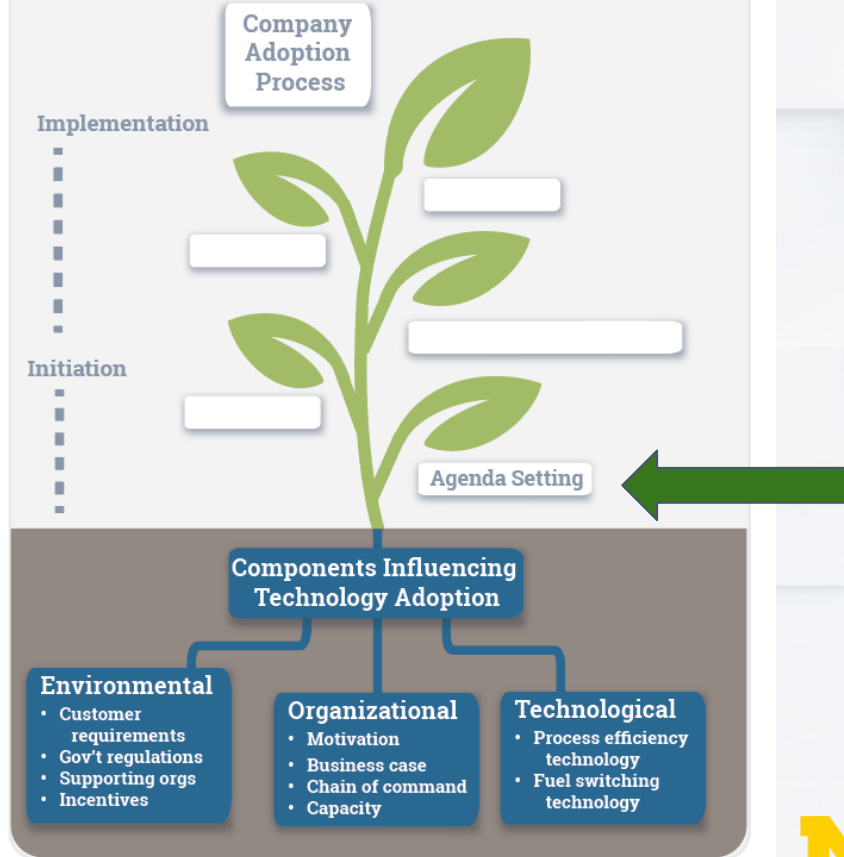Components Influencing Technology Adoption

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Source: Model based on Rogers (2003) and Tornatzky and Fleischer (1990) and integrated with participant interview data .
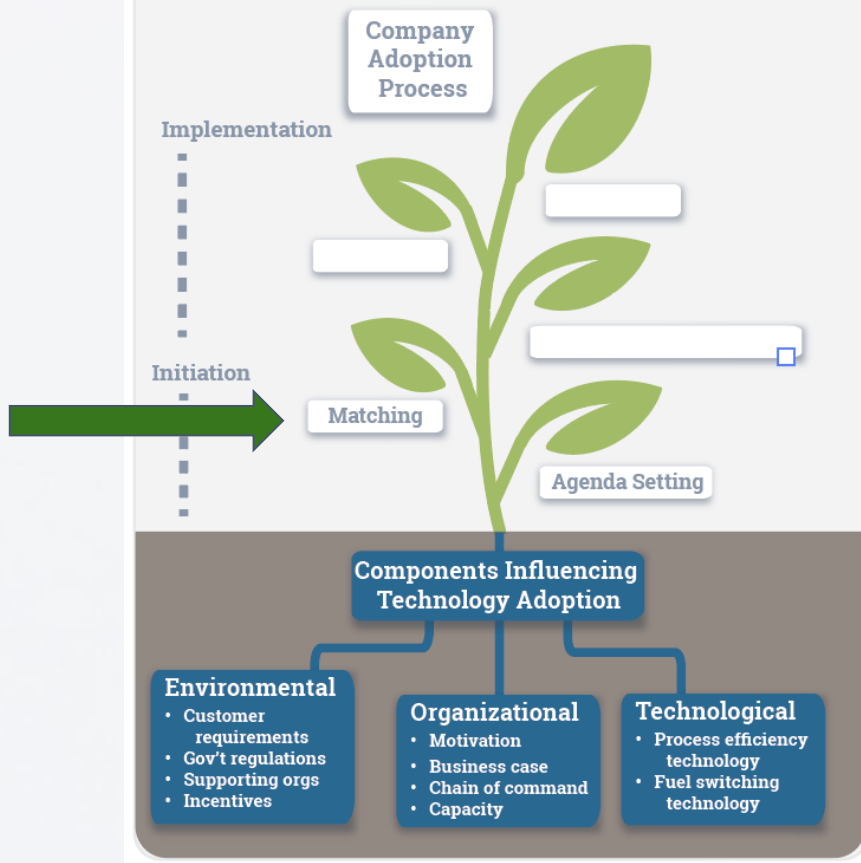
Clean Energy Technology Adoption

Company Adoption Process

Implementation

Initiation

Agenda Setting

Components Influencing Technology Adoption

Environmental
• Customer requirements
• Gov't regulations
• Supporting orgs
• Incentives

Organizational
• Motivation
• Business case
• Chain of command
• Capacity

Technological
• Process efficiency technology
• Fuel switching technology

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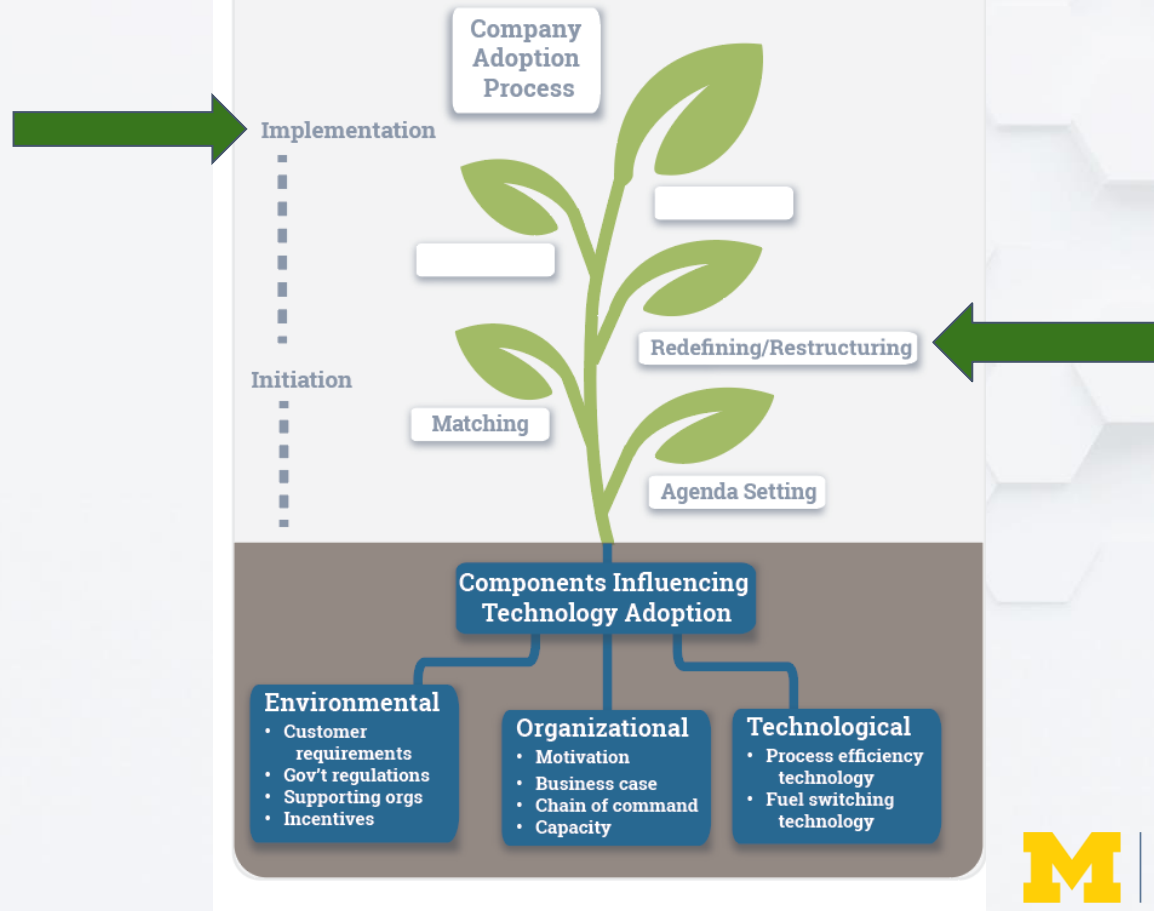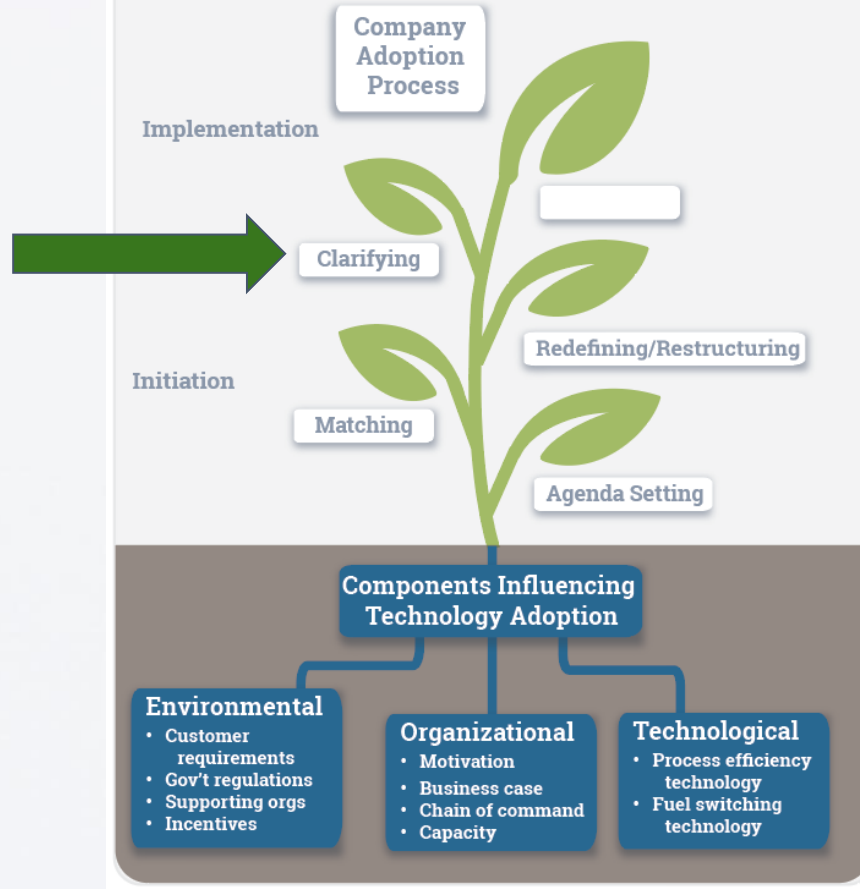
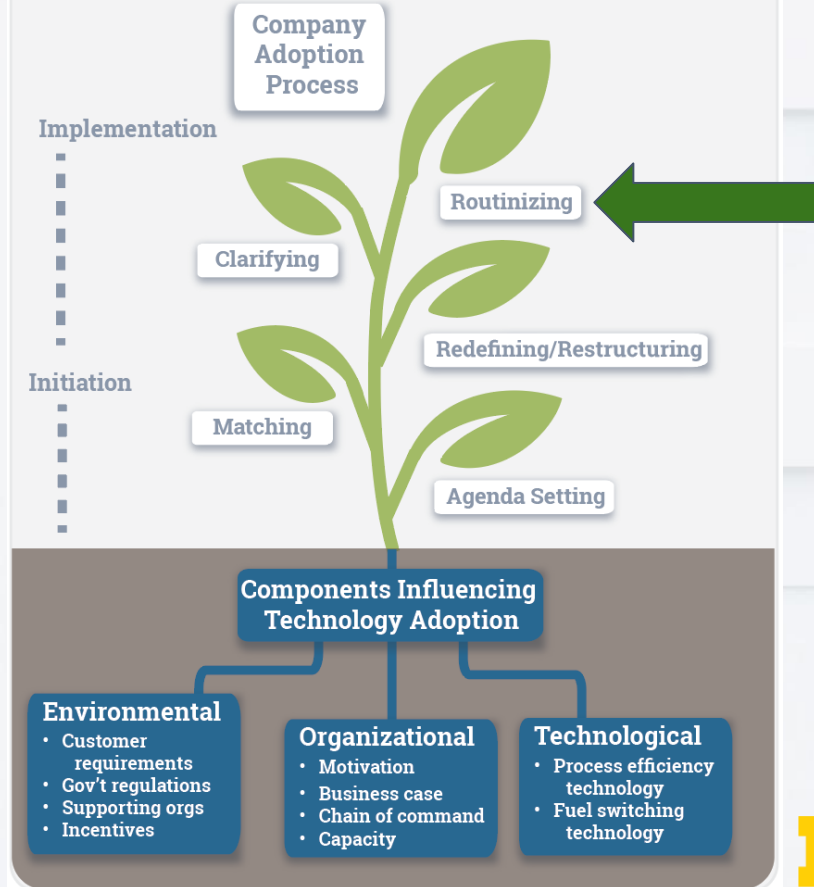Clean Energy Technology Adoption

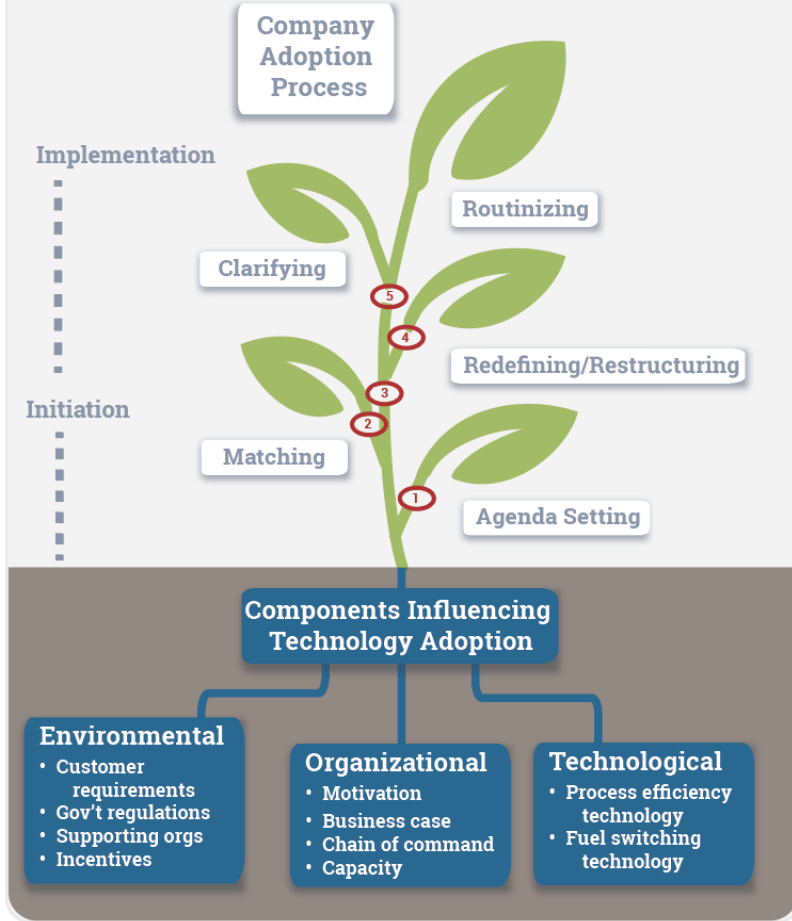Clean Energy Technology Adoption

Clean Energy Technology Adoption

"Even when we have leadership on board, we still find that the individuals that are actually implementing on these projects in certain locations are still very hesitant to pursue them and will strongly oppose them." ~

Participant from a large company

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Clean Energy Technology Adoption
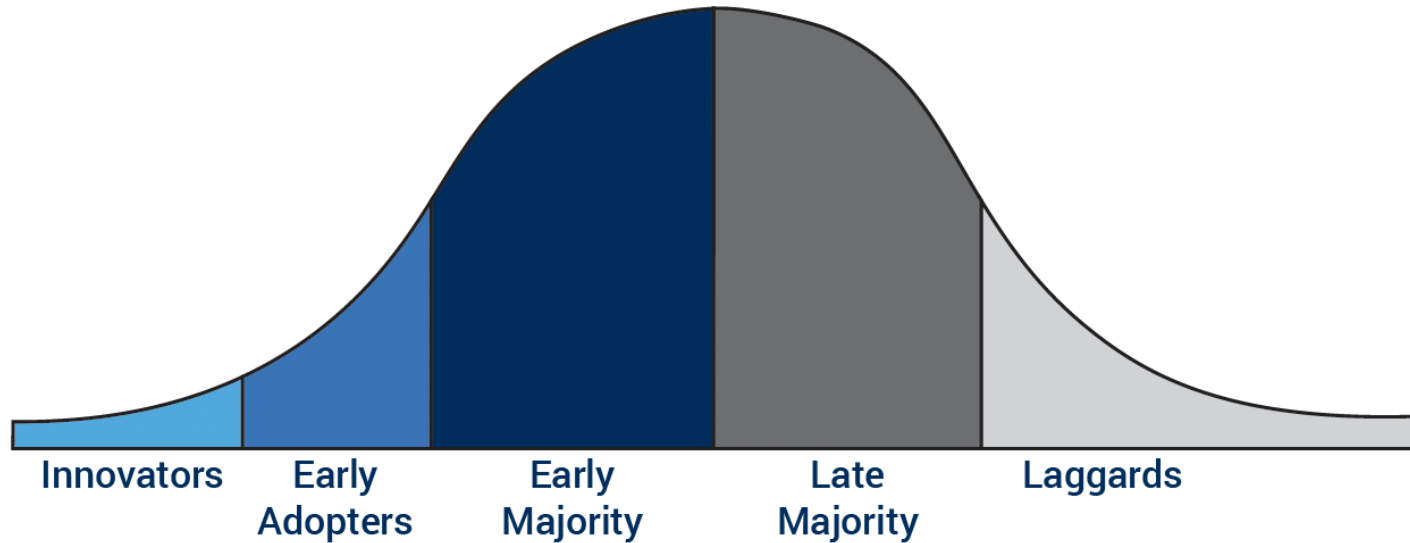
Clean Energy Technology Adoption

Company Adoption Process

Implementation

Routinizing

Clarifying

5
4
Redefining/Restructuring
3
2
Matching

1
Agenda Setting

Initiation

Components Influencing Technology Adoption

Environmental
- Customer requirements
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- Incentives

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Gaps

- **Gap 1 - Lack of requirements and/or penalties**
- **Gap 2 - Knowledge and skills to match technologies**
- **Gap 3: Funding to support implementation**
- **Gap 4: Workforce capacity and capabilities**
- **Gap 5: Objective advice and insights**

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Adoption of Innovations

Categories of Company Adopters

Innovators   Early Adopters   Early Majority   Late Majority   Laggards
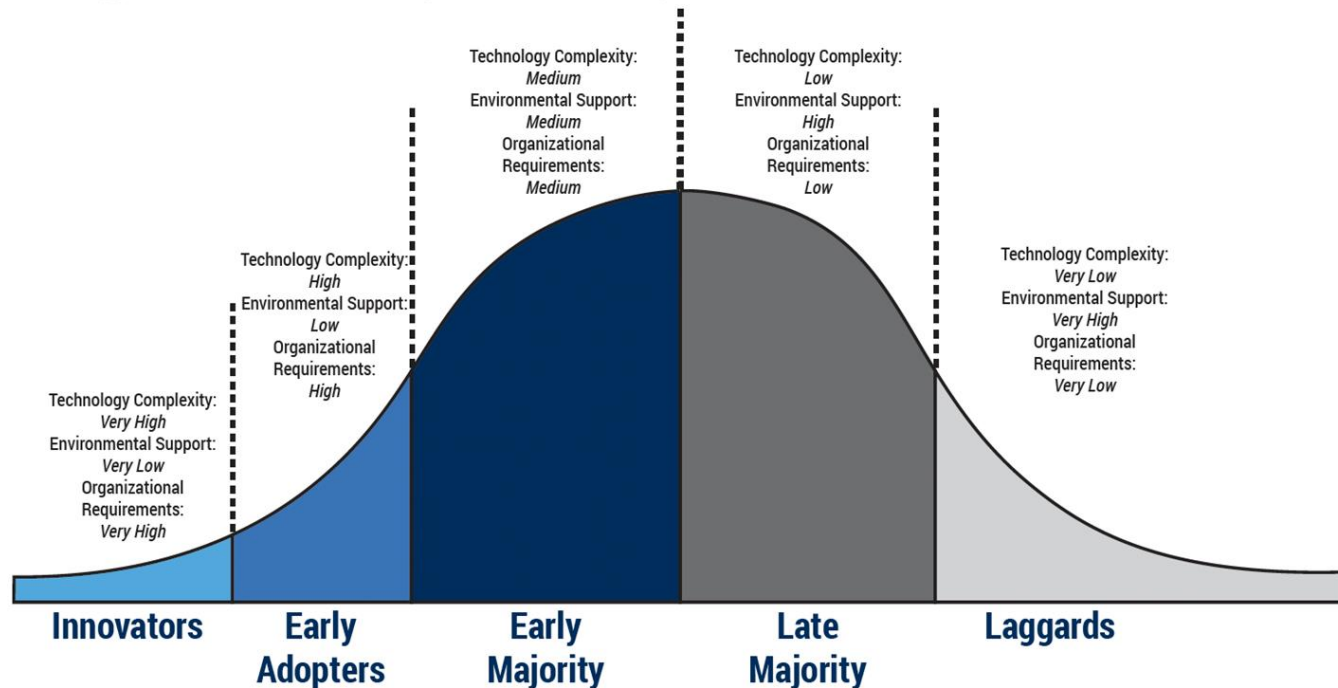
Figure 4. CETA innovations diffuse into industry through five categories of company adopters; based on Rogers (2003).

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Figure 5. Categories of companies by adoption of innovations with detail on the technology, environment, and organizational components based on participant data.
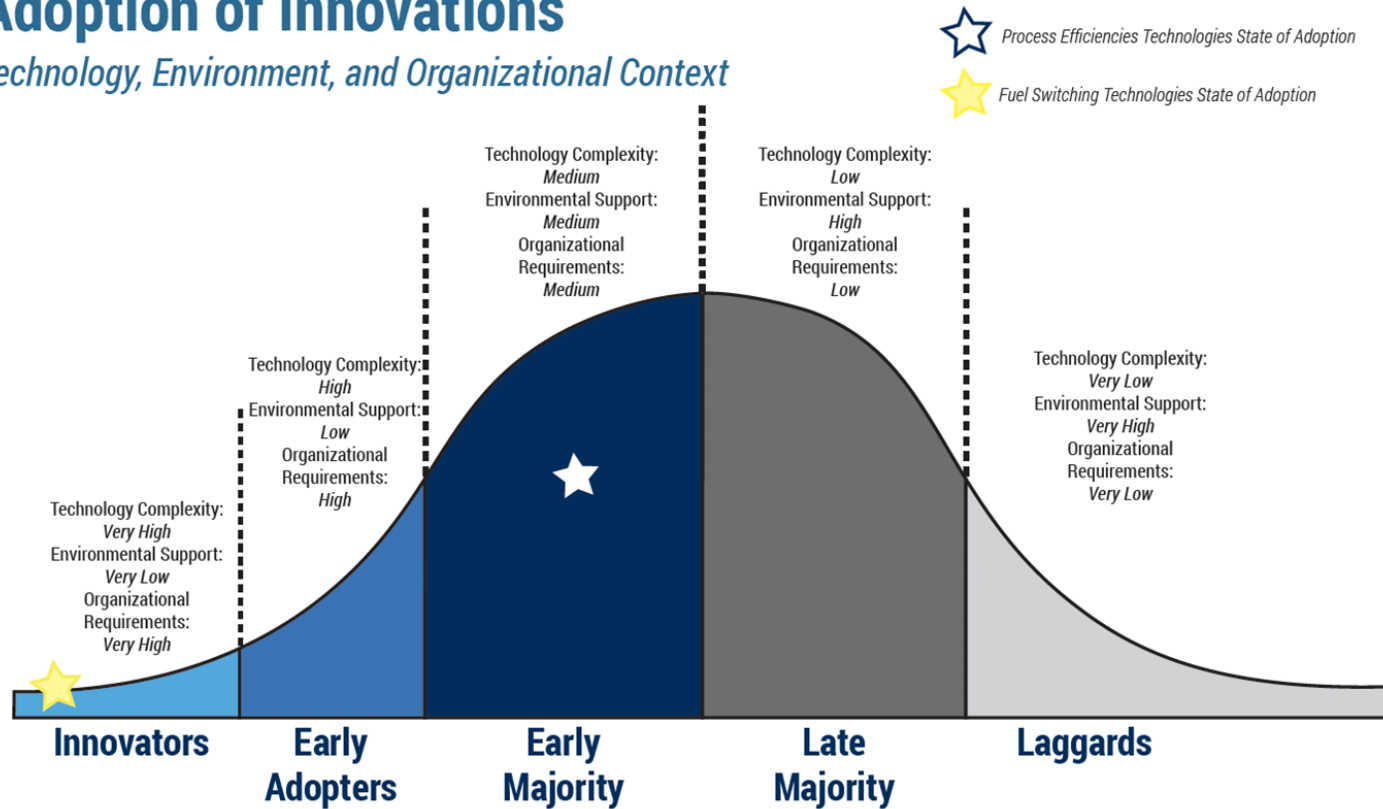
Figure 6. Process efficiency and fuel switching state of adoption conceptually represented within categories of companies.
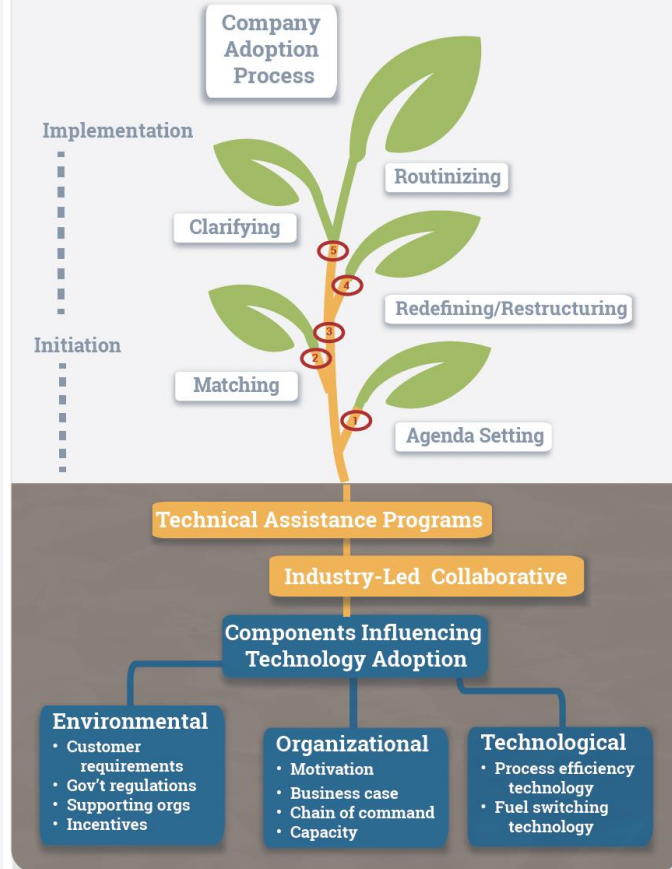
Clean Energy Technology Adoption

Company Adoption Process

Implementation

Routinizing

Clarifying

Matching

Redefining/Restructuring

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Agenda Setting

Technical Assistance Programs

Industry-Led Collaborative

Components Influencing Technology Adoption

Environmental
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Figure 7. Recommendations to accelerate clean energy technology adoption.

Ecosystem Recommendations:
- *Industry-led Collaborative*
- *Technical Assistance Programs*
    - **Objective Energy Coaches**
    - **Resources for Implementation**
    - **Inclusion & Equity**
    - **Technology matching for process efficiencies**
    - **Innovation Support for Fuel Switching**

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Next steps for small & medium-sized manufacturers:

Industrial Assessment Center @ MSU

Michigan Technological University — 1885

Center Established 2021

Collaboration to support all parts of Michigan

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HENRY FORD COLLEGE — FUTURE DRIVEN

MSU IAC Website: https://iac.msu.edu/

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For large and medium plants:

BETTER PLANTS

The Better Plants program works with leading U.S. manufacturers and wastewater treatment agencies to set ambitious energy, water, waste, and carbon reduction goals and commit to reducing energy intensity by 25% over a 10-year period across all U.S. operations. By partnering with industry, the Better Plants program aims to help leading manufacturers boost efficiency, increase resilience, strengthen economic competitiveness, and reduce their carbon footprint through improvements in energy efficiency.

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Small Manufacturers Retooling

Link [here](#).

The RESTART Program @ LTU

The RESTART Program - Retired Engineers, Scientists, Technicians, Administrators, Researchers, and Teachers provides free energy, waste reduction and sustainability assessments to any Michigan small to medium-sized commercial business and public institution of any size.
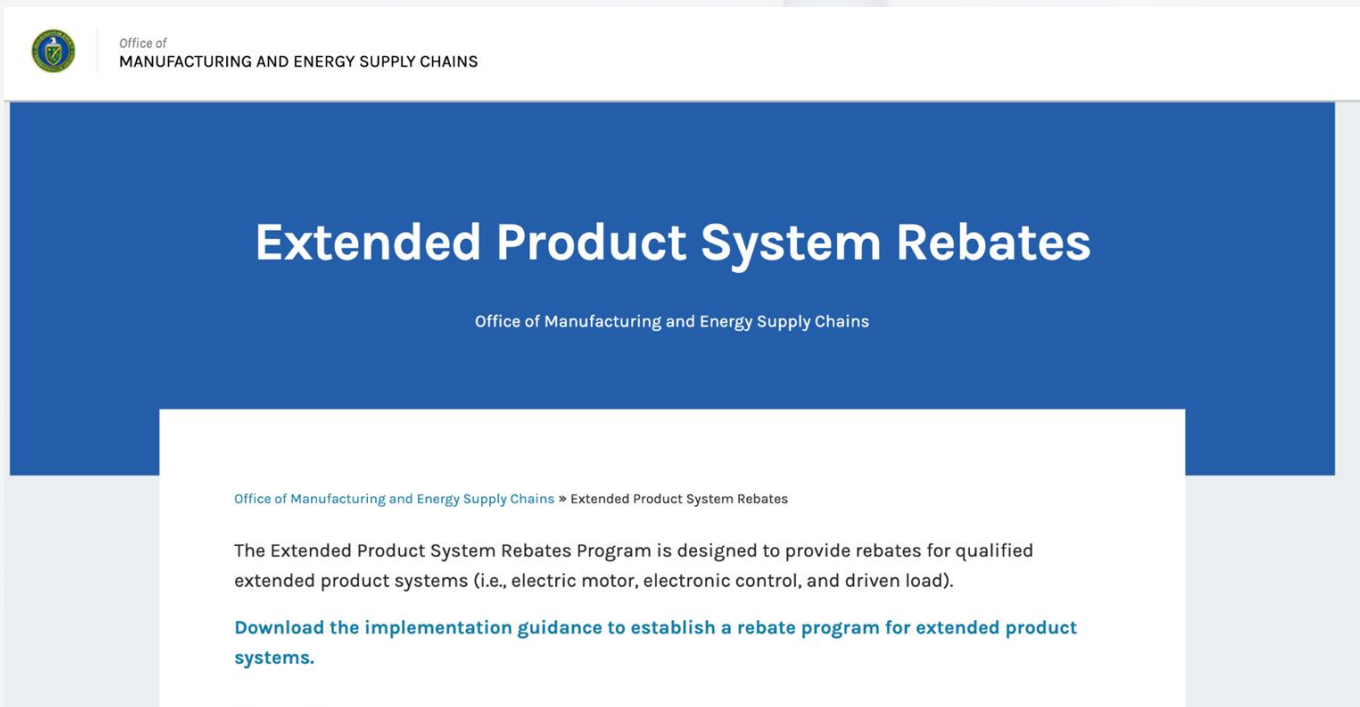
Michigan businesses and public entities can apply here
https://forms.monday.com/forms/embed/70d98ecf2e9bd52d67e0c9e925dae3fa?r=use1

https://www.restartmi.org/

Bipartisan Infrastructure Law - Federal Opportunities

Bipartisan Infrastructure Law- Federal Opportunities

Advanced Energy Manufacturing and Recycling Grants

Office of Manufacturing and Energy Supply Chains

Office of Manufacturing and Energy Supply Chains » Advanced Energy Manufacturing and Recycling Grants

The Advanced Energy Manufacturing and Recycling Grant Program is designed to provide grants to small- and medium-sized manufacturers to enable them to build new or retrofit existing manufacturing and industrial facilities to produce or recycle advanced energy products in communities where coal mines or coal power plants have closed.

Funding Opportunity Announcement Released.

Click here.

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Also, contact your local utility company!

What assistance would help your company in clean energy technology adoption?

Questions?

*Download report
by scanning*

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Funding Opportunities & Assets Reports

Visit Energy Services Webpage
- https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans

Full Roadmap Reports & This Webinar Recording
- https://www.michigan.gov/egle/about/organization/materials-management/energy/industry/clean-energy-assets

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Upcoming Events

- April 11-12, 2023

  MI Healthy Climate Conference

  At Huntington Place in Detroit

- October 24-25, 2023 - Save the date!

  Michigan Sustainability Conference (MiSCON)

  At Treetops Resort in Gaylord

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