

Tepper Cleantech Case Competition

2023

Cleantech Investment Challenge

Case Sponsor



Hosted By



**ENERGY & CLEAN
TECH CLUB**

Tepper School of Business at Carnegie Mellon University

Carnegie Mellon University

Wilton E. Scott Institute
for Energy Innovation

Welcome to the Second Annual Tepper Cleantech Case Competition (TC3). On behalf of the Scott Institute for Energy Innovation and the Tepper Energy & Cleantech Club (ECTC), we're excited that you are participating in this competition.

TC3 will consist of two rounds. In the first round, each team will submit a recorded video presentation by March 13, 2023. From these submissions, five finalists will be selected by TC3 organizers. These finalists will compete with a 10-minute presentation in person on the final day of the CMU Energy Week 2023 on March 24, 2023. Judges will include members of the Emerson Ventures (<https://www.emerson.com/en-us/about-us/ventures>), industry, and faculty at CMU.

All teams, regardless of finalist selection, are encouraged to attend the CMU Energy Week from March 21-24. This week consists of four days of networking, panel discussions, keynote speakers, and receptions. There is considerable value for anyone pursuing careers in the ClimateTech space. Previous CMU Energy Weeks had more than 1,000 attendees (60% from outside the CMU community) and included representatives from over 260 organizations. Find out more: <https://www.cmu.edu/energy-week/index.html>

If you have any questions about the rules, timing, or the case prompt itself, please see the website at energycleantechtepper.com/tc3. If something is still unanswered, email igray@cmu.edu. Responses to questions will be shared with every participating team at the same time, where applicable.

Important Dates

February 27, 7 PM EST: [Zoom Q&A](#)

March 4, Noon EST: Team Sign-Up Deadline (team roster can be updated after this date if it meets the requirements of 2-5 members with at least one MBA student)

March 13: Video Pitch Submissions Due

March 15: Finalists Announced

March 21-24: CMU Energy Week 2023

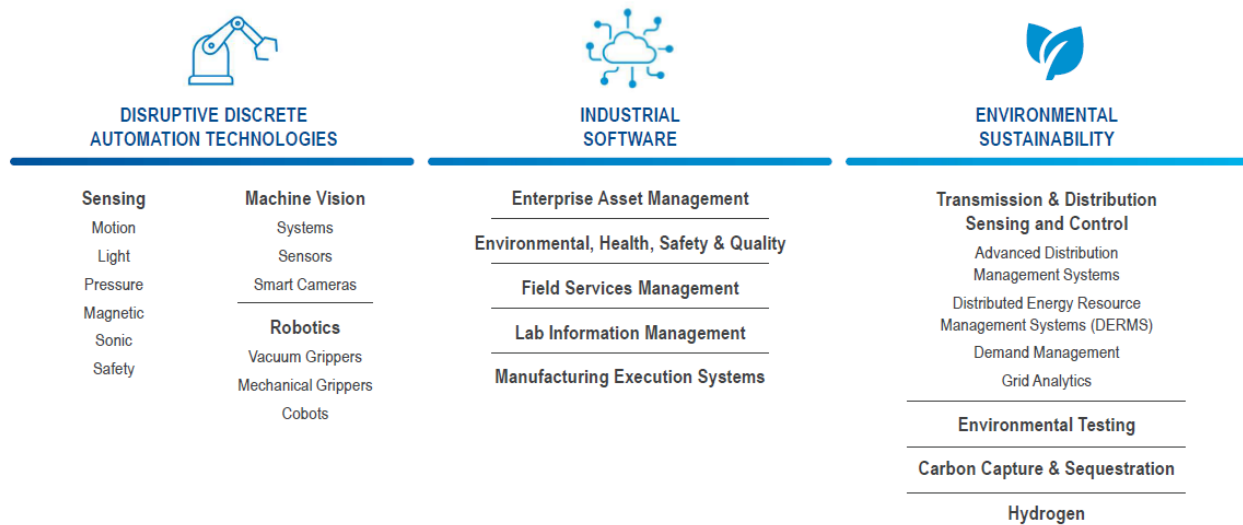
- More information can be found here: <https://www.cmu.edu/energy-week/schedule/index.html>

March 24: Pitch Competition at the 2023 CMU Energy Week

The Challenge

Emerson Ventures invests in early-stage companies with innovative technologies in the areas of discrete automation, industrial software, and environmental sustainability (see below) that: (1) are of high strategic relevance to Emerson businesses / served markets; and (2) have exponential growth potential. Emerson Ventures is particularly interested in finding start-ups that are addressing challenges for both industry and the environment.

Emerson Ventures Investment Focus



Participating teams in TC3 are to act as consultants tasked with identifying and pitching an investment opportunity to Emerson Ventures with a focus on environmental sustainability.

The company pitched will be evaluated in terms their scope of impact on sustainability, product-market fit, and growth potential. Team deliverables for TC3's first round is a ten-minute video submission your team's pitch, with the associated pitch deck, that:

- Presents a well-constructed, data-driven overview of the proposed business or technology for Emerson Ventures, which compliments and/or considers Emerson's businesses and served markets.
- Recommends an investment opportunity which coincides with Emerson Ventures investment approach and investment focus around Environmental Sustainability.

Examples of Investment Focus

Carbon Capture and Utilization or Storage (CCUS) support technologies: In this case, Emerson Ventures is not considering companies looking to design or license new processes for CCUS, but rather products and services that could support CCUS. These services could accelerate CCUS adoption even by reducing barriers to entry or reducing storage permitting hurdles.

Battery Optimization Technology: This category includes software and hardware which improve the performance, impact, or lifespan of batteries in various applications. Technology in this category might increase revenues from electricity storage, reduce the operations and maintenance cost of storage, and/or reduce the negative externalities of the battery's end of life.

EV Charging Infrastructure: This category includes software and hardware solutions to support the accelerated deployment of electric vehicles. Products might target personal or fleet vehicles and grid-connected or islanded applications. Vehicle-to-grid and vehicle-to-load power transfer and management strategies are also included in this category.

Transmission & Distribution Sensing and Control: As the world decarbonizes, many products and services will be electrified. This will necessitate changes not only in how we generate electricity but also how we transmit and distribute this electricity to customers. Increased electricity demand may strain existing infrastructure. Many utilities are considering smart grid upgrades, dynamic line ratings, advanced metering, and load management to ease this transition.

Hydrogen: Renewable hydrogen will likely play a large role in decarbonizing hard to abate sectors such as steelmaking, concrete production, and aviation, among many others. The production, distribution, storage, and use of green hydrogen are all developing technologies with significant challenges to overcome. In this case, Emerson Ventures is not considering companies looking to design or license new processes for Hydrogen, but rather products and services that could support Hydrogen.

Environmental Testing: Increased regulation and consumer pressure demands that companies closely monitor and control their equipment and processes to reduce GHG emissions or pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter. Products which improve a firm's ability to monitor and adjust to reduce emissions will become more important.

Environmental, Health, Safety & Quality: Environmental, safety, health and quality improvements are vital to companies as they strive to protect their employees and stakeholders in the communities which they operate and to protect their brand reputation. Consider solutions which allow a company to operate more efficiently and safely which often leads directly to improving their environmental impact and quality. Also consider products which could reduce the damage to human and wildlife health through improved air and water quality.

Note: Teams are to recommend specific investments in companies that already exist. Outreach to the firm you select is encouraged. Teams are intended to convince Emerson

Ventures and judges from other VC firms of the soundness and usability of their methodology, and then use that methodology to recommend one company for investment in the immediate future. Emerson Ventures typically invests in Series Seed, A, and B companies, and therefore each recommendation should be in that stage of development or projected to enter that stage of development in the near future. Additionally, teams should consider the synergies with Emerson's businesses, served markets, and existing venture portfolio when making recommendations.

Emerson Ventures' ultimate goal for its portfolio is to be as efficient as it can in maximizing possible return on investment while mitigating as much diversifiable risk as possible within its target technology sectors across its portfolio. While Modern Portfolio Theory is presented in this case for context, teams will be evaluated primarily on the methodology surrounding the risk identification and evaluation of new technologies paired with the novelty of their risk-mitigation solution in blending several distinct technology types together.

Rules

Teams

1. Teams may consist of two to five undergraduate or graduate level students
2. At least one member must be enrolled in an MBA program

Video Submission

1. 10-minute maximum
2. Does not reveal school information in video
3. At least two team members must present

Final Round

1. 20-minute maximum
2. Must present in person
3. At least two team members must present

What Is Venture Capital

Venture Capital firms and Corporate Venture firms, like Emerson Ventures, are professional, institutional capital managers that utilize private funds to make strategic investments. While traditional companies in established industries can be risk-rated based on historical data of comparable companies or market assessments, accurately predicting the riskiness of new technologies, products, or business models cannot be done as easily. For traditional lenders, such as banks and pension funds, the unknowns of these novel businesses – such as: will there be demand for this product, how long until I see a return on investment, can this company execute as it says—often prevent them from investing capital.

Venture Capital firms actively seek out new and relatively unknown companies, business models, and technologies that have the potential to upend “business as usual.” At the end of 2018, there were 1,047 registered venture firms in the U.S., with approximately \$403 billion in assets under management. Each year, U.S. venture firms deploy approximately \$70 billion into 8,000 companies that more conservative investment channels deem too risky.

With higher risk can also come higher reward. Venture funds invest capital into start-ups or high-growth companies and often expect a 10x return on investment (ROI) over three- to eight-years, representing the outsized risk of these investments. These returns will be realized only upon an “exit” event, traditionally either a (1) sale to a larger company or (2) initial public offering (IPO) where shares of the company are listed in a public market. The lifetime of a venture fund is typically eight to ten years, meaning all investments must be made and “exited” within that time frame. In 2018, there were 779 disclosed venture-backed mergers and acquisitions, with just 199 of those exits representing \$58.4 billion in disclosed exit value. Also in 2018, venture-backed companies accounted for 40% of all U.S. IPOs, with just 85 venture-backed IPOs raising \$63.6 billion. In 2018 alone, 33 companies valued over \$1 billion held exits, the highest annual total on record, for an aggregate deal value of \$76 billion.¹

Unofficial industry statistics for returns reference the “1/3, 1/3, 1/3” rule. Meaning, one-third of all investments will return \$0 and investments will be lost, one-third will only return enough to pay back the initial investment placed in a company, and one-third will pay out an above 3x multiple of the initial investment. As venture firms build out a fund, they are aware of this short-hand statistic, with managers continually weighing the overall riskiness of their portfolios and seeking to find an optimal mix of risk-adjusted returns. Core questions that arise: “are we diverse enough to spread our risk, hedge against the inevitable bad investments, protect ourselves from broad economic shocks, and come out on the other side with an acceptable Alpha (ie. higher industry-comparable returns relative to investments of a similar risk profile) for our investors?”

Investment theses are sacrosanct for venture funds, dictating where they will invest, and most importantly, where they will not invest. Focusing on investor knowledge, historic

¹ All statistics courtesy of NVCA.org

success, and organization core competencies, funds target specific:

- Funding rounds: Pre-Seed, Seed, Series A, Series B, Series C, etc.
- Company types: software vs. hardware, services vs. products
- Industries: Mobility, Real Estate, Biosciences, FinTech, etc.
- Team: Experienced vs. first-time, team vs. individual, technical vs. business background

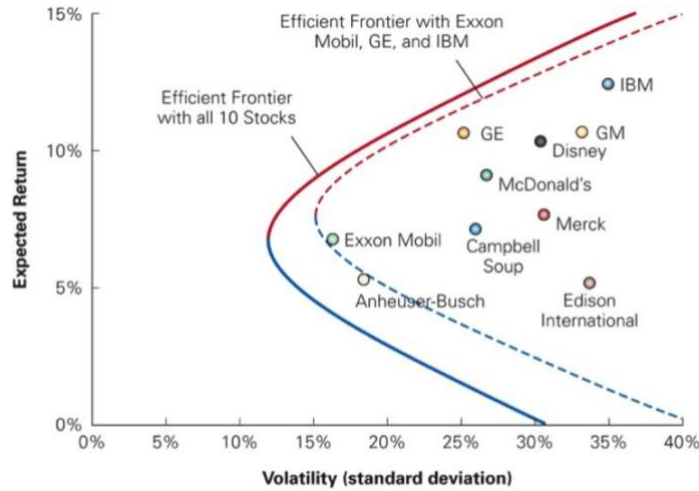
Portfolio Management

Modern Portfolio Theory (MPT) was developed by Nobel Laureate Harry Markowitz in 1952 and explains how investors can construct portfolios to optimize or maximize expected return based on a given level of market risk. MPT emphasizes that risk is an inherent part of higher reward and shows that an investor can construct a portfolio of multiple assets that will maximize returns for a given level of acceptable risk. Likewise, given a desired level of expected return, an investor can construct a portfolio with the lowest possible risk. Based on statistical measures such as variance and correlation, an individual investment's return is less important than how the investment behaves in the context of the entire portfolio.

The total risk of a portfolio has two components: (1) Systematic risk—risk factors common to the whole economy that cannot be diversified away, and (2) Idiosyncratic risk—risk factors specific to a company that can be reduced by creating a diversified portfolio of multiple individual, unrelated investments.

Every possible combination of assets that exists can be plotted on a graph with risk attributed to specific companies, along with combinations of companies in a given portfolio, on the X-axis and the expected return on the Y-axis. This plot reveals the most desirable portfolios. For example, assume Portfolio A has an expected return of 8.5% and a standard deviation of 8%, and that Portfolio B has an expected return of 8.5% and a standard deviation of 9.5%. Portfolio A would be deemed more “efficient” because it has the same expected return but lower risk. By plotting the expected returns with volatility, a specific portfolio’s “Efficient Frontier,” all of the possible combinations of “riskiness” appears as an upward sloping hyperbola. As shown in the graph below, by adding six more stocks to a portfolio, that portfolio’s efficient frontier has been pushed out, meaning it can achieve higher returns with equivalent risk, or lower risk with equivalent returns because the overall volatility of the portfolio is comparatively lower.

Another important concept in portfolio management is the “Sharpe Ratio.” The Sharpe Ratio was developed by Nobel Laureate William F. Sharpe to help investors understand the return of an investment compared to its risk. The Sharpe ratio has become the most widely used method for calculating the risk-adjusted return. MPT argues that adding assets to a diversified portfolio that have low correlations with one another can decrease portfolio risk without sacrificing return.



Simply, the Sharpe Ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Subtracting the risk-free rate from the mean return allows an investor to better isolate the profits associated with risk-taking activities. Generally, the greater the value of the Sharpe ratio, the more attractive the risk-adjusted return.

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

where:

R_p = return of portfolio

R_f = risk-free rate

σ_p = standard deviation of the portfolio's excess return

Adding diversification should increase the Sharpe Ratio compared to similar portfolios with a lower level of diversification. The greater a portfolio's Sharpe ratio, the better its risk-adjusted- performance.²















² Section content from Finance II course materials, Professor Lars-Alexander Kuehn, Tepper School of Business

Emerson Investment Thesis

Emerson, based in St. Louis, Missouri, is a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial and consumer markets around the world. Emerson helps process, hybrid and discrete manufacturers achieve top quartile performance by maximizing production and optimizing energy and operating costs while also protecting personnel and the environment. Emerson consists of five core business segments as described by the technology that each provides.

<p>Measurement & Analytical</p> <p>Measurement & Analytical Flow</p>  <p>ROSEMOUNT MICRO MOTION</p> <p>Process measurement and composition to enhance quality and efficiency</p>	<p>Final Control</p> <p>Flow Controls Isolation Pressure Management Actuation</p>  <p>KEYSTONE BETTIS FISHER</p> <p>Control, isolation, and pressure devices to ensure environmental compliance and productivity</p>	<p>Discrete & Industrial</p> <p>Fluid & Motion Control Branson Appleton</p>  <p>ASCO AVENTICS BRANSON</p> <p>Fluid control, pneumatic, and material joining devices for manufacturing</p>
<p>Control Systems & Software</p> <p>Process Systems & Software Power and Water Solutions</p>  <p>OVATION DELTA V</p> <p>Digital ecosystem that controls plant processes and optimizes assets</p>	<p>Safety & Productivity</p> <p>Tools Dry/Wet Vacuums</p>  <p>RIDGID GREENLEE</p> <p>Productivity & safety of infrastructure, sustainability</p>	

With this technology, Emerson is a “pure play” automation company and the only company that can offer customers solutions for their complete “control loop” – sensors, control software, and device operation. Leading companies across a variety of industries look to Emerson as a trusted partner that continuously innovates to help them meet the next big challenge.

Process	Hybrid	Discrete
Continuous flow of liquid or energy within the process	Mix of continuous flow and batch manufacturing	Discrete product made in batch manufacturing
 Power & Renewables  Chemical  Water & Wastewater  Energy  Refining	 Life Sciences / Pharmaceutical  Food & Beverage  Metals & Mining  Pulp & Paper	 Automotive  Industrial / Commercial  Specialty Machinery  Packaging  Electronics / Semiconductor

To continue pursuing the most innovative automation technology, Emerson created Emerson Ventures, its corporate venture capital arm. Emerson Ventures is an active, strategic partner for early-stage growth companies developing innovative technologies in the areas of discrete automation solutions, environmental sustainability, and industrial software. Emerson Ventures looks at investments according to the following profile and principles:

Strategic Fit: Invest in early-stage growth companies that are innovating in areas closely related to Emerson’s served industries and areas of core expertise

Early-stage: Preference for early-stage investment opportunities (Seed, Series A, and Series B)

Investment Levels: Initial investments generally between \$1 and \$5 million

Emerson Ventures' Due Diligence Methodology

The strength of a fund's due diligence process directly leads to the effective population of a healthy and risk-mitigated portfolio. The Emerson Ventures due diligence process is a comprehensive deep dive into companies it considers for investment with a goal to reach deal finalization within six weeks of initial company engagement.

Emerson Ventures engages in a criteria assessment on a target company and several key areas, among others, are considered:

Strategic Value: How the company would fit into Emerson's portfolio of other businesses, the company's potential as an M&A target, and the relevance to current Emerson market initiatives.

Team: An assessment of the company's management potential to leverage their combined expertise and connections to wield a competitive advantage in their identified sector.

Technology Advantage: The core technology product or service offering the company has developed, its current state of development, risk profile, novelty, intellectual property protections, future plans for improvement, and cost reduction potential.

Competitive Advantage: A detailed look at the company's target market segment, primary and secondary competitors, regulatory environment, emerging customer trends, and relative strength to competitors.

Financials: An assessment of the company's current assets, liabilities, cash flow, and projected assumptions.

Valuation: Detailed methodology comparing a company's stated value to its anticipated growth potential and exit multiple probability.

Each of these areas are calculated and weighed to determine the relative attractiveness of an investment opportunity before deciding whether to pursue negotiations with a company for potential investment.

Emerson Ventures' Investment Portfolio

1. Emerson Ventures current portfolio can be found here:
<https://www.emerson.com/en-us/about-us/ventures>
2. Emerson's recent acquisitions and divestments can be found here:
<https://www.emerson.com/en-us/investors/acquisitions-divestitures>

TC3 Grading Criteria

Judges will be adopting the perspective of Emerson Ventures staff and strategic advisors. Teams will be graded on the following five considerations, each bearing equal weight in the Preliminary and First Rounds. Should weighting of the considerations change between rounds, teams will be notified.

Methodology (20 pts): Teams have created a holistic methodology that revolves around historic and scientific data, rather than solely on assumptions. This methodology is primarily focused on a replicable approach rather than the presented outcome.

Fit with Emerson Ventures (20 pts): The methodology and specific recommendations presented fit with Emerson Ventures and its strategic partners' core competencies, historical investments, and overall investment goals.

Viability (20 pts): Regardless of the stage in which the business is or how mature the technology is, your job is to convince Emerson Ventures that a clear path to commercialization exists.

Creativity (15 pts): Teams are coming up with a methodology utilizing inventive techniques, combinations of business models, and highlighting under-invested technologies. While provided as context and as a suggested framework, teams do not have to strictly adhere to standard Modern Portfolio Theory in their presentation.

Presentation and Delivery (25 pts): The final product appears as a unified whole, with a balanced, professional presentation displaying deep knowledge of the case and recommended solutions.

Additional Presentation Notes

1. Referencing news articles, scholarly reports, interviews, and other reputable sources is encouraged. All non-trivial knowledge should be cited within the slide deck. The citations can be listed in an appendix slide that does not need to be discussed during the presentation itself but must be included in the deck.
2. Teams accepted into the final round will be given an opportunity to resubmit their slide decks prior to the final presentations.
3. Teams are expected to include their team's name on the first slide of their deck. Teams may also include their own names; however, teams should make no reference to their school, mascot, or other identifying symbol of either in their presentation.

Additional Resources

VCS partner with many accelerators, conferences, and institutes around the world to identify start-up companies. Below are a few resources that the Tepper Energy and Cleantech Club think may be helpful to your team as you begin to identify companies of interest. Pay close attention to any alumni associations you may have!

Greentown Labs:

- <https://greentownlabs.com/members/>

Powerhouse:

- <https://www.powerhouse.fund/ventures>

Elemental Excelsior:

- <https://elementalexcelerator.com/companies/>

Cleantech Open:

- <https://www.cleantechopen.org/en/custom/blog/view/34327>

Wilton E. Scott Institute for Energy Innovation at Carnegie Mellon University:

- <https://www.cmu.edu/energy/research-innovation/energy-innovations/startups.html>
- <https://www.youtube.com/watch?v=YHwtGBPMB8k&list=PLbaL-4dKvRmIEkVjPLysVEXMUstuiopoc&index=18>

Office of Energy Efficiency & Renewable Energy at the National Renewable Energy Lab (NREL), American-Made Solar Prize:

- <https://americanmadechallenges.org/solarprize/index.html>