

The Opportunity Continuum: University-Industry Partnerships for Cleantech Investment

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ABSTRACT

Research universities have tremendous potential to contribute to clean technology development—but traditional university practices rarely prioritize commercialization. CU-Boulder is pioneering an approach to move clean technologies along the “Opportunity Continuum” from research idea to commercial venture.

CU’s strategy highlights four key intervention points: (1) Early research; (2) Entrepreneurial skill-building; (3) Proof of concept; and (4) Valley of Death. At each point, the university identifies interventions and partners for strategic investment, and finds ways to actively engage these partners.

Keywords: university, commercialization, partnerships, research, investment

1 BACKGROUND

Accelerating the commercialization of clean technology is critical to addressing the world’s energy and climate challenges. It is also a complex challenge in itself, requiring the active involvement of a wide range of partners.

The University of Colorado at Boulder decided to meet this challenge head-on when it developed a campus-wide Energy Initiative on renewable and sustainable energy in 2006. From the beginning, the three pillars of the Energy Initiative (EI) were *discovery*, *transformation*, and *entrepreneurship*. Scientific and technological research (discovery) is supported by social and policy research (transformation) and early engagement with the private sector (entrepreneurship).

CU’s TEAM program, *Transforming Energy and Markets*, was charged with designing private sector engagement that effectively accelerates the move to market of new university technologies. While CU’s approach draws to some extent on specific local and regional resources, the process and strategies TEAM has used are widely applicable to help enhance commercialization of early-stage research across the country.

2 RESOURCE ASSESSMENT

An early and ongoing aspect of TEAM’s work has been assessing (1) industry interests and needs in the cleantech arena, (2) stumbling blocks to commercialization, and (3) regional resources.

2.1 Industry interests and needs assessment

In talks with nearly 500 business representatives of corporate, entrepreneurial, and financial companies, we identified several key interests. These include:

- A need for early market engagement. Investors want strong deals, and corporate leaders want solutions to their problems. Without knowing up front what the market needs, it is easy for research to overlook opportunities to tackle real-world challenges.
- Expanded support for university researchers in business planning, market analysis, and management team development. The cleantech industry is full of promising ideas, many of them still half-baked from the perspective of market viability. Helping to build the business potential of a new technology would give university research a much stronger position in commercialization and financing.
- Opportunities for the business community to network and learn about new ideas and market trends. The cleantech field is growing so fast that investors, entrepreneurs, and executives with energy responsibilities have a hard time sorting through their options. Finding effective ways to share information is seen as a significant benefit.

2.2 Stumbling blocks to commercialization

Matching university energy research to market needs is no small task. In reviewing how well we could meet industry needs, we identified a number of significant obstacles. These include:

- Lack of incentives for researchers to pursue commercialization. University reward systems are typically heavily oriented to publication. Starting a business won't get you tenure. Nor, in many departments, is there an entrepreneurial culture that even informally encourages a commercial path.
- Failure to protect intellectual property. The "publish or perish" dilemma can lead to publication of ideas which then, ironically, lose their commercial value because they are not patent-protected.
- Lack of understanding of the business world. Researchers don't join a university because they want to be entrepreneurs. Many have limited experience with the business world and find the prospect of licensing technology or building a business daunting.
- The Valley of Death. University research is typically early-stage. It may be supported for a time with SBIR, STTR, and other government funding for product development, but there tends to be a gap—the so-called "valley of death"—where many technologies languish after federal research funding is exhausted and before investors are willing to commit funds to a commercial entity.

Addressing these issues requires significant work within the university to create a foundation for commercial development of energy technologies.

2.3 Regional resource assessment

CU, and Colorado as a whole, have a number of unique strengths that facilitate cleantech development:

- CU is one of the top research universities in the country. It has a long history of interdisciplinary and external collaboration in centers such as CIRES (environmental science) and JILA (physical science). It also has a strong technology transfer office.
- In the energy arena, CU benefits from frequent collaboration with NREL, the National Renewable Energy Laboratory in Golden, CO, as well as with NCAR, the National Center for Atmospheric Research, and NOAA, the National Oceanic and Atmospheric Administration, both located in Boulder.
- Coincidentally with the launch of the Energy Initiative, Colorado's three research universities (CU, Colorado State University, and the Colorado School of Mines) joined with NREL in establishing the Colorado Renewable Energy Collaboratory to facilitate joint research projects in key areas.
- Colorado is rich in natural energy resources, both traditional sources such as coal and

renewable energy such as wind, solar, and geothermal resources.

- The citizens recently passed a renewable portfolio standard for the state's utilities. The governor has made the "New Energy Economy" a centerpiece of his administration and a key aspect of economic development in the state.

On the other hand, Colorado faces some significant constraints:

- Despite the state's healthy economy, legislative mandates over the past decade have severely limited funding for higher education and government. CU receives only seven percent of its funding from the state. Colorado has a difficult time matching financial incentives that other states can offer as part of an economic development package.
- While Colorado has a strong entrepreneurial culture, it has not to date established itself as a center of innovation, with the kind of self-perpetuating generation of ideas and business spin-offs seen in Boston or the Bay Area, for example.

3 THE OPPORTUNITY CONTINUUM

The Opportunity Continuum was designed as a tool to frame the strengths and gaps in commercializing energy technology. The concept, particularly the Valley of Death, was originally articulated by Dr. Marty Murphy of NREL. Figure 1 below shows the path (ideally, though rarely, along the straight line shown) from laboratory research to commercialization.

This simplified graphic does not include all funding and support opportunities, but highlights, in the ovals below the arrows, areas where additional support is needed. The university can play a key role in the early research and early commercialization stages, and can work with regional partners to enhance financial and business development support further along the Valley of Death.

The strategic interventions described below were designed to address these areas where the university can have significant leverage.

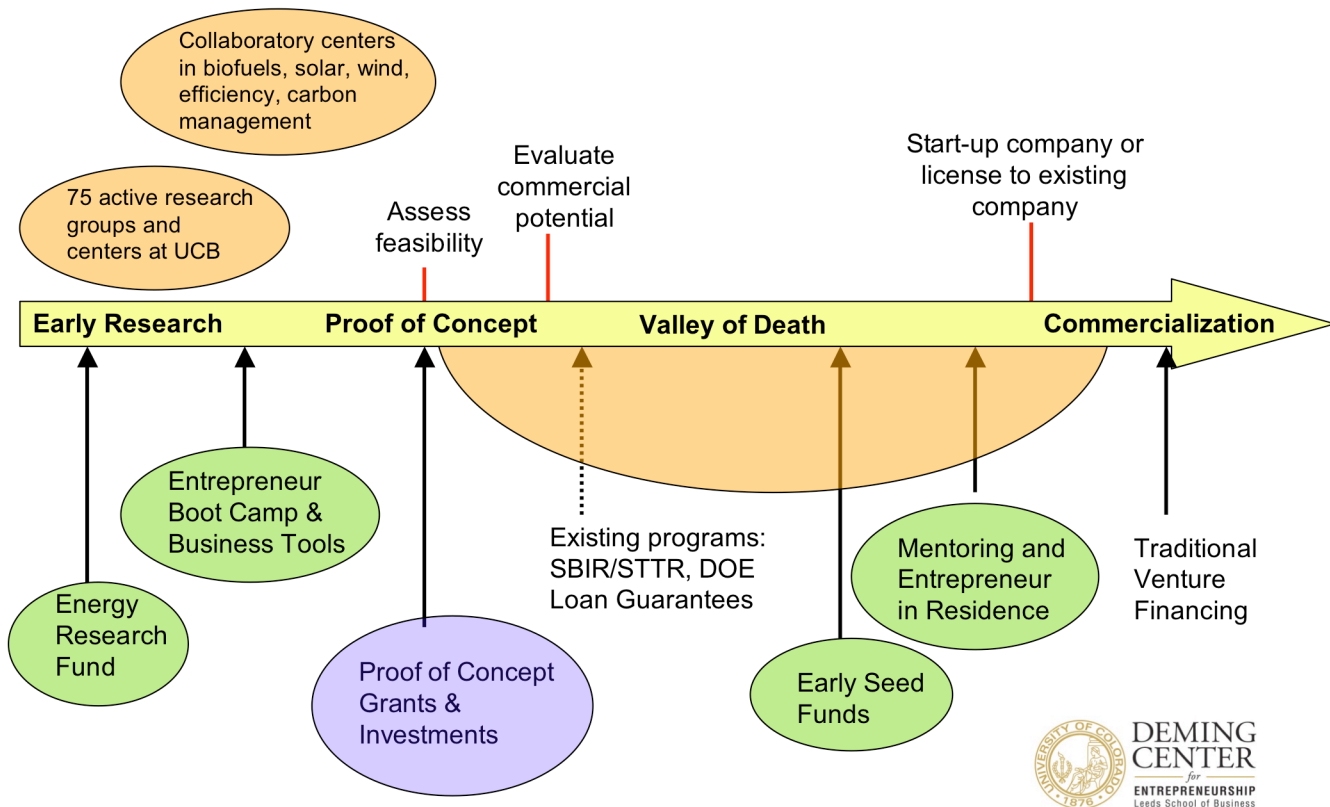
4 STRATEGIC INTERVENTIONS

The core of CU's effort has been to establish the university as a hub of Colorado's cleantech cluster. Four key types of intervention, at different points along the Opportunity Continuum, support this role.

4.1. Seed research funding

Figure 1. The Opportunity Continuum

The Opportunity Continuum: Strategic Intervention for Cleantech Development



It is critical that the university maintain a steady flow of seed research funding for new ideas in cleantech. An annual seed grant competition—in which research must be collaborative within CU and/or with NREL—keeps the ideas flowing, as well as keeping the Energy Initiative leadership aware of cutting-edge ideas in energy research.

4.2. Entrepreneur Boot Camp

A significant task in getting technologies from the lab to the market is “demystifying” the commercialization process. The Entrepreneur Boot Camp currently under development is one tool to engage researchers with potentially marketable technologies in building their business skills and knowledge. This intervention is offered in partnership with CU’s Technology Transfer Office. It also includes one-on-one meetings with researchers, briefings on commercialization throughout the year, and other outreach.

4.3. Proof of Concept grants

CU’s Technology Transfer Office (TTO) has recently launched a program to assess a technology’s market potential. TTO has discovered that small amounts of capital offered as Proof of Concept grants and investments can be a high-leverage intervention. Some 60% of intellectual property that has received CU’s POC grants has been commercialized. TEAM and TTO are working with the state’s Economic Development office on opportunities for POC funding specifically for clean energy.

4.4. Valley of Death interventions

While CU is not itself focused on the later stages of market development, it is in the university’s interest for CU-based ventures to end in success, either as an entrepreneurial company or as a licensing agreement. To this end, TEAM is working closely with a variety of external partners to build an ongoing safety net for fledgling commercial ideas in the cleantech space. Interventions in the Valley of Death time period include:

- Incorporating a clean energy focus area into a local business incubation service, and working with the city and Chamber of Commerce to establish cleantech cluster programs such as networking and business development support in Boulder.
- Offering business/technology roundtables for industry representatives to come together regularly on specific topics of interest.
- Working regionally to support development of public-private entrepreneur-in-residence and early seed funding programs.
- Working through the Collaboratory to attract business attention and research sponsorship in specific areas of research strengths. To date, C2B2, the Collaboratory's biofuels program, has attracted 27 business sponsors, both small and large. Collaborative wind and solar programs are under development and also garnering significant business attention.

In assessing where to make its interventions, CU has chosen to focus on areas where university involvement is critical, and to seek partnerships for areas that make most sense for leadership to come from other sectors.

5 PRIVATE SECTOR PARTNERSHIPS

The resource constraints on the university mandate a creative approach to seeking private sector engagement and support. Businesses are offered a range of opportunities to be part of the Energy Initiative. These include:

- Roundtables, newsletters, and network membership for the purposes of networking, staying apprised of energy research, and finding interns and employees.
- Contributions specifically to the EI Fund or POC programs.
- Joining as a Market Liaison Partner and receiving customized support in connecting with research of interest.
- Sponsored research with one of CU's research areas or in one of the Collaboratory research centers.
- Limited membership in a high-level Energy Initiative Leadership Council, with annual contributions going to support seed research, POC funding, and overall EI operations.

Given the wide-ranging interests of the business community around energy and clean technologies, having a range of opportunities appears to best meet industry needs.

6 LESSONS LEARNED

TEAM's efforts with industry collaborations represent a work in progress. We continue to adjust the program to become more effective in matching industry needs with university research. A few key lessons to date:

- Businesses are often interested in work that does not fit in the traditional research model—more of the “transformative” analysis, such as making the business case for energy efficiency, or analyzing legislative prospects on climate change. It has been valuable to have active centers in the business school and law school that can address some of these other interests.
- As a fledgling program in a state still building its national reputation for clean energy commercialization, we have to work hard to attract and maintain business involvement. This can be a challenge in light of the competing need to use our time effectively and cost-efficiently.
- Conversely, a lot can happen on a shoestring. A foundation of solid research in identified areas of strength is critical, but providing highly responsive service and connection to the business community goes a long way in building a university's reputation for opening its doors to the world of commerce.

TEAM's experience indicates that a community with a research university can establish a win-win partnership in clean technology commercialization. It is important to assess and capitalize on the unique strengths of the university and the region, and to maintain ongoing dialogue so that industry partners feel included and valued in the critical process of streamlining the path to market for clean energy technologies.