Problem Overview Examples

What is the problem?

What has been done already to address problem?

What is the gap that remains?

How do we propose to address this gap?

EXAMPLE 1

NSF ADVANCE: Purdue Center for Faculty Success
PI: Córdova

Introduction

Technological innovation is one of the strongest drivers of economic growth, and succeeding globally requires us to tap into our entire national talent pool. To achieve this, we must break down all barriers that prevent women from contributing fully in academic science and engineering. Efforts by ADVANCE and other programs to identify and address these barriers have led to a substantial portfolio of strategies and tools for producing a stronger and more inclusive science, technology, engineering, and mathematics (STEM) academy. Despite these advances, however, progress in faculty representation continues to come at a glacial pace and with unequal results (Etzkowitz, Kemelgor, and Uzzi, 2000; Sonnet and Holton, 1996). Female science and engineering faculty have increased only 3% over the past five years to reach a current national STEM representation of 17% (Nelson, 2007), and women are still more likely than men to be positioned in lower academic ranks (Trower and Chait, 2002).

Disparity by race and ethnicity also persists as minority men and women continue to progress less successfully through academic ranks than their majority colleagues. The number of underrepresented minority faculty in the top 100 science and engineering departments increased by only 0.5% over the last five years, to reach 5%, and most are assistant professors (Nelson, 2007). The situation is even less encouraging for minority STEM women, who decreased one percentage point in that same time period and constitute only 3% of science and engineering faculty in four-year academic institutions (NAS, 2007).

Purdue University has historically mirrored this national landscape. Our moderately low representation of women in the STEM faculty ranks, nearly invisible percentage of underrepresented minority STEM faculty women, and low representation of women in positions of departmental and center leadership is not due to a lack of talent but instead, as argued by the National Academy of Sciences, to "unintentional biases and outmoded institutional structures that are hindering the access and advancement of women" (NAS, 2007).

Purdue has made major strides over the last ten years to address institutional issues impinging on our women STEM faculty. While strong interventions have positively shaped the Purdue academic climate, however, we have lacked a focused, coordinated, and comprehensive program that can strongly promote the recruitment, retention and advancement of STEM women faculty. We need a major change in the organization and empowerment structures that extend from the faculty level to the highest level of leadership in order to realize the fullest measure of institutional transformation. The proposed **Purdue Center for Faculty Success** will provide this major change. Targeted programs and a new University-level coordination of recruitment, retention, and faculty advancement will have a major impact on STEM faculty women and, in particular, minority women. The Center will undertake social science research, develop programs focused on gaps in our current portfolio of initiatives, and provide comprehensive evaluation of programmatic impacts. University leaders and policymakers, including Purdue President and ADVANCE PI France Córdova, will use the Center's work to inform continued development of institutional policy.

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EXAMPLE 2

NSF IGERT: Solar Economy IGERT (SEIGERT)
PI: Rakesh Agrawal

2. Vision, Goals, and Thematic Basis

Currently, fossil fuel resources of coal, natural gas and petroleum supply nearly 85% of the total energy needs of the US economy. The flow of energy from fossil fuels to end-uses: 1) electricity, 2) heating, 3) chemicals, and 4) transportation is a complex system dictated by resource availability, processing capacity, government policy, world affairs, and market forces. However, recent volatility of petroleum prices, uncertainty of future carbon taxes, and the potential impact of greenhouse gasses on the environment has led to renewed efforts to reduce our dependence on fossil fuels.

Recently, 25 U.S. state legislatures passed legislation that establishes minimum percentages of the state's electricity supply that must come from renewables by a certain date. These so-called Renewable Portfolio Standards (RPS) are shown in Figure 1. The states with RPS account for over half the nation's electricity. The implementation of RPS presents the U.S. with great opportunities and challenges. Currently, the total primary power used in the U.S. by all four major end-uses is 3.3 TW (PCAST, 2006). When averaged over day, night, seasons, and cloud cover, over 1800 TW of sunlight falls on U.S. land. Clearly, economic collection and transformation of solar energy can provide a long-term solution for all the energy needs of the United States.

For decades, the U.S. enjoyed global leadership in solar energy innovation and market share. By 2005, however, the U.S. share of the world production capacity of solar cell modules dropped to 8% while shipments from Europe and Japan increased to 26% and 48%, respectively (EIA, 2007). The economic effect of the decreasing U.S. market share is exacerbated by a rapidly increasing need for solar cell manufacturing. The U.S. Photovoltaic Industry Roadmap foresees a 30% growth of the world solar industry over the next decade and a U.S. solar industry that needs to employ 250,000 people by 2030 (DOE, 2001). However, at a time when U.S. states and industry need a significant increase of highly skilled labor with solar energy expertise, the supply of Ph.D.s in this area is limited Further, of all the research articles published on solar energy, the fraction published by U.S. authors has dropped significantly in the last 30 years, from 49% to 18%. More importantly, of all the journal citations for articles on solar energy, the fraction of citations that U.S. authors receive is down from 61% to 24% in that same time period (Hillhouse, 2007). The output and impact of U.S. research on solar energy is diminishing. These trends clearly define a ***challenge*** of national importance – *it is imperative that the U.S. strategy include effective education and training programs to develop the human resources and intellectual capital that will allow us to compete in this emerging world market for* **Sun-to-Electricity**. Our ***vision*** is to prepare for a fossil fuel-deprived world where nearly all energy demands are met sustainably by solar energy resources.

Examples of 'win differentiators' that answer 'Why Purdue?'

Researcher expertise:
- Co-PI Alice Pawley's gendered boundary research is a new theoretical framework that is of interest to the community
- PI Nick Carpita's journal article on structural models of primary cell walls is the second most-cited paper in the field of plant and animal science.

Equipment/facilities:
- Birck Nanotechnology Center named facility of the year by Controlled Environments
- LECO Pegasus 4D GCxGC-ToF can detect hundreds-to-thousands more compounds than previously seen using conventional gas chromatography

Purdue experience/environment:
- Discovery Park interdisciplinary operating principles
- Purdue's proven capacity to manage large-scale research projects, as illustrated with efforts such as Teragrid and PRISM.

Uniqueness of academic schools:
- School of Engineering Education is the first graduate-degree granting program for engineering education in the nation
- School of Nuclear Engineering awards the most undergraduate degrees than any other nuclear engineering schools in the nation.
- Purdue has top analytical chemistry program in the nation
- CERIAS is the top-ranked information security program

Uniqueness of campus programs:
- Successful Discovery Park Undergraduate Research Internship (DURI)
- National leadership of Women in Engineering Program

Prior Work
- PI Maureen McCann can leverage her $6.4 million project for plant cell wall genomics research in her $25 submission to Department of Energy

General 10-Week Project Timeline

	1	2	3	4	5	6	7	8	9	10
Analysis and Planning										
Distribute documents noted in RFP										
Identify previously successful proposals										
Identify PI										
Problem Overview • *What is the problem* • *What has already been done to address problem* • *What gaps remain* • *How we propose to address gaps*										
Vision										
Goals										
Identify proposal win themes/discriminators										
Program Officer Input										
Contact PO	initial									
Team debrief on meeting										
Refine initial analysis/planning										
Proposed Outline										
Discuss/refine outline structure										
More detailed outline, if needed										
Identify graphics needed										
Partnerships										
Recruit collaborative partners										
Produce "talking points" brochure or website										
Recruit industry affiliates										
Recruit advisory board members										
Collect letters of support										
Management and Personnel										
Identify basic management structure										
Collect biosketches										
Proposal Writing and Editing										
Assign writing										
Write section components										
Compile 1st draft										
Project team 1st edit										
Any outside review input/edit										
Write one-page summary (if NSF)										
Editing iterations										

Red Text: Important to have agreement (and explicit text for problem overview) prior to proposal writing