Wind Energy Science, Engineering, and Policy (WESEP) Integrative Graduate Education and Research Traineeship (IGERT)

2013 Evaluation Report

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WESEP IGERT 2013 Evaluation Report

Executive Summary

The National Science Foundation (NSF) sponsored WESEP IGERT Program (WIP) at Iowa State University (ISU) had students enrolled for one year at the time of the survey (August 2013). Six students* entered WIP in the Fall 2012, two in the Spring 2013 (S13) and six in the Summer or Fall 2013 (F13). The overall assessment is that the program is of very high quality, well regarded by the faculty, well managed, embraced by the WIP graduate students and is preparing the students in keeping with the contract that ISU made with the NSF. In the summary below, we address student and faculty responses to the institutional surveys as well as assessments made during the on-site interviews of WIP students, faculty and university administration. *(Note: two students from the 2012 cohort transferred to other institutions. One student followed his Major Professor to Purdue University to conduct wind energy/power PhD level research. The other student matriculated in the Statistics Advanced Institute for Analytics at North Carolina State U., which offers a terminal Masters degree, as she changed fields of study, to statistical analytics, and she decided "not to pursue a PhD career in research, but rather in data analysis and corporate". Both enjoyed and endorsed WIP but both left to pursue other graduate school opportunities. They both completed the student survey).

The WIP students and faculty are very supportive of building "team research" as a core component of WIP. It should be noted that in the wind energy/power arena, team research is central to the tenets of the ISU proposal, to NSF's support and to the eventual success of WIP. Twelve of 14 students are already working on a team research project and in a field which requires cross-disciplinary, multi-disciplinary research efforts, is building enabling capacity. The students from the 2012 and S13 cohorts completely embrace the real, tangible engagement of the students and the faculty involved in WIP. Moreover, the student response speaks to the strong endorsement and collaboration of the program by the faculty from outside of the students' home departments. The solidly positive response to the question of working on a research project involving multiple disciplines is quite remarkable. The number of students of the total cohort of students in the program working with students who have differing backgrounds is an impressive expression.

WIP appears to be on a trajectory of building a solid international component with 75% of the students agreeing that they are aware of and familiar with current wind power research being conducted in foreign countries. One student revealed that the opportunity to establish collaborations is developing with German scientists at the Fraunhofer Institute and if that emerging relationship comes to pass, she and her major professor will be engaged in a joint collaboration with German industrial scientists. A second student has strong ties to the University of Puerto Rico Mayaguez and to the power industry in Puerto Rico and will capitalize on these networks.

There was only one student who had established collaboration with an industry scientist in Iowa. No students reported interactions with public/government laboratory scientists in the United States. However several WIP faculty members have appointments at the Department of Energy (DOE) Ames federal national laboratory and that presents opportunities that cannot be ignored. In fact, several ISU faculty members involved in both WIP and with the DOE Ames Lab have

ongoing sponsored programs that involve graduate students. Likewise, student interviews revealed that internships are of high interest, but given the newness of the program, none have yet materialized.

As relates to student peer reviewed publications, WIP is too new to expect the students enrolled to have produced many peer journal articles to date. Within a year the 2012 and S13 cohorts should have manuscripts being prepared for submission, being reviewed and being published. What will help this along is the packaging of the PhD dissertations such that several chapters in the document can become standalone publications. At the time of the survey, students in the 2012 cohort reported serving as primary author on four conference presentations and a co-author on four conference presentations, while students in the 2013 cohort reported that they had not yet presented at a conference.

Students and faculty were asked about the usefulness of the Real Time Research Collaborative (RTRCs) offered by ISU every semester since the program began. The students are gaining useful information on how to conduct research as they advance through the program. Faculty reported that the RTRCs were most useful in teaching students how to do research, stimulating and enhancing students' research productivity, and enhancing students' communication skills. They also agreed that the RTRCs were useful in enhancing students' awareness of and ability to respond to ethical issues and helping students to make industry connections. Additionally, all but one faculty member reported that the RTRCs were useful in facilitating students' interdisciplinary work and helping students to learn about environmental and policy issues.

The RTRC was highly lauded by students as a grand learning experience. Students reported that the RTRC was most useful in helping them to learn how to do research, facilitate interdisciplinary work, enhance communication skills, and learn about environmental and policy issues. Students reported that the RTRC was least useful in enhancing their awareness of and ability to respond to ethnical issues and helping them to make industry connections.

The 2012 cohort feels mostly prepared to conduct high quality research; most of the 2013 cohort feels somewhat prepared to conduct high quality research. Most of the students feel well prepared to write peer reviewed research articles and or books. The students feel very comfortable in communicating with people inside of their fields with all saying they are at least somewhat prepared to do so, and with most at least somewhat prepared to communicate with people outside of their disciplinary field, in knowing their discipline in depth and in working in teams of researchers. Students expressed a relative lack of confidence in their collective ability to communicate their research findings to the general public. This preparation is difficult to develop in an academic setting. However, several students offered both in the survey and verbally that they had had an "awesome presentation" about communication by English Professor Jean Goodwin. Perhaps engaging Dr. Goodwin and her colleagues as part of the WIP instructional program would broaden the exposure of the students to communication and further, asking such faculty to serve on the students' advisory committees would ensure that student needs are being met. Here, perhaps Drs. McCalley and Goodwin could approach several Ames organizations to host several "public town hall meetings" where the students could briefly describe wind energy, their research and what economic value in the public good that WIP is providing.

There are 27 ISU faculty members involved in WIP, 18 who participated in the faculty survey. It is of note that one responding faculty responded negatively to many items and somewhat skewed the faculty survey results. The solid response to the query on faculty advising of WIP students indicates a strong faculty support base for WIP students and provides academic strength to the program. WIP faculty reported that they have served as primary author on two journal articles and 13 conference presentations/posters related to WESEP. They also reported serving as co-author on a journal article related to WESEP 11 times and five times as an interdisciplinary author/co-author on a journal article related to WESEP. They reported serving as co-author on a conference paper/presentation related to WESEP 11 times, and an interdisciplinary author/co-author on a conference presentation/poster related to WESEP five times.

The program has exercised five distinct mechanisms for recruiting via: (1) ISU's agreement with the University of Puerto Rico–Mayaquez (UPR-M); (2) recruiting from targeted universities; (3) a WESEP summer Research Experiences for Undergraduate (REU) site; (4) recruiting on the ISU campus; and (5) experience in ISU WESEP events. A proposal was submitted in 2011 to establish an NSF REU site; it was awarded. ISU faculty have recently submitted a second proposal to continue the REU site for another 3 years. WIP faculty have engaged the best ISU undergraduate and MS students to participate in WIP activities through supervision of undergraduate researchers, McNair Scholars, (a program which prepares underrepresented students for doctoral studies), and senior design teams. In addition, ISU has an expanding undergraduate effort in wind energy that has generated positive response from students on campus and beyond. Four courses specifically related to wind energy are now being offered and a wind-energy minor and a Freshman Honor's workshop in wind energy will be offered. In addition, WIP students are having opportunities to mentor undergraduate and M.S. students on the conduct of research, an experience that will serve them well as they pursue research careers in industry or in academia. To enhance this experience, the Center for Learning and Teaching has provided and will provide mentoring advice and assistance.

As a result of the WIP: nearly two-fifths of the responding WIP faculty members agreed that they have attracted better qualified students into their departments; half believed they have attracted a higher percentage of U.S. citizens; and nearly two-fifths said they have attracted students with greater inter and multi- disciplinary backgrounds. One-fourth agreed that more female students are being attracted to their departments because of WIP - this is an important target group. WIP has a very impressive cohort of female students presently enrolled and each exuded confidence, and expressed extraordinary enthusiasm for WIP and for their research.

WIP faculty rated the WIP and Non-WIP students very differently regarding the ability to be able to work in teams of researchers from more than one discipline. The WIP cohort had a 100% rating of being somewhat to very prepared with a mean of 4.23 on a 5-point scale while the Non-WIP cohort resulted in a rating of 2.63. This speaks to the considerable interactivity that WIP has fostered. WIP clearly is becoming a model for how to conduct team research and ISU administration should take note of the success of WIP in building that enabling capacity. All of the responding faculty rated WIP students at least somewhat prepared to collaborate with international scientists with a rating of 4.30. In comparison, faculty rated Non-WIP students at an average preparedness level of 2.88 to collaborate with industrial scientists.

WIP faculty agreed at a 4.13 level that WIP introduced them to new ideas outside of their areas of knowledge and over 80% said that they have met new faculty and over half reported they are more likely to conduct research with those in other departments. WIP has clearly garnered the attention of most of the participating faculty in the exploration of new and likely more fundable, research topics; a very positive outcome for WIP faculty and for their students

Several faculty members were concerned about the students' source or sources of support after the two-year guarantees in the program. Here perhaps multiple other opportunities should be taken advantage of via building partnerships with industry, federal laboratories, funding from agencies like the DOE, the National Aeronautics & Space Administration, the U.S. Department of the Interior, the U.S. Department of Agriculture, state of Iowa agencies, the National Oceanic & Administration National Renewable Energy Laboratory, international partners and so on. Internships and work-study opportunities with industry need to be brokered by program leadership and the faculty. The results of the Faculty Survey indicated that over half of the faculty believed that this program will help make them more competitive in capturing grant and contract support monies. There are several opportunities for students that need to be mentioned here. They include: various DOE student and internships programs; the Boren Fellowship, related to national security in the U.S. and provides support for 1 year for the federal government; NSF's East Asia and Pacific Summer Institutes for U.S. graduate students (EAPSI); the German Chancellor Fellowship for tomorrow's leaders at 30/year including 10 from the U.S., 10 from China and 10 from Russia; and the Robert Bosch Foundation Fellowship Program of 3-6 months in Germany in which Fellows work as consultants in their field of expertise at leading public and or private institutions in Germany. These opportunities would also help build out the international component of WIP. Materials can be made available to the students which describe opportunities through such professional societies as: the American Meteorological Society; the American Geophysical Union; the Institute of Electrical & Electronic Engineers; the Physics Society of America; the National Oceanic & Atmospheric Administration Knauss Fellows Program; other fellows and internship programs in-kind on Capitol Hill in the Nation's Capitol. These programs allow for students or recent PhDs to go to Capitol Hill, serve as science and technical/engineering advisers and position paper writers to staffers of congressional representatives to meet with communications media, policy makers and so on. Most of the awards are quite lucrative and provide living and travel stipends, etc.

WIP is on a planned trajectory of adding 6 - 8 new students annually to have up to 36 - 44 in four years. Having had two from the 2012 cohort leave the program and given the addition of two in S13 and six in F13, there are presently 12 students fully enrolled in the program. Given the burn rate of financial student support, and the commitment of two years of funding to each "new" student, there are concerns about the financial sustainability of WIP. WIP will need approximately $0.5M in Year 3 and approximately $1.0M in Year 5 in non-NSF funds to sustain the program. Where will these funds come from? The NSF proposal details the costs but needs to be re-visited to ensure that these students do not go wanting in their Years 3, 4 and possibly 5 of the PhD program. While three years for time from onset to conclusion is typical for a student in a PhD program, four years is more likely and since some students have entered the PhD program with no MS degree experience, a full five years to PhD is quite likely. The above said, the ISU institutional support of the program, up to $835K, is necessary and laudable. It provides necessary stability. Given the above reality, it would be prudent for the program to look to

internships and work study with private industry and with federal laboratories to meet the funding needs of the program. WIP leadership and the ISU Chief Research Officer need to engage the appropriate entities. ISU has invested in laboratory and computing facilities that industry covets. Thus ISU has leveraged physical, computational, technological and intellectual resources not found in any industrial or government lab. ISU can make these facilities available to industry and government scientists and engineers in return for support of WIP students.

If WIP students work as interns or work study students in industry or federal laboratories and or in university facilities with support from these external (from the university) entities, issues related to students publications, intellectual property rights of ownership, patent applications, patents, and so on, must be addressed. ISU is a public university and its students must be able to publish their work. Meanwhile industry likes to protect its investments by cataloguing findings, results, new findings, and even data as "proprietary". This will be difficult to change. Here, ISU intellectual property and patent attorneys along with upper research administration must be engaged to insure that the deals cut are fair to all. Following the completion of their PhDs, WIP students may find permanent employment with the companies and government labs that they worked at or with. Industry and government scientists, engineers, mathematicians, statisticians, etc., who are advising and or working with WIP students, who also have appropriate pedigrees (such as a PhD), could be given adjunct appointments at ISU and certainly co-author papers, presentations, patent applications, and so on. ISU administrators are uniformly enthusiastically positive about this possibility. Engineering Dean Sarah Rajala and members of her staff have vast experience in how to get this done.

The program leadership and the faculty have redesigned WESEP Course 594, (the Wind Energy Real-time research Collaborative (1-credit) in such a way that it has been transformed from being slightly and increasingly unmanageable to being a well-regarded team taught and team integrated course with a very manageable approach and methodology. The students are learning a great deal both in course-content and on the conduct of research. The 15 week, 16 lecture/presentation schedule of 594 is an excellent course. The course power point presentations (PPTs), which are on-line, are rich with information.

Other notable observations are: The External Advisory and Project Boards are necessary entities; the process of selection of IGERT trainees has been highly successful to date as demonstrated by the faculty response of the high quality of the students recruited to and accepted into WIP; the diversity of backgrounds of the students in the program cover the WIP thrust areas.

The Summer 2013 Workshop on Energy, Transportation and Water Infrastructure 17 -19 July) held at the Memorial Union at ISU, was deemed a major success by the students and faculty attendees. The supporting organizations included NSF-IGERT, NSF-EFRI, ISU-WEI, NSF EPSCoR, ISU In Trans and ISU Science Communication.

1 Introduction and Methodology

1.1 WESEP IGERT Program Background

The Integrative Graduate Education and Research Traineeship (IGERT) program has been developed by the U.S. National science Foundation (NSF) to meet the challenges of educating U.S. Ph.D. scientists and engineers with interdisciplinary backgrounds, deep

knowledge in chosen disciplines, and technical, professional, and personal skills. The program is intended to establish new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to a world-class, broadly inclusive, and globally engaged science and engineering workforce.

Building upon the NSF IGERT platform, the purpose of the IGERT Graduate Program in Wind Science, Engineering and Policy (WESEP) at Iowa State University, in collaboration with the University of Puerto Rico-Mayaguez, is to provide doctoral students with multi-disciplinary training in the skills required for conducting research at the disciplinary interface between engineering, atmospheric science-meteorology, agriculture-economics, and journalism-communication. The WESEP program is a new model in graduate education in which students are engaged in an environment that supports innovation to learn through hands-on experience how their own research may contribute in new ways to benefit society and to learn the processes for the successful implementation of such contributions.

1.2 Evaluation Methods and Procedures

As a key part of the annual evaluation of the program, an annual assessment is filled out by students enrolled in the WIP. This survey was distributed in the late summer and reflects the responses of students who have been in the program for a full year as well as those who have just entered the program during 2013, including those in the new incoming class. As such, several questions could not be addressed by the Fall 2013 students as they had not had sufficient time to adequately experience certain program elements.

As a separate but related component of the annual programmatic evaluation process, an annual survey for faculty engaged in the program was distributed in the late Summer, prior to 15 August, 2013 and reflects the responses of faculty who for the most part have been intimately involved in the execution of the program, recruiting and mentoring of the students, directing the students' research and teaching the necessary courses. There were also responses from faculty who have intentions to be engaged in the program but who have as of fall 2013 not yet been deeply involved.

Part of the Spring and Summer of 2013 was spent by M. Kemis and B. Geisinger of the ISU Research Institute for Studies in Education (RISE) and L. Pietrafesa of North Carolina State University (NCSU), along with J. McCalley of ISU, in the development of evaluation tools to: evaluate categories of research, technical and communication skills and ethical understanding; and to ensure that the information collection process is successful. These specific evaluation tools will be revisited in 2014 to ensure that the evaluation tools are comprehensive but not onerous. Several suggestions to improving the survey are offered within.

The data were collected and collated by M. Kemis and B. Geisinger of RISE and L. Pietrafesa of NCSU. Pietrafesa visited ISU and met with students, faculty and university

administration, in October 2013. There are 27 faculty involved in the program and overall there was a total of 14 students enrolled in the program; with six having entered in Fall 2012, two in Spring 2013 and six in Fall 2013. In order to simplify reporting, the two students who entered in Spring 2013 and the six students who entered in Fall 2013 were combined into an overall 2013 cohort. Two students in the original F12 cohort have since left WIP and ISU. One student followed his major professor to Purdue University to conduct wind energy/power PhD level research. The other student matriculated in the Statistics Advanced Institute for Analytics at North Carolina State U., which offers a terminal Master's degree, as she changed fields of study, to statistical analytics, and she decided "not to pursue a PhD career in research, but rather in data analysis and corporate". Both enjoyed and endorsed WIP but both left to pursue other graduate school opportunities. They both completed the student survey. Thus both students who have left the program did so for personal reasons related to advancing their graduate school careers. So, at the time of this report, there are 12 of 14 students (an 85.7% retention rate). Both students who left the program participated fully in the study and discussed their personal reasons for transferring.

Pietrafesa reviewed all data collected, performed interviews with all students in person and on campus, and with selected faculty and administrators, and developed constructive conclusions regarding the effectiveness of the program. Detailed notes of the discussions held during the interviews and with the focus groups were recorded either during the discussions themselves or immediately following the discussions. Analyses of these discussions were based on an objective assessment of the overall content of the perceptions of the students, faculty and administrators.

The evaluation questions were intended to assess the perceptions of the program from both the student and the faculty viewpoints. The evaluations questions include: how effective have student recruiting efforts been; how effective were the multi-disciplinary efforts; how effective were the inter-institutional efforts; how effective were the training and mentoring efforts; how useful were the Real Time Research Collaboratives; to what extent is the program benefiting from interdisciplinary features; are trainees making progress, gaining skills and achieving in the program; have the graduates gone on to careers of choice; are graduates having successful careers; how has the program impacted the community; and is the program achieving sustainability. In retrospect several questions about student publications, presentations at national meetings and other scholarly activity were deemed somewhat premature, given the newness of WIP, but as the program and the students' progress through the program, the questions will be more meaningful. Additional survey questions may also be added to better understand students' experiences in the program.

The focus groups and interviews conducted were with the students enrolled in the program, the faculty engaged in the program and university administrators involved with the program. Generally the student/trainee, the faculty discussions/interviews and the meetings with university administration were thirty minutes in length. Additionally, all student/trainees participated in a one hour focus group discussion. There was also a forty-five minute visit to the Wind Energy Manufacturing Lab. The institutional data collected

included those which came from the newly commissioned and executed annual surveys of the students/trainees and faculty and from institutional data. Exit interviews and annual surveys of graduates of the program are not yet viable.

2 Results

The results are presented below in four sections: 2.1) Annual student survey; 2.2) Annual faculty survey; 2.3) Student focus groups and interviews; and 2.4) Institutional data. Each of these sections is further broken down into subsections in order to group similar questions and organize the data to aid in the understanding of the IGERT program.

The first year of this survey constitutes a relatively small sample size for the students and the faculty responses; in future years the statistics will become even more meaningful.

2.1 Annual Student Survey

This section of the report details students' responses to the annual student survey and is broken down into three subsections: 2.1.1) Program Activities, 2.1.2) Research and Publication, and 2.1.3) Learning, Preparation, and Suggestions for Improvement. Each of these subsections is comprised of similar questions. The discussion below is presented prior to presentation of and discussion about the responses, by way of example. Six students entered the program in the Fall 2012 cohort, two students in the Spring 2013 contingent and six in the Fall 2013 group for a total of 14 students who matriculated in the program. For the purposes of reporting, the Spring 2013 and Fall 2013 students are combined into a 2013 cohort group. Two of the students who entered the program in 2012 have since left with one having followed his major professor to Purdue University and the other having transferred to North Carolina State University. All 14 students participated in the survey.

2.1.1 Student Program Activities

Table 1 addresses formal training received by the students.

- Three students who matriculated in the Fall 2012 reported that they had not yet had training related to the responsible conduct of research. Similarly, half of the 2013 cohort reported that they had not yet received training in this area.
- Half of the students in each cohort reported that they had received formal training related to statistics, which will be important for all of the students in the program.
- The "bridge" courses experience was clearly on track as the earlier cohort had much more exposure to those courses to date.
- Two-thirds of the 2012 cohort and over one-third of the 2013 cohort reported formal exposure to research methods.
- Four students indicated that they had been exposed to state of the art instrumentation. Half of the students in each cohort reported receiving formal training in professional speaking and presentation skills; the response demonstrates how much the faculty and the students are engaged.
- The communication with people at the university but outside of the students' home disciplines shows a gradual evolution in students becoming familiar with their research and also feeling comfortable about discussing it with others who may have

an interest, expressed or otherwise, in learning about it; half of the 2012 cohort and 37.5% of the 2013 cohort reported receiving training in this area.

- Relatively few students reported receiving formal training in professional writing (one-third of the 2012 cohort and a fourth of the 2013 cohort). Professional writing experience will likely come as students progress through the program and begin to prepare papers, posters, talks, reports, dissertation chapters, and so on.
- Communicating with the general public drew five positives (35.7% overall) which is quite substantial given the fact that the program in new and that such forums and opportunities are not easy to come by for graduate students.
- Twelve of 14 students (85.7%) who responded to the working on a team research project question is a very robust response in a field of endeavor which requires cross-disciplinary, multi-disciplinary research.

Table 1: Formal Training Received

	2012Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)
Responsible conduct of research (ethics)	3	50.00	4	50.00
Statistics	3	50.00	4	50.00
"Bridge" courses to learn background content knowledge outside your field	4	66.67	3	37.50
Research methods	4	66.67	3	37.50
State-of-the-art instrumentation	1	16.67	3	37.50
Professional speaking/presentation skills	3	50.00	4	50.00
Communicating to people outside your home discipline	3	50.00	3	37.50
Professional writing	2	33.33	2	25.00
Communicating to the general public	2	33.33	3	37.50
Working on a research team project	6	100.00	6	75.00

Table 2 deals with the roles of the people that students have collaborated with during their graduate education within WESEP.

- All eight of the students from the 2012 and 2013 cohorts said that they had collaborated with faculty at ISU in their home department, definitive testimony supporting the real, tangible engagement of the students and the faculty involved in the program. This speaks to the strong endorsement of the program by the faculty.
- The strong support of the university faculty for this program and the students in the program is expressed in the 62.5% positive response to the question regarding the

question of faculty from outside of the students' home departments collaborating with the students.

- Only one student reported collaborating with faculty at other universities in the United States; as the program matures there will likely be more opportunities for students to collaborate with faculty at other universities.
- Half of students indicated collaborations with the international faculty community of scholars. This speaks well of the aggressiveness with which ISU faculty mentors and program students have been able to assert themselves at the international level. The program is building a solid international component and is making rapid progress in that important arena.
- There was but one student who had established collaboration with an industry scientist in Iowa. This area needs attention by program leadership and may be addressed via internships and work study opportunities. These opportunities should be brokered by program leaders and faculty and facilitated by industrial partners and sponsors. Here, industry scientists could serve on students committees, co-author papers, etc. These scientists could receive university adjunct or other titles; which could/would serve them well in their companies. It also could lead to industry support for the students and thus the program and could also lead to eventual student employment.
- At the time of the survey, there were no students who had yet established collaboration with an industry scientist outside of Iowa. This is an area that needs to be addressed, though the opportunities may likely grow out of the establishment of collaborations with industry scientists within Iowa first.
- At the time of this survey, there were no students who had had collaborations with international industrial scientists. However, during student interviews, one student indicated that there has been a collaboration of an IGERT student with industrial scientists at the Fraunhofer Institute in Germany during a summer visit by the student. This looks very promising. Still, collaboration with international industrial scientists is clearly an area that needs to be addressed and may evolve as the program becomes established and better known with several international partners.
- No students reported collaborating with Public/government laboratory scientists in the United States. This is clearly a growth area, particularly with a federal U.S. Department of Energy National Laboratory on campus. Additionally ISU faculty members involved in the WESEP program have appointments at the federal national laboratory and that presents opportunities that cannot be ignored or taken lightly. In fact, ISU faculty involved in this WESEP program and with the DOE Ames Lab has ongoing sponsored programs that involve graduate students.
- There is at present one student collaboration with an international public/government laboratory scientist.
- To date there have not been any collaborations with other scholars or consultants.

Table 2: Students' Collaborators

	2012 Cohort n	2012Cohort (%)	2013 Cohort n	2013Cohort (%)
Faculty at my institution in my home department	6	100.00	2	100.00
Faculty at my institution in other departments	5	83.33	0	0.00
Faculty at other universities in the United States	1	16.67	0	0.00
International faculty members	3	50.00	1	50.00
Industrial scientists in Iowa	1	16.67	0	0.00
Industrial scientists in the United States (outside of Iowa)	0	0.00	0	0.00
International industrial scientists	0	0.00	0	0.00
Public/government laboratory scientists in the United States	0	0.00	0	0.00
International public/government laboratory scientists	1	16.67	0	0.00
Other scholars or consultants	0	0.00	0	0.00

*Fall 13 students were not asked to respond to this question.

- Table 3 considers student internships. No students in either cohort reported participating in an internship at this point in the program.
- Opportunities for internships may arise over the periods of Spring, Summer and Fall 2014 and beyond. This will be addressed again in Fall 2014.

Table 3: Internships in which Students Participated

	2012 Cohort n	2013 Cohort (%)	2013 Cohort n	2013Cohort (%)
Private sector industry	0	0.00	0	0.00
Business	0	0.00	0	0.00
Public sector laboratories or agencies	0	0.00	0	0.00
I have not yet participated in an internship as part of the IGERT program	6	100.00	2	100.00

*Fall 13 students were not asked to respond to this question.

2.1.2 Student Research, Publications and Other Scholarly Activity

Students were asked to respond to seven closed-ended response items related to research and publications. Specifically, they were asked about their participation in collaborative research projects, interdisciplinary research publications, number of research publications, the conferences and workshops attended, and the usefulness of the Real Time Research Collaboratives (RTRCs).

In Table 4 collaborative research projects were assessed.

- Half of students responded that they had worked on a research project involving multiple disciplines; this is remarkable given that 83.3% of the 2012 year class is already having that experience and moreover that 25.0% of the 2013 year class is already having the experience.
- 42.9% of the total cohort of students in the program is working with a student or more who have similar backgrounds. This implies that these students will be able to build upon each other's knowledge and move forward in their own research more rapidly.
- 78.6% of the total student cohort was working on a team research project; an astounding accomplishment for the faculty and the management team of the program. Few graduate programs in universities across the U.S. could make this claim in programs that have multiple faculty and multiple students.
- 64.3% of the total cohort of students in the program reported working with one or more students who have backgrounds differing from each other; a very impressive number. It implies that these students will be able to help educate each other and both expand each other's knowledge and also see the context and relevance of each other's research.

Table 4: Collaborative Research Projects

	2012Cohort n	2012Cohort (%)	2013Cohort n	2013Cohort (%)
Working on a research project involving multiple disciplines	5	83.33	2	25.00
Working on a research project with other students who share a similar disciplinary background to my own	3	50.00	3	37.50
Working on a team research project	6	100.00	5	62.50
Working on a research project with other students with disciplinary backgrounds different from my own	6	100.00	3	37.50

Table 5 assesses interdisciplinary research publications.

- The program is relatively new, and a large number of peer-reviewed publications outside students' home disciplines would not be expected at this time. However this is an important component of the program, and continuing to monitor students' progress in this area will provide important information. Within a year the 2012 cohort should have manuscripts being prepared for submission, being reviewed, and being

published in journals, including those outside students' home disciplines. What will help this along is the packaging of the PhD dissertations such that several chapters in the document can become standalone publications.

- One student in the 2012 cohort presented research findings at a conference outside her home discipline. Again, the program is relatively new and a large number of presentations at conferences outside students' home disciplines would be unexpected at this time. However, this is an important component of the program and students' progress in this area will continue to be monitored.

Table 5: Interdisciplinary Research Publications

	2012 Cohort n	2012Cohort (%)	2013 Cohort n	2013Cohort (%)
Published research findings in a journal outside your home discipline.	0	0.00	0	0.00
Presented research findings at a conference outside your home discipline.	1	16.67	0	0.00

In Table 6 the responses to the assessment of student research publications is addressed.

- Despite the fact that the program is relatively new, one student in the 2012 cohort was able to co-author a journal article related to wind energy. As the program continues and students have more time in the program, we would expect to see more students reporting refereed publications. Within a year the 2012 cohort should have manuscripts being prepared for submission, being reviewed, or in-press.
- There have been four presentations by students, all from the 2012 cohort, as the primary author at a conference.
- There have been four presentations by students, all four from the 2012 cohort, which students have made as a co-author at a conference. 2012 students also reported that they served as an interdisciplinary author or co-author on three conference papers or poster publications.
- 2012 cohort students also reported serving as the primary author on three other publications, co-author on two other publications, and interdisciplinary author or co-author on one other publication. These non-peer reviewed publications can serve as a precursor to peer reviewed publications, such as technical reports that are then turned into manuscripts, etc.
- Table 6 cannot yet be evaluated for standard deviations because we do not have sufficient numbers of respondents. As the numbers grow in future years the situation will change.

Table 6: Student Research Publications, Conferences and Other Scholarly Activity

	2012 Cohort n	2012 Cohort mean	2012 Cohort s.d.	2013 Cohort n	2013 Cohort mean	2013 Cohort s.d.
Journal articles in refereed journals						
Primary Author	0	0.00	—	0	0.00	—
Co-author	1	0.17	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
Conference paper or poster Presentations						
Primary Author	4	0.67	—	0	0.00	—
Co-author	4	0.67	—	0	0.00	—
Interdisciplinary author/co-authors	3	0.50	—	0	0.00	—
Book chapters						
Primary Author	0	0.00	—	0	0.00	—
Co-author	0	0.00	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
Books						
Primary Author	0	0.00	—	0	0.00	—
Co-author	0	0.00	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
Patent applications						
Primary Author	0	0.00	—	0	0.00	—
Co-author	0	0.00	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
Approved patents						
Primary Author	0	0.00	—	0	0.00	—
Co-author	0	0.00	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
Grant proposals						
Primary Author	0	0.00	—	0	0.00	—
Co-author	0	0.00	—	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—	0	0.00	—
All other publications						
Primary Author	3	0.50	—	0	0.0	—
Co-author	2	0.33	—	0	0.0	—
Interdisciplinary author/co-authors	1	0.17	—	0	0.00	—

Table 7 addresses conferences and workshops attended by the WIP students.

- 57.1% of students have attended conferences at ISU.
- 35.7% of the students have presented a poster at ISU, but no students presented a paper at ISU.
- 42.9% of the students have presented posters and one student also made an oral presentation at conferences away from ISU but within the U.S. This is good exposure for the students as to what is happening on the national scene and to what will be expected of them as they prepare their poster and oral presentations for upcoming meetings
- Of the conference/workshop attendees, 83.3% of the 2012 cohort made either a poster or an oral presentation at conferences within the U.S.; this is a remarkable showing.

Table 7: Conferences and Workshops Attended

	Attended a conference n	Attended a conference %	Presented a poster n	Presented a poster %	Presented a paper n	Presented a paper %
At home institution						
2012 Cohort	4	75.00	3	50.00	0	0.00
2013 Cohort	4	50.00	2	25.00	0	0.00
Within the U.S. (outside the home institution)						
2012 Cohort	3	50.00	5	83.33	1	16.67
2013 Cohort	3	37.50	1	12.50	0	0.00
Outside the U.S.						
2012 Cohort	0	0.00	0	0.00	0	0.00
2013 Cohort	0	0.00	0	0.00	0	0.00

- Students were asked about the usefulness of the Real Time Research Collaboratives (RTRCs) as shown in Table 8.
- Students agreed that the RTRCs were at least a little useful in helping them learn how to do research, with five of the eight students reporting that it was somewhat useful in this area.
- Students indicated that their research productivity was being stimulated and enhanced in the RTRC.
- All students agreed that the RTRCs were helping to facilitate their interdisciplinary work, with six of the eight students reporting that the RTRC was at least somewhat useful in this area.
- All students agreed that student communication skills are being affected and improved in the RTRC. Two students indicated that the RTRC was a little useful in enhancing communication skills, while six students reported that it was somewhat useful.
- Six students indicated that the RTRC enhanced their awareness of and ability to respond to ethical issues, while two students indicated that the RTRC was not helpful

in this area. The students may need additional formal training regarding ethical conduct herein.

- Six students reported that the RTRC was a little or somewhat useful in helping them to make industry connections, while two students indicated that the RTRC was not at all useful in boosting their industry connections.

Table 8: Usefulness of the Real Time Research Collaborative.

	Not at all Useful	A Little Useful	Somewhat Useful	Very Useful	n	Mean	s.d.
Learning how to do research							
2012 Cohort	0	1	4	1	6	3.00	0.63
2013 Cohort	0	1	1	0	2	2.50	0.71
Stimulating and enhancing your research productivity							
2012 Cohort	0	3	1	2	6	2.83	0.98
2013 Cohort	0	1	1	0	2	2.50	0.71
Facilitating your interdisciplinary work							
2012 Cohort	0	1	4	1	6	3.00	0.63
2013 Cohort	0	1	1	0	2	2.50	0.71
Enhancing your communication skills							
2012 Cohort	0	2	4	0	6	2.67	0.52
2013 Cohort	0	0	2	0	2	3.00	0.00
Enhancing your awareness of and ability to respond to ethical issues							
2012 Cohort	2	2	2	0	6	2.00	0.89
2013 Cohort	0	1	1	0	2	2.50	0.71
Learning about environmental and policy issues							
2012 Cohort	0	0	6	0	6	3.00	0.00
2013 Cohort	0	1	1	0	2	2.50	0.71
Making industry connections							
2012 Cohort	1	2	3	0	6	2.33	0.82
2013 Cohort	1	1	0	0	2	1.50	0.71

Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful
*Fall 13 students did not answer this question.

2.1.3 Student Learning, Preparation, and Suggestions for Improvement

Students were asked two closed-ended response items related to their perceptions their own of preparedness and the opportunities provided by their graduate program. Students were also asked to provide suggestions for improving the IGERT program.

In Table 9 students' perceptions of preparedness was polled.

- Five students in the 2012 cohort (83.3%) felt either somewhat or mostly prepared to do so; and seven of the 2013 cohort (87.5%) felt "somewhat" to "very" prepared to do so.
- The students felt very comfortable in communicating with people inside of their fields with all 14 saying they were somewhat to very prepared to do so.
- Eleven of the 14 students (78.6%) felt mostly or very prepared to work in an academic setting and 13 of 14 (92.9%) felt somewhat to very prepared.
- Thirteen of 14 students (92.9%) felt mostly or very prepared to conduct research in an ethical manner which bodes well for the high integrity of the research that these students will conduct.
- Ten of 14 (71.4%), including all six 2012 students, felt somewhat to very prepared to present their research findings to their peers. Four students from the 2013 cohort (50.0 %) felt little or not prepared.
- 85.7% of the students (12 of the 14) felt they are somewhat to mostly prepared in knowing their discipline in depth.
- All of the students were somewhat to very prepared to work in teams of researchers across the landscapes of within their discipline and with other disciplinary colleagues.
- Only three (21.4%) of the students felt but little prepared to collaborate with international scientists. Alternatively 78.6% felt somewhat to very well prepared in such a potential collaboration.
- 78.6% of the students felt somewhat to very well prepared to write peer reviewed research articles or books; in keeping with the above responses.
- 85.7% of the students (12 of the 14) felt that they were somewhat to very prepared to communicate with people outside of their fields; this is an important self-perception.
- The students were not confident overall with their ability to communicate their research findings to the general public. This response might seem to be in conflict with the previous finding. However, the students clearly interpreted the previous question to mean communications with other scientists while this one is on less familiar turf; namely non-scientists. To address this, the students could collectively approach some community organization in Ames and offer to have a "Town Hall" meeting where say six students who have been in the program for at least one full year, could make a total of an hour long presentation, with brief 6-8 minute power point vignettes about the highlights of their research, and the public could then ask questions about wind power and what it would mean for Iowa. By doing this the students would be forced to prepare at the level that they need to speak to non-scientists.
- All of the 2012 cohort students reported feeling mostly or very prepared to work outside of academia, while the 2013 cohort was variable, with five students reporting that they were a little or somewhat prepared and three reporting that they were mostly or very prepared.

Table 9: Students' Perceptions of Preparedness

	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared	n	Mean	s.d.
Conduct high-quality research								
2012 Cohort	0	1	1	4	0	6	3.50	0.84
2013 Cohort	0	1	5	1	1	8	3.25	0.89
Communicate with people inside your field								
2012 Cohort	0	0	2	3	1	6	3.83	0.75
2013 Cohort	0	0	1	5	2	8	4.13	0.64
Understand and work in an academic setting								
2012 Cohort	0	0	1	3	2	6	4.17	0.75
2013 Cohort	0	1	1	4	2	8	3.88	0.99
Conduct research in an ethical manner								
2012 Cohort	0	0	0	4	2	6	4.33	0.52
2013 Cohort	0	1	0	4	3	8	4.00	0.99
Present research findings to scientific peers								
2012 Cohort	0	0	2	4	0	6	3.67	0.52
2013 Cohort	1	3	1	2	1	8	2.88	1.36
Know your discipline in depth								
2012 Cohort	0	0	2	4	0	6	3.67	0.52
2013 Cohort	0	2	0	6	0	8	3.50	0.93
Work in teams of researchers from more than one discipline								
2012 Cohort	0	0	2	4	0	6	3.67	0.52
2013 Cohort	0	0	4	2	2	8	3.75	0.89

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared

Table 9: Students' Perceptions of Preparedness (con't)

	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared	n	Mean	s.d.
Work in research teams within your discipline								
2012 Cohort	0	0	2	3	1	6	3.83	0.75
2013 Cohort	0	0	2	3	3	8	4.13	0.83
Collaborate with international scientists								
2012 Cohort	0	1	0	4	1	6	3.83	0.98
2013 Cohort	0	2	4	1	1	8	3.13	0.99
Write research articles or books								
2012 Cohort	0	0	2	3	1	6	3.83	0.75
2013 Cohort	2	1	4	1	0	8	2.50	1.07
Communicate with people outside your field								
2012 Cohort	0	0	4	2	0	6	3.33	0.52
2013 Cohort	0	2	2	3	1	8	3.38	1.06
Communicate research findings to the general public								
2012 Cohort	0	2	2	1	1	6	3.17	1.17
2013 Cohort	2	1	2	1	2	8	3.00	1.60
Work outside of academia (industry, public sector)								
2012 Cohort	0	0	0	4	2	6	4.33	0.52
2013 Cohort	0	4	1	2	1	8	3.00	1.20

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared

In Table 10 students' perceptions of the IGERT WESEP program are presented.

- 87.5% of the students agreed or strongly agreed that they are able to study their fields in as much depth as they desired. No barriers appear to be present for student inquiry.
- 75.0% of the students agreed or strongly agreed that they have developed the ability to communicate and work on research issues in a multi-disciplinary setting.
- All of the students agreed or strongly agreed that this academic program is highly demanding on their time.
- Three quarters of the students agreed or strongly agreed that they are allowed adequate opportunities to network with researchers outside of the ISU. Curiously, one student disagreed here.
- 75.0% of the students agreed that they were familiar with current research being conducted in foreign countries; this is an impressive expression of the rich international literature and the new knowledge that is being advanced across the globe.
- 62.5% of the students confirmed that they agreed or strongly agreed that they were prepared to conduct research outside of ISU. This bodes well for the students experience abroad and also for their ability to work in industrial and or federal laboratories away from the ISU campus.
- 62.5% of the students have developed the confidence that they now agreed or strongly agreed that they were being prepared for a wide range of career possibilities. That is very important in the early careers of young scholars.
- 62.5% of the students agreed or strongly agreed that they were part of a strong student community. This is a somewhat puzzling response. During the separate and collective meetings with the students there was no suggestion that there wasn't a sense of strong camaraderie amongst the students. Moreover the responses to prior questions (above) indicated that the students work well together and have learned from each other.

Table 10: Students' Perceptions of their Graduate Program

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Mean	s.d.
I am able to study my field in as much depth as I like.								
2012 Cohort	0	0	1	4	1	6	4.00	0.63
2013 Cohort	0	0	0	1	1	2	4.50	0.71
I have developed the ability to communicate and work on research problems with researchers from more than one discipline.								
2012 Cohort	0	0	1	5	0	6	3.83	0.41
2013 Cohort	0	0	1	0	1	2	4.00	1.41
I experience high demands on my time from my academic program.								
2012 Cohort	0	0	0	0	6	6	5.00	0.00
2013 Cohort	0	0	0	1	1	2	4.50	0.71
I receive adequate opportunities to network with researchers outside this university.								
2012 Cohort	0	1	0	4	1	6	3.83	0.98
2013 Cohort	0	0	1	1	0	2	3.50	0.71
I am familiar with current research being conducted in my field in foreign countries.								
2012 Cohort	0	1	1	4	0	6	3.50	0.84
2013 Cohort	0	0	0	2	0	2	4.00	0.00
I have been prepared to conduct research outside my institution.								
2012 Cohort	0	2	0	4	0	6	3.33	1.03
2013 Cohort	0	0	1	0	1	2	4.00	1.41

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree
*Fall 13 students were not asked to respond to this question.

Table 10: Students' Perceptions of their Graduate Program (con't)

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	n	Mean	s.d.
I am being prepared for a wide range of career possibilities.								
2012 Cohort	0	2	1	2	1	6	3.33	1.21
2013 Cohort	0	0	0	2	0	2	4.00	0.00
I am part of a strong student community.								
2012 Cohort	0	1	2	3	0	6	3.33	0.82
2013 Cohort	0	0	0	0	2	2	5.00	0.00

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree
*Fall 13 students were not asked to respond to this question.

2.1.4 Student Written Responses in the Student Survey

What suggestions do you have to improve the IGERT program?

- None so far, as I have just became an IGERT student and won't have much feedback until I experience the program itself. I am very excited to be part of this program and am honored to have been selected
- There is no/very little help on paper publication or professional writing. A list of journals and guidance on paper publication would be great
- At this time, I have little exposure to the IGERT program, but from my current experience I believe there should be a heavier emphasis on RT5 in the program
- Including non-technical disciplines in the program such as sociology, economics, communications, etc. would allow for more rigorous research to be done on these areas which are highly necessary for acceptance of wind energy by the American public
- I believe an opportunity could be presented to allow the students to discuss their research within the IGERT program to see how it relates to others
- More courses should count towards the major
- It would be nice to have more industry seminars
- Make sure all of the administrative details (PoS, co-majoring, etc) are well-known and well-documented
- Limiting the number of research projects to be done as part of classes connected with the program and/or wind energy that need to be done that are not directly tied to my personal research to no more than one per semester

Please use this space to discuss any other comments or concerns you may have

- There were none.

2.2 Annual Faculty Survey

This section of the report details faculty members' responses to the annual faculty survey and is broken down into three subsections: 2.2.1) Research and Publications; 2.2.2) Impact of IGERT on Graduate Students; and 2.2.3) Impact of Participating in IGERT and Suggestions for Program Improvement. Each of these subsections is comprised of similar questions.

2.2.1 Overview

All 27 of the WIP-affiliated faculty members at Iowa State University were sent an e-mail in August 2013 inviting them to complete the faculty survey. Of these 27 faculty, 18 responded to the survey. Not all faculty members responded to every question.

- Faculty participation in the IGERT program is presented in Table 11.
- The two-thirds response to the question of faculty advising IGERT students (12 of 18) is a strong faculty support base for the 12 students presently in the program; a strength in the program.
- Half of the faculty involved in IGERT conduct WESEP related research.

- Surprisingly only five (27. 8%) of the responding faculty reported that they attend WESEP lectures or workshops. 22.2% (4) of the 18 responding faculty had IGERT students working in their labs at the time of this survey.

Table 11: Participation in the IGERT Project

	n	%
I advise IGERT graduate students	12	66.67
I serve on IGERT dissertation committees	4	22.22
I conduct IGERT-related research	9	50.00
I attend IGERT workshops or lectures	5	27.78
IGERT graduate students work in my lab	4	22.22
I teach IGERT courses	5	27.78
I contribute to IGERT project management	1	5.56

2.2.2 Research, Publications and Other Scholarly Activity

This section provides an overview of four closed-ended questions related to faculty research and publication and other scholarly activity. Faculty members were asked about the numbers of publications which they had authored, coauthored, and/or participated in interdisciplinary research on. They were also asked about interdisciplinary research publications and other scholarly activity.

- The faculty response to the query regarding their research publication activity over the prior one year period is provided below in Table 12.
- Overall, the one year snapshot of faculty activity is in keeping with those of a cadre of solid university faculty at a Research I university. The faculty engaged in the WIP in general conduct laboratory science and also numerical modeling.
- On peer-reviewed journal articles related to WESEP, faculty reportedly served as a primary author twice, a co-author 11 times, and an interdisciplinary author/co-author 5 times. On conference presentations or posters related to WESEP, faculty reportedly served as primary author 13 times, co-author 11 times, and an interdisciplinary author/co-author eight times. Across 18 faculty this indicates a very engaged graduate faculty.

Table 12: Faculty, Publications and Other Scholarly Activity Related to WESEP

	n	Mean	s.d.
Journal articles in refereed journals			
Primary Author	2	0.12	—
Co-author	11	0.65	—
Interdisciplinary author/co-authors	5	0.29	—
Conference paper or poster presentations			
Primary Author	13	0.76	—
Co-author	11	0.65	—
Interdisciplinary author/co-authors	8	0.47	—
Book chapters			
Primary Author	0	0.00	—
Co-author	0	0.00	—
Interdisciplinary author/co-authors	6	0.35	—
Books			
Primary Author	0	0.00	—
Co-author	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—
Patent applications			
Primary Author	0	0.00	—
Co-author	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—
Approved patents			
Primary Author	1	0.06	—
Co-author	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—
Grant proposals			
Primary Author	4	0.24	—
Co-author	2	0.12	—
Interdisciplinary author/co-authors	1	0.06	—
All other publications			
Primary Author	0	0.00	—
Co-author	0	0.00	—
Interdisciplinary author/co-authors	0	0.00	—

- The faculty involvement in publications and conference presentations outside of their home disciplines is presented in Table 13. Comments below also consider collective faculty responses reported in both Tables 12 and 13.

- Eight presentations at conferences in areas outside of the faculty home fields is considerable.

Table 13: Research Publications and Professional Conference Talks/Posters Outside of the Faculty Home Discipline

	n	%
Published research findings in a journal outside your home discipline.	7	43.75
Presented research findings at a conference outside your home discipline.	8	50.00

2.2.3 Impact of IGERT on Graduate Students

Faculty members were asked to respond to an open-ended question about departmental recruiting of graduate students and three closed-ended questions related to the impact of IGERT on graduate admissions, the preparation of graduate students, and the usefulness of the Real-Time Research Collaboratives (RTRCs).

What strategies were used to attract a highly qualified, diverse pool of applicants for the IGERT program?

Five faculty responded to this question. Three respondents indicated that they were not sure how recruitment occurred, while two faculty members mentioned recruiting in professional forums and with a variety of institutions. Faculty responses included the following.

- "I am not really sure."
- "Really don't know. Student was identified and I worked with applicants after they were in contact with ISU."
- "Barb Brown sent emails and made phone calls to a variety of institutions having large under-represented populations."
- "I was not directly involved in recruiting."
- "The program is widely advertised in professional forums."

2.2.4. Impact of IGERT on Faculty Home Departments

WESEP faculty were asked to respond to a series of questions on the impact of IGERT on their home department admissions; as shown in Table 14.

- 37.5 % of the responding faculty "agreed or strongly agreed" that the IGERT students are better qualified than other department students. Nearly twenty percent of the IGERT faculty disagreed or strongly disagreed that the IGERT students are more highly qualified than other department students.
- Half of the responding faculty agreed that WESEP has attracted more students who are U.S. citizens then normal for their department.
- 37.5% agreed or strongly agreed that the students attracted into WESEP have inter and multi- disciplinary backgrounds; an important attribute for students to have, given the nature of the WESEP program.
- 43.8% of the responding faculty agreed that WESEP has attracted students from a collectively more varied disciplinary background.

- 37.5% of the responding faculty agreed that students with different career goals have been attracted into WESEP program.
- 12.5% of the responding faculty agreed that WESEP has attracted more applicants from underrepresented minority groups. This needs to be looked at in the context of the recruitment policies and procedures discussed above; as this is a key component of that plan.
- One-fourth of the responding faculty agreed that more female students are being attracted to their departments because of WESEP. This is an important target group. The WESEP program has a very impressive cohort of female students presently enrolled.
- None of the responding faculty agreed that more international students were being attracted to their departments because of WESEP. In fact 37.5% of the faculty disagreed or strongly disagreed with this question.

Table 14: Impact of IGERT on Departmental Admissions

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	n	Mean	s.d.
We have attracted better qualified students	1	2	7	5	1	16	3.19	0.98
We have attracted more students	1	1	8	4	2	16	3.31	1.01
We have attracted more students who are U.S. citizens	1	0	7	3	5	16	3.69	1.14
We have attracted students who have inter/multidisciplinary backgrounds	1	1	8	3	3	16	3.38	1.09
We have experienced increased admissions inquiries into our program	1	1	11	3	0	16	3.00	0.73
We have attracted students from a collectively more varied disciplinary background	1	1	7	6	1	16	3.31	0.95
We have attracted students with different career goals	1	1	8	4	2	16	3.31	1.01
We have attracted more underrepresented minority students	1	3	10	2	0	16	2.81	0.75
We have attracted more female students	1	1	10	4	0	16	3.06	0.77
We have attracted more international students	1	5	10	0	0	16	2.56	0.63

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

2.2.5 Comparison of IGERT to Non-IGERT students

IGERT faculty were asked to compare IGERT and Non-IGERT graduate students in their respective home departments, as detailed in the responses in Table 15. This reveals how the IGERT cohort is viewed versus the Non-IGERT cohorts by the same faculty. Notably, on average the IGERT students were rated as being better prepared than their Non-IGERT peers on every item.

- Both the IGERT and Non-IGERT cohorts were viewed as overall being able to conduct high quality research with the Non-IGERT cohort viewed as being mostly prepared versus the IGERT cohort as being half way between mostly to very prepared. The former may speak to the high quality of ISU graduate students in general and the latter may speak to the exceptionally high quality of the IGERT students in particular.
- The IGERT students were viewed, on average, as being "mostly to very" prepared to communicate with people outside of their fields, while the Non-IGERT students were viewed as being "a little to mostly", centered about "somewhat". This may reflect the fact that the IGERT students came into the program because, for the most part, they were very focused on wind energy and feel comfortable sharing their perspectives.
- The question regarding the ability to be able to work in teams of researchers from more than one discipline drew a remarkably disparate rating of the two cohorts. All faculty rated the IGERT students between somewhat and very prepared with a mean of 4.23 on the 5-point scale. Meanwhile the Non-IGERT cohort ratings ranged from "not to mostly" prepared, with half of faculty rating Non-IGERT students as being not prepared to a little prepared, and with no faculty reporting that Non-IGERT students were very prepared to do this. This resulted in an overall rating of 2.63 on the 5-point scale for the Non-IGERT group. The WESEP program clearly is becoming a model for how to conduct team research.
- 83.3% of faculty rated the IGERT as being mostly to very prepared to work outside of academia. Since most graduate students have spent the greater part of their lives within the halls of universities, getting prepared to work "in the real world" is not always a straightforward process as the demands and expectations are quite different outside of academia. The Non-IGERT students were also rated highly here, with 81.3% of faculty reporting that Non-IGERT students were either somewhat or mostly prepared. However, none of the faculty rated Non-IGERT students as being very prepared.
- 90.0% of faculty evaluated IGERT students as being mostly to very prepared to collaborate with international scientists with an overall rating of 4.30 on the 5-point scale. Here 18.8% of faculty rated the Non-IGERT students as being not prepared. The overall rating of the Non-IGERT students was 2.88/5.
- 90.9% of faculty rated the IGERT students as being somewhat to very prepared to communicate their research findings to the general public, with a distribution centered about "mostly". One faculty member indicated that IGERT students were not prepared to do this. The mean was 3.73 of the 11 responding faculty. Non-IGERT students were rated considerably less prepared in this area. One-fourth of faculty reported Non-IGERT students are not prepared, 43.8% of faculty rated them as a little or somewhat prepared, and 31.3% of faculty rated them as being mostly or very prepared.
    - The WESEP IGERT students have a wonderful opportunity to test their communication skills here. They could plan and host a "town hall meeting" in a public, off-campus venue in Ames and make up to five power point presentations of their work to the public. Invitations could be sent to various organizations, e.g., the Ames Chamber of Commerce, Rotary Club, Elks, UNICO, and so on. Following the presentations the students would entertain

questions and comments and respond accordingly. Dr. J. McCalley would be present as the moderator and as an observer.

Table 15: Preparation of Graduate Students

	Not prepared	A little prepared	Somewhat prepared	Mostly prepared	Very prepared	Not sure/ not applicable	n	Mean	s.d.
Conduct high-quality research									
IGERT Graduate Students	0	0	1	4	7	4	12	4.50	0.67
Non-IGERT Graduate Students	0	0	2	12	2	0	16	4.00	0.52
Present research findings to scientific peers									
IGERT Graduate Students	0	0	1	5	6	4	12	4.42	0.67
Non-IGERT Graduate Students	0	0	3	10	3	0	16	4.00	0.63
Know their own discipline in depth									
IGERT Graduate Students	0	0	1	5	6	4	12	4.42	0.67
Non-IGERT Graduate Students	0	0	3	9	4	0	16	4.06	0.68
Communicate with people inside their field									
IGERT Graduate Students	0	0	2	5	6	3	13	4.31	0.75
Non-IGERT Graduate Students	0	0	4	8	4	0	16	4.00	0.73
Work in research teams within their discipline									
IGERT Graduate Students	0	0	1	6	5	4	12	4.33	0.65
Non-IGERT Graduate Students	0	2	3	8	3	0	16	3.75	0.93
Understand and work in an academic setting									
IGERT Graduate Students	0	0	2	4	6	3	12	4.33	0.78
Non-IGERT Graduate Students	0	0	5	7	4	0	16	3.94	0.77
Write research articles or books									
IGERT Graduate Students	0	0	3	4	6	3	13	4.23	0.83
Non-IGERT Graduate Students	0	1	5	6	4	0	16	3.81	0.91

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.
Not Sure/Not Applicable responses are not included in the calculation of the mean and standard deviation.

Table 15: Preparation of Graduate Students (con't)

	Not prepared	A little prepared	Somewhat prepared	Mostly prepared	Very prepared	Not sure/ not applicable	n	Mean	s.d.
Conduct research in an ethical manner									
IGERT Graduate Students	0	0	4	4	5	3	13	4.08	0.86
Non-IGERT Graduate Students	0	1	6	6	3	0	16	3.69	0.87
Communicate with people outside their field									
IGERT Graduate Students	0	1	1	4	7	3	13	4.31	0.95
Non-IGERT Graduate Students	1	4	7	3	1	0	16	2.94	1.00
Work in teams of researchers from more than one discipline									
IGERT Graduate Students	0	0	2	6	5	3	13	4.23	0.73
Non-IGERT Graduate Students	2	6	4	4	0	0	16	2.63	1.02
Work outside of academia, (industry, public sector)									
IGERT Graduate Students	0	1	1	5	5	4	12	4.17	0.94
Non-IGERT Graduate Students	0	3	6	7	0	0	16	3.25	0.77
Collaborate with international scientists									
IGERT Graduate Students	0	0	1	5	4	5	10	4.30	0.67
Non-IGERT Graduate Students	3	3	4	5	1	0	16	2.88	1.26
Communicate research findings to the general public									
IGERT Graduate Students	1	0	3	4	3	4	11	3.73	1.19
Non-IGERT Graduate Students	4	2	5	4	1	0	16	2.75	1.29

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.
Not Sure/Not Applicable responses are not included in the calculation of the mean and standard deviation.

2.2.6 Usefulness of the Real Time Research Collaboratives (RTRCs) from the Faculty Perspective

Faculty members were asked a series of questions about the RTRCs. Their responses are given in Table 16.

- The RTRCs were found by the faculty to be of very high value in the instruction of students on the conduct of research. All of the responding faculty found the RTRCs to be somewhat to very useful.
- The RTRCs were found by the faculty to be highly valuable in the process of stimulating and enhancing research productivity. All of the responding faculty found the RTRCs to be somewhat to very useful.
- The RTRCs were found by the majority of the faculty to be highly valuable in the process of facilitating students' interdisciplinary research. Ninety percent of the faculty who responded found the RTRCs to be somewhat to very useful.

- 88.9% of the faculty found the RTRCs to be somewhat to very useful in improving in enhancing students' communication skills.
- 88.9% of the responding faculty found the RTRCs to be somewhat to very useful in improving the enhancement of the students' awareness of and ability to respond to ethical issues. This is in keeping with the students' response to a question in-kind in Table 9.
- The RTRCs were found by the majority of the faculty to be highly valuable in the process of teaching students' in the arenas of environmental and policy issues. Ninety percent of the faculty found the RTRCs to be somewhat to very useful.
- 88.9% of the faculty found the RTRCs to be somewhat to very useful in helping to make industry connections. This is not in keeping with the students' response to a question in-kind in Table 8.

Table 16: Usefulness of the Real Time Research Collaboratives

	Not at all useful	A little useful	Somewhat useful	Very useful	Not sure/ not applicable	n	Mean	s.d.
Teaching students how to do research	0	0	2	7	7	9	3.78	0.44
Stimulating and enhancing your research productivity	0	0	3	6	7	9	3.67	0.50
Facilitating students' interdisciplinary work	1	0	4	5	6	10	3.30	0.95
Enhancing students' communication skills	0	1	2	6	7	9	3.56	0.73
Enhancing students' awareness of and ability to respond to ethical issues	0	1	5	3	7	9	3.22	0.67
Learning about environmental and policy issues	1	0	4	5	6	10	3.30	0.95
Making industry connections	0	1	4	4	7	9	3.33	0.71

Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful.
Not Sure/Not Applicable responses are not included in the calculation of the mean and standard deviation.

2.2.7 Impact of Participating in IGERT and Suggestions for Program Improvement

Faculty members were asked to respond to three closed-ended questions related to the impact of participating in the IGERT program, including the amount of time they spent on activities in their home department, the impact of IGERT on their professional lives, and the impact of IGERT on their home departments. They were also asked for suggestions on how to improve the IGERT program.

Faculty responses to the question of how involvement in IGERT has affected their time spent in their home departments are summarized in Table 17.

- 88.9% of the 16 responding faculty found that their IGERT participation has not affected their time spent teaching courses in their home departments. The other two

faculty said they spent more (one) and less (one) time than previously teaching courses in their home departments.

- Over three quarters (75.6%) of the 17 responding faulty said that their involvement in the IGERT program had not affected their advising of students in their home departments. Alternatively, three of the faculty (17.7%) said they had less time to devote to their home based graduated students and one of the faculty (5.9%) said that they had more time. All of the 17 responding faculty said that they were able to spend equal or more time conducting research with other departmental faculty.

Table 17: Time Spent in Home Department

	Less time		Equal time		More time	
	n	%	n	%	n	%
Teaching department courses	1	5.56	16	88.89	1	5.56
Advising department students	3	17.65	13	76.47	1	5.88
Engaging in department leadership activities	3	17.65	14	82.35	0	0.00
Conducting research with other departmental faculty	0	0.00	14	82.35	3	17.65

2.2.8 How has IGERT influenced your professional life

The question that is being addressed in this section is: "to what extent do you agree or disagree with the following statements about the impact that participating in the IGERT project has had on your professional life?" The responses to the above question are presented in Table 18.

- Fourteen of 16 faculty members (87.5%) agreed or strongly agreed that they had been exposed to new ideas outside of their area of knowledge.
- For the question of whether or not faculty engaged in the program have met new faculty in other departments because of the program, 13 of the 16 responding faculty said that they agreed or strongly agreed. In the academic environment, meeting with faculty from departments outside of a home department does not occur frequently. However, when the opportunities arise, important new productive relationships can and often do occur. As such, meeting and interacting with other faculty under the umbrella of a graduate student PhD program could be a catalyst to new interactive activities amongst faculty who otherwise would never have met nor had chances to exchange interests and ideas.
- 62.5% said that they agreed or strongly agreed that they have been able to work with a greater variety of students
- 56.3% of faculty agreed that they have been able to work with a greater variety of students.
- Over half of faculty indicated that they were more likely to conduct research with colleagues in disciplines outside their own. This is a strong outcome of the opportunities that this program has created for faculty at ISU.
- Moreover, 56.3% agreed or strongly agreed that their teaching had become more interdisciplinary because of their involvement in the program. Making connections

between course content and subject areas outside of the course per se are not typically obvious to the students. As such pointing out the relationships that exist to other disciplines is important to the education and growth of students.

- 62.5% of faculty said that they agreed or strongly agreed that they were more likely to consider team teaching with faculty outside of their home departments.
- Obtaining research grants is a very difficult process as all R-I University faculty know. A faculty's promotion and tenure status will strongly depend on her/his success in the grant arena. Anything that can help faculty be successful at obtaining grants is of great benefit to the academic and scholarly success of the faculty and the faculty's students and post-docs. 56.3% either agreed or strongly agreed that they were in a better position to obtain new research grants because of their participation in the IGERT program.
- The faculty research tool kit can become staid in isolation. National and international meetings often serve the purpose of introducing new approaches and new technological and modeling advances that faculty researches can adopt to aid their research pursuits. Here 43.8% of the faculty agreed that this program has introduced them to new research techniques. The idea that this program, focused on graduate students, has had the overall effect of broadening the research tools that some faculty can bring to bear on a problem is a substantive outcome of this program.
- Often research topics are limited in scope and the formal funding agency review process, which is a highly competitive one generally with only those proposals which offer more breadth and depth being funded. In the field of a faculty often there are limited opportunities to advance new ideas, concepts, approaches and areas of research pursuit. So, any opportunities that a faculty member can take advantage of to explore new research topics, either cross-disciplinary or inter-disciplinary or both are generally embraced by productive, open-minded, opportunistic faculty. This IGERT program has garnered the attention of 37.5% of the participating faculty in the exploration of new research topics which would otherwise not be funded.
- 37.5% of the responding faculty agreed that they were able to work with better qualified students than the Non-IGERT students in their home departments. Half of the responding faculty disagreed that they have less time than previously to conduct their own research because of their involvement in the IGERT program. 43.8% were non-committal. No respondent "strongly agreed" with the statement and one faculty member "agreed" with the statement. Taken collectively, the conclusion is that the IGERT program has not negatively impacted the time that faculty have to conduct their own research for most faculty. And in light of the testimony and findings above, the research opportunities of the faculty have improved given their involvement in this program.

Table 18: Impact of IGERT on Professional Life

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	n	Mean	s.d.
I have been exposed to new ideas outside my area of knowledge.	1	0	1	8	6	16	4.13	1.02
I have met faculty in other departments whom I would not otherwise have met.	1	0	2	6	7	16	4.13	1.09
I am able to work with a greater variety of students.	1	0	5	4	6	16	3.88	1.15
I am more likely to conduct research with colleagues in disciplines outside my own.	1	0	6	3	6	16	3.81	1.17
My teaching has become more interdisciplinary.	1	1	5	3	6	16	3.75	1.24
I am more likely to consider team-teaching with a faculty member outside my department.	1	0	5	7	3	16	3.69	1.01
I am in a better position to obtain new research grants.	1	0	6	6	3	16	3.63	1.02
I have learned new research techniques.	1	1	7	4	3	16	3.44	1.09
I can explore research topics that would not otherwise be funded.	1	2	7	2	4	16	3.38	1.20
I am able to work with students who are better qualified than non-IGERT students in my department.	1	1	8	4	2	16	3.31	1.01
I have less time to conduct my own research.	3	5	7	1	0	16	2.38	0.89

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

2.2.9 Impacts of IGERT on Faculty Home Departments

The responses to this question are summarized in Table 19.

- 75.0% of faculty said that the IGERT program did improve the quality of faculty research in their home department. One-fourth of faculty indicated that IGERT did not improve the quality of faculty research in their home department.
- 87.5% of the responding faculty believes that the program "altered the research scope" of faculty involved in the program. Only 12.5% said it did not.
- 81.3% of the responding faculty reported that the program improved faculty mentoring of students in their home departments. Alternatively 18.8% of the responding faculty reported that the program did not.

Table 19: Impact of IGERT on Faculty's Home Department

	Not at all - 1	2	3	4	Extensively - 5	n	Mean	s.d.
Improved the quality of faculty research	4	1	7	4	0	16	2.69	1.14
Altered the research scope of involved faculty	2	2	5	4	3	16	3.25	1.29
Improved faculty mentoring of students	3	1	8	3	1	16	2.88	1.15

2.2.10 Suggestions of IGERT engaged faculty on ways to improve the WESEP IGERT program

What suggestions do you have to improve the IGERT program?

Faculty responses are listed below as they were provided.

- "My only worry is that it seems to place far more demands on PhD students than would normally be the case for students in my own discipline (demands include extra classes, seminars, activities)."
- "It is hard to say, though, if things would be improved giving the students a bit more free time. This might be helpful for getting research done, but would definitely diminish the unique aspect of multi-disciplinary education and interaction."
- "It would be very beneficial to set up meetings with the faculty members who supervise IGERT/WESEP graduate students and explain to them the expectations from the IGERT/WESEP graduate students and also to provide them information on the IGERT/WESEP program."
- "The findings of this survey need to be shared with the IGERT/WESEP faculty members and discussed on how they can be of further help to improve the IGERT/WESEP program."
- "Share the expectations of the IGERT/WESEP students with the supervising faculty members."
- "I have ended up with a good graduate student."
- "I hope to grow my related research in the wind area."

2.2.11 Other Comments or Concerns of the WESEP IGERT engaged faculty

Please use this space to discuss any other comments or concerns you may have.

Here four faculty responded in the Faculty Survey and several faculty provided input during separate discussions. Concerns expressed in discussions are provided in 1 – 6 below. Direct quotes of the faculty from the Faculty Survey are in 7 – 10 below.

- Several faculty members were concerned on whether or not the students were getting enough depth in key areas related to their areas of study and more specifically their research areas. This may be an area for further discussion by the faculty engaged in the program; particularly the Co-PIs of the WESEP IGERT program.
- Several faculty members wondered whether or not there were too many requirements in the program, or should the program be more flexible. Here, faculty might propose

to negotiate with IGERT program management to substitute some non-required course for some required courses as deemed necessary and appropriate.

- Several faculty members were concerned about the students' source or sources of support after the two-year guarantees in the program. Here perhaps multiple other opportunities should be taken advantage of via building partnerships with industry, federal laboratories, funding from agencies like the U.S. Department of Energy, the National Aeronautics & Space Administration, the U.S. Department of the Interior, the U.S. Department of Agriculture, state of Iowa agencies, the National Oceanic & Administration National Renewable Energy Laboratory, international partners and so on.
- Internships and work-study opportunities with industry need to be brokered by program leadership and the faculty. The results of the faculty survey said that the faculty believed that this program will help make them more competitive in capturing grant and contract support monies.
- The program leadership and the faculty have redesigned Course WESEP 594 in such a way that it has been transformed from being slightly and increasingly unmanageable to being a fantastic team taught course with a very manageable approach and methodology. The students are learning and will learn a great deal both in course content and on the conduct of research.
- There are several opportunities for students that need to be mentioned here. They include:
    - various U.S. Department of Energy student and internships programs
    - the Boren Fellowship which is related to national security in the U.S. and provides support for one year for the federal government
    - the U.S. National Science Foundation East Asia and Pacific Summer Institutes for U.S. graduate students (EAPSI); the German Chancellor Fellowship for tomorrow's leaders at 30/year including 10 from the U.S., 10 from China ad 10 from Russia
    - the Robert Bosch Foundation Fellowship Program of 3-6 months in Germany in which Fellows work as consultants in their field of expertise at leading public and or private institutions in Germany

- "My only worry is that it seems to place far more demands on PhD students than would normally be the case for students in my own discipline (demands include extra classes, seminars, activities). It is hard to say though if things would be improved giving the students a bit more free time."
- "It would be beneficial to set up meetings with the faculty members who supervise IGERT/WESEP graduate students and explain them (sic) the expectations from IGERT/WESEP graduate students and provide them information on the IGERT/WESEP program."
- "I have ended up with a good student. Hope to grow my research in the wind area."

3 Student Focus Groups and Interviews

The following is a summary of the WESEP/IGERT student discussions both on an individual interactive interview basis and in a collective setting. Notes were taken during the

discussions both with individual students and with the collective group of students. Not all of the students met on an individual basis but all of the students were present at the collective gathering.

The students were well informed about the status of their research projects and enthusiastic to discuss their theses. Several students commented that they were very happy with and "loved" the IGERT program. Students were pleased with the excellent facilities available to them, including the Wind Simulation and Testing Lab, the Tornado Simulator, and The Applied Science Center. The also reportedly were pleased with their training in statistics, the format of WESEP 501, the Graduate Student Research Symposium, and the economics and jurisprudence workshops.

Students were reportedly pleased about their relationships with other students. One student indicated, "We have come to rely on each other's' area of expertise and are not shy about getting help from each other." Another said, "The students are very considerate of each other and helpful to each other. We help each other out." Three students commented that they really liked the student office and found it to be a great learning environment.

Similarly, students suggested that communication and relationships between the students and faculty were very positive. In addition, students suggested that the departmental seminar on ethical communication was very good. One student pointed out that there was a need for students to, "interact and communicate with the public, the press, policy makers and so on." Other students reported a desire to have more interaction with industry, including student participation in industry internships. Students also wondered whether it was possible to have industry mentors serve on student committees; the fact that this is, in fact, an option should be communicated to students.

Students expressed interest in having greater ties with the social sciences, specifically mentioning sociology and resource economics. Students hoped to have social scientist faculty members involved in instruction and serving on student committees, social science students involved in the program, and more social science courses available to students.

In addition to the social science courses, students also desired a number of other courses to be included in the curriculum. One student stated, "We need to increase the number of acceptable courses in the curriculum because I need to broaden my education." Students specifically discussed wanting to learn more about health monitoring, continuum mechanics, data analysis, policy, and environmental renewable policy. One way to help students learn about environmental renewable policy would be to have materials available to the students which describe opportunities through such professional societies as: the American Meteorological Society, the American Geophysical Union, the Institute of Electrical & Electronic Engineers, the Physics Society of America, the National Oceanic & Atmospheric

Administration Knauss Fellows Program, other fellows and internship programs in-kind on Capitol Hill in the Nation's Capital.

Appendix A. Annual Student Survey

You have been selected to participate in this study because of your involvement as a graduate student in the Iowa State University Wind Energy Science, Policy, and Engineering IGERT program. We are trying to learn more about the IGERT program and its impact on graduate students and faculty members. In order to do this, we are asking you to complete this short survey, which should take about 10 minutes of your time. Your responses are extremely valuable in helping us to improve the program.

Your responses to the survey are confidential. All individual responses will be aggregated and reported as a group. If you have any questions, please feel free to contact Brandi Geisinger, brandige@iastate.edu, at 294-9622.

Throughout this survey, we use the term 'home discipline' to describe your primary field or department outside of WESEP.

When did you first start the wind energy graduate program?

- ○ Fall 2012
- ○ Spring 2013
- ○ Fall 2013

Have you received formal training or taken courses in the following areas? 'Training' includes workshops, seminars, retreats, special sessions within a course, etc. Check all that apply.

- ☐ Responsible conduct of research (ethics)
- ☐ Statistics
- ☐ "Bridge" courses to learn background content knowledge outside your field
- ☐ Research methods
- ☐ State-of-the-art instrumentation
- ☐ Professional speaking/ presentation skills
- ☐ Communicating to people outside your home discipline
- ☐ Professional writing
- ☐ Communicating to the general public
- ☐ Working on a team research project

How well prepared do you feel to do each of the following tasks?

	Not Prepared	At Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared
Conduct high-quality research					
Communicate with people inside your field					
Understand and work in an academic setting					
Conduct research in an ethical manner					
Present research findings to scientific peers					
Know your own discipline in depth					
Work in teams of researchers from more than one discipline					
Work in research teams within your discipline					
Collaborate with international scientists					
Write research articles or books					
Communicate with people outside your field					
Communicate research findings to the general public					
Work outside of academia (industry, public sector)					

Please indicate the extent to which you agree or disagree with the following statements about your program.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I am able to study my field in as much depth as I like	○	○	○	○	○
I have developed the ability to communicate and work on research problems with researchers from more than one discipline	○	○	○	○	○
I experience high demands on my time from my academic program	○	○	○	○	○
I receive adequate opportunities to network with researchers outside this university	○	○	○	○	○
I am familiar with current research being conducted in my field in foreign countries	○	○	○	○	○
I have been prepared to conduct research outside my institution (e.g., in an internship)	○	○	○	○	○
I am being prepared for a wide range of career possbilities	○	○	○	○	○
I am part of a strong student community	○	○	○	○	○

With which of the following types of people have you worked on research projects while in your current graduate program? Check all that apply.

- ☐ Faculty at my institution in my home department
- ☐ Faculty at my institution in other departments
- ☐ Faculty at other universities in the United States
- ☐ International faculty members
- ☐ Industrial scientists in Iowa
- ☐ Industrial scientists in the United States (outside of Iowa)
- ☐ International industrial scientists
- ☐ Public/government laboratory scientists in the United States
- ☐ International public/government laboratory scientists
- ☐ Policymakers or planners
- ☐ Other scholars or consultants

What type of internships have you participated in as part of the IGERT program? Check all that apply.

- [ ] Private sector industry
- [ ] Business
- [ ] Public sector laboratories or agencies
- [ ] I have not participated in an internship as part of the IGERT program

Which of the following experiences have been part of your graduate training? Check all that apply.

- [ ] Working on a research project involving multiple disciplines
- [ ] Working on a research project with other students who share a similar disciplinary background to my own
- [ ] Working on a team research project
- [ ] Working on a research project with other students with disciplinary backgrounds different from my own

Please provide counts of any professional publications related to wind energy on which you were the PRIMARY AUTHOR during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Please provide counts of any professional publications related to wind energy on which you were a CO-AUTHOR (not the primary author) during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Of the professional publications related to wind energy you listed in the two previous questions, how many of them included students or faculty from a discipline other than your own, industrial scientists, public or governmental employees or international scientists as either the primary author or a co-author?

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Have you engaged in any of the following research activities in the last year? Check all that apply.

- ☐ Published research findings in a journal outside your home discipline
- ☐ Presented research findings at a conference outside your home discipline

Please provide the following information for conferences or workshops you have attended.

	Attended a Conference	Presented a Poster	Presented a Paper
At home institution	☐	☐	☐
Within the U.S. (outside the home institution)	☐	☐	☐
Outside the U.S.	☐	☐	☐

How useful were the Real Time Research Collaboratives (RTRC)s in each of the following areas?				
	Not At All Useful	A Little Useful	Somewhat Useful	Very Useful
Learning how to do research	○	○	○	○
Stimulating and enhancing your research productivity	○	○	○	○
Facilitating your interndisciplinary work	○	○	○	○
Enhancing your communication skills	○	○	○	○
Enhancing your awareness of and ability to respond to ethical issues	○	○	○	○
Learning about environmental and policy issues	○	○	○	○
Making industry connections	○	○	○	○

What suggestions do you have to improve the IGERT program?

Please use this space to discuss any other comments or concerns you may have.

Thank you for completing the survey. Please click >> to submit

Appendix B. Annual Faculty Survey

You have been selected to participate in this study because of your involvement as a faculty member in the Iowa State University Wind Energy Science, Policy, and Engineering IGERT program. We are trying to learn more about the IGERT program and its impact on graduate students and faculty members. In order to do this, we are asking you to complete this short survey, which should take about 10 minutes of your time. Your responses are extremely valuable in helping us to improve the program.

Your responses to the survey are confidential. All individual responses will be aggregated and reported as a group. If you have any questions, please feel free to contact Brandi Geisinger, brandige@iastate.edu, at 294-9622.

Throughout this survey, we use the term 'home discipline' to describe your primary field or department outside of WESEP.

In what ways do you participate in the IGERT project?

- ☐ I advise IGERT graduate students
- ☐ I serve on IGERT dissertation committees
- ☐ I conduct IGERT-related research
- ☐ I attend IGERT workshops or lectures
- ☐ IGERT graduate students work in my lab
- ☐ I teach IGERT courses
- ☐ I contribute to IGERT project management

Please indicate whether your IGERT participation has resulted in your spending less time, equal time, or more time on each of the non-IGERT responsibilities listed below.

	Less Time	Equal Time	More Time
Teaching department courses	○	○	○
Advising department students	○	○	○
Engaging in department leadership activities	○	○	○
Conducting research with other departmental faculty	○	○	○

Please provide counts of any professional publications related to wind energy on which you were the PRIMARY AUTHOR during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Please provide counts of any professional publications related to wind energy on which you were a CO-AUTHOR (not the primary author) during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Of the professional publications related to wind energy you listed in the two previous questions, how many of them included students or faculty from a home discipline other than your own, industrial scientists, public or governmental employees or international scientists as either the primary author or a co-author?

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Have you engaged in any of the following research activities in the last year? Check all that apply.

- [ ] Published research findings in a journal outside your home discipline
- [ ] Presented research findings at a conference outside your home discipline

To what extent do you agree or disagree with the following statements about the impact that participating in the IGERT project has had on your professional life?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I have been exposed to new ideas outside my area of knowledge					
I have met faculty in other departments whom I would not otherwise have met					
I am able to work with a greater variety of students					
I am more likely to conduct research with colleagues in disciplines outside my own					
My teaching has become more interdisciplinary					
I am more likely to consider team-teaching with a faculty member outside my department					
I am in a better position to obtain new research grants					
I have learned new research techniques					
I can explore research topics that would not otherwise be funded					
I am able to work with students who are better qualified than non-IGERT students in my department					
I have less time to conduct my own research					

What strategies were used to attract a highly qualified, diverse pool of applicants for the IGERT program?

Has the presence of the IGERT grant had an impact on your departmental admissions in any of the following ways?					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
We have attracted better qualified students					
We have attracted more students					
We have attracted more students who are U.S. citizens					
We have attracted students who have inter/multidisciplinary backgrounds					
We have experienced increased admissions inquiries into our program					
We have attracted students from a collectively more varied disciplinary background					
We have attracted students with different career goals					
We have attracted more underrepresented minority students					
We have attracted more female students					
We have attracted more international students					

How well do you think your IGERT graduate students are being prepared for the following tasks?						
	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared	Not Sure / Not Applicable
Conduct high-quality research						
Present research findings to scientific peers						
Know their own discipline in depth						
Communicate with people inside their field						
Work in research teams within their discipline						
Understand and work in an academic setting						
Write research articles or books						
Conduct research in an ethical manner						
Communicate with people outside their field						
Work in teams of researchers from more than one discipline						
Work outside of academia (industry, public sector)						
Collaborate with international scientists						
Communicate research findings to the general public						

How well do you think your graduate students **who are not IGERT students** are being prepared for the following tasks?					
	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared
Conduct high-quality research					
Present research findings to scientific peers					
Know their own discipline in depth					
Communicate with people inside their field					
Work in research teams within their discipline					
Understand and work in an academic setting					
Write research articles or books					
Conduct research in an ethical manner					
Communicate with people outside their field					
Work in teams of researchers from more than one discipline					
Work outside of academia (industry, public sector)					
Collaborate with international scientists					
Communicate research findings to the general public					

To what extent has the IGERT grant affected your department in the following ways?					
	Not At All - 1	2	3	4	Extensively - 5
Improved the quality of faculty research					
Altered the research scope of involved faculty					
Improved faculty mentoring of students					

How useful were the Real Time Research Collaboratives (RTRC)s in each of the following areas?

	Not At All Useful	A Little Useful	Somewhat Useful	Very Useful	Not Sure / Not Applicable
Teaching students how to do research	○	○	○	○	○
Stimulating and enhancing students' research productivity	○	○	○	○	○
Facilitating students' interndisciplinary work	○	○	○	○	○
Enhancing students' communication skills	○	○	○	○	○
Enhancing students' awareness of and ability to respond to ethical issues	○	○	○	○	○
Teaching students about environmental and policy issues	○	○	○	○	○
Making industry connections	○	○	○	○	○

What suggestions do you have to improve the IGERT program?

Please use this space to discuss any other comments or concerns you may have.

Thank you for completing the survey. Please click >> to submit.