March 1, 2013

Hon. Angela Williams, Chair
Hon. Tracy Kraft-Tharp, Vice-Chair
Business, Labor, Economic and Workforce Development Committee
Colorado House of Representatives
Colorado State Capitol
200 East Colfax
Denver CO 80203

Hon. Lois Tochtrop, Chair
Hon. Cheri Jahn, Vice-Chair
Business, Labor and Technology Committee
Colorado Senate
Colorado State Capitol
200 East Colfax
Denver CO 80203

Re: Annual Report from the Colorado Renewable Energy Authority

To the Honorable Chairs and Members of the House Business, Labor, Economic and Workforce Development Committee and the Senate Business, Labor and Technology Committee:

On behalf of the Board of Directors of the Colorado Renewable Energy Authority, I hereby provide this report to you regarding the activities of the Authority over the past year, in accordance with Section 24-47.5-102(3), Colorado Revised Statutes.

The principal statutory purpose of the Authority is to direct the allocation of State matching funds to support research proposals of the Colorado Energy Research Collaboratory, a research consortium consisting of the Colorado School of Mines, Colorado State University, the University of Colorado at Boulder and the National Renewable Energy Laboratory. In this report, I will refer to this consortium simply as "the Collaboratory."

But I do want to inform you that the Collaboratory's name has recently changed: the "Colorado Renewable Energy Collaboratory" is now the "Colorado Energy Research Collaboratory." For several years, the Collaboratory has been engaged in research to reduce the carbon impact of fossil fuels and the carbon emissions from our energy systems, overall. This important aspect of our research, though, was not reflected in the Collaboratory's original name. The new name encompasses the Collaboratory's entire research portfolio.

A Record of Successful Investment of State Funding

In 2006, the General Assembly appropriated $2 Million per year for three fiscal years, ending in June, 2009. H.B. 06-1322. These State matching funds were appropriated to the Authority for

allocation to the Collaboratory. The Collaboratory would then use these matching funds to attract and supplement funding from federal and other public and private sources.

Under Section 24-47.5-103, the Authority was required to demonstrate by June, 2012 that at least $6 Million in federal grants or contracts for renewable energy research in Colorado had been secured through the Collaboratory programs. In 2012, we reported to you that the General Assembly's commitment of $6 Million for the benefit of the Collaboratory had attracted federal and industry funding in excess of $37 Million.

Today, we are pleased to report that, over the past six years, the Collaboratory has received federal and industry funding in the amount of **$50.3 Million**. This represents the baseline of new funding into the state, with no multiplier, so the actual economic impact of this research funding for Colorado is much higher. Nor does this figure include the economic impact from the clean energy companies that have been created by or have been attracted to Colorado by the Collaboratory institutions. In short, $50.3 Million is a very conservative estimate of the positive economic impact of the Collaboratory over the past six years.

To attract these federal and industry funds, the Collaboratory has expended or committed $6.14 Million of State matching funds.

Finally, there is one more piece of good news. Much of the $50 Million in research funding represents second and third generations of research, funded by both federal and industry sources. These later generations of research flow directly from first generation research supported by State matching funds, but the subsequent generations of research generally receive no additional matching funds. As a result, *Colorado continues to see additional returns on the original investments of state matching funds.* In the coming years, Colorado will see even more economic benefits generated by the original $6 Million appropriation.

There is a wealth of detail regarding the Authority's and the Collaboratory's operations in the following pages and the appendices, but here is a brief overview of the Collaboratory's performance since its launch in 2007:

- **The Collaboratory centers' private members have contributed more than $4.72 Million to support the centers' shared (non-exclusive) research.**
- **Private industry has funded or committed to fund more than $8.12 Million in sponsored research by the Collaboratory centers and individual Collaboratory institutions.**
- **The federal government has funded or committed to fund more than $37.45 Million in sponsored research by the Collaboratory institutions.**
- **To attract these private and federal funding commitments of more than $50 Million, the Collaboratory has expended or committed $6.14 Million in State matching funds.**
- **The Collaboratory has generated more than eight dollars in private and federal funding for every one dollar of State matching funds.**
- **The Collaboratory is helping to attract large and small employers to Colorado and to create home-grown businesses with strong roots in Colorado and growing employment rolls.**

The foresight of the General Assembly and Governor Owens in 2006 was essential to the shared goal of establishing Colorado as a clean energy research leader. The General Assembly's commitment of State of Colorado funds for the use of the Collaboratory is still a critical factor in attracting private support for the Collaboratory's centers and in allowing the Collaboratory to successfully compete for federal research funding.

IN APPENDIX E TO THIS REPORT, I SUMMARIZE THE ACTIVITIES OF THE COLLABORATORY CENTERS THAT HAVE RECEIVED STATE MATCHING FUNDS THROUGH THE AUTHORITY. EACH OF THESE CENTERS IS MANAGED BY A LEADERSHIP TEAM THAT INCLUDES REPRESENTATIVES FROM ALL FOUR OF THE COLLABORATORY INSTITUTIONS, WITH ONE INSTITUTION SERVING AS THE LEAD. IN SHORT, THESE CENTERS – AND THEIR GREAT SUCCESS TO DATE – EXEMPLIFY TRUE COLLABORATION.

THE LEADERS OF THESE CENTERS AND THE WORLD CLASS RESEARCHERS AT THE FOUR COLLABORATORY INSTITUTIONS ARE RESPONSIBLE FOR THE SUCCESS OF THE COLLABORATORY AND FOR THE SCIENTIFIC, TECHNOLOGICAL AND ECONOMIC BENEFITS THAT HAVE FLOWED TO THE STATE OF COLORADO.

Doing More With Less

The original $6 Million appropriation has now been expended, with very successful results, as documented above. Recognizing that the State's own budget has been stretched to the limit for the past several years, the Collaboratory has worked to continue this record of success without seeking a new appropriation. When the recession of 2008 hit, many energy companies reduced their research budgets, and Collaboratory centers lost industry members. In response, the Collaboratory leadership restructured the model for matching funds, preparing for a long, slow evolution of the Collaboratory, instead of the early, explosive growth. The initial $6 Million appropriation, expected to last three years, was carefully managed to last five years.

In 2010, Governor Ritter created a one-time opportunity for the Authority and the Collaboratory to earn $2 Million in State Fiscal Stabilization Funds, a federal funding source under the American Recovery and Reinvestment Act of 2009. Based on the Collaboratory's successful partnerships with private industry, the Collaboratory met the terms of this grant. These new funds were transferred to the Authority, for the benefit of the Collaboratory, in 2011.

To maximize the benefits of these funds, the Authority and Collaboratory leadership began in 2011 to gradually reduce the amount of matching funds available to the Collaboratory's established research centers (biofuels, solar and wind). The Collaboratory intends to use most of its remaining matching funds to support research proposals for federal research grants, which offer the best opportunity for substantial funding and scientific impact. Over the past six years, federal grants have provided the best short term leverage of Collaboratory matching funds, generally providing at least $4 for every $1 of matching funds.

The Collaboratory continues to search for alternative sources of funding, and for cost-saving practices to stretch the remaining matching funds. The Authority and Collaboratory leaders agree, however, that, in the long term, State matching funds are essential to attract federal and industry funding for the following reasons:

- Most federally funded energy research grants require some level of matching funds as a precondition for application;
- Industry partners view state matching funds both as an indicator of state commitment and as a way to stretch their own research investments; and
- Other states are successfully using matching funds to attract industry partnerships to their own research institutions.

With this understanding, the Collaboratory leaders are now in discussion with state administrative and legislative leaders to identify a continuing source of State matching funds for the Collaboratory.

Helping to Build Colorado's Economy

H.B. 06-1322 recognized that the development and production of clean energy will advance the economic well-being of Colorado. Since the Collaboratory's launch in January, 2007, we have seen a substantial expansion in Colorado's clean energy research, development, production, and manufacturing capabilities.

The Collaboratory attracts employers to Colorado by building an educational and research cluster that serves industry. By educating undergraduate and graduate students in science, engineering, business and other disciplines, the Collaboratory ensures that clean energy businesses and their suppliers can find the talent that will help them succeed. The close partnership between NREL and the universities has also helped to attract world class researchers. Without this powerful partnership, many of these nationally recognized researchers would have been hired by our competitors in other states and countries. In short, clean energy companies locate where the R&D community can support their needs, and Colorado's R&D community is recognized world-wide.

The Collaboratory is playing a key role in attracting and supporting homegrown and relocated clean energy companies. These employers already represent thousands of jobs in Colorado. We are grateful that the Collaboratory's role in bringing businesses and jobs to Colorado has been acknowledged by State officials, by the Metro Denver Economic Development Corporation, and by other Colorado economic development agencies.

Protecting Colorado's Role as a Leader in Clean Energy Innovation

The Collaboratory is a uniquely successful model of true collaboration. Our first generation of research has led to second and third generations, leveraging $6M in state matching funding to attract more than $50 Million in additional federal and industry funding for advanced energy research in Colorado. But the continued success of the Collaboratory is not guaranteed.

To survive, an R&D community needs a constant stream of new research ideas, supported by a combination of public and private funding. The Collaboratory has made excellent use of the State funding provided to us in past years, and these funds have been essential to attracting industry and federal support for our research.

From 2007 to 2012, the biofuels, solar, and wind sectors helped to grow and support Colorado's economy. These sectors will continue to play a significant role in Colorado's economic growth. In addition, two other areas of energy innovation will play increasing large roles: carbon management and energy systems. All of these energy sectors, along with the traditional energy sectors of oil and gas and, to a lesser extent, coal, will drive the creation of new technologies, new companies, and new jobs. The Collaboratory's reputation for research excellence has been and will continue to be a central factor in attracting and nurturing these companies.

But the Collaboratory's success and the impact of clean energy R&D as an economic driver have not been ignored by other states. Today, it's widely recognized that the states that succeed in establishing leadership in this still emerging sector will attract major national and international companies and investment. This success will bring research, manufacturing, construction, and financial jobs to those states for the next 25 years and beyond.

In 2007, when the Collaboratory was launched, it was one of very few clean energy research centers around the world. Today, many states are competing for leadership in clean energy research, development, and production. And a number of these states – California, Michigan, Ohio and New York, for example – provide far higher levels of state support for their clean energy R&D than Colorado has been able to.

Initially, the Collaboratory's research assets were so strong that the Collaboratory was able to successfully compete, even with lower levels of matching funds, but, the lure of higher state support elsewhere has lured away some of our industry partners. We don't need to match the highest levels of funding offered by some other states, but the Collaboratory must have a reliable source of State matching funds to compete on this new playing field. To be effective, the funds must be dedicated to the Authority for the benefit of the Collaboratory, and the funding must be committed for at least three years, so the leadership of the Authority and the Collaboratory can manage the programs for long term success.

The Directors of the Colorado Renewable Energy Authority are grateful for the past support of the Colorado General Assembly, and we are proud that we have exceeded your and our expectations in the effective investment of these State funds. We look forward to continuing this productive relationship, and we will be pleased to respond to any questions you may have at this time or in the future.

Sincerely,

Philip P. DiStefano, Ph.D.
Chancellor, University of Colorado Boulder
Chair, Colorado Renewable Energy Authority

Appendix A

COLORADO RENEWABLE ENERGY AUTHORITY

BOARD OF DIRECTORS

Philip DiStefano, Ph.D., Chancellor
University of Colorado at Boulder
(Chair)

Dan Arvizu, Ph.D., Director
National Renewable Energy Laboratory
(Vice-Chair)

TJ Deora, Director of Energy and Environment
IHS

Anthony Frank, Ph.D., President
Colorado State University

Kimberly Jordan, CEO
New Belgium Brewing Company

Ken Lund, Director
Colorado Office of Economic Development & International Trade

M.W. Scoggins, Ph.D., President
Colorado School of Mines

Appendix B

COLORADO ENERGY RESEARCH COLLABORATORY

CORPORATE MEMBERS – FEBRUARY, 2013

Colorado Center for Biorefining and Biofuels (C2B2) Member Companies:

- Chevron Technology Ventures
- Cool Planet Energy Systems
- Gevo
- Rentech
- Shell Global Solutions
- Total American Services

Center for Revolutionary Solar Photoconversion (CRSP) Member Companies:

- Abengoa Solar
- General Motors
- Sharp Corporation
- Tokyo Electron
- Total

Center for Research & Education in Wind (CREW) Member Companies:

- RES-Americas
- Vestas
- WindLogics, Inc.

Appendix C

PRIVATE AND FEDERAL FUNDING FOR COLLABORATORY RESEARCH [1] 2007 - 2012

Shared Research [2]

❖ C2B2, CRSP and CREW industry member contributions for the centers' shared research projects (Matched by $4.282 Million in State funds)	**$4.72 M**

Sponsored Research [3]

❖ Industry and other private (e.g. foundation) funding	$8.12 M
❖ Federal funding (Matched by $1.858 M in State funds)	$37.45 M
SUB- TOTAL SPONSORED RESEARCH	**$45.57 M**
TOTAL SHARED AND SPONSORED RESEARCH FUNDING FROM PRIVATE AND FEDERAL SOURCES	**$50.29 M**
Total Matching Funds Expended or Committed Through 2012	$6.14 M

THE COLLABORATORY HAS EMPLOYED $6 MILLION IN STATE FUNDS TO ATTRACT $50 MILLION IN PRIVATE AND FEDERAL ENERGY RESEARCH FUNDING TO COLORADO SINCE 2007.

Leverage on State Funding **> 8:1**

Notes:

1. The Collaboratory research centers include:
   - Colorado Center for Biofuels and Biorefining – C2B2
   - Center for Revolutionary Solar Photoconversion – CRSP
   - Center for Research and Education in Wind – CREW
   - Carbon Management Center – CMC (to begin operations in 2012)

2. Shared research is conducted through the Collaboratory research centers and is funded with a combination of industry membership fees and state matching funds. Topical areas for shared research proposals are identified by industry members, and proposals are then submitted by university and NREL researchers. Proposals are selected for funding by industry members and center leaders. If patents result from shared research projects, all industry members of the center are able to benefit from a paid up, non-exclusive license.

3. Sponsored research may be federally or industry funded and may be conducted by one or more Collaboratory institutions directly or under the umbrella of a Collaboratory research center. Federally funded sponsored research generally requires matching funds, provided by the Collaboratory and other public and private partners. Industry sponsored research generally receives no matching fund support. If patents result from privately sponsored research, the private sponsor generally has the right to negotiate for an exclusive license, consistent with federal law.

Appendix D

Cumulative Collaboratory Research Metrics
2007 – 2012

Industry Members	52
Colorado Companies as Members	15
Non-member Companies Participating in Collaboratory Activities	88
Shared Research Projects	116
Industry Sponsored Research Projects	18
Federally Sponsored Research Projects	37
Other Sponsored Research Projects (foundation, institute, university etc.)	9
Researchers engaged – Shared Research	174
Researchers engaged – Industry Sponsored Research	34*
Researchers engaged – Federal and Foundation Sponsored Research	185*
Undergraduate Students Engaged	89
Publications	37*
Patent Filings	9*

Note: Metrics with an asterisk do not include researchers, publications or patented filings related to follow on sponsored research projects flowing from shared research projects.

Appendix E

COLORADO ENERGY RESEARCH COLLABORATORY

Institutional Centers Summary – February, 2013

Colorado Center for Biorefining and Biofuels

The Colorado Center for Bio refining and Biofuels, known as C2B2, was the first research center launched by the Collaboratory. C2B2 conducts world class research to develop new biofuels and bio refining technologies with the goal of transferring these advances as rapidly as possible to the private sector. C2B2 also trains new researchers for the clean energy industry in Colorado, and sponsors have the opportunity to recruit future employees. C2B2 offers important value to the State and to the sponsors, by providing educational and work opportunities for undergraduate, graduate and post-doctoral students. The University of Colorado - Boulder is the lead institution for C2B2, but all four Collaboratory institutions play prominent roles in the activities of the Center.

C2B2 has lost a significant number of its corporate members due to two factors: the severe recession beginning in late 2008 and the creation of many competing research centers in other states beginning in 2009. C2B2 membership declined from 33 industry members in 2008 to 14 in 2011, and now numbers 6. Although smaller in number, C2B2's current sponsors still include leaders from the oil and gas industry, including Chevron, Shell, and Total. C2B2 also includes some of the most exciting emerging companies in biofuels and biorefining: Gevo and Sundrop Fuels, both Colorado based; and Cool Planet Energy Systems, a California startup focused on producing gasoline substitutes from biomass. Though a startup, Cool Planet's current investors include Google, BP, General Electric, and ConocoPhillips.

A reduction in the number of members, however, does not indicate a drop in research funding. To the contrary, C2B2's researchers have been enormously successful in attracting industry and federal research support.

The sponsors' funding and State matching funds have supported 66 research seed grant, postdoctoral, and graduate fellowship research projects, from 2008 through 2012. In addition, C2B2 supports additional educational opportunities: a summer "Research Experience for Undergraduates" program, helping to develop the scientists and engineers of the next generation, with support from State matching funds, and professional "short course" seminars on topics related to biorefining and biofuel production.

The Authority provided a total of $2.132 Million in State matching funds to C2B2 in 2007 through 2012. With this State support:

- C2B2 has attracted $2.6 Million in membership commitments for shared research programs through 2012.
- C2B2 members Chevron and EcoPetrol contributed an additional $376,000 in fellowships for graduate students and post-doctoral researchers.
- The National Science Foundation awarded $336,000 to support C2B2's Research Experiences for Undergraduates program from 2010 to 2012, and,
- NSF has just announced that it intends to extend funding for this outstanding program for another three years, through 2015.

ConocoPhillips has funded more than $3.4 Million in sponsored research to date, and the four Collaboratory institutions have generated additional research funding from private and federal sources as a result of C2B2 relationships.

In addition to these C2B2 programs, the Authority has also supported Collaboratory institutions in pursuing federal funding for biofuels research programs:

- In 2010, the Authority committed $1.275M in matching funds to support successful proposals from research teams including NREL and the Colorado School of Mines, bringing $11.3 Million in federal funding to these two institutions.
- In 2011, the Collaboratory committed $240,000 in matching funds to support a successful biofuels proposal that will bring an additional $1.5 Million to NREL and CSU.

In total, then, State matching funds of $3.647 Million are directly responsible for attracting more than $19 Million in federal and private funding for biofuels research and educational programming in Colorado.

But that is only the first level of C2B2's and the Collaboratory's contribution to economic growth in Colorado. This "first generation" of federal and privately sponsored research is just the beginning, because many of C2B2's shared research projects have attracted far greater funding for second, third and fourth generations of research founded upon the basic discoveries of the first generation. These later generations of research generally require no additional matching funds from the Authority, so the leverage of the State's initial contribution grows and grows. **At present, we calculate that later generations of research based upon C2B2 shared research have, to date, brought an <u>additional</u> $24.5 Million in federal and private research funding to Colorado.**

In total, then, the investment of $3.647 Million in State matching funds to C2B2 and Collaboratory institutions working on biofuels projects has attracted $43.5 Million in both federal and private research, as well as educational funding to Colorado.

Even this estimate does not include the substantial economic benefit to Colorado from biofuels companies which have spun out of, or which have moved here to work with our powerful research community, including Gevo; Genesis Biofuel; OPX Biotechnologies (recipient of the Governor's Excellence in Renewable Energy Award for 2010); Solix Biofuels; and Sundrop Fuels. Each of these successful companies is now based in Colorado, and employing Colorado residents. C2B2 is a key driver of this economic development, but we have not included any of this economic benefit in the calculations presented in this report.

But there is yet one more important measure of C2B2's success. C2B2 researchers have:

- Filed six patents developed through shared and sponsored research,
- Published more than 29 journal articles, and,
- Provided over 70 technical presentations at professional scientific conferences.

The creation of valuable intellectual property and peer reviewed, published literature confirms the merit of the Collaboratory public/private model and the success of C2B2.

Despite this success, though, C2B2 still faces significant challenges. C2B2 is competing directly with large private and federally funded research cooperatives. The relatively small "matching" investments made by the Authority in the Collaboratory centers, as compared to centers in other states, has reduced sponsor retention, research and development, and technology transfer through business creation. Unfortunately, the Authority does not have sufficient funds available to continue to match both industry and federal funding at the same rate as most of the competing centers.

In conclusion, biofuels and biorefining research (and related employment opportunities) are of greater and greater interest to undergraduate students, graduate students, and postdoctoral researchers. C2B2, however, without proper funding, is unable to meet the educational needs of all interested students at CU, CSU, Mines, and NREL. The more scientists and engineers we are able to train and graduate, the more successful we will be in building an advanced biofuels industry in Colorado, an industry that has and will continue to create jobs and tax revenues for our state.

Center for Revolutionary Solar Photoconversion

The Collaboratory's Center for Revolutionary Solar Photoconversion, or CRSP, conducts research with the objective of developing technologies that can produce clean solar fuels and electricity at costs comparable to traditional fuels and electrical power. The Colorado School of Mines is the lead administrative institution for CRSP, and the Scientific Director of CRSP is one of only ten Research Fellows at NREL. All four Collaboratory institutions participate in CRSP's research programs and are equally represented in its management structure.

CRSP presently includes five corporate members, with major domestic and international companies. CRSP's member companies have been hard hit by turmoil in the international market for solar photovoltaic panels, caused by unfair trade practices of Chinese government-supported manufacturers. Cheap Chinese panels have drastically reduced the cost of installing both commercial and residential solar generating equipment, a boon to consumers, but non-Chinese solar manufacturers have been struggling to compete. U.S., Japanese and French manufacturers – who have been the core of CRSP's membership – highly value CRSP's research capabilities, which can help these companies reduce their manufacturing costs. Unfortunately, these same companies are cutting their research budgets in an effort to survive.

Despite these significant short term challenges, the future for solar energy and solar photovoltaics, in particular, is very positive. The falling cost of solar photovoltaic energy is creating greater demand, and solar technologies are gradually playing a larger role in power generation worldwide. CRSP is working with the industry to find ways to reduce the costs of production and achieve profitability and, hopefully, the solar industry will return to stability in 2013 or 2014.

Since 2008, CRSP has received approximately $1.66 Million from its member companies. CRSP has also received more than $3 Million in federal research funding, part of a larger DOE commitment described below. To date, CRSP has earned $1.67 Million in matching funds from the Authority.

CRSP's federal research funding was earned through the Center's participation in a multi-institutional team, including NREL and Los Alamos National Laboratory. This team was selected by the U.S. Department of Energy for funding as a prestigious Energy Frontier Research Center in

advanced photo physics. With the benefit of a commitment of $300,000 in State matching funds, CRSP participating research institutions (including CU-Boulder, CSM, and NREL) will receive a total of $6.6 Million over five years from the US DOE.

CRSP also works closely with the National Science Foundation's first – and only – Renewable Energy Materials Research Science and Engineering Center (REMRSEC), housed at the Colorado School of Mines. The REMRSEC is also closely engaged with NREL. The close collaboration between these two research centers and the four institutions magnifies the capabilities of all of these Colorado organizations.

CRSP has filed for three patents developed through CRSP sponsored research, a very significant achievement for CRSP and a sign of CRSP's coming of age. After four full cycles of shared research projects, valuable intellectual property is being developed, defined and protected. This momentum will continue to accelerate in the coming years.

CRSP is also engaged in cooperative research programs with two internationally regarded programs: the Research Corporation for Science Advancement, headquartered in Tucson, Arizona, and the Research Center for Advanced Science and Technology, a program of the University of Tokyo.

Center for Research & Education in Wind

The third Collaboratory center, the Center for Research & Education in Wind, was publicly launched in August, 2009. CREW is the first Collaboratory center to include additional research institutions beyond the four Collaboratory member institutions. In recognition of the wind industry's interest in atmospheric sciences, CREW invited two of the world's leading atmospheric science research institutions to participate: the National Center for Atmospheric Research and the National Oceanic and Atmospheric Administration, both of which operate laboratories in Colorado. The University of Colorado-Boulder is the lead institution for CREW, and the Scientific Director resides at Colorado State University.

Topics of CREW research cover a wide range of topics, including: integration of energy storage to control wind farm output; innovative approach to the design and control of wind farms; modeling system and ensemble data assimilation for wind energy predictions; active coating materials for preventing icing on wind blades; and mitigation devices for generated aero-acoustic noise.

CREW's members include leaders in the manufacture of wind turbines and the development of wind farms: RES Americas, Vestas and WindLogics. Since CREW's launch in 2009, CREW's corporate members contributed a total of $460,000 in membership fees to support shared research activities, and additional contributions from Vestas as part of its sponsored research. CREW has received a total of $475,000 in State matching funds.

A total of 34 proposals shared research proposals were submitted by faculty and scientists from the CREW institutions in 2009 - 2011. CREW was able to fund 10 of these proposals. In 2012, CREW received 9 proposals and awarded three seed grants for shared research.

CREW also conducts sponsored research, generally funded and directed by a single company. Vestas has funded $498,000 of sponsored research with CREW since 2010.

2012 has been an extremely challenging year for the U.S. wind industry and for CREW. Historically, the federal wind production tax credit has generally been re-authorized every two years, but the PTC was caught in electoral politics in 2012 and reauthorization was postponed until after the presidential election. As a result, in mid-2012, there was a precipitous drop in the planning and development of new wind farms, and orders for new wind turbines plummeted.

Because the PTC was reinstated in December, 2012, however, the market will regain some equilibrium in 2013. This will enable wind turbine manufacturers and wind farm developers – the two primary sectors for CREW's member companies – to gradually return to normal operations.

The wind industry has already contributed a great deal to Colorado, but the industry's best years are still ahead. CREW will continue to serve as a magnet to attract wind power companies to our state.

Carbon Management Center

The Collaboratory's first three research centers have been focused on renewable energy technologies, but the Carbon Management Center's focus will include research and policy analysis having direct application to the coal, oil, and natural gas industries. This work will have direct application to the electric utility industry as well, which is the largest consumer of coal and natural gas, and the largest emitter of carbon dioxide in the state.

The Carbon Management Center was not publicly announced until October, 2012, but the center actually commenced research activities in 2009, with a federal grant to conduct basic research related to geologic sequestration of carbon dioxide. The CMC received $342,744 in State matching funds to qualify for $1.37 Million in federal funding.

The CMC will conduct research on the science and technologies of methane and carbon dioxide capture, commercial re-use of carbon, and carbon sequestration (both deep geologic sequestration and terrestrial sequestration through plants and soils). The CMC will also offer independent and reliable policy analysis.

More than 20 companies attended the CMC launch event in October, and the center will soon be organizing new research activities. The CMC is led by the Colorado School of Mines.

Energy Systems Center

The Energy Systems Center will be a smart grid and energy efficiency research center. The Center will focus on the research, design, and demonstration of the electrical grid of the future. This will include the technologies to design, build, and operate more efficient buildings. Led by Colorado State University, this center will work with private and public partners to study and overcome the challenges to building a more efficient, reliable and secure grid that incorporates more clean and renewable energy.

The Energy Systems Center will benefit from two world class hard-wired grid simulators: the InteGrid Lab, a CSU laboratory in operation since 2006, and the Energy Systems Integration Facility, an NREL laboratory and office structure now under construction. When ESIF is fully operational in spring, 2013, it will be the world's most powerful smart grid research, test and demonstration facility.

The Energy Systems Center will launch in late 2013.