COLORADO SCHOOL OF MINES
EARTH · ENERGY · ENVIRONMENT

M. W. Scoggins, Ph.D.
President

February 26, 2010

Hon. Joe Rice, Chair
Hon. Sara Gagliardi, Vice-Chair
Colorado House of Representatives Business Affairs and Labor Committee
Colorado State Capitol
200 East Colfax
Denver CO 80203

Hon. Lois Tochtrop, Chair
Hon. Suzanne Williams, Vice-Chair
Colorado Senate Business, Labor and Technology Committee
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 Affairs and Labor Committee and the Senate Business, Labor and Technology Committee:

On behalf of the Board of Directors of the Colorado Renewable Energy Authority, I hereby 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 purpose of the Authority is to direct the allocation of State matching funds to support one or more research proposals of the Colorado Renewable Energy 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 accordance with H.B. 06-1322, 24-47.5-101 et seq., State matching funds may be allocated to attract and support funding from federal and other public and private sources. The 2006 legislation appropriated $2 Million per year for three fiscal years, ending in June, 2009. The Authority has until June, 2012 to demonstrate that at least $6 Million in grants or contracts for renewable energy research in Colorado have been secured through the Collaboratory programs. The Authority Board anticipates that the $6 Million benchmark will be met and surpassed well before 2012. In fact, private and federal funds in excess of $13 Million have already been paid or committed for Collaboratory research.

- **As of this date, the Collaboratory centers' private members have contributed more than $2.587 Million to support the centers' <u>shared</u> (non-exclusive) research. The Collaboratory centers and individual Collaboratory institutions have also received private and federally funded commitments for <u>sponsored</u> research in the amount of $13.07 Million, for a total of $15.657 Million.**

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- **To attract these private and federal funding commitments of more than $15 Million, the Collaboratory has received $3.23 Million in State matching funds, so the Collaboratory is generating six dollars in private and federal funding for every one dollar of State matching funds. In addition, the Collaboratory has helped to attract major employers to Colorado.**

Through the past twelve months, the Directors of the Authority have worked closely with the leadership of the Collaboratory to support the activities of the Collaboratory. The General Assembly's commitment of State of Colorado funds to match private and federal funding has been a significant factor in attracting private members to the Collaboratory's centers and in successfully competing for federal research funding.

H.B. 06-1322 recognized that the development and production of renewable 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 renewable energy research, development, production and manufacturing capabilities. The Collaboratory, as the most visible symbol of Colorado's renewable energy research capabilities, has played a key role in attracting and supporting homegrown and relocated renewable energy companies. These employers already represent hundreds of jobs, and their plans of near term expansion will generate thousands of additional jobs. We are grateful that the Collaboratory's role in bringing businesses and jobs to Colorado has been acknowledged by Governor Ritter, the Metro Denver Economic Development Council and ConocoPhillips.

In the following paragraphs, I summarize the Collaboratory centers that have received State matching funds through the Authority, including a brief overview of each center's research focus and the amount of State, private and federal funds committed. In reviewing the success of these centers, it is worth remembering that each center 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.

Colorado Center for Biorefining and Biofuels

The Colorado Center for Biorefining and Biofuels, known as C2B2, is the first research center of the Collaboratory. C2B2 conducts world class research to develop new biofuels and biorefining technologies and transfer these advances as rapidly as possible to the private sector. C2B2 also trains new researchers for the renewable 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 at Boulder is the lead institution for C2B2, but all four Collaboratory institutions play prominent roles in the activities of the Center. Although C2B2 did lose some corporate members due to the severe recession, the center added others, and C2B2 now includes more than 20 private sponsors, with leaders from the agriculture, oil and gas, chemical, automotive and manufacturing sectors, ranging in size from Fortune 500 companies to many small Colorado renewable energy companies.

The sponsors' funding and State matching funds have supported a total of 29 research projects from 2008 to 2010. In addition, C2B2 has supported graduate and post-doctoral fellowships and a summer "Research Experience for Undergraduates" program, helping to develop the scientists and engineers of the next generation. Chevron has contributed more than $170,000 to support graduate student fellowships. In 2009, C2B2 presented a professional "short course" seminar, attracting representatives from seven member companies and five companies considering membership in C2B2. At the most recent meeting of C2B2 industry members in February, 2010, more than 100 industry and

Collaboratory research representatives met to review and discuss graduate and post-graduate research projects.

ConocoPhillips, a founding member of C2B2, has entered into a sponsored research agreement through C2B2 for $5 Million in renewable fuels research. GEVO, an early stage but internationally recognized biofuels company, moved its headquarters, research operations and 50 employees to Colorado from California, to be closer to our research community and to C2B2, in particular. A number of biofuels companies have been spun out of the universities, including Genesis Biofuel, OPX Technologies (recipient of the Governor's Excellence in Renewable Energy Award for 2010), Solix Biofuels and Sundrop Fuels, each of which is based in Colorado, employing Colorado residents and participating in C2B2.

The Authority has provided a total of $1.65 Million in State matching funds to C2B2, equal to the annual financial commitments of the private sponsors. With this State support, C2B2 has attracted $1.65 Million in sponsors' commitments for shared research programs. ConocoPhillips has funded more than $900,000 in sponsored research to date, with a commitment for an addition $4.1 Million over the next few years. In addition, the four Collaboratory institutions have generated additional research funding from private and federal sources as a result of C2B2 relationships.

C2B2 has achieved great success with judicious and effective use of these State matching funds, and could continue to make good use of future funding. However, the three year appropriation of State matching funds has expired, the three-year commitment of matching funds to C2B2 by the Collaboratory and Authority has expired, and other Collaboratory centers are still early in their development and require matching funds to attract private and federal funding. Due to the combination of these factors, the Collaboratory and Authority leadership have determined that no further matching funds can be provided to C2B2 unless and until additional State funding is available.

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. This objective is composed of two tasks: increasing the efficiency of solar technologies by increasing the portion of solar energy converted to electrical or chemical energy, and reducing the cost of direct solar technologies. The work employs modern disciplines including nanoscale science, photobiology, photoelectrochemistry, photophysics, and inorganic and organic photovoltaics. NREL is the lead administrative institution for CRSP, but, again, all four Collaboratory institutions participate in CRSP's research programs and are equally represented in its management structure.

CRSP presently includes 14 corporate members, with major domestic and international companies, including several of the world's largest solar photovoltaic manufacturing companies, the world's two largest auto manufacturers, as well as smaller startups, from the aerospace, automotive, chemical, manufacturing equipment and solar energy industries.

In 2008, CRSP's first full year of operations, the center collected approximately $417,000 from its sponsors and received an equal amount in matching funds from the Authority, all of which funding supported CRSP's shared research activities. In 2009, CRSP again received more than $400,000 in fees from its private members, again matched with State matching funds.

CRSP also partnered with a multi-institutional team, including NREL and Los Alamos National Laboratory, which was selected by the U.S. Department of Energy for funding as a prestigious Energy Frontier Research Center in advanced photophysics. 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 and the National Science Foundation's first Renewable Energy Materials Research Science and Engineering Center (REMRSEC), located at CSM, have agreed to partner on various activities.

In 2010, CRSP will continue to operate its shared research program, conduct its portions of the research of the DOE Energy Frontier Research Center, and continue its relationship with the CSM REMRSEC. In addition, CRSP expects to soon announce its first privately sponsored research project involving one of its member companies and CSU.

CRSP has achieved remarkable early success and has shown great potential as a leading solar research center and as an economic driver for the State of Colorado. CRSP will receive additional State matching funds in 2010, but the availability of matching funds in future years will depend upon future appropriations by the General Assembly.

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. Recognizing 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 Boulder, Colorado. The University of Colorado at Boulder is the lead institution for CREW. CREW's research areas include modeling, design and testing of wind turbines; localized wind forecasting and other atmospheric sciences; design and operational guidance for wind farms; and electrical control systems for wind turbines.

CREW's founding members include some of the world's largest manufacturers and developers of wind power technology and generating facilities: Mitsubishi, RES Americas and Vestas. WindLogics, a leader in consulting services for wind farm developers and operators, is the fourth founding member of CREW. In 2009, the corporate members paid $120,000 in membership fees, matched with State funds. Vestas also committed $100,000 to the first sponsored research with CREW.

Although the wind power sector was stronger than most of the economy, it suffered in 2009 from the tight credit climate. As credit restrictions ease in 2010, the wind power industry will resume its rapid growth, and CREW's membership will quickly expand.

Additional Collaboratory Research Centers

In 2010, the Collaboratory will also formally announce two new Collaboratory centers and a new research partnership:

- **Carbon Management Center**: The CMC will conduct research on the science and technologies of carbon capture, commercial re-use of carbon, and carbon sequestration (both deep geologic sequestration and terrestrial sequestration through plants and soils) and will also offer independent and reliable policy analysis. This center will be led by the Colorado School of Mines. In 2009, the Carbon Management Center received $342,744 in State matching funds to qualify for $1.37 Million in federal funding to conduct basic research related to geologic sequestration of carbon dioxide.

- **Energy Efficiency and Management Center**: The EEMC will be a smart grid and energy efficiency research center, focused on the research, design and demonstration of the electrical grid of the future and the technologies to design, build and operate more efficient buildings. Led by Colorado State University, this center will work with private and public research and funding partners to develop the hardware, software, processes and demonstration projects to build a more efficient, reliable and secure grid that incorporates more clean and renewable energy. Because buildings use approximately 40% of our nation's total energy consumption, EEMC will also work to develop the materials, technologies and processes for more efficient building design and operation, efficiencies which will contribute to a more reliable and cleaner grid.

- **Solar Technology Acceleration Center**: SolarTAC is a privately owned and operated testing and demonstration facility, closely affiliated with the Collaboratory. SolarTAC, now under construction in Aurora, approximately five miles southeast of Denver International Airport, and will become one of the world's leading facilities to test and demonstrate solar technologies. The national prominence of SolarTAC is exemplified by its founding members and principal funders – Xcel Energy, Abengoa Solar and SunEdison – and by its additional members – Electrical Power Research Institute (the research arm of the nation's largest electric utilities) and NREL. Through NREL, DOE funds will be invested at SolarTAC to create a testing and demonstration platform for solar thermal electric storage technologies at SolarTAC. Although SolarTAC is not a Collaboratory center, the Collaboratory has been engaged in the formation of SolarTAC since its inception and will provide research capabilities to support the private and publicly funded activities at the facility.

Federal Research Funding Opportunities Under the Stimulus Bill

The American Recovery and Reinvestment Act of 2009, generally known as the Stimulus Bill, dramatically increased funding for a range of research and development programs, including renewable energy and energy efficiency. Nearly all of these new federal funding opportunities require private, state or local matching funds. The Authority Board of Directors and the Collaboratory leadership have worked closely to make sure that Colorado State matching funds can be available when appropriate to support proposals by Collaboratory institutions for major federal funding. For example, the Energy Frontier Research Center program is funded under the Stimulus Bill, and CRSP and its partners successfully competed for an EFRC award with the assistance of Colorado State matching funds.

Financial Reports

The following financial reports are attached:

- Colorado Renewable Energy Authority 2010 Budget;
- Listing of present corporate members in Collaboratory research centers.

Conclusion

In 2009, the Colorado Renewable Energy Collaboratory continued to build its reputation and to demonstrate its capabilities as a major renewable energy research center. Although both C2B2 and CRSP lost some partners due to the recession, both centers added other partners. The Collaboratory

also won federal research funding for the first time in 2009 and added privately sponsored research projects to its portfolio.

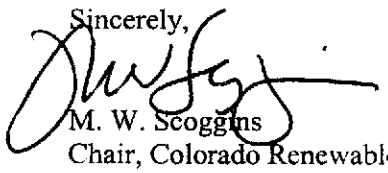
On the other hand, 2009 marked the last installment of the funding appropriated by the General Assembly in 2006. The Collaboratory's success in attracting private partners over the past three years is due, in significant part, to the availability of these State matching funds. Although many other states have much larger pools of matching funds to employ in the competition for research grants and contracts, the Collaboratory's research assets are so strong that the Collaboratory has been able to successfully compete even with lower levels of matching funds.

While the Authority Board and the Collaboratory leadership are keenly aware of the budget crisis facing the General Assembly, we respectfully remind the Chairs, Co-Chairs and Committee Members that clean energy manufacturing and the development of clean energy generating facilities represent one of the few sectors showing positive growth in Colorado over the past year, and this sector will play a large role in leading Colorado out of this recession. The Collaboratory's reputation for research excellence has been and will continue to be a central factor in attracting and nurturing these companies.

Many states are now competing for leadership in renewable energy research, development and production. Those states that succeed in establishing leadership in this still emerging sector will attract major national and international companies, bringing research, manufacturing, construction, and administrative jobs for the next 25 years. Colorado should not draw back from its demonstrated leadership and commitment to this critical economic sector. If we are to protect and advance Colorado's stature as a leader in the New Energy Economy, it is essential that the General Assembly renew and expand the matching funds appropriations as soon as the State's budget permits.

The Directors of the Colorado Renewable Energy Authority are grateful for the support of the Colorado General Assembly. We will be pleased to respond to any questions you may have at this time or in the future.

Sincerely,



M. W. Scoggins
Chair, Colorado Renewable Energy Authority

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COLORADO RENEWABLE ENERGY COLLABORATORY
Corporate Members – 2010

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

- Catchlight Energy
- Ceres
- Chevron
- Cobalt Biofuels
- ConocoPhillips
- Ecopetrol-ICP
- Flad Architects
- General Motors
- GICON
- Gevo, Inc.
- Kimberly-Clark
- LiveFuels, Inc.
- Mascoma
- OPX Biotechnologies, Inc.
- Shell Global Solutions
- Solix Biofuels
- Sundrop Fuels
- Valero
- ZeaChem

Center for Revolutionary Solar Photoconversion (CRSP) Member Companies:

- Abengoa Solar
- Applied Materials, Inc.
- Ascent Solar Technologies, Inc.
- G24 Innovations, Limited
- DuPont
- Evident Technologies, Inc.
- General Motors
- Konarka Technologies, Inc.
- Lockheed Martin
- Motech Industries Inc.
- QFlux, Inc.
- QuantumSphere, Inc.
- Sharp Corporation
- SunEdison, LLC
- Solasta, Inc.
- Toyota
- Toyota Electron, Ltd.

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

- Mitsubishi Power Systems Americas, Inc.
- RES-Americas
- Vestas
- WindLogics, Inc.

Colorado Renewable Energy Authority
Budget
January 1 - December 31,

Description	Actual Prior Year 2007	Proposed Budget 2008	Actual Year 2008	Proposed Budget 2009	Actual Year 2009	Proposed Budget 2010	Inception to Date Revenue and Expenses
ESTIMATED REVENUES							
Beginning Balance January 1	$ -	$ 2,037,633	$ 2,037,633	$ 3,211,858	$ 3,211,858	$ 2,992,213	
Operating Revenues:							
Appropriation	2,000,000	4,000,000	2,800,000	1,200,000	1,200,000	-	$ 6,000,000
Interest Income	37,633	60,000	68,568	10,000	5,612	5,000	111,813
TOTAL REVENUES	2,037,633	4,060,000	2,868,568	1,210,000	1,205,612	5,000	**6,111,813**
TOTAL AVAILABLE REVENUES	2,037,633	6,097,633	4,906,201	4,421,858	4,417,470	2,997,213	
ESTIMATED EXPENSES							
Operating Expenses:							
Administration	-	-					
Audit	-	3,100	3,064	4,055	4,055	4,055	7,119
Other	-	-	494	450	517	500	1,011
TOTAL EXPENSES	-	3,100	3,558	4,505	4,572	4,555	8,130
Appropriated Reserved:							-
Operating Expenses	-	1,750,000	1,690,785	2,370,000	1,420,685	900,000	**3,111,470**
Ending Balance December 31,	$ 2,037,633	$ 4,344,533	$ 3,211,858	$ 2,047,353	$ 2,992,213	$ 2,092,658	**$ 2,992,213**

2010 Budgeted Operating Expenses
CRSP: $500k
CREW: $400k

2009 Budgeted Operating Expenses:
C2B2: $500 k Colorado Center for Biorefining and Biofuels – actual matching fund disbursement is likely to equal $500 k
CRSP: $500 k Center for Revolutionary Solar Photoconversion – actual matching fund disbursement is likely to equal $500 k
CREW: $500 k Center for Research & Education in Wind - actual matching fund disbursement is likely to be more than $300 k, but less than $500 k, but too soon to project
CMC: $500 k Carbon Management Center – actual matching fund disbursement is likely to be $342 k, although it could be as much as $500 k, but too soon to project

Grant	Date	Name	Memo	Amount
	05/21/2008	CO Center for Biorefining and Biofuels	University of Colorado	500,000.00
	08/31/2008	CO Center for Biorefining and Biofuels	Wachovia-Collaboratory Photo Conversion Workshop-CU Foundation	4,000.00
	10/16/2008	Co. Rev. Solar Photo Conversion	NREL	416,584.70
	10/16/2008	CO Center for Biorefining and Biofuels	University of Colorado	750,000.00
	11/30/2008	CO Center for Biorefining and Biofuels	University of Colorado (Amount should have been $20,200 not $20,400)	20,400.00
	12/31/2008	University of Colorado Boulder	In November disbursed $200 to much to the University of Colorado.	-200.00
	04/17/2009	Co. Rev. Solar Photo Conversion	NREL	370,000.00
	07/09/2009	Alliance for Sustainable Energy, LLC	Match to CRSP for DOE EFRC award	100,000.00
	09/21/2009	University of Colorado Boulder	C2B2 matchting funds	497,500.00
	11/19/2009	University of Colorado Boulder	Center for Research in Wind (CREW)	120,000.00
	11/19/2009	Colorado School of Mines	CO2 Saline Storage Demonstration - matching funds -DOE	342,000.00
	12/23/2009	University of Colorado Boulder	return of grant funds	-8,814.74
Total Grant				3,111,469.96
TOTAL				**3,111,469.96**