

COLORADO SCHOOL OF MINES

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M.W. Scoggins
President

February 29, 2008

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

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

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.

I am pleased to report that the Directors of the Authority have worked closely with the leadership of the Collaboratory to support the activities of the Collaboratory. As of this time, the Directors of the Authority have made commitments to provide matching funds to two Collaboratory research centers, but no matching funds have actually been disbursed, for the reasons explained below. I can also report that the State of Colorado's commitment of the matching funds has been – and will continue to be – an essential factor in the Collaboratory's success.



H.B. 06-1322 recognized that the development and production of renewable energy will advance the economic well-being of Colorado. The past year has demonstrated the truth of this legislative prediction, and we have seen a rapid expansion in Colorado's renewable energy research, development, production and manufacturing capabilities, and the Collaboratory has played a significant role in this progress.

This report summarizes the funding commitments made by the Authority to two Collaboratory research centers and then explains the statutory conflicts that have delayed actual disbursement of funds. This report also provides a preview of Collaboratory research centers that are currently under development. Finally, I summarize some of the positive economic impacts of the Collaboratory's activities.

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 is a research venture between large and small businesses and the four Collaboratory institutions. The C2B2 partners will perform world class research to develop new biofuels and biorefining technologies and transfer these advances as rapidly as possible to the private sector. 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 was announced by the Collaboratory in March, 2007, and commenced operations on July 1, 2007. C2B2 now includes 27 private sponsors, including leaders from the agriculture, oil and gas, chemical, automotive and manufacturing sectors, such as Archer Daniels Midland Company, Chevron, ConocoPhillips, Dow Chemical, DuPont, General Motors, Shell Global Solutions, Suncor Energy, Weyerhaeuser and W.R. Grace, as well as more than a dozen Colorado renewable energy companies.

Sponsors are attracted to C2B2 because they can access the broad capabilities of four major research institutions through a single point of contact. 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 sponsors' funding and state matching funds will support 10 research projects in 2008. A summary of the first round of these research "seed grants" is attached as Appendix A. In addition, the sponsors' funding will support three post-doctoral fellowships and a summer "Research Experience for Undergraduates" program.

C2B2 has the potential to attract many biorefining companies to Colorado to participate in the research programs and to benefit from the highly trained researchers and technical workers C2B2 will produce. In fact, the research strengths of the Collaboratory were a key factor in bringing ConocoPhillips' training and technology center to Colorado.

In support of C2B2, the Authority has committed to provide matching funds equal to the annual financial commitments of the sponsors for shared research projects, up to a maximum of

\$500,000 in the first year, \$750,000 in the second year and \$1,000,000 in the third year of C2B2 operations. C2B2 did receive sponsor commitments in excess of \$500,000 in its first year and is presently entitled to receive \$500,000 in matching funds from the Authority.

The C2B2 leadership team is comprised of Alan Weimer, Ph.D., Executive Director and Principal Investigator (CU-Boulder); Al Darzins, Ph.D. (NREL); John Dorgan, Ph.D. (Mines); Will Medlin, Ph.D. (CU-Boulder); and Ken Reardon, Ph.D. (CSU).

Center for Revolutionary Solar Photoconversion

The Collaboratory's Center for Revolutionary Solar Photoconversion, or CRSP, was conceived in response to a request for proposals from the U.S. Department of Energy Office of Science. NREL is the lead Collaboratory institution for the CRSP proposal to DOE, but, again, all four Collaboratory institutions will fully participate. The research focus of CRSP is to produce clean solar fuels and electricity at costs comparable to current fuels and power through revolutionary new technologies in photoelectrochemistry and photobiology.

CRSP is in the final stages of enlisting founding sponsors and expects to formally announce its creation in March or April, 2008. As with C2B2, CRSP's sponsors will include major domestic and international companies as well as smaller startups.

The Authority has committed up to \$1 Million per year for three years to CRSP to be used to match up to 15% of federal funding to CRSP or to match the annual financial commitments of CRSP's private sponsors.

The CRSP leadership team is comprised of Arthur Nozik, Ph.D., Scientific Director (NREL); Carl Koval, Ph.D. (CU-Boulder); Bruce Parkinson, Ph.D. (CSU); and Craig Taylor, Ph.D. (Mines).

The Existing Obstacle to Authority Disbursements to the Collaboratory Centers

In 2006, the General Assembly appropriated to the Authority \$2M per year for three years to support the Collaboratory's activities. H.B. 06-1322, 24-47.5-101 et seq. This legislation also requires repayment to the State out of intellectual property licensing revenues generated by the Collaboratory. 24-47.5-102(4). However, the repayment provisions of Section 102(4) are in conflict with federal law. For this reason, C2B2 has been unable to accept the committed matching funds from the Authority.

In essence, federal law says that an inventor and sponsoring institution who receive federal funding must retain ownership of patents and licensing fees. See 1980 Bayh-Dole Act (P.L. 96-517) and implementing regulations (37 C.F.R. 401). The purposes of this federal law are to provide an incentive for inventors and institutions to commercialize their inventions and to provide a source of funding for future research. Any institution that does not abide by this federal law loses eligibility for federal research funding.

Because Section 24-47.5-102(4) requires repayment to the State out of licensing fees from Collaboratory intellectual property, this provision is in conflict with the Bayh-Dole Act and in conflict with the universities' policies adopted to comply with federal law. If the universities were to accept funding from the Authority pursuant to the existing Colorado statute, they would lose eligibility for all federal research funding.

The Authority Directors have consulted with the Collaboratory and, together, the Authority and the Collaboratory have taken steps to address this conflict between state and federal law. First, in order to allow C2B2's shared research projects to go forward, the universities reallocated their own funds to temporarily replace the Authority's committed matching funds. Second, the leadership of the Collaboratory and the Authority have worked with state legislators to propose an amendment to the 2006 legislation to eliminate the conflict with federal law. See S.B. 08-081. If this bill becomes law, then the Authority will release the matching funds that are already due to C2B2 and will be in a position to disburse funds to CRSP as they become due.

Additional Collaboratory Research Centers

By the end of 2008, the Collaboratory also expects to announce:

- an additional solar energy research center directed toward near-term technologies for photovoltaics and concentrating solar power;
- a wind energy research center, including modeling, design and testing of turbine blades and towers, micro-climate forecasting, and electrical and control systems;
- a carbon management center, including research on carbon capture technologies, carbon sequestration technologies and policy analysis; and
- an energy efficiency and management research center.

The Role of the Collaboratory in Colorado Economic Development

Although the Collaboratory is only one year old and has only one fully operational research center at this time, the impact of the Collaboratory can already be seen in Colorado's efforts to grow and to attract renewable energy companies. Here are a few indicators of the Collaboratory's success to date and its potential for the future:

- Sponsorship of C2B2 by 10 major multinational companies;
- Attraction of ConocoPhillips' technology and education center to Colorado;
- Sponsorship commitments from major multinational solar companies to CRSP;
- Meetings with major international wind energy companies, including discussions regarding the location of research and development offices in Colorado;
- Cooperative efforts with the Governor's Office and regional economic development agencies to bring R&D and manufacturing activities to Colorado;
- Deeper NREL engagement with the Colorado community;
- More successful recruiting of highly regarded professors, senior researchers and graduate students by the universities and NREL;

- Positive relationships with sources of federal funding, including the Colorado congressional delegation and the U.S. Department of Energy.

The Authority and the Collaboratory expect that 2008 will see more announcements of major renewable energy companies establishing Colorado operations and the creation of additional Colorado startups.

Conclusion

Over the past twelve months, the Colorado Renewable Energy Collaboratory has emerged as a major renewable energy research center. The Collaboratory's early success has been due in significant part to the availability of state matching funds to attract private and federal monies. Many other states have much larger pools of matching funds to employ in the competition for research grants and contracts. We believe that Collaboratory's research assets are so strong that the Collaboratory has and can successfully compete even if the Colorado state matching funds are not equal to those offered by other states.

However, if we are to continue Colorado's recent success in building the New Energy Economy, additional matching funds will be essential. The Collaboratory must have an adequate baseline of matching funds to compete for federal and private funding opportunities.

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

COLORADO RENEWABLE ENERGY AUTHORITY
BOARD OF DIRECTORS

M.W. (“Bill”) Scoggins, Ph.D., President
Colorado School of Mines
(Chair)

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

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Governor’s Office of Economic Development and International Trade

Kimberly Jordan, CEO
New Belgium Brewing Company

Larry Edward Penley, Ph.D., President
Colorado State University

G.P. (“Bud”) Peterson, Ph.D., Chancellor
University of Colorado at Boulder

Tom Plant, Director
Governor’s Energy Office

Appendix A

COLORADO CENTER FOR BIOREFINING AND BIOFUELS SEED GRANT RESEARCH PROJECTS - 2008

C2B2 Seed Grants

C2B2 solicits research proposals from the faculties of the four Collaboratory institutions in search of highly innovative research projects covering all aspects of renewable resource conversion. Each year, a portion of these Seed Grant Proposals are selected for funding using C2B2 Center Sponsorship dollars and Colorado state matching funds.

For the 2008 financial year, ten Seed Grants were selected for funding out of a total sixty-seven submitted proposals. These ten proposals were recommended for funding by a committee representing the 27 private sponsors of C2B2. A list of the ten Seed Grants selected for funding and their placement within the C2B2 six research thrusts follows.

Feedstock Engineering, Plant Biotechnology & Crop Engineering

Enhancing Yield in Sugar Beet as a Model Energy Crop

Project Investigator: Daniel Bush

C2B2 Institution: Colorado State University

Establishment of a Bioenergy-Focused Microalgae Strain Collection Using Rapid, High-Throughput Methodologies Project Investigator: Al Darzins

C2B2 Institution: National Renewable Energy Laboratory

Biochemical Engineering

Biofilm Engineering for Improved Production of Cellulosic Biofuels

Project Investigator: Ryan Gill

C2B2 Institution: University of Colorado

Multifunctional, High-Throughput Optical Screening of Fuel Producing Microbes

Project Investigator: Ralph Jimenez

C2B2 Institution: University of Colorado

Proteomic Investigation of the Mechanisms for Lipid Storage in Microalgae

Project Investigator: Kenneth Reardon

C2B2 Institution: Colorado State University

Process Engineering

Sugar and Enzyme Recovery During Saccharification with High Solids Loading

Project Investigator: Robert Davis

C2B2 Institution: University of Colorado

Alcohol/Water Separations Using IL-Based Polymer Membranes

Project Investigator: Richard Noble

C2B2 Institution: University of Colorado

Thermochemical Engineering

Rapid Solar-thermal Conversion of Algae to Syngas

Project Investigator: Alan Weimer

C2B2 Institution: University of Colorado

Product Engineering

Biorefinery Integration through Coproduction of Bioplastics

Project Investigator: John Dorgan

C2B2 Institution: Colorado School of Mines

Systems Engineering

A Field-to-Wheel Systems Optimization and Process Design for a Thermochemical Lignocellulose-to-Biofuels Plant

Project Investigator: Thomas McKinnon

C2B2 Institution: Colorado School of Mines