



CCHRC REPORT

Volume 7 Issue 4

A publication of the Cold Climate Housing Research Center

December 2007

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Message from the President



2007 has been a very busy year for the Cold Climate Housing Research Center. We have been in our new facility for over a year, and the focus of our activities has moved from construction to delivering and refocusing on our research mission.

From an individual to a global perspective, sustainability is the challenge we now all face. Our focus needs to be directed on the elements that we can most effectively address; one being the shelter that our families and neighbors rely on intimately and daily. The rising cost of energy is crippling many communities in our beautiful state. Even in our less remote areas, escalating gas, heating fuel and electric prices are taking a significant and increasing percentage of every Alaskan's income.

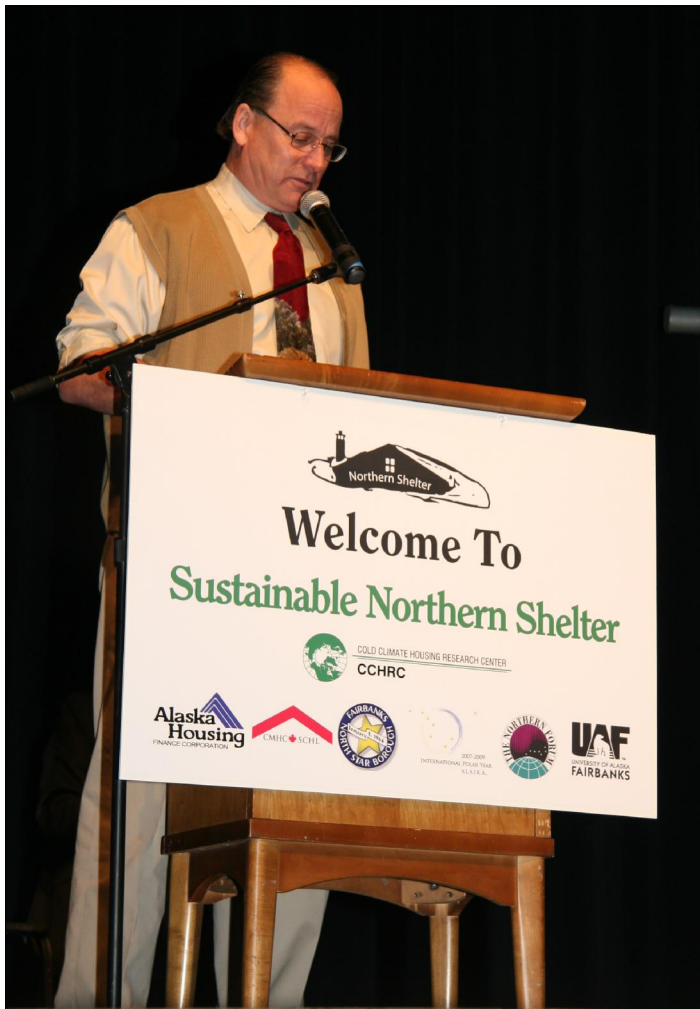
The CCHRC Research and Testing Facility shows some of what is possible and affordable. The ability to witness current building technology in a working demonstration brings substance to discussion. Incorporating internet tools that facilitate easy access to the daily performance of the building's systems is an effective way to communicate to a worldwide audience. CCHRC has made great progress on our web presence this fall. Presentations from a very successful and productive circumpolar forum on Sustainable Northern Shelter in October are now available at www.cchrc.org/forum.html for viewing and listening to during these cold, dark mid-winter days. You can join an ongoing dialogue generated from the conference. I hope you will all use our new website as a tool to learn about our new demonstration and research projects.

Prioritizing new projects to be pursued, initiated and brought to a timely and constructive conclusion is an immediate goal. This will require the revitalization of our statewide Research Advisory Committees. Some have been much more active than others. The importance of the RAC member's engagement in CCHRC is and always has been a significant component of the corporation's structure. I am looking forward to productive time with the committee members in the months ahead.

As we move in to a new year, there is a great responsibility on us all to find solutions and direction toward a bright future for our children and grandchildren. In addition to the future research we will be doing to address sustainability concerns, we are also moving in other directions. We are working toward a product testing a lab where industry members will be able to see how their products perform in the extreme Alaska climate. Additionally, we have initiated a big push to provide our research results to the community. To that end we are setting up ties with educators and the media to inform people of our research results.

I hope all of you take moments to enjoy the life we have here at the top of the world, in this amazing timeless place where wild space and nature surround us. Alaska may very well be where the inspiration is born to insure a sustainable future for mankind. Happy 2008 to all of you.

Sustainable Northern Shelter Up Date



Borough Mayor Jim Whitaker



The Forum on Sustainable Northern Shelter in a World of Diminishing Resources was a success for northern communities. CCHRC and the forum planning committee were very pleased with the turnout, discussion, and outcome.

The purpose of this three day forum was to discuss approaches to develop sustainable buildings and communities. The Forum was the result of an alliance of private and public sector organizations with the shared vision of bringing together the most outstanding minds from around the circumpolar north to address northern building science and technology, energy and alternative energy systems, and appropriate sustainable design of buildings and communities.

Addressing these pressing issues demands action and collaboration internationally and across both public and private sectors. Approximately 180 attendees and speakers from 6 countries and many states across the US came together in Fairbanks for the first in a series of biennial forums on sustainable building practices and infrastructure development. Additionally, the forum was setup for web-casting and web-conferencing. This technology allowed viewers from around the world to take part in the event and engage in a constructive dialogue.

Everyone that attended, either in person here in Fairbanks or through the internet, was a part of a constructive and positive exchange and we plan to encourage continued communication through our website. To that end an audio web stream of the event is available on the CCHRC website along with the speakers' power point presentations (www.cchrc.org). The video portion of the event is being edited at the time and will be available at a later date. We are also drafting a report of the proceedings and will post that report after the speakers have reviewed their sections. Included in that report will be research agenda and suggested action items for appropriate, effective approaches to sustainability. Currently those have all fallen into four different categories: education, demonstration, implementation, and financing. That list will be completed in the beginning of 2008 and utilized by CCHRC in our research and planning.

The challenges those of us who live in these beautiful Northern regions face demands proactive and immediate action. There is a shared passion among us to create a sustainable living environment, meeting the needs of the present without compromising the ability of future generations to meet their needs. The forum was a step in that direction. It will take many more for the vision to become a reality. With everyone's effort that will be possible.



Message from the Director of Research

The CCHRC Research Agenda

CCHRC was formed to address issues of sustainable shelter using applied research. This applied research is focused on finding practical solutions to the real world problems of building shelter that is healthy, durable and sustainable. Today the issues around sustainability have taken on a new urgency with fuel prices skyrocketing, the polar ice caps and permafrost melting, and other resources such as water and gravel becoming critically short in supply. In this context the important housing research issues for CCHRC (responding to the need to reduce the environmental impact of buildings, to develop more sustainable communities, and to assist builders in responding to these challenges) are listed below. For each of these issues there is a need to find the best solutions for the circumpolar north, test the ideas or products, demonstrate their effectiveness, and where possible develop new products or technologies that are manufactured locally:



Dr. John Davies, Director of Research

- Tools and training materials for the integrated design of green buildings and communities
- Cost-effective, energy efficient, attractive **envelope designs**, including wall systems, roof and floor systems, doors, and windows
- Cost-effective, energy efficient, healthy **ventilation solutions**, including heat recovery and filtration designs
- **Renewable Energy Systems** for houses, buildings, and villages
- Resource and energy efficient **lighting and water systems**
- **Cost-effective and durable foundation systems for a changing northern environment**
- **Cost-effective energy retrofit programs for existing buildings**
- Standards and codes for buildings and buildings systems, products, and materials

2007 Research Summary

HMEP Update

Dr. John Davies and Ryan Colgan

The Hybrid Micro-Energy Project (HMEP) is advancing on schedule and in-line with CCHRC expectations.

The HMEP is a project designed to demonstrate how a variety of renewable energy sources can work together to power small scale energy demands in Alaska on a year-round basis. The project gives particular attention to the high-latitude challenge of minimal solar energy in the winter when heat and electricity demand is greatest, and abundant solar energy in the summer when demand is minimal.

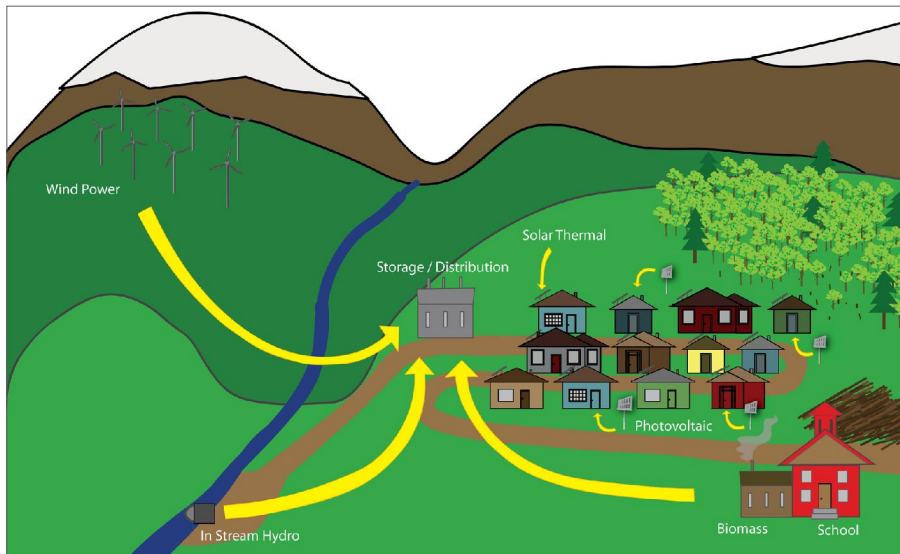
The HMEP consists of 10 to 15 kilowatts of solar photovoltaic tracking arrays, two different types of solar hot water collectors, at least one biomass fired combined heat and power (CHP) unit, and off-site wind generation data collection, all of which will be integrated to provide year-round heat and power to the Research Test Facility (RTF). The fully operational HMEP components will substantially contribute to CCHRC's goal to make its RTF a net zero energy building.

Adding the HMEP to the RTF site enables CCHRC to demonstrate how energy efficient design, sustainable infrastructure, and renewable energy can combine to create sustainability in the extreme Arctic environment.

The solar PV arrays are installed and will be officially commissioned on winter solstice. The solar thermal equipment is in place and final installation is in progress. CCHRC issued an RFP to identify the most appropriate biomass CHP system. Responses have been received and are being evaluated. Finally, CCHRC has identified wind power generation data collection sites and is working on data collection protocol.

Data from the HMEP system components will be available through the CCHRC website and other HMEP research will be available through regular updates.

HMEP Update Continued



Funding Spotlight

A special thanks to those who helped make the HMEP a reality:

BP

Fairbanks North Star Borough

State of Alaska

Siemens

GW Scientific

Remote Power Incorporated

CCHRC Wood Energy Project

Dave Misiuk, P.E.

CCHRC's Wood Energy Project commenced earlier this year and has been steadily gaining momentum and public interest. With home heating oil now over \$3.00 per gallon, the interest in renewable energy sources such as heating with wood is at a level not seen since the 1970's. Part of CCHRC's ongoing research is to identify and test new (and some very old) technologies and how they can be successfully added to both new and existing homes in order to reduce oil usage. The good news is that there are now many very efficient and low-emissions systems to choose from; wood-burning technology has improved dramatically since the previous peak in residential wood-burning.

Some of this year's Wood Energy activities included:

- Calibration of four portable emissions testing devices (Oregon Method 41) that can be used in the field to determine relative particulate emissions
- Presentation of "Biomass Energy R&D at CCHRC" at the Alaska Wood Energy Conference held in Fairbanks in November
- Presentation of "Wood Heat- An Alternative to Oil?" at UAF's Museum of the North Lecture Series in December.

There are a number of things that CCHRC will be pursuing in the near future as part of our ongoing research including:

- Travel to the northwest and northeast US and eastern Canada to visit wood-burning appliance manufacturers and testing labs to learn more about the latest technologies
- Implement a demonstration residential-scale biomass Combined Heat and Power (CHP) system at CCHRC's facility
- Develop and demonstrate a locally manufactured thermal water storage tank which is considered the heart of a wood-burning and/or solar heating system, allowing these renewable energy systems to be effectively added to new or existing home's hot-water heating systems
- Design contest for an "affordable masonry heater" for Alaska, in collaboration with the *Masonry Heater Association of North America*
- Develop a heating appliance testing and certification program that will highlight technologies appropriate for the northern environment and provide homeowners with practical product information that might be otherwise hard to obtain in a fast-paced market.

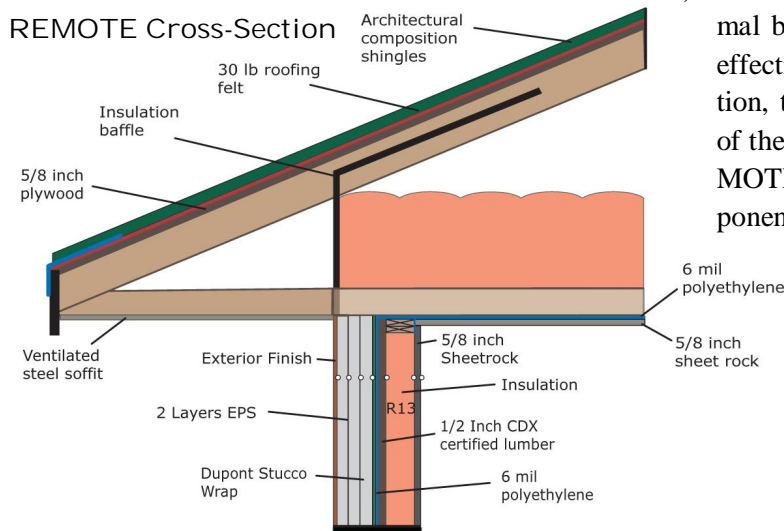
As always, we welcome visitors interested in wood energy to visit our facility to discuss wood-heating, see our masonry heater and any of the other appliances that might currently be in our lab.

REMOTE Performance at CCHRC Research & Testing Facility

CCHRC used the REMOTE (Residential Exterior Membrane Outside-insulation Technique) wall system in the CCHRC Research & Testing Facility (RTF). The REMOTE wall system addresses interior moisture and mold problems while increasing a building's energy efficiency. Research shows that REMOTE performs well throughout Alaska.

the structure is twofold:

- 1) With insulation installed to the exterior of the structure, condensation within the building envelope is eliminated. The dew point is now located outside the moisture barrier and not inside the wall structure. Any precipitation that penetrates the exterior sheathing can drain off.
- 2) The exterior insulation also eliminates concerns of thermal bridging in the framing significantly increasing the effective R-value of the insulation. With cavity insulation, the framing members can reduce the rated R-value of the insulation up wards of 35% to 40%. With the REMOTE wall, the warm interior allows the building components to dry to the inside.



The RTF walls also have monitors in the wall structure so wall performance can be studied. The graph below displays the live streaming data which is available at:

http://www.gwscientific.com/cchrc/rtf_data/

REMOTE Performance at the RTF

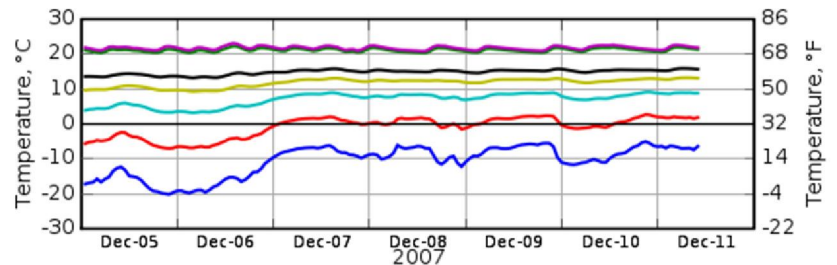
Moisture Control

Building assemblies must control the migration of moisture. In particular, water vapor will move from wetter to drier areas, areas of higher to lower air pressure, and warmer to colder areas. When this happens water vapor commonly condenses on relatively cooler surfaces.

The graph below shows data from the monitors in a wall section of the RTF for a week this winter. Although the temperatures have been mild for this time of year, it is apparent that the temperature both under 6" of the Expanded Polystyrene (outside the vapor barrier) and inside the structural plywood (inside the vapor barrier) never came near reaching conditions where condensing could occur. Earlier field data on Fairbanks homes with REMOTE walls showed similar results at much colder temperatures (-40 degrees).

Moisture inside the building envelope can cause structural damage to wood framing and drywall, lower the insulation value, and cause indoor air quality problems by creating an environment allowing mold growth. Common practice has been to install a vapor barrier on the interior side of the framing & insulation. Due to the many penetrations necessary it is likely that some moisture will get into the wall and needs a way out before damage can occur, so the exterior needs to be vapor permeable. This has worked fairly well in cold, dry climates, but requires great care in installing and sealing the vapor barrier and fails in cold, wet climates where the building must be sealed on the outside of the envelope.

Wisdom & Associates (www.wisdomandassociates.com) will be adding the REMOTE wall information to their classes.



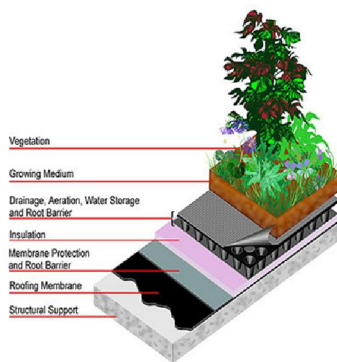
- Outside Expanded Polystyrene, Under Outer Coating
- Under 2" Outer Expanded Polystyrene
- Under 4" Outer Expanded Polystyrene
- Under 6" Outer Expanded Polystyrene
- Inside Plywood, Under Fiberglass Insulation
- Inside Under Sheetrock
- Sheetrock, on Room Side

REMOTE Wall Design

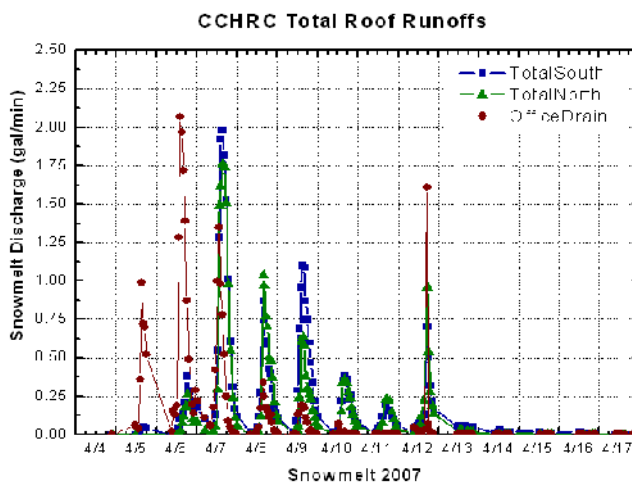
The benefit of insulation on the exterior of

Roof Hydrology Spring 2007

During the 2007 spring break-up, various snowmelt and runoff processes of the CCHRC building and surrounding grounds were monitored. The intent was to gain general knowledge of water dynamics and to look at volumes of available water from both green roofs, and shingled roofs. Among other measurements, discharge from the roof drains was examined during



snowmelt to calculate the amount of water draining from each roof. Runoff from each drain was measured for the two green roofs and the volumes were added together. The drainage from the office shingled roof was also assessed. Pictures were taken to record the distribution of snow during snowmelt. Snowmelt observations from the three roof are shown in the graph to the right.



- Peak runoffs were ~ 1-2 gal/min.
- One-day time lag between the administration building roof and the green roofs.
- A rain event on 4/12/07 shows up as a stronger peak on the office roof versus the two green roofs.
- Preferential melting occurred around the green roof drains.

Cold Weather Concrete Demonstration 2007

Pouring concrete in Alaska has always been subject to seasonal difficulties. Standard concrete mixtures do not cure properly in temperatures much below 32 degrees Fahrenheit because the water freezes, significantly weakening the concrete. A possible solution was demonstrated by the Cold Regions Research and Engineering Lab (CRREL), the Juneau Economic Development Council/SpringBoard, CCHRC and University Redi-mix at the CCHRC Research and Test Facility. To demonstrate a new cold weather concrete mixture two test pours were done on frozen ground in unheated areas during March of 2007. Each pour had a separate set up and the slabs' temperature and curing time were monitored throughout the process. The compressive strength was tested at regular intervals after being placed. Successful use of this process would allow Alaskan contractors to extend the construction season without building enclosures and would result in cost savings – up to one-third, according to Dr. Charles Korhonen, retired CRREL scientist.

The test pour was set up at CCHRC's Research and Testing Facility in two different exterior locations. The ambient temperature was about 10 to 15 degrees Fahrenheit. Each location was prepared differently.

The south entrance site was prepared by clearing away snow down to existing gravel fill. A form was constructed for pouring a five inch thick concrete slab. Inside the form, 5/8 inch rebar and wire mesh were placed in the standard fashion for reinforcement. The slab was poured directly onto the existing gravel. Alternatively, the ground next to the north lab was prepared by thawing and removing the upper one foot of soil. The area was backfilled with five inches of compacted NFS gravel. Next two inches of Extruded Polystyrene foam (XPS) were placed over the gravel. A form was created and two layers of 5/8 inch rebar were laid in a grid pattern. Finally, a ten inch thick slab was poured using the cold weather concrete mixture.

The biggest drawback of the tested formula is that it costs approximately \$350 per cubic yard in Fairbanks, due to the quantity and price of the admixtures used. University Redi-mix, who batched and delivered the CRREL-specified mix to CCHRC for this demonstration regularly, extends the practical concrete placement season using a formula of their own. The one they recommend has an approximate cost of \$170 per cubic yard. (*CCHRC has not yet tested this formula*)

To view formulas visit:

<http://www.cchrc.org/Reports/snapshot07-09cwc.pdf>

Certified Alaska Tough

It has been one of the goals of CCHRC from the beginning to develop and test products suitable for use by Alaskan builders and homeowners. The completion of the Research & Testing Facility gives us the space to make this a reality.

CCHRC has been pursuing getting the “Certified Alaska Tough” phrase and logo registered. We filed an application on August 31, 2007 for an “intent to use” service mark. The next step is to prioritize the classes of products we want to test and develop standards. Our Industry Advisory Council will be advising us on what products they would like CCHRC to test and a general set of testing guidelines which will have to be expanded for different classes of products.



Annual General Membership Meeting

CCHRC held its Annual General Membership Meeting in conjunction with our Sustainable Northern Shelter Forum on October 27, 2007. Elections were held for 4 seats on the 11 member board of directors. Brent LeValley was the only incumbent on the slate and was elected to continue in his seat on the board for three more years. CCHRC welcomes three new board members, Dave Miller from Fairbanks, Alan Wilson from Juneau, and Kelley Roth from Ketchikan who were also elected for three year terms.

CCHRC wants to thank three of our original board members who reached the end of their terms this year. Chuck Dearden in Ketchikan, Steve Burnett in Juneau and Dave Dillard in Fairbanks. They have been with us since the

beginning and will be greatly missed. We thank them for their support over the years.

We also want to thank Oliver Drerup and Wendy Knight who recently resigned from the board due to taking on greater responsibilities in their jobs. Oliver has also been with CCHRC from the beginning and been an invaluable guide. The CCHRC board was happy to appoint Bill Semple, who was an ex-officio member from Canada Mortgage and Housing Corp. (CMHC), to fill Oliver's seat. Wendy represented rural Alaska on our board and Jess Dilts of Hydaburg has been appointed to her seat.

Thank you to all our board members, past and present. CCHRC is fortunate to have such dedicated volunteers.

CCHRC Update and Farewells

Gail Koepf

Since this is the Fourth Quarterly issue of the “CCHRC REPORT” this year, it has been expanded to include a general wrap-up of some of the more important research and events of 2007. We encourage everyone to visit our website which has a great new look and functionality. There is much more on the website than we can ever include in our quarterly publications. We also encourage anyone in Fairbanks or traveling through to come tour the building and see a great deal of new building and energy technology applied. We have weekly public tours on Thursdays at 2:00 pm.

CCHRC is saying farewell to two long-time staff members and is happy to welcome the two new staff members replacing them.

Casey Schoen has been with CCHRC for almost three years. She joined CCHRC when the capital campaign turned into an actual construction project for the Research and Testing Facility and was in charge of the financial oversight of the entire project. She has also helped Mike Musick with the LEED certification process. When CCHRC moved into the new building, she took over the financial oversight for all operations and managed the building as well. Casey is leaving us to continue her education full-time. We will certainly miss her, but are happy for her sake that she is making this move and also happy that we are all invited to her wedding this summer!

I am overjoyed to write my own farewell! I have been privileged to work with CCHRC since the very beginning



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Welcome new and renewing members

*Hydaburg Cooperative Association
Building Knowledge, Inc.
TNHA Housing Authority
Sydney B. Kelly
Marquam George
Phil Schad
Jennifer Williams*

Membership: Please make sure your membership is updated. Membership level information and an application is available on our website at: <http://www.cchrc.org/membership.html>.

CCHRC Update and Farewells (continued)

and have greatly enjoyed watching it grow from rented office space for 2 part-time employees (Jack & myself) to where it is now. I have learned a lot and enjoyed meeting homebuilders and building science people from around the state. I could probably not be coaxed away for another job, but travel & adventure is another matter (especially at this time of year). Nate Mohatt is our new Office Administrator and I have every confidence in him. Welcome Nate!

Nate Mohatt moved to Fairbanks when he was 7 years old and has spent most of his life here. He has always had a love and passion for sustainable living and stewardship of the environment; however, his educational and professional career have taken him in many different directions. He has a Master of Fine Arts in poetry and is currently pursuing a doctoral degree in psychology and creative writing. Nate has worked in health care management and community health planning, mental health research, Alaskan politics, teaching, the publishing industry, and as a bicycle salesman and mechanic. At CCHRC he will fill the role of office administrator, making sure that everything is running smoothly and clearing the path for important projects. He is a published poet with a knack for numbers and organization. He is married to Jamie Mohatt of Fairbanks, and together they have a 2 year old daughter, Esmé.

The CCHRC Report is sent to members, funding agencies and to those requesting information about CCHRC. Response to this report is welcome.

The Industry Advisory Council (IAC) is comprised of CCHRC corporate members and will offer advise on industry research needs. The RAC is appointed by the Board of Directors to advise CCHRC on research. Contact a RAC committee member in your area with your input and concerns.

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