

ARCTIC THERMAL SHUTTERS & DOORS

Project Title: Arctic Thermal Shutters and Doors

Applicant Contact Information: Arctic Sun, LLC
Attn: Karl Kassel
PO Box 74798
Fairbanks, AK 99707
(907) 457-1297
Karl@arcticsun-llc.com
www.arcticsun-llc.com

Partners: None

<u>Total Project Cost:</u>	\$150,000
Grant Funds Requested;	\$120,000
Arctic Sun Match;	\$30,000

(Match will include cash and labor at a rate not to exceed Davis-Bacon)

Previous Grant Projects and/or Applications: None

1. Project Summary:

- a. **Project Description:** The construction of truly sustainable, energy efficient buildings in cold climates presents many challenges. Leaders in the industry recognize the weakest links in high-performance building envelopes are currently the windows and doors. This project will develop, perfect and place in operation several thermal shutter and door options to satisfy a variety of construction applications.

Arctic Sun has performed preliminary testing, feasibility and development, and is poised to move this technology forward to fully operational and deployed status. We have demonstrated thermal shutters provide the R-value necessary to achieve high-end performance standards. Thorsten Chlupp has and continues to work with Passive House Institute USA and Passiv Haus Institute in Germany to develop modeling protocol to estimate shutter performance. We have had a functioning prototype installed for more than a year on the only Passive-House-qualified home in Alaska, or anywhere in the world as far North as latitude 64. This grant project will allow us to refine sealing methods and mechanical operating systems to maximize total system performance and perfect manufacturing techniques. Ultimately, we will provide several models of shutters and doors, tailored to specific applications, budgets and personal preferences.

- b. **Project Eligibility:** High performance shutters and doors dramatically improve the overall energy efficiency of a structure, which in turn conserves energy. Even though this concept is understood in Alaska, few buildings are currently outfitted with them because of the lack of adequate, functional products. This project will produce full-service commercial Made-in-Alaska products within a few years.
- c. **Project Innovation:** In almost all existing super-insulated buildings in Alaska, the windows generate the greatest energy drain of the building systems. This weakness essentially eliminates any gains in increasing the R-value of the other wall components, and limits the ultimate overall building performance. To achieve Passive House building standards, thermal shutters are absolutely required. There are no windows manufactured anywhere today that provide the necessary U-value while allowing adequate solar gain. While thermal shutters are the only way to reach Passive House criteria, they are a difficult solution. Outside of our work, there is little research data and no commercial products on the market. For the industry to move the agenda of sustainable construction forward, we must resolve the flaws in our current window systems. This project accomplishes that. It will increase building performance, reduce operating costs, and provide a stepping stone to even greater gains in complete building efficiency.

As an example, Reina/Arctic Sun is working on the design for a new public library in Ester, Alaska. The client is interested in having this facility meet the Passive House standard. After maximizing the efficiency of all of the structure's systems, the total building energy consumption was reduced to an admirable 20 kWh/m²/yr (current US average is 130). However, the Passive House requirement is not more than 15 kWh/m²/yr. The simple addition of thermal shutters to the model reduced energy consumption to 13 kWh/m²/yr, surpassing the goal. The manipulation of no other build component or system achieved the standard. The shutters alone will save the 278-m² library 1946 kWh of energy per year.

d. Priority:

- i. Arctic Sun, LLC is a subsidiary of REINA, LLC. Both companies are wholly Alaskan owned and operated. Arctic Sun Alaska Business License #969490.
- ii. Arctic Sun just recently opened its doors, but Reina has previously partnered with the Cold Climate Housing Research Center, the University of Alaska and the Alaska Center for Appropriate Technology.
- iii. REINA/Arctic Sun has already invested significant time, money and energy in bringing this technology forward to where we are today. Additionally, we will provide a \$30,000 match specifically for this project.
- iv. The potential for widespread deployment of this technology is tremendous. Virtually every heated building with windows in Alaska could benefit by installing thermal shutters.

2. Technology Validation and Research Methodology:

- a. **Objectives:** The objective is to produce at least two styles of thermal shutters, flat and folding, and possibly another innovative blown-in filled-cavity model. This project will also create at least two grades of advanced thermal doors.
- b. **Methodology:** Arctic Sun will manufacture these products in our shop in Fairbanks. We will work with local building contractors to install them in existing and new structures. Before and after thermal imaging will be utilized to document actual performance. Computer modeling (Therm and PHPP) will be employed to synthesize the data to quantify actual energy savings expressed in BTUs. These numbers can then be used to calculate the economic impact at various fuel rates. Arctic Sun intends to work closely with the Cold Climate Housing Research Center, the Alaska Center for Energy and Power, the PHIUS Technical Committee (Passive House US), and the Canada Mortgage and Housing Corporation. Fairbanks' extreme climate offers an exemplary testing environment for demonstrating and documenting the effectiveness of these products. Third party involvement and validation will provide credibility, reliability and market trustworthiness to help speed deployment.

3. Summary of Project Schedule and Summary of Project Budget:

Activity	Schedule Start	Schedule End	Budget
Complete engineering and design specifications for solid panel units	Sept 2012	Nov 2012	Grant: \$15,000 Match: \$3,000
Complete engineering and design specifications for blown-in shutters	Sept 2012	Dec 2012	Grant: \$15,000 Match: \$3,000
Purchase and delivery of manufacturing supplies	Oct 2012	Jan 2013	Grant: \$25,000 Match: \$5,000
Manufacture shutters and doors, pre-build and ongoing as needed	Nov 2012	Aug 2013	Grant: \$20,000 Match: \$4,000
Install units in various applications	Nov 2012	Aug 2013	Grant: \$20,000 Match: \$4,000
Prepare technology validation protocol and equipment	Dec 2012	Jan 2013	Grant: \$10,000 Match: \$2,000
Data collection and monitoring	Jan 2013	Feb 2014	Grant: \$10,000 Match: \$2,000

Final analysis and performance reports; findings published	March 2014	March 2014	Grant: \$5,000 Match: \$1,000

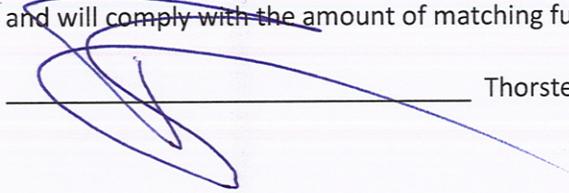
Shutters and doors will be installed at a variety of locations throughout 2013. Testing and monitoring will commence at the time of installation and continue through the winter of 2013-14. Winter is obviously the best time to evaluate actual performance, and consequently, our intention is to produce a detailed summary report in spring 2014, after a full winter of data collection and monitoring.

4. **Project Team Qualifications:** The project team will consist primarily of staff at Arctic Sun, LLC.
 - a. **Thorsten Chlupp**, Project Manager; Thorsten is the owner of Arctic Sun and is an international leader in Passive House design and construction. He has presented his research regarding sustainable building envelopes across the lower 48, Canada and around the globe. His previous experience includes consulting work with Cold Climate Housing Research Center, Alaska Center for Appropriate Technology, and the University of Alaska Fairbanks.
 - b. **Karl Kassel**, Project Coordinator: Karl is the General Manager of Arctic Sun and will oversee the day to day activities of the project. He previously owned and operated K2 Custom Construction and built a variety of high efficiency homes in interior Alaska. His current passive solar designed home is the poster-child for energy efficiency and has been the topic of feature stories and presentations regarding sustainable construction in cold climates.
 - c. **Michelle Sikma**, Project Secretary: Michelle is the Arctic Sun Office Manager and will provide accounting support as well as assist with compiling and presenting data and performance reports.
 - d. **Trades Staff:** Trades staff at Arctic Sun is highly experienced in the detailing required to make routine products more efficient. They will assist with developing the manufacturing techniques to produce quality products cost effectively. They will also ensure Arctic Sun shutters and doors are installed properly to specifications.

5. **Discussion of Commercialization of Funded Technology:** There currently exists a broad market for thermal shutters and doors, but there are essentially no products available in North America. Everyone involved in the construction trade in Alaska is aware of the need for well insulated building envelopes. They are also aware that windows and doors are the weakest link in the existing technology. Germany produces a few adequate doors, but they are currently not available in North America. Thermal shutters are not manufactured or available anywhere in the world. The door is wide open for the rapid deployment and commercialization of this technology, and the immediate need is equally as great. Removal of this bottleneck will allow the science of sustainable building to move forward.

When energy efficient shutters become available and affordable, the demand will be high across Alaska. The addition of quality shutters to a wall-system will not only improve the performance of the window, it will enable the entire system to be upgraded further. Total energy savings will be significant from the shutter alone, but the ultimate savings potential from a completely upgraded wall-system is incredible. Every heated building in Alaska has the potential of saving energy simply by the installation of shutters and/or better insulated and sealed doors. This project will showcase the technology and provide finished products for many applications.

6. **Signed Applicant Certification:** By signature on this application, I certify that we are complying and will comply with the amount of matching funds being offered.



Thorsten Chlupp, Owner/President Arctic Sun, LLC