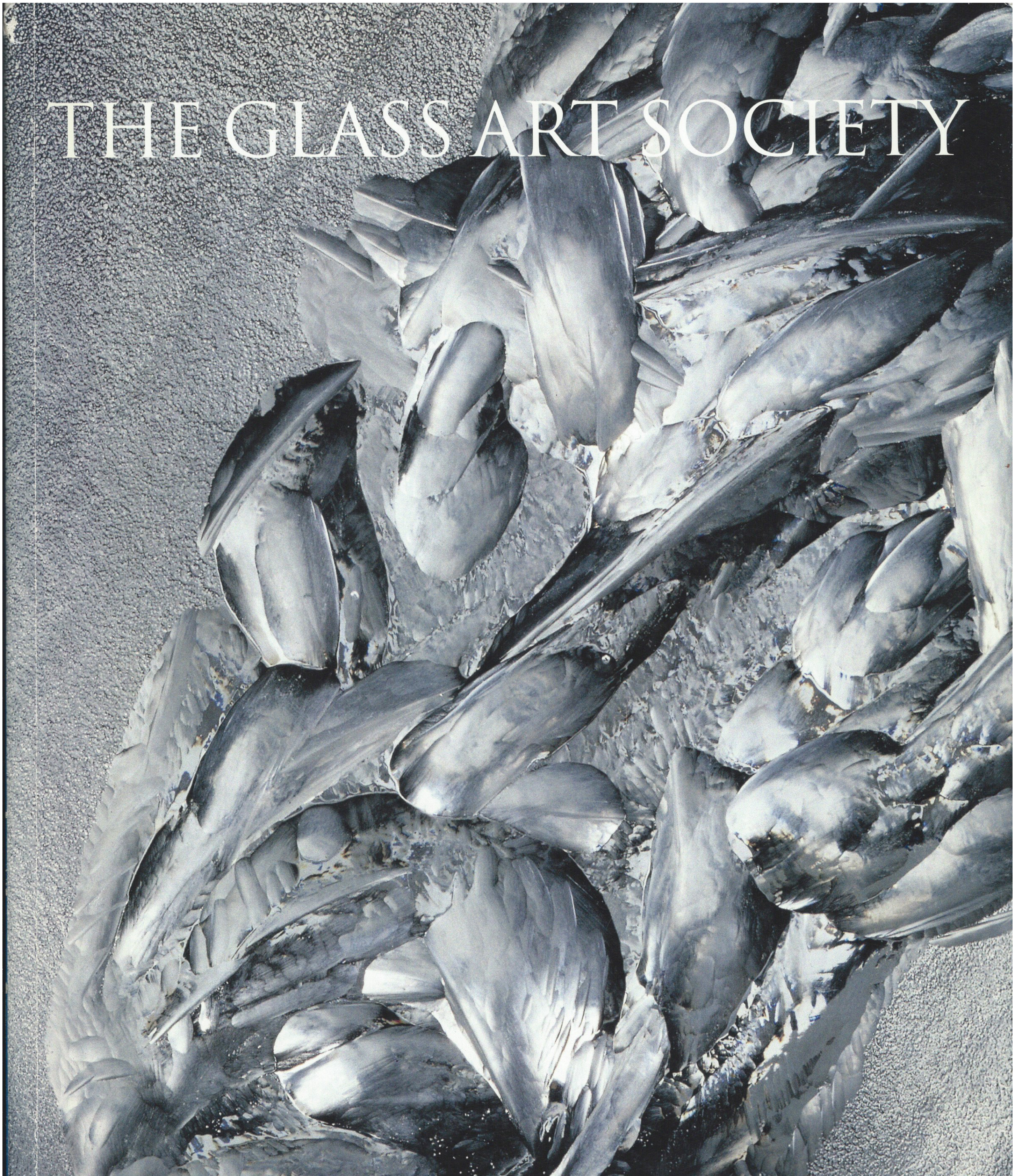
THE GLASS ART SOCIETY



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Panel:

BIOGLASS—HOW TO CREATE MORE EFFICIENT STUDIOS THAT UTILIZE RENEWABLE ENERGY SOURCES

Hugh Jenkins, moderator: Recuperation Advances and Vegetable Oil

The panelists, all active glass artists, decided that even though our topic is loaded with issues of political and ecological importance, we would confine our comments to projects and solutions to the cost of energy in today's glass studios. The three main areas discussed were efficiency, community, and renewable fuels. The illustrations, photos, and charts used in this presentation are viewable on the www.bioglass.org website.

The efficiency of high temperature equipment is primarily based on insulation. Effective layered insulation profiles may be based on wall thickness, optimum effective insulation, and cost. Ceramic fiber is often over-used in common practice. Its transparency allows radiant heat to penetrate and it requires an opaque layer to create an effective system. Insulating firebrick (IFB), calcium silicate, mineral fiber, insulating cement, and even fiberglass, are all effective alternatives at lower temperatures.

By using all refractory materials in the heat exchangers and air passages, recuperator efficiencies have improved to almost 70% savings on fuel. Reduced weight and greater efficiency with the use of a ceramic radiant tube allows for easier fabrication and even more return. Recuperation has reduced the fuel use in 80 - 100 lb. furnaces from fifteen gallons of propane per day to less than five gallons per day (20K BTU/hr). With much lower fuel use it becomes more attractive to take advantage of increased efficiency of scale. A 300 lb. furnace now in operation uses only three times the fuel of a 30 lb. furnace.

Many shops are changing to electric furnace operation. That still leaves glory holes as candidates for recuperation, which would reduce fuel use by about half. Improved door design, such as a scissor closure, will be important in further glory hole efficiencies. Recuperated burners have a higher flame heat than premix gas/air burners. Twin burners spread the heat and simulate the behavior of a ribbon type burner. Box design with IFB backed by mineral insulation has proven superior to fiber-lined barrel glory holes

In shops where there is multi-step process or in schools needing multiple work stations, four-port glory holes offer a huge increase in efficiency allowing four heating stations on one burner. Recuperation of a four-port glory hole is the next step in improvement over dedicated single-user glory holes.

Recuperation has been successfully adapted to a ceramic kiln and is currently being tested. Though kilns are only periodically used, improved fuel efficiency–especially at the high end of firing where recuperators are at their best–would reduce a major cost for ceramic studios.

Vegetable oil is a high-energy potential fuel. Recent experiments have resulted in a practical, low-cost, easily operated burner for glass furnaces. The volume of fuel used is slightly less than the propane used for the same unit. The practical use of vegetable oil requires a consistent supply, storage for a reasonable volume, pump operated filtration, compressed air for fuel atomization, and accurately metered fuel delivery. In short, you have to create a parallel fuel supply to your furnace and start-up on gas fuel is still necessary. Glory holes and kilns fired on fuel oil are also candidates for vegetable oil if a gas pilot or double burner is used.

METHANE, 20 TIMES MORE POTENT THAN CO_2 IS A GREENHOUSE GAS THAT HEAVILY CONTRIBUTES TO THE GLOBAL CLIMATE CHANGE

EPA Landfill Methane Outreach Program
Environmental Benefits Calculator

Using 100 scfm of landfill gas will provide annual environmental benefits equivalent to any one of the following:

Removing 2,289 vehicles
Planting 3,262 acres of forest
Preventing the use of 27,759 barrels of oil
Displacing the use of 1,304,675 gallons of gasoline
Heating 126 homes

We recognize the potential problems of shifting agricultural production from food to fuel. We are promoting the use or conversion of waste stream organic materials to fuel as a currently viable alternative to fossil fuels. Methane from consumer and agricultural wastes, and vegetable oil from food processing meet this standard. It is foreseeable that the demand for bio-source fuels from waste or direct production will make them less accessible and more costly on a par with other fuels. There is no doubt that energy demands on all sources will continue to increase.

Conceptual design for a sustainable structure by Vanessa Baumann. A finalist proposal for the proposed Ohio Valley Creative Energy arts campus in Borden, Indiana (north of Louisville, Kentucky). Baumann's design incorporates reclaimed concrete slabs and reused shipping containers

Electric energy has the potential of development from other sources such as geothermal, wave, nuclear, and direct solar. Several questions at the end of the presentation indicated interest in solar capture as heat, photovoltaic power, and hydrogen from water electrolysis. We support, applaud, and encourage further investigation of these sources.

Lori Beck: Turning Trash Into Treasure

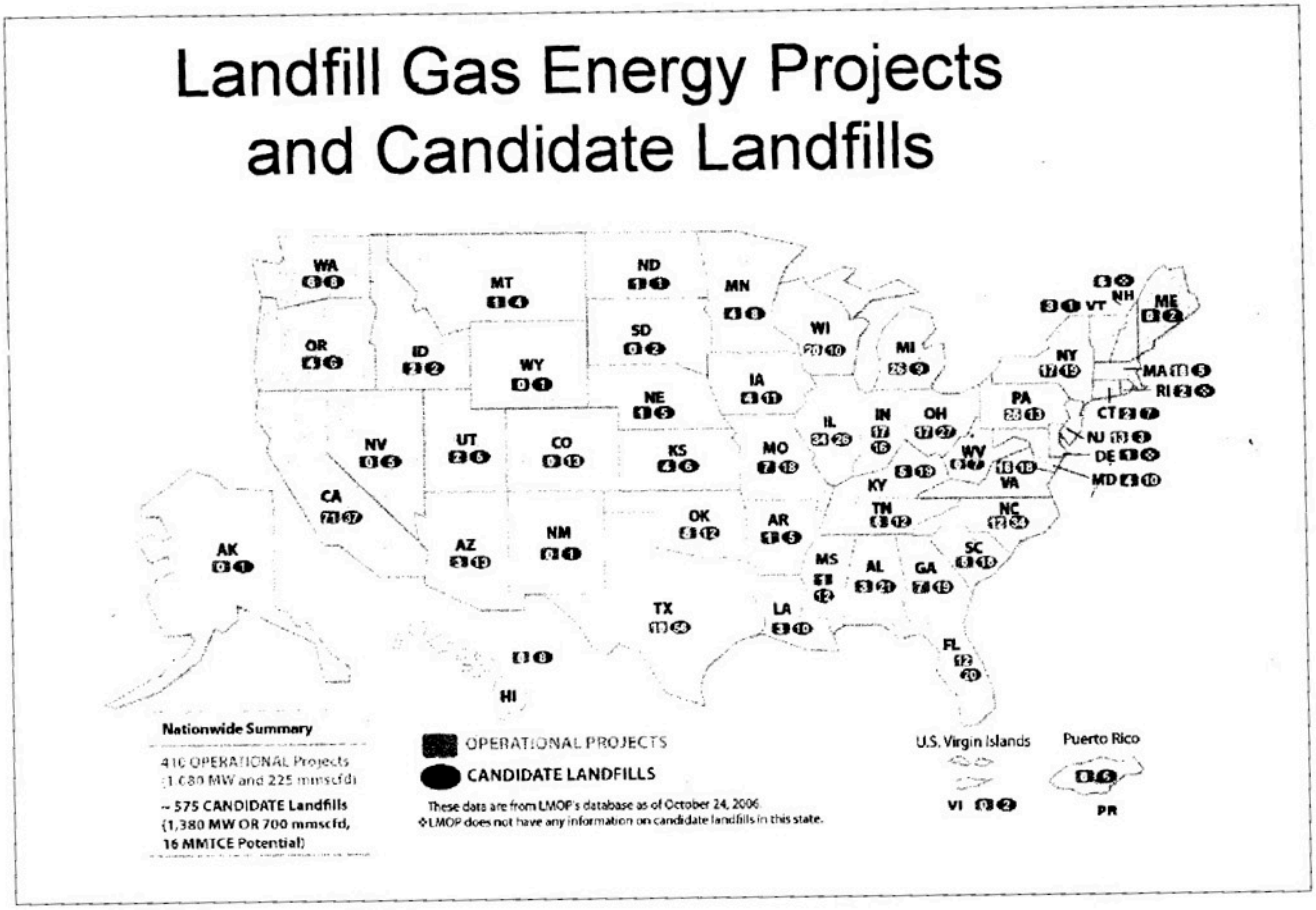
Ohio Valley Creative Energy (OVCE) is a grassroots, 501(c)(3) nonprofit organization that is currently developing plans to build a state-of-the-art, heat intensive studio facility to be powered by landfill gas or methane. OVCE will research, develop, and demonstrate the most efficient and innovative approaches to energy utilization and provide a basis to improve efficiency in glass studios worldwide.

The OVCE arts campus will be located adjacent to the Clark-Floyd landfill in southern Indiana (about fifteen miles from Louisville, Kentucky) and is projected to be a three-million-dollar, 25,000 sq. ft. facility that will provide studios for glass (flameworking, hot glass, slumping, fusing, and casting), metal (forge, foundry, and fabrication) and ceramics (electric, soda, raku, and wood kilns), as well as an exhibition gallery, educational center, boutique, outdoor amphitheater, and a sculpture garden.

OVCE has partnered with Hoosier Energy, a major regional energy provider, to become the first commercial/community partnership of any landfill gas project in the world. Hoosier Energy will run a two-MW electricity generation station that will provide green power for area consumers to purchase. All excess gas will be donated to OVCE, an annual value exceeding $80,000. Other partners include the EnergyXchange, Jackson County Green Energy Park, Environmental Protection Agency, Landfill Methane Outreach Program, Community Foundation of Southern Indiana, Indiana State Department of Energy, Clark-Floyd landfill LLC, National Endowment for the Arts, and Caesar's Foundation of Floyd County.

OVCE is currently in its final phase of planning and is projected to break ground in mid 2008. Upon the completion of construction OVCE will select the first ten glass residents. The resident artists will sign a one- to three-year contract and pay $300 a month with work exchange offered. Selection will be based on need and the desire to further professional development, as well as to commitment to OVCE's mission, vision, and values.

There are over 450 operational landfill gas projects in the United States and over 500 candidate landfills that produce at least 700 SCFM (Standard Cubic Feet per Minute) of gas flow. On average it takes 30 - 40 SCFM to power a shared glass studio, so thousands more landfills may be available for smaller operations. Since we all make trash, consider being an advocate to put it to good use for your community. For more information on developing a landfill gas project in your community start here:



http://www.epa.gov/lmop/. For more information about OVCE, please visit: www.ohiovalleycreativenergy.org

Eddie Bernard: Efficient Studio Design

As a builder of glass studio equipment I have had many opportunities to improve on efficiency. I believe that emphasis should be focused on the reduction of fuel use, regardless of the type of fuel. There are many factors to consider such as equipment size, insulation profiles, air tightness, flue sizing, heat exchange, control methods, and electrical consumption.

Recuperation is a process by which exhaust gases preheat the combustion air so that there is more available heat from the flame to heat the furnace and the glass. The greater the difference in ambient air temperature and the process temperature, the more the combustion air robs heat from the flame; the rate is exponential. The air in our atmosphere consists of 79% nitrogen, which is an inert gas that does nothing in a combustion reaction other than steal heat and bond with other atoms to form harmful byproducts such as nitrous oxide–a greenhouse gas known to deplete the ozone layer. The more that the combustion air is preheated, the greater the opportunity for the formation of nitrous oxide. Although recuperation has been known to reduce fuel consumption in furnaces by as much as 66%, if the mixture is not tuned using exhaust gas analysis, then there is more work to be done. Although we can save money by reducing fuel consumption we should be aware that we might still be causing harm to the environment if we don't tune our furnaces properly. The higher the cost of fuel, the more quickly these systems will return their cost.

The reduction of fuel consumption by recuperation has other benefits such as lower noise level, lower ventilation requirements, lower overall studio temperature, and smaller furnace combustion volume. All of these factors result in "trickle down" savings of studio operating costs.

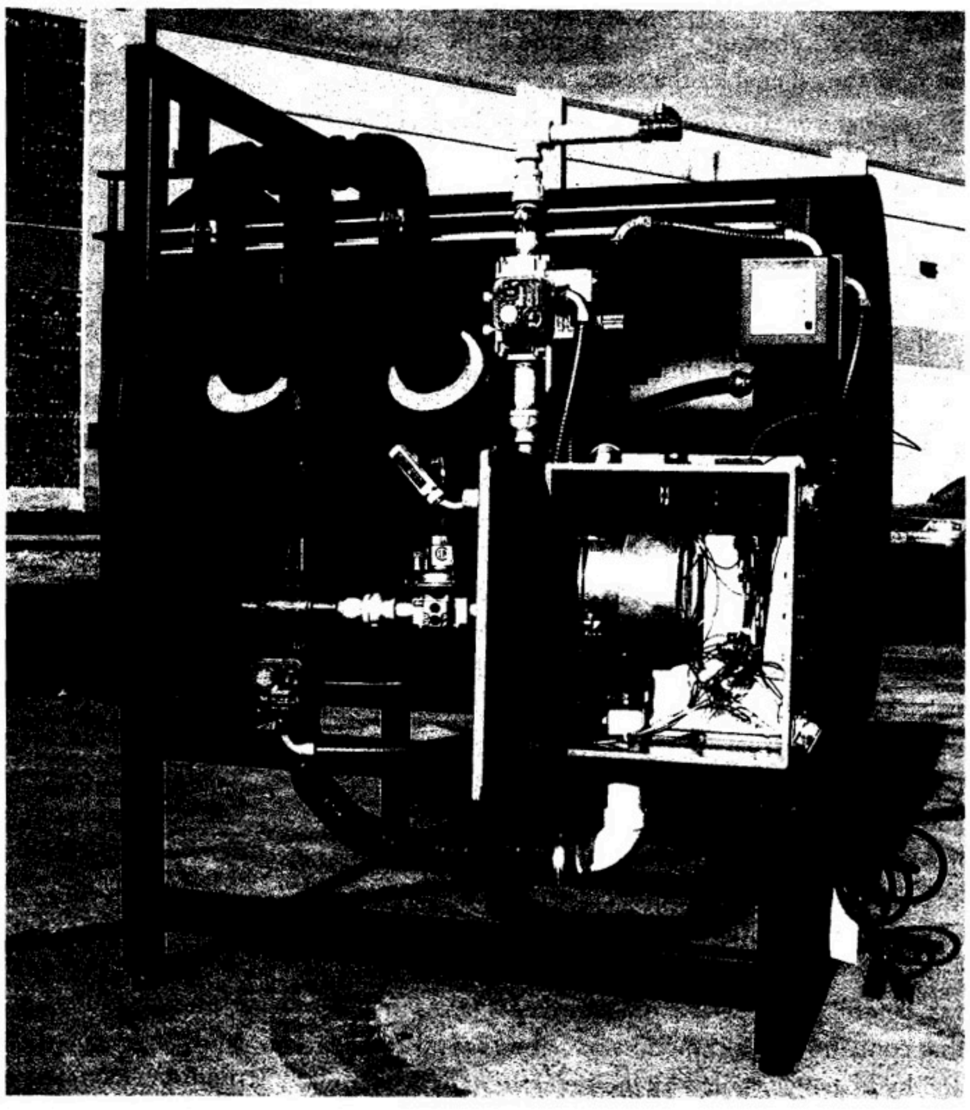
Efficient glassmaking is a mindset. In some factories it is common for workers to reheat glass in the furnace or have three people using a bench at the same time. Lunch is warmed on or near the furnace. In our art-making arena we each use a dedicated glory hole, which makes some sense because we are making unique pieces and can do without distractions. Where we can, however, we should implement the use of multiple-port glory holes. Community or multi-user glass studios are also a great way to reduce the total fuel costs.

Over the past ten years I have measured the fuel consumption of four different sized non-recuperated pot furnaces that were all built in the same style and idling full of glass at 2,100°F. The 120 lb. capacity furnace used 55K BTU/hr, the 240 lb. furnace of similar design used 60K BTU/hr, the 350 lb. furnace used 65K BTU/hr, and the 455 lb. furnace used 72K BTU/hr. The increase in fuel use was from only 8 - 11% with each successively larger furnace despite the greater mass and surface area. This indicates that the greatest heat losses in well-built furnaces are from openings such as the door and the flue. Economy of scale may be considered when justified by greater glass use.

The use of variable-speed blowers saves electricity. When a large constant-speed blower supplies the air, electricity is wasted because the blower runs at full speed even when only a whisper of air is flowing into the furnace. Alternatively, a variable-speed blower receives a signal from a temperature controller to either speed up or slow down as needed. Such blowers use 250 watts at high speed and 140 watts at low speed compared to a constant 3,500 watts typical of larger blowers. The result is a savings of several hundred dollars per month.

Temperature-controlled glory holes can be run at lower temperatures because they respond dynamically when the glass enters the glory hole or when the doors open. They also may have a longer lifespan because they are not allowed to overheat. In school situations they will maintain constant heat with no manual adjustment.

Gas/air mixers should be selected for their ability to mix gas intimately, i.e. the molecules are arranged in close proximity to each other so they can react with each other. Homemade mixers should be avoided unless a professional product does not exist for the fuel of your choice.



Glory hole with temperature control and variable-speed blower built by Eddie Bernard

Our social standing as artists enables our work to provoke, instigate, and inspire change, or it can potentially mire our cultural ambitions in apathy. The question is: Can our art serve as a vehicle for important progressive social change? — James Ronner

Reflective aluminum paint inside the steel drum of a glory hole reflects light back towards the inside of the hole, thereby decreasing radiant heat loss in the form of light.

The use of biofuels to heat furnaces and glory holes or run electric generators is currently under development. Animal fats also have potential and algal oil is an energy source that is gradually becoming more available and can be grown quickly. Bubbling the exhaust gases from the glass studio through the algae in photobioreactors will enable it to grow faster. This practice goes further than simply recouping heat because it sequesters the carbon dioxide, thereby decreasing the contribution to global warming by decreasing the amount of carbon dioxide emitted. Because the algal oil is produced by algae that have absorbed the carbon dioxide in the exhaust, burning the oil enables the same carbon to be reused.

Julie Conway: Some Background

The idea of this panel discussion and BioGlass® as a concept came to me in 2005 when I worked for three months assisting various European glassmakers. I was stunned by the one constant that existed in each studio that I visited: the enormous costs for operating glass studios and their threat of extinction. Cam Ocagi, the glass school in Istanbul, pays something like the equivalent of $30,000 per month for gas including a 60% tax from Russia. During my travels I also heard of the loss of several significant historic glassmaking studios and factories. French cities that were once glass factory towns, including Sars-Poteries, have closed their plants due to high fuel costs and fierce competition from China. Numerous Muranese glassmaking houses have fallen into bankruptcy after many years in business.

As a contemporary designer, I believe that we need rapid and creative responses to the current human and environmental challenges. We need to introduce innovative ideas that apply to our interconnected world communities. I have dedicated the past two years to researching alternative fuels with engineers working with biomass, hydrogen technologies, wastewater, methane gas, landfill gas, vegetable oil, and syngas (a gas mixture that contains varying amounts of carbon monoxide and hydrogen generated by the gasification of a carbon containing fuel to a gaseous product with a heating value) in hopes of finding solutions to our problems of cost and environmental impact from the use of fossil fuels.

The BioGlass project has connected me with colleagues on the panel and others including Simon Pierce from Quechee, Vermont, with his millpond hydro-powered furnace, Mary White from the Crucible Fire Arts Center in Oakland, California, which draws its electricity from rooftop solar panels, and the EnergyXchange in Burnsville, North Carolina, that fuels its hot glass and ceramics studio with landfill methane gas.

My plan is to help develop the use of renewable fuel sources for glass artists and provide information on our new Web site: www.bioglass.org. I encourage everyone to sign up on the mailing list to keep up with our latest discoveries and to let us know of any glass studios or projects in the world that utilize renewable energies.

James Ronner: An Economy of Waste

Inevitably, we as a community will either adopt sustainable practices or extinguish our furnaces. Fuel efficiency is paramount and its effects are both immediately tangible and pervasive. Community resource sharing–by public access or group use studios–is a method that achieves higher efficiencies via the economy of scales and facilitates the use of several types of renewable energy. The success of previous market based initiatives in sulfur dioxide and nitrous oxides abatement warrant further discussion by for-profit public access glass studios as carbon offset projects.

It is imperative to understand that our incredible energy demands will most likely necessitate a portfolio of renewable fuel technologies. The multiplicity of technologies and resources needed to sustain non-fossil fuel furnaces underscores the importance of fuel efficiency and community resource sharing. In addition, demographics, resource variation, and regulatory incentives will influence which energy technologies are feasible in each region. Glass art appears to be uniquely positioned to take advantage of the benefits of waste-to-energy processes such as vegetable oil, landfill gas, and anaerobic digestion. Each of these resources has its own problems: food versus energy crops, finite resources, and logistical complexity.

Currently the United States does not have a cohesive federal energy policy, which has slowed the progress on renewable fuel sources. The state and regionally based regulatory mechanisms that do exist are encouraging but insufficient to make a truly meaningful impact. Ironically, a promising long-term waste-to-energy plan has been developed for areas with the absence of regulatory incentives and a presence of high-density energy potential from livestock waste.

It is important that we all do what we can to conserve energy and nurture the development and deployment of renewable energy resources. The future of the fire arts is fundamentally reliant on the establishment of this ideal as practice. We, as artists, are afforded an envious social standing that some may consider a burden. Our social standing as artists enables our work to provoke, instigate, and inspire change, or it can potentially mire our cultural ambitions in apathy. The question is: Can our art serve as a vehicle for important progressive social change?

Hugh Jenkins, moderator, has worked in glass since 1969 and was introduced to glassblowing at the Foundry in Honolulu, HI. He brought glass into the Punahou School art department in 1972 and taught there until 1998. During summers and sabbatical leaves he also taught several sessions at Penland School of Crafts in North Carolina. Since 1996 he has focused, in collaboration with Stephanie Ross, on a richly colored series of bowls and vases. Between 1999 and 2000 he established a professional glass studio on the Big Island of Hawaii. Jenkins also focuses on energy recovery and efficient studio operation, specializing in recuperation for furnaces and glory holes. In 2006 he invented a successful burner for using vegetable oil as fuel in Studio Glass furnaces.

Eddie Bernard is a member of the Glass Art Society Board of Directors and is also an artist, expert glass technician and equipment builder, and the owner of Wet Dog Glass, LLC in New Orleans. He earned his BFA in glass from the Rochester Institute of Technology and teaches at venues worldwide. In 2002 Eddie and his wife, Angela, founded a public-access glass studio called Conti Glass, LLC. It was destroyed in 2005 by the floodwaters of Hurricane Katrina's storm surge and soon reorganized as the nonprofit New Orleans Creative Glass Institute.

Lori Beck is the founder and director of Ohio Valley Creative Energy, a grassroots nonprofit organization based in Louisville, KY. OVCE designs methane-powered, heat-intensive art studios for glass, clay, and metal, and is a center for the education and advancement of sustainability. Lori was one of the first students in the glass program at the University of Louisville and works in the public access studio, Glassworks. She recently completed the graduate program in critical and curatorial studies at the University of Louisville.

Julie Conway is the owner and designer of Illuminata, a glass studio for creating functional and sculptural work. Studio Illuminata is dedicated to the development of renewable and bio-sustainable fuel sources. A portion of the profits is directed toward this new energy initiative, thereby helping to protect the environment and the future existence of glass arts.

James Ronner is a sculptor and biologist. He earned his BS degree in glass sculpture and cell and molecular biology at Tulane University in New Orleans, Louisiana. During his undergraduate studies, Ronner received several grants and instructed at Tulane University and the New Orleans School of Glassworks. He received his master of science from Tulane while studying the molecular microbial ecology behind several waste-to-energy concepts. Currently he is producing his own sculpture and working for New Orleans glass artist Andrew Brott as a design and fabrication consultant.