

# Energy Efficiency

## The Future of Glass Making

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Independent research through Undergraduate Research Opportunities Program  
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*This project is an investigation of current glass making technologies for the purpose of reducing the energy consumption of the glass art community. Sustainable practices, renewable resources, and innovative technologies are pressing topics under discussion around the world. It is important for glass artists to realize their reliance on fossil fuels and be proactive in their efforts to reduce this expenditure. This paper will discuss the original research study on energy efficiency and the development of [www.GlassArtEnergy.org](http://www.GlassArtEnergy.org), a user-friendly archive of credible resources about ways glass artists can reduce their energy expenditure through equipment maintenance and the use of renewable energy.*

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### Introduction

Glass making relies on three basic pieces of equipment: the furnace, the glory hole, and the annealer. The furnace melts the glass, the glory hole maintains the heat of the glass, and the annealer systematically brings the glass to room temperature in order to prevent cracking from thermal shock. All of this equipment requires a source of energy, such as propane or natural gas. In the 1960s, for the first time in glass making's 4,000-year history, artists began exploring glass as a fine art medium rather than a production material.

Large industrial glass melting furnaces were scaled down to smaller sizes suited for the individual artist.

These innovations sparked what is now known as the American Studio Glass Movement (Hampson 2015). Since then, many university and higher education programs have developed accredited glass making programs. There are also private, non-profit, and for-profit studios all around the world.

The establishment of [www.GlassArtEnergy.org](http://www.GlassArtEnergy.org) is an archive of primary resources for educational purposes and information exchange between glass makers around the world. It is intended to increase awareness of energy efficiency in glass making in order to encourage artists to make these adaptations in their personal practice. There is ongoing research regarding the integration of renewable forms of energy into studio practice and this website is a way for artists, educators, students, manufacturers,



Amber O'Brien has been involved with the glass community for the past four years in Rhode Island and Hawai'i. She has recently received her Bachelor of Fine Arts in Glass at the University of Hawai'i at Mānoa (UHM). Having received a research award from the Undergraduate Research Opportunities Program, she is working to increase energy efficiency in the glass world by creating a user-friendly public online archive that collects and provides information to educate and inspire the application of sustainable and mindful practices.

and those interested in technological research to easily access this information, share new developments and exchange ideas.

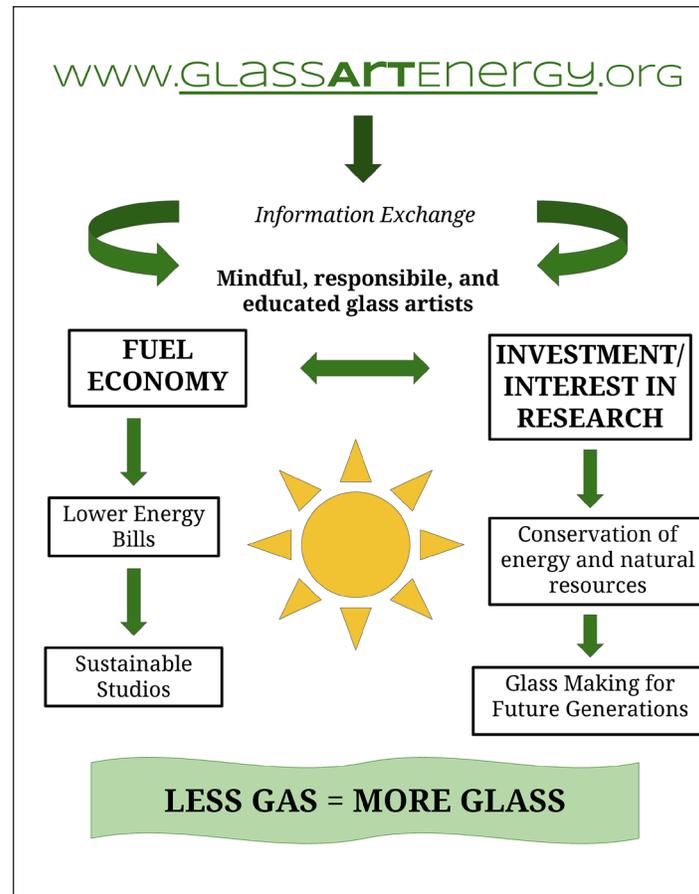
## Objective

Glass making is a collaborative medium and the sharing of information has been a pinnacle of the progression of glass making techniques and equipment. Before the Internet, glass makers mainly communicated through hands-on experience, personal interactions, and written methods such as magazines and newsletters. Now, we are in the midst of a fast-paced digital age where most reading and research is done online. Putting credible information together on a single website has the potential to make glass makers more likely to read these resources and educate themselves about the importance of conserving energy.

Rising fuel prices have been an obstacle for glass art studios over the past decade. Many studios have had to shut down because of financial difficulties. Glass artists have been involved in creating more cost-effective and fuel-efficient equipment since the beginning of studio glass art. It is important now, in the peak of environmentalism, to educate the community regarding sustainable studio practices and their role in the future of glass making.

## Methodology

The majority of the observations and information gathering took place at the 45th Annual Glass Art Society Conference in Corning, NY in June 2016. The Glass Art Society is a 501c3, non-profit, international organization



whose purpose is to advance education, promote the development of the glass arts, and support the worldwide community of artists who work with glass. The conference is an annual gathering of the minds—through lectures, modules, and demonstrations the glass art community exchange ideas, innovations, creations and inspiration. Located next to the museum is the Rakow Research Library, the world's foremost archive and reference collection on the history of glassmaking.

Through communication with Glenn Cook, the head scientist at Corning, Inc., and Toots Zynsky, a pioneer of the American Studio Glass

Art Movement, I was invited to be a member of the Green Panel, an annual panel discussion which discusses new energy efficient technologies, innovations and improvements that have happened over the past year. The audience consisted of a network of glass makers who are interested in reducing their energy expenditure while simultaneously lowering the costs of their studio operations.

The community was very welcoming to the idea of [www.GlassArtEnergy.org](http://www.GlassArtEnergy.org) and readily shared their knowledge, published work, and the trials and tribulations of creating their own equipment and maintaining a glass art facility. This involvement led me to explore other studios on the East Coast to gather as much information as possible. I traveled to: Corning Amphitheater, Hands On Glass and Vitrix Glass in Corning, New York, Urban Glass, Brooklyn Glass, and Scanlan Glass in Brooklyn, New York, The Banana Factory in Bethlehem, Pennsylvania, Wheaton Village in Milton, New Jersey, Martha's Vineyard Glass in Vineyard Haven, Massachusetts, Riker Glass in East Providence, Rhode Island, and Toots Zynsky Inc. in Providence, Rhode Island.

## Results

At each studio I was given a detailed tour of the equipment and operations which gave insight to the multitude of unique nuances of increasing efficiency in their practice. For instance, closing the furnace and glory hole doors when not in use will prevent heat from escaping thus reducing the amount of fuel required to maintain the desired temperature. Hank Adams claims that by turning off the glory holes during his lunch break, he was able to save thousands of dollars each year. Hands On Glass uses pneumatic glory hole doors which allow the artist to close the doors with a foot pedal. Martha's Vineyard Glass and Scanlan Glass use the residual heat from the equipment to heat their studios during the winter months. There are many more examples; each studio operates according to what they are producing which requires specific systems and equipment maintenance.

Aside from these basic practices to reduce energy consumption, GlassArtEnergy.org hosts a variety of downloadable PDFs of published articles from the Independent Glassblower, (Glass Art Society) GASnews, Glass Journal, Glass Art Magazine, American Craft Council, and many other credible resources. It offers a way to navigate the Environmental Protection Agency website and how to find sustainability standards in each state. There is a section about renewable energy technologies such as reclaimed cooking oil (Waggoner 2012), hydroelectric power (Bolduc 2010), solar power (Melchione 2016), landfill methane gas (Landfill Methane Outreach 2010), electric furnaces and their use of molybdenum (International Molybdenum Association 2013), as well as current research being done by the Glass Manufacturing Industry Council (Glass Manufacturing Industry Council 2008) and Recycled Energy Development, LLC (Casten 2010).

## AROUND THE WORLD

In 2006, Stazione Sperimentale del Vetro, a research laboratory funded by the glass industry located in Murano, Italy sponsored a project which assessed energy reduction technologies available and their feasibility (Ferry 2006). Traditional Murano furnaces, natural gas furnaces, recuperative furnaces, oxy combustion furnaces, and factory furnaces were investigated. The results were varying and warrant further study, but this report acts as

a baseline of different technologies which can be used in further research.

Durk Valkema, a member of the Green Panel, was one of the first to view the equipment in glass studios as an integrated whole and has designed private and industrial furnaces that are cost-effective and fuel-efficient. His work took place in the Netherlands and Greater Europe. Valkema had no formal education in engineering and furnace technology and learned through experimentation and advice from engineers he encountered. In 1974 he built the first tank furnace with a nozzle-mix burner, called the NA Tempest burner. This design used flue gasses to heat an annealer, which reduced the energy consumption of the studio by more than seventy percent (Waggoner 2015). He continued to design and build efficient furnaces and traveled to other countries, such as Bali, Indonesia, New Zealand, Sweden, and Scotland, to install them. His equipment was so efficient that equipment makers in the United States began to imitate his design, such as Charlie Correll.

## AMERICAN INNOVATIONS

The American Glass Art Movement was inspired by glass art making in Europe. Charlie Correll of Massachusetts designed and built his first recuperative glass furnace in 1981. The new designs resulted in better glass, more durable furnaces, and a 60% reduction in his fuel consumption. As word spread, and as the field changed, the need for quality recuperative glass furnaces in the United States was met by Correll Glass Studio (Correll 2015). Since, manufacturing companies have invested time and money into research and development of furnaces, glory holes, and annealers. Companies such as Wet Dog and Spiral Arts have increased the efficiency of their equipment through modifications such as variable speed blowers and digital systems which allow for programming and monitoring of the internal temperature and proportions of the combustion gas and forced air.

Mark Weiner, another member of the Green Panel, meticulously documents his energy use in order to make adjustments if necessary to make operations more energy efficient and less expensive. He states: "lower running costs of equipment help free the artist...and provides them affordable access to a top-quality glass working facility that allows them to make unique pieces of artwork" (Glass Art Society Journal 2016). He suggests that the glass art community is in the midst of a technological

revolution. If the momentum of this attitude towards improving the efficiency of glass making studios continues, there is potential for significant improvement in current practices.

Spiral Arts of Seattle was founded by Fred Metz, another member of the Green Panel, and is currently known as one of the best glass art equipment manufacturers. Partnered with the Corning Museum of Glass, Metz and his team designed an all-electric glass blowing studio for the purpose of entertainment on cruise ships. Since 2008, the Museum has been blowing glass out at sea on three of Celebrity's Solstice Class ships and is consistently rated as a top entertainment experience by guests. This is an incredible achievement for the glass art community. Having a fully functioning studio run entirely off electricity brings hope for the future. It is evident that glass making is moving in a sustainable direction; solar power has the potential to power the electric equipment thus eliminating the need for fossil fuels. This is still currently being researched however.

### ACADEMIC INITIATIVES

Rachel Berwick, the final member of the Green Panel, is department head of the glass facility at the Rhode Island School of Design (RISD). Her dedication to environmentalism has sparked the initiative of integrating sustainability into education at the university level. She asserts that:

“As makers we have to think about the materials we use and how we use them. If we teach our students to think about the world outside of the studio as connected to the world inside the studio, then we help them to understand that what we do as artists is always connected to the larger world” (Glass Art Society Journal 2016).

There is a lack of widespread education and training about energy management and conservation regarding glass art studios. Progress can be made by instilling good habits, attitudes and mindfulness in every individual using the studio. Berwick believes that artists, students, educators, manufacturers, and those interested in future of glass making should be encouraged to make proposals to solve the energy problems through an academic approach to experimentation and innovation.

The history of glass making revolves around the sharing of information through word-of-mouth and ob-

servations. This tradition still holds true today; the most important information lies in the minds of experienced glass makers. By asking questions and discussing the topic of energy efficiency, I was informed about many important figures, lectures, and developments in the field of glass making, most of which I was previously unaware. This knowledge enhanced exploration of the topic and contributed to the collection of data for the website.

### Discussion

One major challenge studio glass artists face is meeting the increasing demands of the 21st century. Studio glass art relies on a cohesive balance between many factors such as: high quality products, meeting environmental regulations, capital productivity, and the cost of energy.

This research has developed into an ongoing project that requires the participation of glass artists around the world who are willing to connect, collaborate, share their personal knowledge and contribute to the continuously updating resource database. Through awareness, maintenance and research, the glass art community has the potential to produce long-lasting sustainable studios, energy efficient glass makers, and the spread of credible information to those who would like to learn about ways to reduce their energy consumption and overall costs of running a studio.

This site is an educational initiative which aims to raise awareness and mindfulness about energy conservation and the future of glass making. Whether or not energy costs rise or fall, planet Earth needs us all to consume less traditional fossil fuels, use resources more efficiently, and continue to develop and utilize renewable energy sources.

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For more references, visit [www.GlassArtEnergy.org](http://www.GlassArtEnergy.org)