**Mission**

To create a low cost dynamic window coating that improves building energy efficiency, while enhancing occupant comfort and building aesthetics.

**Business Overview**

**Value Proposition:** Building windows cover an estimated area of about 2,500 square km in the US and are critical to energy efficiency and occupant comfort as they determine the amount of natural light and heat from the sun that enters a structure. Our objective is to create a dynamic window coating utilizing a proprietary nanocrystal ink solution that improves the light and the heat control characteristics of current products at a substantially lower price.

**Business Model:** Heliotrope will commercialize its coating technology in partnership with one or more manufacturers of building glass or finished windows. Such an approach will enable the company to avoid the capital-intensive nature of independent manufacturing, while integrating into the process development cycle of major customers and ultimately, to make use of their well-established product assembly and distribution relationships. We will also seek non-exclusive licensing arrangements for the core technology in related areas as appropriate.

**Product Development Plan:** Heliotrope has demonstrated proof-of-concept for its core technology and complete lab-scale prototypes at Lawrence Berkeley National Laboratory’s (LBNL) Molecular Foundry. Heliotrope’s development plan includes an in-house pilot phase to create and validate an optimized prototype. In parallel, we will optimize the low capital and operating costs of Heliotrope’s manufacturing process for production-scale units.

**Financing:** The company has already raised ~$2M in seed capital, to bridge from materials discovery to lab-scale prototypes, including a recent ARPA-E award and a 1st place award in Saint Gobain’s NOVA competition. Based on industry comparables, Heliotrope will need subsequent funding of $5M-$8M to develop full-scale demonstration units and $10M-$15M to launch commercial production. However, these capital requirements can be substantially reduced through partnering and access to contract manufacturing capabilities.

**Technology**

Heliotrope’s smart window technology leverages a novel electrochromic (EC) effect discovered by the founders to control light and heat transmission dynamically. Our nanocomposite EC coatings switch reversibly between three states: solar transparent, heat blocking, and heat and light blocking (i.e. darkened, see image at right). A small voltage (under 5V) controls the optical state of the device. Minimal power is consumed during switching and almost none is used to maintain either of the two solar blocking states. This yields great flexibility for system integration and low cost installation. Importantly, the window coating is transparent in the case of device failure.
Potential Markets

Heliotrope’s technology can be relevant to a range of window products, including buildings, satellites, and automobiles. We are focusing on the commercial fenestration market (annual worth $1.4B in the US and $13.1B globally) given the immediate potential of our technology to improve the efficiency of building lighting, heating, and cooling. Note that several segments of this business are cost-sensitive and early discussions with window manufacturers and vendors point to the affordability of Heliotrope’s technology as a market enabler. Several of these other industry segments may become important over time. We will determine their impact on commercialization as our technology matures.

Competitive Landscape

Within the U.S. window market, around 60% of unit demand is served by a handful of large companies, namely Pilkington (part of NSG Group), PPG Industries, Asahi Glass, Cardinal Industries and Guardian. NSG Group, Asahi Glass and Saint-Gobain are the major players at the global level. All of these companies are actively pursuing advanced dynamic window technologies. For example, Saint-Gobain recently announced its acquisition of Sage Electrochromics to establish their position in this space. In comparison, a variety of dynamic electrochromic (e.g., Chromogenics, EControl-Glas, Soladigm, Sage, Gesimat) and thermochromic (e.g., PleoTint, RavenBrick) coatings are under development, but have achieved very limited commercial success, due to high cost and to performance challenges.

Heliotrope Team

Mike Clary: Mike serves as CEO at Heliotrope. Previously, Mike was an Executive In Residence at Kleiner Perkins where he was the founding CEO for three companies in the alternative energy field, including GMZ Energy, which is now moving into production of a solar thermal device for combined hot water and power generation. Before KPCB, Mike was a Vice President at Sun Microsystems where during his 20 year tenure he led the licensing and adoption of the revolutionary Java technology and the development of many other hardware and software products.

Jason K. Holt, PhD: Jason serves as COO/President at Heliotrope, leading the company’s financing and industrial partnership efforts. He has over 15 years of R&D experience across academic and industrial environments. He most recently founded NanOasis, a venture-backed startup developing nanomaterials-based water filtration membranes, leading that company through two rounds of venture financing and transitioning the technology from bench to pilot-scale. He is a trusted consultant to the government/venture community on energy, water, and advanced materials technologies, evaluating technical/market risk and business models of startups in these sectors.

Guillermo Garcia, PhD: Guillermo is CTO and co-inventor of Heliotrope’s EC technology. Currently leading prototype development at Heliotrope, his expertise in EC device fabrication and characterization is central to the success of the company. Guillermo holds a PhD in Mechanical Engineering from UC Berkeley. He has additionally obtained a Management of Technology certificate from UC Berkeley’s Haas School of Business in 2009 and a Professional Engineering Leadership certificate from UC Berkeley in 2011.

Delia Milliron, PhD: Delia is a co-founder and the lead inventor of Heliotrope’s EC technology. Currently a staff scientist at LBNL’s Molecular Foundry, she is a leading researcher in solution processed inorganic electronic materials and devices. Her photovoltaic technologies were recognized with an R&D 100 award (2009), have been licensed, and are under development by venture-backed companies. The potential of her EC window concept to have disruptive impact was recognized in 2010 by a Mohr Davidow Ventures Innovators Award. She will consult on technical development at Heliotrope.