

## Hydrogen Recycling Systems and Compressors For Industrial and Energy Applications



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“There are many important advanced energy technologies in varying stages of development out there, and I think that bringing these potentially transformational technologies to market is critically important for our society. I am talking not only about our technology, but the many other incubating technologies that will provide greater sustainability and efficiency in the production and use of energy. Some that are just concepts and ideas today will one day make a huge difference in this world.”- Dr. Trent Molter

**CEOCFO:** *Dr. Molter, would you tell us about Sustainable Innovations?*

**Dr. Molter:** We are a company that builds and delivers products for hydrogen supply, energy storage and CO<sub>2</sub> transformation applications. These products have multi-billion and trillion dollar markets. We provide our customers with solutions that are half the cost of current options. Our first products solve some of the more mundane problems in the world. We are building systems that recycle hydrogen that is used to make stainless steel shiny, make silicon wafers cheaper and to make glass clear. But we are also extending our product development efforts to focus on some very important needs. For example, we can efficiently store energy from wind and solar using our systems. We can purify and compress hydrogen for fueling vehicles reliably and with no contamination by lubricants needed for mechanical compressors. We are working out a way to derive clean hydrogen fuel from biowaste. We can convert waste carbon dioxide into fuels and commodity chemicals allowing us to synthesize new chemicals in brand new ways. Our technology is a platform that can do many different things.

**CEOCFO:** *How do you decide on where to apply the technology?*

**Dr. Molter:** The company is initially focused on addressing near-term hydrogen re-use markets. Industry uses hydrogen for controlled atmosphere operations to treat different materials, such as stainless steel and glass, and wastes most of the hydrogen in the process. We wanted to find a way for manufacturers to recover that hydrogen and save money.

**CEOCFO:** *Are people aware of the waste?*

**Dr. Molter:** They may be aware that they are wasting the hydrogen but, up to this point, they haven't considered any other options. For example,

stainless steel heat treaters would routinely buy lots of hydrogen, run it through their annealing furnaces and simply vent it when they've finished a furnace run. That is the way it has been done for sixty or seventy years. Until now, there has not been a cost effective and reliable alternative, so they never considered that they could potentially recycle that gas and save money.

**CEOCFO: *Would you explain the technology?***

**Dr. Molter:** It is an electro-chemical process that is derived from fuel cell technology. Fuel cells have traditionally been used by NASA as a way to convert the chemical energy contained in hydrogen into electrical energy on board spacecraft, and are now being used for clean transportation in places like California, Japan and Germany. The way that we use the technology is like an electrochemical filter. In the hydrogen recovery system, we feed a waste stream of hydrogen into a stack of electrochemical cells. We apply electricity to the cell stack and the waste hydrogen will break down into its constituent parts, cross through the membrane and then re-combine on the other side into pure hydrogen, which is sent back to the industrial process. In that manner the customer can receive pure hydrogen for his process. The waste gas that we filter out typically contains a host of impurities that has come from the process and we vent those.

**CEOCFO: *What products are available today?***

**Dr. Molter:** We are introducing a series of products to address market needs. We make one unit that recycles 100 kilograms per day of hydrogen and are developing a smaller version as well. There are two target applications for these products. The first is metal heat treating applications such as bright annealing of stainless steel. Second, that same unit can be used in semiconductor applications where silicon wafers are treated with hydrogen in a part of the process called a "fab". In both circumstances, we can capture the waste hydrogen from the process and recycle it. In addition, we are working on a hydrogen compressor based on an evolution of this technology that can produce high pressure hydrogen gas without relying on moving parts. Currently all the hydrogen compressors on the market use mechanical means of compression such as rotating machinery or diaphragms. Often these compressors require maintenance on a regular basis. Our membrane system can compress the hydrogen without any moving parts and in essence, without requiring any significant maintenance for many, many years. That is a big deal for the industry. Not only does it produce a very efficient device but it is also a device that you do not have to go in and take apart every few thousand hours of operation.

**CEOCFO: *Is the industry aware of Sustainable Innovations?***

**Dr. Molter:** Not so much. We are a little over eight years old and have been an R&D company for that period. We support our technology development efforts with R&D contracts. We are just starting to transition to become a product manufacturer. About a month ago, we went through our first commercial financing round with the objective of supporting that transition. With this injection of capital, we are now headed for sequential product releases and are marching along the commercialization pathway.

**CEOCFO: *What is the plan to gain attention?***

**Dr. Molter:** It is interesting because we know many of our customers. I have actually dealt in these same markets before. I created another

company, almost twenty years ago to this day, that provided similar products to these industries. It was a slightly different solution: hydrogen generation systems, but the end users were similar. Our current products complement those of my prior company. We understand the customers' needs, we know a lot about the pathways to market, the distribution channels and so on. We hope to be able to move our product to market through these same or similar distribution channels.

**CEOCFO: *Is timing a factor?***

**Dr. Molter:** I think there are a lot of factors at play. Right now the end users are all being pinched financially, margins are very thin in the manufacturing sector so everybody is looking for an edge. That has made people pay attention to solutions like ours. I think people are very interested in our products as a result. At the same time, people are cautious and want to make sure that our solution is right for them.

**CEOCFO: *Are your solutions easily understandable and do companies see the ROI and effectiveness?***

**Dr. Molter:** We usually have to sit down with them at length and go through a model that shows them the pay-back analysis in order to help them understand the value. It is not the kind of thing where you can drop a flyer on their desks and have them see the pay-back instantly: You have to explain the solution and you have to look at their unique operation and understand together whether this technology is a fit for them or not. It may not be a fit in every situation. Our objective is to find situations where the product solution works for both the customer and our Company.

**CEOCFO: *What is your geographic reach or where will you be starting?***

**Dr. Molter:** We are located in Connecticut and we plan on manufacturing here. As far as installations are concerned, there are a number of customers clustered around this region and the Mid-Atlantic. There are also several customers located in the Midwest as well as in the western portion of the US. That said, there is a lot of interest in what we are doing in Europe. We have been approached by many folks, particularly with regard to our compression activity, from European entities. There is a move afoot to utilize hydrogen for energy applications in Europe as well as in Japan and Korea. We have recently received many inquiries from overseas.

**CEOCFO: *Would you be working directly with the customer worldwide or might you eventually work through partners?***

**Dr. Molter:** It will likely be a combination. If it is the same model that we follow from my prior company, we are going to wind up working both with partners as well as distributors, customers and end-users.

**CEOCFO: *What have you learned from your prior experience?***

**Dr. Molter:** What I've learned is that you always have to work harder to prove value to your customer when you are introducing a product that is brand-new to the market. You want to begin with a customer that is easy to work with and who understands the fundamental value proposition of your new product or technology. It is important to make sure that the lines of communication are open and that you are always there for your customer as issues and opportunities arise throughout the product introduction process. Empathy is an important factor when it comes to

customer relations. You must realize that your customer has put a lot of his own time and capital at-risk to reap the value of your product.

**CEOCFO: *What surprised you throughout the process of developing your company and products?***

**Dr. Molter:** The largest surprise to me was the resilience of the people involved, including employees, partners, customers and investors. As you are introducing products, the process can, at times, feel like an emotional roller coaster to the people. You go through some difficult times and some very good times. You tend to develop a core group of people that will absolutely go to the mat for the company no matter what. It's important to recognize those people early on and they become the backbone of your company.

**CEOCFO: *Why is Sustainable Innovations an important company?***

**Dr. Molter:** Energy and its impact on the environment is the #2 problem in the world today. Water is the #1 problem. Our technology provides a solution to this global resource constraint. I have talked mostly of the initial hydrogen recycling product that we plan on releasing but as we move forward we are focused on energy storage systems that address the integration of renewables into electricity grids, which is going to be extremely important as we meet the needs for a global energy economy, and a system to recover waste CO<sub>2</sub> to turn it into fuel and other resources. These are two technologies that are going to be a critical part of our energy future.

**CEOCFO: *Final thoughts?***

**Dr. Molter:** There are many important advanced energy technologies in varying stages of development out there, and I think that bringing these potentially transformational technologies to market is critically important for our society. I am talking not only about our technology, but the many other incubating technologies that will provide greater sustainability and efficiency in the production and use of energy. Some that are just concepts and ideas today will one day make a huge difference in this world. Finding ways to move them forward is imperative.

