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The challenges of global warming and energy security present extraordinary opportunities to grow new industries and to remake our industrial society in a sustainable form. Not since JFK marshaled us go to the moon have we had such a clarion call to our young people to do well while doing good and they have heard this call on their own. The opportunity to energize generations of engineers, scientists, business leaders, builders, and policy makers is precious.

As an engineering graduate in 1976, I was motivated to work in solar energy by the oil embargoes of the early 70s. Fortunately, the opportunity was there. I was hired onto a DOE-funded program at a photovoltaics company and within two years I knew what I wanted to do with my professional life. The term photovoltaics refers to the direct conversion of sunlight to electricity using semiconductor devices – that is, with no moving parts. I'll use the acronym PV.

I returned to MIT for a PhD in engineering and invented a new technology for making PV wafers called String Ribbon. String Ribbon is now the core technology of two companies. One of them, Evergreen Solar, is a NASDAQ listed US company that employs approximately 1000 people at its R&D facilities and manufacturing plant in Massachusetts. But along the way from lab to public company much time was lost due to a lack of resources. In fact, String Ribbon lay fallow for 8 years beginning in 1986 when oil prices dropped precipitously and PV funding dried up.

On Sept 12, 2001, I turned my MIT research program fully to renewable energy. This was my personal reaction to the events of 9-11. My students, staff, and I created three new technologies in PV. In 2007 I co-founded 1366 Technologies to take these inventions from the lab at MIT into industry. We are now 25 people working to change the energy landscape, and we are one of 150 solar startups in the US.

This chart captures some of the history of PV and the rationale behind our company. It is centered on wafer-based silicon PV, which accounts for approximately 90% of product sold. The chart shows the cost of electricity from PV installations graphed against the cumulative production of PV panels. It covers the period from 1978 - when solar cells were used in space - through today, and projects forward to 2020. What we see is a steady decline in cost with production. This is a classic learning curve of the type that characterizes most manufacturing enterprises. The cost reductions are achieved in part by economy of scale. But in PV, the major contribution is a succession of technological advances which act cumulatively to reduce costs dramatically. This situation is similar to the sequence of developments that has kept silicon the dominant material in microelectronics for over 30 years.

While PV is already economical in some markets without subsidy, in a few years unsubsidized costs will drop sufficiently below the price of electricity from natural gas that we will reach grid parity while still allowing for sufficient profitability to sustain growth. Continuation of the current 35% annual growth rate through 2020 will get us to parity with coal. At that time, PV will satisfy 7% of global electricity demand. Storage technology to compensate for intermittency will become necessary by 2025. Once this storage problem is solved, PV will become the largest manufacturing industry in history.

PV modules are simple, attractive products with proven field reliability, and they are made mostly from sand. The challenge is to bring the cost down. Our aim at 1366 is to contribute key innovations in the march of PV to grid parity.

For example, today, the highest cost step is manufacturing the silicon wafers that cells are built on. Cast blocks of silicon 6" wide and 12" long are sawn into wafers using a process which is itself expensive and which wastes half the silicon and half the cast brick. The wasted portion ends up as un-reclaimable dust. At 1366 we have a new process for directly producing high quality silicon wafers with no sawing and no surface treatment required. This single step can save 30% of the cost of making a PV module.

From my experience, the biggest issue facing the rise of PV as a global energy source is consistency in funding and in the economic landscape. For example, after a few strong years, the venture capital community has drastically cut back on funding for PV. The current credit crunch makes it difficult to finance the multi-megawatt installations that are central to the future of PV. Federal funding for R&D has been up one decade, down for two and is now beginning to recover. What I can say is that the up and down federal funding cycle has enjoyed strong bi-partisan support.

Mr. Chairman, you also asked for thoughts on policy. I am not a policy expert or even amateur. But I note that changes in energy infrastructure take decades and I can suppose that a primary goal of effective policy should be to smooth out the wild fluctuations which have plagued the development of PV. It would be helpful to provide more support when fossil fuel prices are relatively low and allow the private sector to carry more of the weight when they are high – the exact opposite of the natural tendency.

Thank you for your attention.