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Thinking as Big as Big Oil

This is not a technology talk, this is an implementation talk. I work in what is fondly known as downstream solar. And we all know what flows downstream. While you've heard a lot today about how we're going to manufacture the next best solar product, or how the grid is going to accept solar, I will talk today about how we are going to scale solar, both upstream and downstream.

I cannot blame Al Gore for my being here, but I can blame Bill McKibben. It was Bill's writing that finally made me wake up and smell the carbon back in 2001. I also can't even blame Al Gore for my current aspirations. It was in a magazine article, I've forgotten which, but various pundits from all walks were asked to give Gore some unsolicited advice in his quests for beating global warming. And one of them was titled "Think as Big as Big Oil". So I cut out that paragraph heading, and I've got it taped to my telephone. I see it all day long.

I need to interject at the start here that we're in a vortex. The updraft currents are huge, chiefly the change in administration, but also the recently passed ITC, the now-decreasing cost of PV modules, and the general societal recognition that global warming is a huge problem we must address now. The downdrafts are obvious, the economic mess resulting in the tightness of credit and general shell-shocked attitude and behavior of much of the business world, and decreasing energy prices. And then there is what I call the cross-current, the revaluation of the Euro. (Was $1.65/Euro, now $1.25/Euro.) This vortex can make it difficult to plan, and difficult to move. But we cannot wait for the vortex to abate, we must move now, work within the vortex and use it to our advantage

The solar industry is having yet another year of great growth in the United States. We'll install something like 400 MW in 2008 throughout the country, up from something like 280 MW in 2007. Not bad, an increase of 43%. Roughly, it means that the US solar industry has about $3 Billion of revenue. That's a lot of Twinkies. It's also less than ExxonMobil. In fact, it's less than TWO DAYS of ExxonMobil's revenues; just

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ExxonMobil's -- not the entire US oil industry. It's also less than spending in the US on:

- Mother's Day ($15.8 Billion) {About.com}
- Father's Day (sorry Dad's, only 9.9 billion) {About.com}
- Valentine's Day ($17 Billion, boy do I feel cheap!) {CNN.com}

Put another way, the entire US solar PV industry, if put into a single company, would not qualify as a Fortune 500 company. Too small. It seems we have a long way to go to get to 'As Big as Big Oil'.

Recently, I was at the Solar Summit in Phoenix. Most of the solar industry's major companies, as well as many of the top advocacy groups, gathered to discuss what our policy objectives should be moving forward. We'd just won passage of the extension and expansion of the Investment Tax Credit, a huge win, and now needed to ask ourselves "what next". As preparation for the Summit, we all were asked to submit our industry projections for how much solar PV (and hot water and CSP) would be installed, on an annual basis, in 2020. I spent some time thinking about this, as did others. The Mode (meaning the most common answer) of the answers submitted was 10 GW of PV installed annually as of 2020. That puts our industry, in 2020, at the $40 to $50 Billion level. Thankfully we'll have passed, probably, Valentine's Day. Unfortunately, we'll not have surpassed Christmas. Even this year, where the experts are predicting that spending will be cut in half, shoppers will spend over $80 Billion, down from what would have been over $160 Billion. {American Research Group, USAToday.com}

So 10 GW does not strike me as thinking as big as big oil. It strikes me as thinking small.

I predicted a more robust and some would say adventurous number. I predicted 125 GW of annual installation in 2020. Mine was not the highest submission, but I was awarded the 2020 Solar Vision award by SEIA. While 125 GW, 250 times our current level of installations, may seem impossible, it is not. To get there we need aggressive, but achievable growth rates of 80% for the next five years, then a growth rate of 50% until 2020. Or, a straight line growth of 67% from now until 2020. Tough, but not unparalleled.

If we do this, get to 125 GW of annual installations, then we will be at a revenue level of a bit more than ExxonMobil. We still would not be at the level of the combined US oil companies (unless they have shrunk by then, or increased because oil is so expensive), but we would be in the same league. And we would be truly contributing

in the fight against climate change. And I, for one, am not in this game to play; I'm in it to win -- to accomplish our mission for our company, for our country, and for our planet.

There is the often talked about comparison to the Apollo project. The chief similarity there is that Apollo was a focused effort of national will, and stable and continuous backing by the government. Really very significant and relevant to our situation. But they did not really build too much. Another example, with a lot more construction and manufacturing involved is the cell phone industry. Went from nothing, to "can't get it out of my hand" in less than 20 years in the US. From 1996 to 2005, the cell phone industry had a Cumulative Annual Growth Rate of 50%. And Toyota Prius. From 2001 to 2006, sales of those fuel economizing and "ultra stylish" "performance" cars have grown at 58% cumulative.

So, how do we do it? How do we create the demand, and the supply, to grow to become significant? How do we get as big as big oil?

Take an average new PV manufacturing facility; let's assume something like the new Evergreen facility in Devens, MA. It's a 160 MW facility, meaning that it will produce, in one year, PV modules with 160 MW of peak power production capability. The plant has been built in phases over two years, primarily due to cash flow and PV market uncertainty. Let's compress construction into one year, which they have shown they can do. And this is a fact that surprises some people… we can build PV manufacturing fast because we can build multiple plants at one time, and because plants keep on getting bigger. So that 160 MW facility will manufacture 160 MW of product every year from now on. Understand also that the Evergreen plant takes in refined polysilicon, and manufactures finished PV modules. It is fully vertically integrated under one roof. But this model works whether or not manufacturers are vertically integrated. Industry average cost for a plant, from wafer fab through module assembly, is about $2/watt, for a total cost of $320 Million for our sample plant at Evergreen. We take that 160 MW and we install it someplace average, like Long Island, and get 1300 kWh/kW every year, for a total of about 208,000 MWh/year.

Fortunately, Evergreen is not the only company building PV manufacturing plants. Let's start with a somewhat arbitrary, but close to real world number and say that in 2008 there were a total of 500 MW of PV manufacturing plants constructed. Remember, this can be crystalline, polycrystalline, string ribbon, or any flavor of thin film. For our purpose here, PV is PV. Now, in 2009, let's build a second round of manufacturing plants. To meet our target, we do not need to build another 500 MW,

we 'only' need to build another 335 MW. And of course, the product that was installed in the first year is still creating electricity. Do this every year:

- Build 67% additional manufacturing plant. (So 2010 is 560 MW, 2011 is 935 MW, 2012 is 1.5 GW and 2013 is 2.6 GW. Basically we are applying Moore's Law to manufacturing ramp up of PV.
- Install the product produced by all the plants each year (an ever increasing number). By 2013 we are installing 6.5 GW per year.
- Keep operating the plants that have been installed (not much to the operation)
- Decrease costs by 5% per year for the first ten years for both manufacturing and installation.
- Total installed capacity by 2013 years is about 15 GW.
- Total annual manufacturing / installation capacity is 6.5 GW
- Total annual energy production is about 8500 GWh/yr …conservatively…that's what eight and a half 1 GW nuclear plants peak at.
- These plants most likely either do not require transmission upgrades, or they can piggy back on another line during the day.
- By 2013, we've invested about $90 billion in this plan.
- By 2013, we're at grid parity, and there is no incremental cost to adding more solar.

Just as important as the cost though, is the fact that this example shows that we CAN scale up solar as fast as other options, potentially faster. I don't know of any nuclear or 'clean' coal plan that delivers this much generating capacity, peak or base load, in this little time. We CAN make a very large amount of our electricity from solar PV (and other solar sources), and we CAN make solar into a major job creation engine along the way.

What we need is the WANNA.

Of course, some would say we need the money. I say we have the money if we have the wanna. We are talking about $100 billion or less to get to grid parity. And not all of that will be public money. Probably less than half of it is public. That's a minor investment compared to, well, compared to almost anything these days. The auto companies want $25 Billion, and really that is only to tide them over to March of next year. The loan guarantees, insurance subsidies, and other benefits that the nuclear industry has received for its first 8 reactors (so their first 8 GW as compared to our first 8 GW outlined above) is staggering, though better hidden than the solar subsidies.

So we know we have the money, we just need the will to spend it in the right place. Frankly, $50 Billion of public subsidy over a five year period, a combination of state and federal funding, is compared to the benefit, small. So let's not shirk away from it when we're going to our legislatures and the US Congress. As a fundamental part of the birth of the new economy, this investment will create good US jobs and careers for the future, most of which cannot be outsourced to other countries. So we can move toward solving the economic crisis, the energy crisis, and the climate crisis, with a single expenditure.

I should stress that the $100 billion price tag is NOT just for the manufacturing capacity I've described, but also for the capacity to install it.

While a large task, we can understand how to scale manufacturing. We've seen it done before so often with consumer goods. What is harder to understand is how do we get all these projects installed. After all, at 6.5 GW of installations per year in 2013, we will need to be installing the following projects:

- 300,000 4 kW homes
- 10,000 200 kW businesses
- 250 5 MW utility systems
- 20 100 MW large utility systems

LOTS of Systems!

But let's establish some context. These are not actually big numbers.

- About 4 Million homes get re-roofed every year. Re-roofing is a bigger project than installing solar.
- The industry is already installing hundreds of businesses in a year. Think of how many new buildings are built, or how many HVAC retro-fits or how many commercial re-roofs there are in a year.
- There are about 3300 utilities in the US. One in 10 needs to do a system of this size each year. Certainly many will do more.
- The industry has done no 100 MW PV systems to date, but several have been announced or are on the drawing boards.

The solar industry needs to stop being impressed with ourselves at how fast we are growing, and start looking to outside construction industry for models. And then we need to improve on those models, because as we move past grid parity, we actually do start doing a lot of systems, quickly, and we actually do scale the industry to a size and capacity unmatched in construction. But it's still construction.

Innovation in construction is almost an oxymoron. So much construction is performed just as it was 20, 30 years ago. The IT revolution has not been embraced. This needs to change.

By creating a model of project delivery rather than project installation, we can greatly streamline and optimize the process. Of course, construction folks say that there are too many variables, that you cannot simply deliver a project, you have to install it, and that each job is too different. I simply happen to disagree.

Imagine the complexity of delivering a package to the other side of the country, over night. Problems you might run into:

- Incorrectly enter the address from the handwritten label
- Put it in the wrong bin
- Put the wrong bin in the truck
- Flat tire on the truck, or other mechanical problem
- Sick truck driver
- Bad weather on the roads
- Put bin in wrong plane
- Sick airplane pilot or copilot
- Mechanical problem on the plane
- And all these problems again on the receiving side until it gets to your door

Granted, there are problems in package delivery, especially if it actually is really critical! But the fact is that FedEx has a success rate of over 98%. Modern information technology can recognize the glitches that WILL occur, and create pre-designed ways around them. Of course, this does not work without scale. Given scale, we can create a construction industry that 'delivers' our systems to homes and businesses quickly and profitably (and I mean turnkey installation). We need to:

- Standardize
- Create on-line sales and closing methods
- Master-schedule engineers, supervisors, crews and product
- Think like a delivery company
- Put IT on the roof, as well as in the warehouse and on the truck
- Reinvent construction

groSolar is working to do this. It obviously takes time and money, but we are mapping the way and starting to implement items.

So I started this with my vision and prediction that in 2020, the solar industry will be installing 125 GW of PV in the US each year. I have laid out some strategy and plans for how to accomplish this goal, which I consider both immanently achievable and critically necessary. I need to add two points:

First, groSolar has established a track record of making plans and achieving them. While this is an industry goal, not a goal that groSolar will meet alone, I state that we will be placing the same energy toward meeting this overall goal that we do to meeting our own goals.

Second, we need to understand that we are at an historic time. An interesting thing about historic times is that it is a time when things do not happen according to what has happened in the past. It is a time when looking back and planning from a historical perspective does not allow us to achieve our necessary goals. It is a time, in fact, when history-based planning will result in failure. As we look at the financial markets, as we work to rebuild them, and as we speak to investors about the future of solar and the path to profitability, we need to be clear that this path may not look like historical paths. Make no mistake, I'm talking about and planning for hugely rapid growth. At no time in our history has a CONSTRUCTION industry grown so fast. At no time in our history has Venture Capital been required in Construction like it is now. So we need to educate and convince our financial partners that in downstream solar particularly, some of the metrics, rules, and planning of the past are not appropriate. The scaling of the industry will require capital for more years, delaying payouts. This is not an excuse for bleeding capital, as some are doing, but it is an argument for revenue, not profit, based investing for the near term. And it is an argument for investing in downstream solar, distribution and construction, which is unfamiliar territory to most.

As I mentioned in my introduction, we're in a vortex right now. This vortex can make it difficult to plan, and difficult to move. But we cannot wait for the vortex to abate, we must move now, work within the vortex and use it to our advantage. This is not a time to repeat history; this is a time to **make history**.