

Clean Tech: A Long Term Buy Opportunity?

A Report from the 9th Annual Clean Tech Investor Summit

Executive Summary of Key Insights

- A changing of the guards? As traditional VCs are retreating from clean tech, Corporate Venture Funds are becoming more interested and active in this space; they are well positioned to take innovations from early concept to pilot and large scale commercialization.
- B2C and B2B markets: Few clean tech products and businesses are as intuitive and tangible to consumers as Tesla's cars, SolarCity's value proposition and products from Nest. However, the majority of clean tech companies continue to focus on the B2B markets with higher complexity and longer sales cycles.
- Business model innovation: Business model innovation for clean tech is as important as technological innovation. This includes where and how innovation is developed, as well as how it is brought to market, but there are inherent challenges from technological and market uncertainties, and some business models have been less successful than others.
- IT and big data have the potential to transform some aspects of clean tech, involving energy exploration and production and the smart grid.

• Leapfrogging the U.S. for China and India? More clean tech companies are going to China and India to prototype and commercialize their technologies. They are bypassing the U.S. for economies that have a more acute need, higher risk appetite, greater government investment and fewer regulatory constraints.

Industry Challenges

The recent macroeconomic situation has not favored clean tech. The Euro-zone crisis has decreased support for clean tech, while lower growth in Asia and the unrest due to the Arab spring in the Middle East has negatively impacted many industries, including clean tech. The U.S. financial crises and resulting economic recession, along with spectacular collapses such as Solyndra and A123, resulted in lower investments in clean tech-as much as 33% lower, with the industry losing 55% of its valuation. U.S. federal clean tech investments are down by \$44 billion over the past four years. Investments in clean tech are now focused on late stage and more mature technologies, creating a "valley of death" for new entrants.

The Long-term Need for Clean Tech is Real, Especially in Emerging Economies

The clean tech opportunity remains real. Energy demand will continue to rise due to increasing numbers of people entering the middle class and nearly 70 million in annual worldwide population growth over the next several decades. Current worldwide demand for energy is 12 billion GWh and is estimated to increase to 54 billion GWh by 2050, thereby creating a \$37 trillion opportunity in the energy industry.

Energy is connected to immediate short-term issues, such as pollution in China and the lack of reliable power in much of the emerging world. Beijing recently experienced one of its worst pollution levels ever; about 10 times as bad as the worst days in Los Angeles in the 1990s. Pollution is estimated to cost China over \$100 billion, and the Chinese government is determined to take action. India experienced the largest blackout in its history last year, with over 600 million people without power for days. India is estimated to become the world's largest net importer of coal by 2020.

Energy and Clean Tech— Does it Fit the VC Model?

Some of the first clean tech funds have passed their 10-year anniversaries. The sector's track record is less than stellar, and it is time to ask some tough questions. There have been few successful exits, a number of significant collapses, and several clean tech funds are operating with negative overall returns. VCs are becoming increasingly reluctant to invest. Is the energy and clean tech sector a natural fit for VCs?

Several factors suggest otherwise. Unlike many sectors, moving a technology in clean tech from successful bench-scale to prototype plant or pilot can require investments over \$100 million take several years to build, and still fail. This "revelation" is beginning to sink into the VC world. Very few clean tech products are as tangible as a sleek Tesla car or Solar City's simple and compelling business proposition. This is why Tesla and Solar City will remain the exception to the rule of difficulty in raising large amounts of money for much more complex and B2B oriented clean tech technologies or business models. The energy and clean tech sector's economies of scale and time help explain the often cited valley of death and limited success of VCs so far.

Will there be an exit opportunity for clean tech VCs and their startups in the long run? As VCs are retreating, strategic players and Corporate VCs are increasingly entering the game. Their large balance sheets, long-term strategic and return horizons, and their vast installed infrastructure are excellent complements for cashstarved clean tech startups looking for long life-cycle prototyping and commercialization support. There are many clean tech startups and few strategic players. This match up is shaping up to be a buyer's market.

Opportunities

Some major elements of the energy industry—for example, power generation—have historically not been innovators. Industry R&D spend of less than 3% of revenues compares unfavorably with other industries that are seen as innovators, such as biotech (19%) and software (14%).

The opportunities for innovation in clean tech and the energy sector exist across the value chain:

• Exploration and production of traditional energy sources, such as hydraulic fracturing and horizontal drilling, and non-traditional sources such as hydrates. While we need to learn more about

environmental impact and address related concerns, these technologies can alter clean tech competitiveness.

- Advances in renewable sources of energy, such as the continued decreasing cost of solar.
- Distributed deployment of renewable energy.
- Optimization in the storage and transport of energy, including the smart grid and technologies such as batteries and ultra-capacitors.
- Smart utilization and more efficient end use application of energy in commercial and consumer applications, such as LED, smart controls (e.g. Nest), and new business models (e.g. Solar City).
- The application of data analytics across the value chain, such as the coming together of IT and energy to optimize at every point and improve efficiencies, such as smart grid infrastructure.

Learning from Success Stories—Tesla Motors

Tesla has succeeded in forming an unlikely alliance between two cultures, that of Silicon Valley and Detroit. In November 2012, Motor Trend named Tesla's Model S Car of the Year, from a field of 11 finalists that included the Ford Fusion, Porsche 911, and the Hyundai Azera. The Model S is the first electric car to win such an accolade, and the judges' decision was unanimous.

The reason for Tesla's success includes a number of factors such as:

- Innovation: Tesla has innovated on many different dimensions in engineering: motors, power electronics, charging and also within the business system such as distribution.
- Team: Focus on melding the best talent of Silicon Valley and Detroit.

- Partnerships: Early partnerships with Daimler, Toyota, and Panasonic enabled it to quickly acquire expertise that it may have otherwise struggled with. Toyota's assistance has proven crucial in the industrialization of the Model S.
- Perseverance and belief in their mission: Tesla set out to simply build the best car—and not just the best EV or best car in its class.

Tesla believed that a blend of innovation and design would be critical to gaining consumer acceptance and that innovation had to come first. It believed that a vertically integrated strategy would be best, with full control over critical components such as power, battery, and electronics. As a result, it has improved battery technology by 7% to 8% every year, and

MODELS

Business Model Innovation and Ecosystems

Business model innovation for clean tech is as important as technological innovation. This includes where and how innovation is developed, as well as how it is brought to market.

Innovations such as hydraulic fracturing could change the energy landscape by significantly lowering the cost of natural gas, and this in turn, could impact the manufacturing ecosystem, bringing it closer to sources of cheaper energy. There are three major externalities that impact manufacturing: demand for goods, access to capital and resources, and access to talent. It is possible that we scientists and engineers from different disciplines, organizations, and sectors to work together to solve the country's energy problems.

Partnerships between emerging startup companies and corporations can also improve and foster innovation. Viable supply chains are critical for corporations to build robust solutions and startups looking to partner with them must prove capability in supply-on-demand as well, not just technology. To work together, they need to understand and align to each other's objectives.

Real-world Examples

Examples of business model innovation in reaching end consumers and application markets include Solar City and Better Place. However, companies such as Better Place also highlight the inherent challenges in driving business model innovationthere is technological uncertainty, and gaining traction is proving to be very difficult.

Better Place (electric vehicles market): Founded by Shai Agassi, Better Place believes that electric vehicles have not taken off yet as the consumer value proposition was built on an environmental value propositionconsumers had to pay more for the vehicle, sacrifice convenience, and benefit from improve mileage. However, this missed what the mass consumer market desired. Better Place seeks to provide what the mass market wants: to buy the most convenient and affordable car while not paying more than the typical cost of gasoline to drive it.

these seemingly

incremental innovations can make a huge difference after 10 years. This is evidenced by the fact that battery technology has improved 40% from the Roadster to the Model S. Other innovations include a "super charge" network that is comprised of infrastructure and equipment in the field for support. Model S customers receive this support for free, and Tesla is focused on rolling the infrastructure out of the city where extended driving ranges for road trips may mean inability to plug into a home garage. may see a resurgence in manufacturing in advanced economies, especially North America, if the access to resources, especially energy, eases in the future.

The U.S. Department of Energy (DOE) is focused on creating partnerships that will enable this. The Advanced Research Projects Agency—Energy (ARPA-E), since its founding in 2009, has funded over 275 potentially transformational energy technology projects in areas as diverse as battery technology, transistors, storage systems, and bio based fuels. ARPA-E encourages Better Place offers consumers a leased vehicle battery. They do not have to purchase the battery up-front, saving them as much as \$10,000 or more on the vehicle purchase price. In return, consumers pay a monthly service fee, fixed at either \$300 per month, or variable at \$0.15 per mile, which guarantees them access to a vehicle battery when and how they need it. Battery swap outs are done at Better Place EV battery stations.

According to Better Place estimates, energy density, cost per KWh, and life-cycles for batteries tend to improve by 15% every 18 months. This enables them to benefit through an overall reduction of 50% in the battery cost per mile every 18 months. Consumers benefit by saving on the cost of the EV battery (as much as \$10,000) and therefore are able to trade up and buy a better car.

However, the value proposition and viability of this model is still in question, unproven, and hotly contested by many. There are several reasons for this: (1) The model requires a trade-off-consumers will have to pay a monthly service charge (in the \$300 range), while forfeiting the ability to charge for lower cost at night in their own home or garage, and (2) There is no agreement on battery technologies and realistic improvement trajectories, and (3) Many EV OEMs are not yet on board as partners; this endeavor depends on strong ties with OEMs. These could result in a limited or niche adoption for the Better Place business model, such as taxis or vehicles that are on the road for a significant amount of time, where charging time can result in loss of revenue. Further, improvements in battery technology and cost over the longer term may nearly completely erode the value proposition.

Solar City (residential solar market): Solar City has successfully pioneered an energy provider business model



in California, where they sell electricity and lock in electric rates for residential use for 20 years. The business model leverages leases and state tax incentives to offer the customer lower electricity rates from day one without any up-front investment. Solar City does not rely on feed in tariffs to utilities as this can result in low pricing due to utility buying power. Solar City has ambitious growth goals nationally, and believes the business model is easily replicable internationally, beginning with island nations, who face inherent difficulties in power generation and are usually ideally suited for solar. Any market with oil-fired generation on the margin is a contestable market for Solar City.

Solar City believes the cost of solar panels is no longer a limiting factor; it has dropped from as much as \$4/ watt a few years ago to now \$0.60/ watt. Their main challenges are the balance of system cost (installation, conversion, circuitry, etc.) and consumer adoption. Balance of system costs have proven stubborn in resisting reductions. Solar City's unique business model of vertical integration allows them to roll out improved installation systems and processes and capture these benefits at scale. Their customer acquisition costs are high, as much as \$2,500 per customer, while the typical utility only needs to spend \$17 per

customer. A huge opportunity exists for a solar service provider to lower customer acquisition cost by realizing economies of scale. First, they must determine how to take advantage of increasing mass market awareness of solar and build their brand.

Solar business models in emerging markets include micro-grid solar and selling prepaid electricity, similar to the model of prepaid mobile.

IT and Energy—the Big Data Opportunity

Opportunities to improve efficiencies and optimize systems exist across the energy value chain. Opportunities are currently seen in smart grid applications for both utilities and consumers. Utilities in 39 states have been mandated to provide up to \$10 billion in energy efficiency rebates and incentives. PG&E is a leader in this area, pulling together over 19 different and disparate sources of data to create a "360 Degree Surround Sound" multi-channel marketing approach. The value proposition for utilities is significant; a study by C3 Energy and McKinsey puts a total savings potential of \$10 to \$12 per customer year from monitoring misuse, outage analysis, to demand side optimization.



Specific opportunities in data/IT in the energy industry include:

- Energy infrastructure security
- Monitoring technologies and equipment
- Employee safety and monitoring
- Analytics
- Predictive maintenance

U.S. Government's Top Areas of Investment in Energy

Grid resilience and modernization: As the power outage during the recent Super Bowl demonstrates, and impacts from Hurricane Sandy have shown, there is a significant need to modernize the electric grid in the U.S. There is also a pressing need to improve cyber security and integrate renewables into the grid.

Natural gas: The tremendous advances in technologies such as hydraulic fracturing have created an opportunity possibly to export natural gas or liquefied natural gas. Research on methane hydrates will be a top DOE priority.

Solar: The government would like to see a continued decrease in the cost of solar. The DOE's SunShot program is a collaborative national initiative to make solar energy competitive with other forms of energy by the end of the decade. There will be a continued focus on lowering the cost of installation, providing financing, and refining utility business models in solar.

Electric vehicles: EV Everywhere is part of a plan from the U.S. government that includes advanced power train development and the reduction of gas-powered vehicle use over the next decade. The plan has been expanded to include workplace charging.

High performance computing and big data: Researchers see advanced supercomputing as a critical enabler in the development of new production and conversion technologies. This includes all components of the value chain, from exploration (seismic processing) to production (new stimulation technologies) to use (gas-to-liquids conversion).

Clean energy finance: Programs such as the Department of Energy's Loan Guarantee Program were developed to help renewable energy projects cross the "valley of death" and will play a key role in spurring commercial investments in innovative technologies.

Eye on China

China's role in the clean tech industry is tremendous. It is the largest solar panel manufacturer and has the largest wind testing facility in the world. Its priorities include cleaner coal, as well as the ability to harvest its large reserve of shale gas. China continues to invest in the energy industry worldwide, including in the U.S. and managing U.S.-China relationships, including energy, is therefore of vital importance.

Solar and Renewables vs. Fossil

In the past, the solar market has been highly concentrated with 6 markets providing nearly 80% of demand. These markets have seen an inverted V pattern: rising at program start, growing due to generous subsidies, and declining as politicians got alarmed by volumes, and flattening out due to political action. This was further exacerbated by solar panel manufacturers starting to add capacity at market peak thinking demand would continue to grow, and nonprice constraints such as transmission capacity and grid connectivity issues. Solar seems to follow the traditional boom-bust cycles of capital-intensive manufacturing and conversion industries such as oil refining, steel and others.



The long-term outlook for solar depends on the global macroeconomic situation (GDP growth) and the price for hydrocarbon based energy. Opportunities for solar include:

- Continue to move to "grid parity" in terms of costs and developing new business models. However, the term "grid parity" is vague as it depends on factors such as the market, location, season, time of the day, etc.
- Rural electrification in emerging and developing regions such as India and Africa. There is an 18-month payback for solar when it displaces liquid fuel such as kerosene.
- Managing off-grid demand through solar can be cheaper and faster than connecting that demand via transmission lines to central generation stations.
- Mining industry—30% of their cost is electricity, however, they have been skeptical of solar as they need 24x7 reliability; this represents an opportunity for the solar industry to innovate on the business model to provide reliability.

Interaction with fossil-based fuels: Today's battery storage systems are not good enough to provide reliable systems and in the U.S., natural gas could be a fuel of choice as a backup.

Water-energy nexus: There is a huge opportunity to reduce the amount of water used in and limit environmental impact of energy production and use. Conversely, there is also a significant opportunity to improve the energy efficiency in extracting, filtering and transporting water.

In shale gas, there is an opportunity to recycle water and use it to produce energy. Re-use of water (especially grey or non-potable water), sewage processing and waste management could provide energy and other valuable resources.

"The Opportunity of 1%"

If clean tech can impact 1% of overall energy use, it is still a material opportunity at \$300 to \$500 billion. This shows the magnitude of the opportunity and is the long-term incentive for the industry to continue to innovate. Even incremental opportunities will be material.

Clean Tech and You

Whether you are an energy company looking to invest in clean tech, or a clean tech company looking to grow and scale your business it is beneficial to explore the following questions:

- Is clean tech viewed as a challenge or opportunity in your industry and within your company?
- How can you turn clean tech into an opportunity?
- What are the relevant futures for your industry against which you should develop your clean tech strategy?
- How can you create a clean tech portfolio that addresses your short, mid and long term goals and strategies?
- How do you develop a go-tomarket strategy and create a scalable clean tech business?

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Our clients seek out Clareo when they're looking for bold new ideas, outside-in thinking fueled by a network of leading global experts, and plans that are grounded in reality.

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