Lynx
Investment Advisory

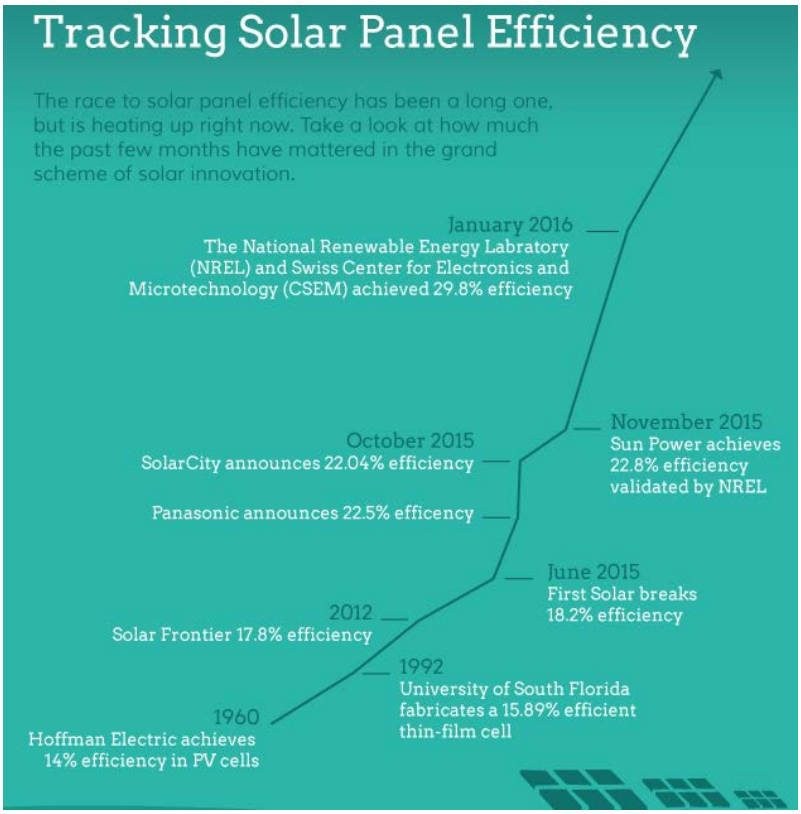
**A Promising Technological Future and Possible Investment Implications**

At Lynx we strive to anticipate changes and ascertain their impact on capital markets. As we look at the world around us, we see many remarkable technologies on the cusp of potentially resolving some of the biggest environmental concerns we collectively share. This paper is designed to highlight a few technologies likely to impact our lives over the next ten years, while providing a platform for further discussion around their potential effects on our investment landscape.

At the root of the technologies discussed below is the issue of climate change. Scientists believe climate change is a direct result of increasing carbon emissions. Given our understanding today, we believe there are four distinct technologies being designed that will reduce carbon emissions over the next ten years, consequently revealing profound investment implications. The four technologies in question are solar power, storage batteries, autonomous driving and electric vehicles. To follow is a brief description of their development to-date, as well as our expectations for their future impact.

**Solar Panels:** According to the EPA, human activities that involve burning fossil fuel for electricity, heat, and transportation are the primary drivers of carbon emissions. Approximately 30% of carbon emissions are caused by generating power at the grid using fossil fuels. Coal and natural gas have become the choice fuel for power production. Though solar technology is not new, its costs and reliability have prevented utility companies and households from embracing it. Recent advancements are allowing for both the efficiency solar panels and their associated costs to undergo exponential change. Solar panel efficiency is measured by the amount of light it captures, which is then converted to energy. Earlier in their evolution, solar panels were only 14% efficient, prohibiting wide use. But since 2015, driven by new investment, efficiency has taken a big leap (see Chart 1) and solar panels now achieve efficiency of approximately 30%. Similarly, the cost of a solar panel installation ten years ago was $8.80 per watt, while today the price is down by over 60% to $3.30/watt. This price decrease is the chief reason many homeowners are increasingly installing solar power systems. For a standard 6 kW system the gross price has dropped from $52,000 to $20,000. Subtracting the current 30% federal tax credit, the price drops to $14,000 for a solar energy system that can power most, if not the entire home.

Chart 1




Source: Energysage

**Storage Batteries:** Similar to the developments in solar panels, storage battery technology is also developing rapidly. Initially, solar power was not considered reliable as it was dependent on the availability of sunlight, so cloudy days and/or nighttime required a return to the grid. This changed in 2016 when Elon Musk's Tesla launched Powerwall 2, a battery pack with the ability to store electricity generated from solar panels, subsequently allowing for use at night. This development fueled the demand for solar plus storage solutions. Apart from daily use, homeowners can now have a clean back-up supply, which can be accessed during any traditional grid power outage. The cost including installation for the Powerwall 2, which Tesla claims can power an average home for seven continuous days when combined with a traditional solar power system, is approximately $8,000. This price easily competes with the cost to install an automatic back-up generator, which incidentally requires regular maintenance, is noisy and uses dirty fuel, while the Powerwall 2 is maintenance free.

In summary, solar plus storage solutions have the potential to completely revolutionize how electricity is generated both at the utility company and household levels.

**Electric Cars**: Electric technology or battery powered cars are not a new technology but have captured the public's attention following Tesla's launch of its model S in 2012, which *Consumer Reports* certified as being the best car it had ever tested. The key to a successful electric car is the efficiency of the storage battery and hence the recent domination of Tesla, although other manufacturers are catching up. The new Chevy Bolt, after a $7,500 tax credit, is priced below $30,000 and has a range of 250 miles. Volvo recently announced that all of its cars will have electric or hybrid engines by 2019. The Economist magazine had a cover story following the announcement, which aptly proclaimed, 'the death of the internal combustion engine'. According to America's National Resources Defense Council, today's electric cars reduce carbon emissions by 54% when compared with the traditional gasoline powered vehicle. This percentage is likely to rise as both the efficiency of charging a car, as well as the generation of greener electricity, grows and improves. New electric cars will likely have a better range and a faster charge process in the near future.

**Self-Driving Cars**: Recently SAE International (Society of Automotive Engineers) and NHTSA (National Highway Transportation Safety Administration) defined levels of automation for autonomous vehicles. Each succeeding level from zero to four adds increasing autonomy. Many vehicles currently on the market are already at level two autonomy, meaning the vehicles can combine adaptive cruise control with lane centering technology. In addition, many car manufacturers and some new entrants such as Google's autonomous vehicle division Waymo are testing level four self-driving cars, which operate without any safety driver, with all functions fully automated. According to Waymo, in just one year from 2015 to 2016, the frequency with which their emergency drivers had to intervene or engage on test roads fell by 80%, engaging on an average only once every 5,000 miles. Waymo recently began testing level four self-driving cars on actual roads in Phoenix, Arizona without safety drivers. The public was invited to participate in these rides.

Now that we have briefly described each technology, the important questions become their implications on civilization. Then taken a step further, how each might affect the investment universe. While all potential implications are yet to become clear and at this stage it is impossible to predict with any certainty the story's ultimately conclusion, below we suggest a few outcomes that may emerge.

- Pollution and carbon emissions will appreciably decline, bringing health benefits to the nation.
- Human productivity will rise, though associated jobs will require a higher level of education.
- With the decline of the internal combustion engine, the economies of middle-east countries and the profitability of their oil companies may diminish.
- Revenues for oil companies and their service providers, such as oil pipelines, may decline.
- Utility companies may see lower revenues as homes generate their own power and supply the utility companies any excess.
- While some premium car manufacturers may survive, a mass consolidation will occur among brands that provide utilitarian vehicles.
- Transport might be delivered as a service from companies, which invest in a fleet of self-driving cars. Instead of owning a car, an individual may pay a subscription much like Netflix, for their driving needs.
- Software companies such as Google and Uber will likely own a bigger piece of the transportation business.
- The accident rate, especially rear ending accidents and fender benders, will go down appreciably, impacting auto insurance companies and the premiums they charge. Car insurance companies may deal more with fleet owners or manufacturers rather than individuals.
- With less ownership, car financing as a source of revenue for banks may decline, while the number and size of parking garages may also shrink.

These are a few of the potential implications as we see them today, however ultimately this list could be considerably longer. While these developments are quite obviously in their infancy in terms of future ramifications, at this stage just considering their potential impact on a balanced portfolio and embarking on a dialog regarding the topic is advisable.

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