



# THE BROAD DIMENSION

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## The Future is Sunny

Our nearest star, the Sun, produces energy that is equivalent to 100 billion one-megaton nuclear bombs going off every second, and while only a small portion of that energy reaches our planet, it is still sufficient to meet 35,000 times the electrical energy needs of the world.



Sometimes this is referred to as 'free energy', but of course that is not true. Taking PVs (photovoltaics) as the obvious example, there is cost involved in mining and processing the silicon and other materials, costs of installing and maintaining the installation, and finally there is the cost of disposing of the potentially hazardous material at the end of its life. But it has been calculated that, even taking the most pessimistic assumptions, the PV industry is now at least carbon-neutral by now, and probably has been carbon-negative for a decade or more.

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The most obvious sign of the growth of solar power has been the increase in the amount of residential roofs that are covered with PVs. That growth has been spurred by grants that are now being threatened, but the cost of PVs has come down so far (about a 65% drop over 5 years), and continues to drop. They are now at the point where they are becoming economical in many regions, even without grants and tax credits.

Solar installations on commercial properties have not seen the same growth, and suffer the problem of often not having a large roof area to take traditional PVs. In cities, a high-rise building is going to have a small roof compared to its total floor area, and that roof space could be needed for HVAC equipment and other uses. Even so, commercial solar projects have been growing about 30% per annum recently. Many different ways are being found to incorporate PVs into the façades of buildings, as illustrated by the mockup below, prepared by Walters & Wolf in conjunction with Solaria. This shows the use of PVs in sun shading, spandrels, and even curtain wall vision panels.



Solar power of buildings can be both active and passive. In the mockup above, the PVs would be active solar power, but those same curtain walls and sun shading could be used to provide passive solar power, utilizing and regulating the heat gain from the Sun.

However, the largest source of solar power has been utility solar generation, and almost 80% of recent solar installations have been of this type, driven partly by a desire to protect the environment, but also by the fact that solar can now have an edge economically.

The improvement in power storage technologies has been another driver for all types of solar installations, because the power is not required only when the Sun is shining, and even then it can be blocked by clouds, seriously reducing power production. Local community power systems are also being planned and developed, which will help avoid the average 7% power loss over long-distance transmission lines, and should make power supply more resilient in the event of natural disasters.

Solar does present potential problems for utilities. As more residential and commercial solar installations come online, including local community systems, the demand for utility power will lessen. They will have to maintain the same infrastructure though, which is likely to lead to a need to increase charges, making solar installations even more attractive. That is a problem the utilities are well aware of, and planning for. And the decrease in traditional power plants creates a positive impact on the environment, with the reduction of greenhouse gases.

One prediction is that 50% of the world's energy will be met by renewable source by the year 2040, and solar power will be a major part of that. So the future is sunny!

*Thanks to Solaria for their assistance in preparing this article*

## 3D Laser Scanning

When working on an alteration project, there may be no as-built documents available, but maybe some scans of the original construction drawings, if you are lucky. And no one can guarantee that the dimensions and layout shown on the drawings truly represent what actually got built. If the height of the structural floor slab is an inch or two lower than expected, it can cause a lot of problems if you are trying to squeeze a lot of pipes and ducts through a restricted ceiling space. If a column is not quite where it was shown on the drawings, it can throw off the structural calculations. So, it has always been essential to carry out an on-site survey to verify and correct the old documents. Traditional methods to achieve this have forever been time consuming and expensive.



Then along came 3D laser scanning technology, making the process a lot quicker. Unfortunately, the equipment needed was also very expensive, and required a lot of analysis work on the data. But now the costs have come down substantially, and software is much more integrated, so it is now a relatively straight-forward process to take the scanning data and turn it into a 3D BIM, such as Revit. It can still be a fairly large investment, but it can have a short payback period.

Basic laser scanning technology is used in many things, from scanning bar codes at a supermarket checkout, laser printers, and laser shows, etc. Those types of applications generally involve the use of a moveable mirror to direct the laser beam. Something like a laser scanner needs to operate in two dimensions, and might use two mirrors, moving independently but coordinated. To go to 3D, you



need to add a servo-controlled lensing system, so the laser beam can be steered to specific points in a fine grid and the distance measured.

3D laser-scanning is not only used for construction work, of course. If you find yourself in a self-driving car, it will probably be 3D laser scanners that are preventing you playing bumper-cars with the other traffic on the road, and if you take a trip to the International Space Station it is that same technology that will guide you to a safe docking.

The technology is not without its limitations. Lasers are coordinated light beams, so they travel in straight lines and cannot see through solid objects or around corners. Consequently, scanning a room that has its ceiling in place will tell you nothing about the MEP services above the ceiling, and one scan is unlikely to give you all the information you need. You will need to take a number of scans, and the information from them all is imported into software and combined to give a 3D point-cloud, which basically means a cloud or collection of 3D data points. That information can then be imported into Revit or other BIM software. There the solid objects that have been found can be identified, because a laser scanner will not know the difference between a beam and a duct, for instance. But it will have the dimensions exact. There may be dozens of scans needed, and the data for each may reach to 10GB or more, so appropriate computer hardware is needed to store and manipulate the data.

Renovation work and MEP coordination are not the only fields where laser scanning can come into its own. If delicate research or medical equipment is going to be placed on the floor of a building, getting the floor completely level may be a priority, and laser scanning can quickly establish if there are problems or not, before the concrete

has set. Monitoring buildings or bridges for subsidence or deflection is another use that the technology is put to, where it plays an important role in risk management and forensic investigation. If portions of the interior construction are going to be prefabricated, then scans of the structure can ensure that the prefabricated components fit just right. Scans of historic structures can ensure that the building can be restored to its original splendor in the event of a natural or man-made disaster. It has also been used to generate virtual walk-throughs of buildings that can be viewed online by potential renters or buyers. Once the technology is there, new uses will constantly be found for it.

the rules and restrictions governing business operations has certainly added to the rally, as has the talk of tax breaks. But the underlying confidence appears to stem from the fact that the economy has been showing steady growth for some time, and it is felt that the infrastructure initiative, etc., can only add to it. There had been some fears about trade wars disrupting growth, but it appears that a more measured approach is being followed. It seems likely that the stock markets will pull back soon, because valuations are already very high and fuelled by speculation that is likely to take longer to turn into reality than many hope, but that doesn't mean a new recession has arrived.

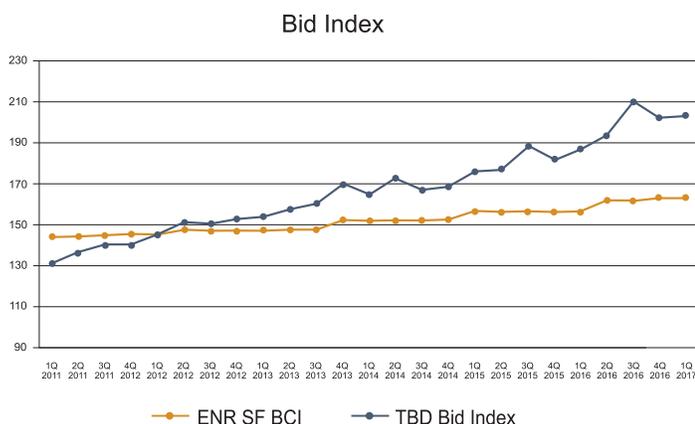
## Optimism with Caution

The markets are not supposed to like uncertainty, but they seem to be bucking the trend this time (writing at the end of February). The contentious election and a rather tumultuous start to the Trump presidency still leaves a lot of uncertainty as to how many policy decisions will work out, but the stock markets have been pushing to new heights, and that same confidence is being reflected in the construction industry. The Confindex quarterly readings continued to edge up as 2016 drew to an end and we entered 2017, including the Year Ahead Outlook Index.

We still have to see how the infrastructure plan will be implemented, but it remains very much on the administration's radar. Increases in growth would almost certainly advance the Fed's timetable for interest rate hikes, and that concerns a number of people, because we have become used to almost non-existent interest rates. But unless inflation really takes off, which it shows little sign of doing at present, we can expect any rate increases by the Fed to be small. Related to inflation is the potential impact of changes to immigration policies, because finding any staff, let alone qualified ones, is already proving difficult and expensive in the construction industry, and that difficulty and expense could multiply.

It has been called the Trump Rally, but the markets had been pushing higher before the election as well. The plans announced by President Trump for loosening up some of

The potential dismantling of the Dodd-Frank legislation could be a great benefit to banks, and to other businesses as a knock-on, but the concern is that it could lead to a new financial collapse. It was, after all, put in place to prevent the kind of situation that led to the Great Recession, but again we have to wait and see if the regulations are simply tweaked (and most agree it needs some tweaking) or abolished.



When you look at the world as a whole, the US certainly shows up as a beacon of stable growth. China's economy still seems to be slowing, Japan continues to have a stagnant economy despite Abenomics, India seems to have shot itself in the foot with its currency issues, and Europe is still trying to work out what is happening with the likes of Brexit and Greece's debt problems. With Trump having investments around the world, we can hope that his administration doesn't become too protectionist and isolationist. Then, the growth we are experiencing could continue for some time.

*Geoff Canham, Editor*