

THE BROAD DIMENSION

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Microgrids

A microgrid is an energy grid that can operate independently of the public electricity supply grid. In some cases, it may be totally independent of the public grid, in which case it is known as an isolated microgrid, and this situation often arises in remote locations. Usually the microgrid is connected to the public grid by means of a PCC (point of common coupling), and can take power from the public grid at times, and at other times may feed power into it.

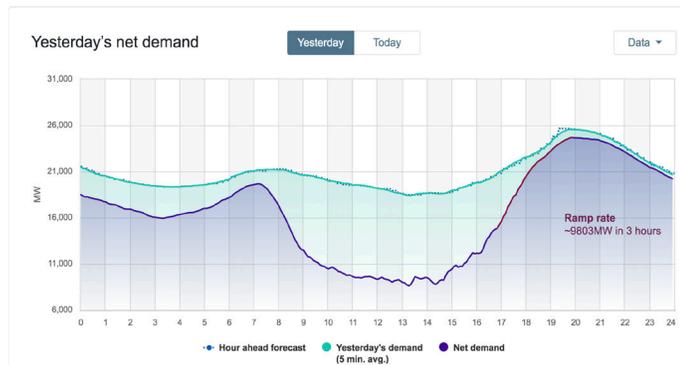
The advantages of a microgrid include the ability to maintain a power supply during times of public outages, which is why emergency facilities, military bases, and even manufacturing facilities and the like, will regularly use them. They also provide energy closer to the point of



usage, resulting in less power loss due to transmission, and a microgrid can also make good use of locally available renewable power resources. The California ISO website (www.caiso.com) displays a graph showing how much of the total electrical demand is being met by such renewable resources.

Net demand (demand minus solar and wind) AS OF 15:00

This graph illustrates how the ISO meets demand while managing the quickly changing ramp rates of variable energy resources, such as solar and wind. Learn how the ISO maintains reliability while maximizing clean energy sources.



Being able to switch between the locally produced power source of the microgrid and that of the public grid, can allow you to make better use of lower rates from public utilities at certain times of the day. Some utility providers, such as PG&E, are adjusting their rate structures to incentivize storage, such as lithium-ion batteries. Microgrids can also improve the overall resilience of the public grid, and enable it to make more use of distributed renewable resources. When using renewable generation sources, they aid the community as a whole by helping reduce greenhouse gas emissions.

Microgrids come in a wide range of sizes. If you have a solar installation on your house, together with storage capacity to supply power when the sun isn't shining, then you have a microgrid. You might also be able to earn money, by supplying power to the public grid at times when you are generating more than you need. A microgrid might also be serving a whole campus or community.

The three main ingredients of a microgrid are a power source, a storage method, and a method of controlling the power supply, and often connecting it to the public grid. The power source is often renewable, such as photovoltaics (PVs), wind-powered generators, geothermal, or hydro-powered, but they might also be diesel-powered generators. The energy storage system would usually be batteries (almost invariably lithium-ion), but can also include compressed air, flywheels, or other methods.

The controller is a critical part of a microgrid, and must maintain voltage and frequency, and prevent power surges by constantly adjusting in relation to the weather and to unit pricing, etc. The controls would normally include a switch that might have the ability to connect or disconnect automatically with the public grid, or it might require manual operation. When used as part of a resilient system, the controller will maintain reserve capacity. This reserve capacity will support the systems in the eventuality of utility loss.



This technology can already be cost effective, and prices of components are continuing to drop. Many building owners, if they are not already incorporating it into new buildings, are making provision in the building design for its incorporation at a later date.

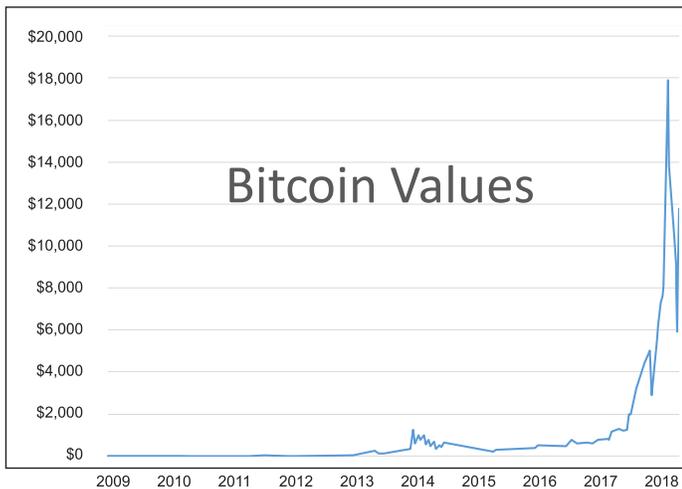
Thanks to John Griffiths of Contech-CA for his assistance with this article, and to Justin Miller of Charge Bliss for the images.

Bitcoin Tech in Construction

Bitcoin has been making the news a lot recently, with its wild gyrations in value, the hacking of some of the cryptocurrency's exchanges, and concerns about the amount of energy it expends on its 'mining' operations, which exceed the energy usage of a number of nations in the developed world. All that might indicate that Bitcoin still has a lot of growing to do, and is itself still under

construction. But that wasn't the intended meaning of this article's title.

Bitcoin is built on a new technology called Blockchain. With Bitcoin, transactions are bundled together into 'blocks' that get added to the Blockchain about once every 10 minutes through a process known as mining. We won't delve into the ins-and-outs of 'mining' here, but the important point is that a block really just represents some form of transaction that is facilitated by the Blockchain technology. That makes the technology applicable to any form of hierarchical or peer-to-peer transaction. Some have described it as the next big thing after the Internet.



Bitcoin was implemented after the crash that led to the Great Recession, and was designed to get around the banks, but now banks, themselves, are starting to use Blockchain technology. The technology has been touted as a way to avoid the middleman, and providing a chronological, secure and verifiable record of transactions. With Bitcoin, the identity of the parties involved is deliberately hidden, but that doesn't have to be the case. Probably in most cases you would need to know the identities of who you are transacting with, and maybe even know their qualifications. The software can be designed to enable that, by the creation of digital IDs. Blockchain has been adopted by the Australian Securities Exchange to replace its current clearing system, and the technology has been used for the sale of a property without the need for realtors as intermediaries. These are examples of Smart Contracts.

A Smart Contract is a transaction that follows 'if ... then' rules, and it utilizes Blockchain to record transactions and trigger the responses. Such rules can apply to most things in construction, and in industry in general. For instance,

'if all materials are delivered to site, then subcontractor gets paid \$X', 'if all materials have been installed, then subcontractor gets paid \$Y', 'if installation has been tested and proved correct, subcontractor gets paid \$Z'. It is automating business logic and eliminating the middleman, which should speed up activity. Imagine a situation where contractors and subcontractors actually know they are going to get paid promptly on completion of their work. Everything is controlled by an algorithm, with no room for human prejudice, procrastination, or prevarication.

Blockchain doesn't keep information in one location, but rather each party has a copy of it, that is constantly updated. Effectively, each computer monitors all the rest, making the Blockchain almost impossible to tamper with, because any unauthorized changes will quickly become apparent. Thus, it makes an ideal record of who did what and when on a project, in the event that any dispute arises.

An organization that runs on rules, like those in a Smart Contract, can be seen as a DAO (Decentralized Autonomous Organization), and the teams involved in the construction of a building could form a DAO that would manage the project. It has been suggested that a building itself can be set up as a DAO. Together with the Internet of Things, the DAO, working through its Blockchain-controlled Smart Contracts, would be able to know when maintenance or replacement work was required, and place orders for same; it could take care of regular payment, like insurances and property taxes; and it could ensure rents or other incomes were paid promptly.

There are a number of issue to be worked through, as Blockchain technology comes into more general use. For instance, a Smart Contract is not actually a legal contract, but a piece of software that sets the rules for, and carries out, transactions. But BIM was used before people started writing it in as a contract document. Issues of confidentiality and intellectual property rights need to be addressed, and accounted for. There is also the fact that one party may like using one Blockchain, and another party using another. But again, as with BIM, there are already methods being devised of letting one Blockchain recognize and interact with another. So, we really just need to see who will be the driving force for adoption of Blockchain technology in the construction industry, and that is likely to come from government and other large building owners, since it is largely about compliance.

Volatility Returns

Writing at mid-February, the stock market has been showing extreme volatility, with record-breaking drops in points. We had the worst ever points drop for the Dow, and the second worst, all in one week. But does volatility equate to the start of a recession? Are the boom times coming to an end? The answer seems to be, 'Not yet'.

investment to stocks. Bond yields rise as central banks ease back on the stimulus programs that helped us out of the Great Recession. Raising interest rates are part of that, and the Fed is also selling Treasury notes it purchased through its quantitative easing program. Business has got used to low, almost non-existent, interest rates, but that does not reflect the reality of a healthy economy.

The latest job report showed the strongest growth for more than 8 years, and there are now more job vacancies open than there are people to fill them. The problem is that often the people available don't have the skills or the inclination to take the available jobs. Encouraging training programs, to help workers gain new skills, was a priority for former Fed chairperson, Janet Yellen.

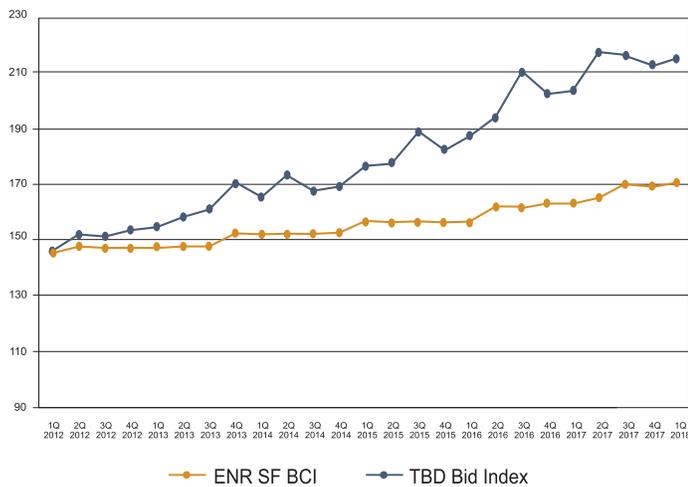
Business confidence and consumer confidence both remain high, and global economic growth has gained steam. In the U.S., 4% growth is predicted for the first quarter, and the European Union grew at the fastest rate in a decade (2.5%) in 2017. So, there are no signs of an immediate recession, but the fear is that the economy could overheat.

There do remain some fears of trade wars (which might be starting; tariffs could push steel prices up around \$300/ton) and international tensions that could derail the economy. Also, there is some concern that, as cheap money ends, some companies may find their fundamentals are not as strong as they thought.

All the incentive packages should boost business and the economy, and therefore boost stocks. But they also may increase inflation, and lead to more rapid rises in interest rates, which are not good for business because they make finance more expensive. So, stocks could go up, or they could come down, and we're seeing both at present (sometimes in the same day).

More specifically on the construction front, the Architecture Billings Index remains in positive territory, although perhaps showing a bit of a slowdown. Statistics on construction starts continue on an upward trend but are showing more volatility (ups and down in the graph). The CONFINDEX report shows that confidence within the construction industry remains high, even though down a bit from the year before, and there is more concern about how things might get in 2019. When things seem to be going too well, we tend to expect them to change. And we know that things will change, but there doesn't appear to be any reason to believe they will in the near future.

Bid Index



Escalation in construction costs has been rising fairly fast for the past few years, but the signs of wage growth are leading to fears that general inflation will start to pick up as well. In fact, inflation has gone up to about 2.1%, marginally over the Federal Reserve's target. Rising wages could eat into some of the corporate profits, and inflation could give the Fed a good reason for increasing the pace of interest rate rises. Currently, the level of inflation means they can continue their slow and steady rate increases, but if it rises much above their target level of 2% they could accelerate the rate rises. The expectation is that inflation will increase in all of the developed world as the labor market tightens.

Bond yields (such as those for the 10-year Treasury note) have been rising, giving concerns that rising borrowing costs might slow the economy. The tax bill and the budget deal are going to make it necessary for the Treasury to borrow more money, by issuing more bonds. Such an increase in supply results in a drop in price, and corresponding increase in yields, which makes them more attractive as an alternative