

THE BROAD DIMENSION

the newsletter of tbd consultants - 1st quarter 2016



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Net Zero Energy

One of the main features of LEED has always been the idea of energy efficiency. The push these days, however, is going beyond being an efficient consumer of energy to being a producer of it — at least satisfying your own demands for it and perhaps even supplying more energy to the grid than you take from it.

As we mentioned in a previous article, there are varying definitions for Zero Energy Buildings (ZEB, or NZEB, Net ZEB, because it is the net end result, after subtracting energy produced on site from the energy used that we are considering). Whatever definition is used, the goal is to reduce the dependence on fossil fuels and lower carbon emissions.

The first thing that has to be acknowledged is that it can be very difficult for most buildings to provide enough energy to meet traditional requirements, so the initial task is to reduce the energy needs. Well over 50% of energy ‘needs’ can be eliminated in this manner. Techniques for achieving these savings are becoming more mainstream, and include the use of LED lighting, and using high-efficiency,

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low-power, appliances. Sensors that can turn off lighting and appropriate appliances when a room or zone is not occupied help overcome the problem of getting users to be economic in energy usage. Designing the building to control the amount of natural lighting can reduce the need for lighting in the first place, and save even more energy.



Bringing too much light into a building can create problems, such as giving more need for cooling, so sun-shading or even reducing the amount of glass can be an advantage. The era of the big glass box might be coming to an end. Reducing the area of curtain walling can bring the goal of achieving net zero energy closer, while saving initial capital cost at the same time.

Innovative HVAC systems have always played a large part in energy reduction, with options such as utilizing solar heat gain, the thermal mass of the building, ground-source heat pumps, and variable refrigerant flow units, all having their uses.

Improved insulation, triple in lieu of double-glazing, draft stripping, and the orientation of the building in relation to the sun are other design features that can improve energy performance. The premium cost for the energy saving measures may end up in the region of 10% of the construction cost, but should pay for itself several times over in energy cost savings.

Once energy usage has been reduced as far as it can go, then comes the task of trying to provide that energy. Methods for doing so include photovoltaics, wind-powered generators, biogas, and even fuel cells.

Fuel cells convert oxygen (from the air) and hydrogen (which may be obtained from biogas or natural gas) into water, and providing heat and electrical power in the process. However, it is still a fairly expensive technology, and hasn't seen a lot of use yet.

Biogas is a renewable resource, but burning it to power a generator can create greenhouse gasses, which is not good for the environment, so this would also not be a top choice for on-site power.

Wind-powered generators are good, non-polluting, power sources, but their use on a building can be problematic unless there is a large site where a wind-farm can be set up, and there is also the problem of birds flying into them to be considered.

That leaves photovoltaics as the main option, especially since their efficiency has been improving and their cost decreasing. The problem here stems from the fact that with high-rise, and even many medium-rise, buildings there will probably not be sufficient area for photovoltaics to provide enough power to meet the building's needs. The roof is the primary area normally used for PVs, but the amount of roof space, compared to building floor area, becomes fairly small in high-rise buildings, and that area is often going to be reduced further by the need to reserve some of it for HVAC equipment. Sun-shading and canopies will also provide areas where PVs can be installed, and it is even possible to get glazing that incorporates PVs, but these other areas are not likely to be as effective at gathering the sun's energy as roof-mounted PVs are. PVs can also be used effectively on canopies over on-grade parking, but again these opportunities are less likely with high-rise buildings.

The use of district-wide Net-Zero Power planning is one option for meeting power needs, taking advantage of the power-generating opportunities of lower-rise buildings and open spaces to help meet the needs of those that cannot provide enough themselves. Buildings that produce a surplus of energy are sometimes called energy-plus buildings.

Solar hot water systems are also a viable option for reducing the dependence on electrical or gas power.

Buildings will normally still have a need to be connected to the power grid, because the opportunities to provide the power at the times that power is required are not

always available, and on-site power storage is expensive and problematic. So buildings would take power from the grid as needed, and feed power back into the grid during times of surplus. But as NZEBs become more common, the power utilities will end up providing less power, while needing to maintain the same distribution infrastructure and similar generating capacity. That will mean that they will need to come up with an alternative revenue method, other than simply charging for power supplied, but probably getting more of their income from a simple grid-connection charge. Having the utilities utilize more renewable-energy generating capacity, such as tidal or wave-power generation, wind farms, geothermal, and hydroelectric generation helps to further the aims behind NZEBs.

OSHA Confined Spaces

Construction sites have always been places where dangers exist, and OSHA works to mitigate those risks as much as possible. In that regard, one of OSHA's latest updates is in connection with confined spaces that require permits for entry, and such spaces are defined as follows:

- A space large enough for a worker to enter, but which has limited means for entry or exit, and is a space not intended for regular or continuous occupancy, and
- It can potentially have a hazardous atmosphere, or an engulfment hazard, or any other serious hazard such as exposed wiring that could prevent a worker leaving without assistance.

The contractor must have a person who can identify such potentially hazardous confined spaces, and that person might be a consultant or an employee with sufficient training. Warning signs must be placed at the locations that are identified.

Trenches and pit excavations are also confined spaces that carry a risk of injury or death when working in them, but they are covered by separate regulations.



Where a confined space requires permits for entry, only those workers who have been specifically assigned to work in the space, have appropriate personal protective equipment, and who have had training related to the potential hazards may enter. And before they do, the employer must provide a permit detailing what measures have been taken to ensure the workers' safety and naming the workers that are allowed to enter. Such workers must also be allowed to observe the testing that is carried out to ensure the safety measures have been effective.

The space must be continuously monitored (unless not technically possible) using electronic monitors, a trained observer, or other means, as appropriate. If, say, a hazardous atmosphere is observed to be recurring in the space, any workers in there must be immediately evacuated and the permit would be suspended until the space is returned to the condition specified in the permit.

People trained to respond in the event of an emergency must be available, and other workers are to be prevented from entering to attempt a rescue. If people already trained in regard to the hazard have ended up in trouble, untrained personnel attempting to enter are only likely to compound the problem. Where an employer is relying on local emergency services for any necessary rescue, arrangements must be made for notification when such services are not available and the confined space must be evacuated at those times.

Ideally, rescues should be effected from outside the confined space by having the entry workers wear some form of body harness with a retrieval line where feasible.

A trained attendant is to be assigned to monitor the space and keep in touch with the workers in the space to ensure that they are safe. The attendant is also there to ensure that only permitted workers are allowed to enter.

These regulations (of which this is just a short summary, of course) went into effect on August 3, 2015, although OSHA is refraining from issuing citations related to the regulations until January 8, 2016, where an employer has made a good-faith effort to comply.

Onward & Upward, Slowly

The economy is improving, but there are still headwinds to push against, especially from abroad. Europe is always teetering on the edge of recession, and Japan is back in it again. Economic growth in China has dropped, although there are no reliable figures to really say how well they are doing. And the drop in oil prices is hitting the OPEC countries and causing disputes among the member states.

While other nations are reducing their interest rates and their central banks are providing additional infusions of capital to boost their economies, here in the US the Fed has been signaling its happiness with the way things are going by doing the opposite. Quantitative easing was phased out in October 2014, and (writing at the end of November) we expect that December 2015 will see the first increase by the Fed in interest rates since June 2006. The strong dollar has been affecting exporters, and there is a concern that rising interest rates will only strengthen the dollar further, but the effect on exports should be small.

The US construction market, with the exception of single-family housing, has been picking up nicely again as the economy has been improving. Multifamily housing has been doing well, as has the commercial and retail sector. The institutional market, including healthcare and government work, has not picked up as fast, but there are signs that these areas are starting to catch up. More money is flowing into government coffers from taxes, and healthcare is facing a less uncertain future following High Court rulings on so-called Obamacare, so we are starting to see more investment from these sources.

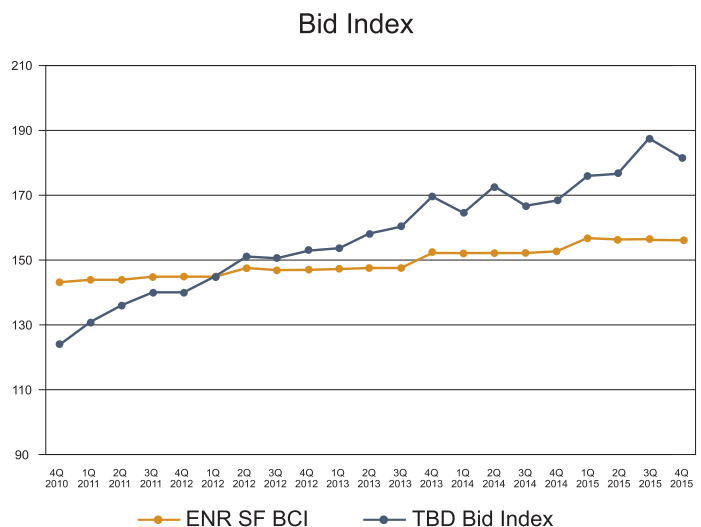
The Architectural Billings Index, which is a guide to the work coming over the following year or so, has been on a



continuing, if erratic, upward trend for the past year or so. That is a good indication that the volume of construction projects will continue rising for the next year at least.

The bad news is that there may not be the staff, in the design offices and on the construction site, to meet the demand. Contractors have been complaining about the lack of available craftsmen for some time, and it is not as though there are people unemployed who can fill the posts.

Unemployment rates are down to traditional norms, and it seems that a lot of the construction workers who got laid off during the recession have found work elsewhere, and are not too eager to return to this notoriously cyclical sector. In order to attract staff, contractors are having to offer increased salaries and other benefits, which is pushing bid prices up despite the fact that material prices overall have been dropping.



So for 2016 we can expect to see a continuing, if slower than we'd like, increase in the construction market, with escalation of bid prices remaining ahead of general inflation.

Geoff Canham, Editor