
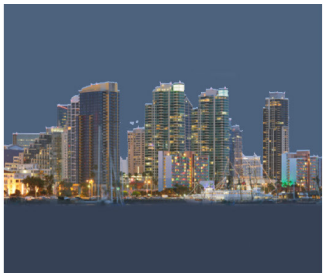

THE BROAD DIMENSION

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In this Edition:

Climate Change Costs

People had been warning about the inevitability of a global pandemic long before Covid-19 struck, yet we were still taken by surprise when it came. The virus may still have some tricks up its sleeves, as we are seeing with the variants that have emerged, but the multiple vaccines that have been rolled out are bringing a measure of control to that emergency. Perhaps now we can really start to address another growing situation that we have also been warned about for a long time now but which, unfortunately, cannot be fixed with one or two jabs in the arm.

Climate change is here now and will remain a problem that we will be living with for a long time, whatever we do. The question is – how bad are we going to allow things to get? Global carbon dioxide (CO_2) emissions dropped by up to 7% during 2020 due to lockdowns, but we can expect a rebound in emissions in 2021, not a continuation of the decrease. However, 2020 was still the second warmest year on record, despite the cooling effects of a La Nina weather pattern. All-time highs, almost 10°C above average for parts of the year, were experienced in regions of the Arctic resulting in massive ice melts. Some of that was due to natural cycles, but far from all. The Arctic used to be a carbon sink, now it is a source.

When we talk of climate change, we are talking about effects arising from changes in the level of greenhouse gasses (mainly carbon dioxide and methane) that are causing average worldwide temperatures to rise. We have already added about 1°C to pre-industrial times (say, in the last 150 years or so) with two-thirds of that warming being contributed by CO_2 which lasts in the atmosphere for several hundred years. This is leading to increased melting of the icecaps and glaciers, in turn leading to rising sea levels that are threatening coastal communities. Over the past century, sea levels have been rising around 1 to 2mm per year on average, but in recent years that has grown to 4 to 5mm annually. Ocean currents are changing, weather patterns worldwide are changing noticeably. The five years since the 2015 Paris agreement were the warmest on record according to the World Meteorological Organization (WMO).

We can't say that climate change causes hurricanes and wildfires, but those changes can be shown to be making them more deadly. Of course, nobody was really expecting wildfires to be ravaging Siberia or winter storms to be blanketing Texas with snow and ice. Climate change might be due to increasing average temperatures worldwide but weather, as a result of those climate changes, can vary very dramatically from the average.

The burning of fossil fuels to power our industry and commerce has been our main contribution to the greenhouses gasses, and there hasn't been a lot of alternatives to that in the past, but the list of options we have now is growing. Solar, wind, and wave power generation are all now mainstream, and the long-talked about option of hydrogen as a power source for transport, including aircraft, is finally being demonstrated as practical and cost effective. There are solutions out there, all we need to do is implement them before the damage gets too severe. The US has reduced its total emissions while still growing its economy, but we need to get close to zero new greenhouse gas emissions to enable the climate to recover.

The world has been trying to limit temperature to inside of a two degrees Celsius rise, which one study suggested would affect the US GDP by around 0.5 percent. Many researchers fear that we have passed the point where we can achieve that goal, and suggest an average global temperature rise of four degrees Celsius is more likely. That's only double the target increase, but the effect on US GDP is estimated at 2 percent, a four-fold increase. As temperatures rise, the effects rise geometrically rather than arithmetically and generally it is poorer areas that are likely to get affected most, so large portions of the world can expect more severe hits than places like the US and Europe. That said, a 2 percent effect still doesn't sound too bad, until you realize that Japan's GDP was only affected about 3% by the devastating force-9 earthquake of 2011, but their economy was severely affected. Do we really want something that has similar impact to a major earthquake in every state worldwide every year? The models indicate that even a 1.5 degree Celsius increase will result in more droughts and floods and extreme heat events. Our coral reefs are already being damaged, and these kinds of temperature changes could kill them off completely. How do you put a cost on something like that?

The US, UK, EU, China, Japan, South Korea, South Africa, Canada, and other nations have set long-term goals for lowering carbon emissions. But goals are one thing, and producing results is another. It has been estimated that policies worldwide should result in a 2.9°C temperature rise, but that assumes those policies will lead to actions. Governments alone cannot get us there; it will take the combined efforts of everyone to achieve these goals.

Covid has shown us that we can adapt quickly when necessary, with governments acting decisively and people's behavior changing in a matter of weeks. But regarding climate, the changes have to be long term. There's no quick fix like a vaccine, but it also means that there's no need or advantage in closing everything down. The technology and know-how for solving this problem exists, and more is being worked on.

Looking on the bright side, a recent survey covering 50 countries carried out by the UN showed that 64% of those surveyed considered climate change as representing a 'global emergency', so it appears that there should be an impetus for driving change. On the other hand, the global shortage of microchips has led to automobile manufactures having to limit their production. In that regard, GM is keeping its supply of microchips reserved mainly for its lines of SUVs and Corvettes, because those are the vehicles in greatest demand by the public. So, …

Geoff Canham, Editor, TBD San Francisco

Construction & Climate Change

The construction industry has been addressing issues related to climate change for a long time now. The LEED rating system for buildings began encouraging environmentally-sensitive construction back in 1994, and there have been other, more targeted, green building rating systems complementing it. Various green building initiatives have come from Federal, state, institutional and commercial entities have all been making 'green construction' become the norm, rather than the exception. They have helped nibble away at construction's estimated contribution to global carbon emissions of close to 40%.

One study by the US Energy Information Administration in 2010 estimated the building sector as being responsible for 44% of US CO_2 emissions, ahead of even the transportation sector (34%) and the industrial sector (21%). This study was carried out in 2010, 16 years after LEED was introduced and the rating system was on its third iteration. The situation may have improved somewhat in the past decade, but the construction industry is known for being very slow to change.

Almost three quarters of the carbon emissions associated with construction relate to the burning of fossil fuels. The steadily increasing usage of solar power, along with the banning of natural gas as a power source by many local authorities is helping immensely with this aspect. A new type of solar panel is being developed that almost doubles the effectiveness of panels in turning the Sun's energy into electricity. Those kinds of technologies address the use of fossil fuels during the life of the building while it is

occupied. The more frequent adoption of prefabrication in the construction of the building can also lead to more efficient usage of power and less need for diesel-powered on-site construction plant and equipment.

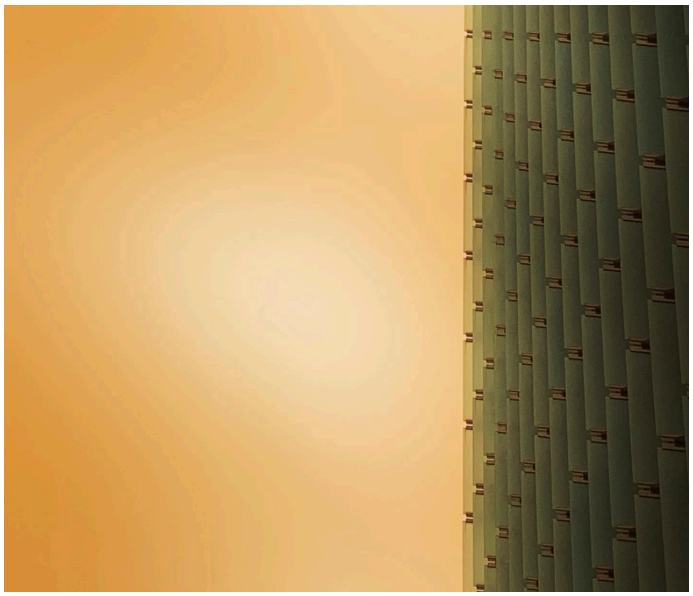
The other contributing factor to construction's carbon emissions is the choice of construction materials. The term normally used for this is Embodied Carbon and it comes from the manufacture and delivery of materials, as well as the construction process when installing it. This has been calculated as contributing 11% of the global carbon emissions. LEED has addressed these kinds of issues by encouraging locally-sourced materials (less fuel burned getting the materials to site), recycling materials (reducing fuel usage in extracting raw material and producing the product), and the use of sustainable materials such as bamboo and wood products (which are carbon absorbers during their growth stage).

Steel and concrete have been the favorites for structural systems, but together they contribute about 16% of the world's CO_2 emissions, fairly evenly split between the two. That is similar to the total US emissions. Steel's contribution mostly comes from the use of coking coal to fire blast furnaces, and the use of hydrogen as an alternative fuel is one option being studied. Concrete's contribution is a harder problem to solve, since it is linked to the chemical reactions involved in converting limestone into cement. One solution is to capture the CO_2 emissions before they enter the environment. The problem with these kinds of solutions, at present, is that they are more expensive to use than traditional methods (not taking into account the future cost of the long-term effects of climate change).

The other option is to use less of those materials, through innovative design solutions that reduce the steel and concrete content or finding a different material for the building's structure. Happily, engineers are coming up with much improved methods for supporting even high-rise buildings with timber as the structural component in the form of cross-laminated members. We may have a gut reaction against cutting down trees, but their increased use in construction will also generate a financial incentive for planting more.

Better recycling and reuse would reduce the need for the extraction and processing of natural resources. A report commissioned by the G7 nations suggested that these activities account for over 90% of global biodiversity loss and water stress, and around 50% of global greenhouse gas emissions. Of course, some of that extraction and processing relates to the production of steel and cement, so there is some overlap with these issues.

Coming up with new technology and methods to make the construction industry more of a solution to the climate crisis will be essential in the longer term, but simply implementing the known solutions will take us a long way. These include more recycling of materials and reuse of existing buildings, using prefabrication in the construction of new buildings, careful selection of materials to reduce the embedded carbon content, designing buildings to be more energy efficient and making maximum use of natural heating, cooling and lighting, and even implementing systems like just-in-time (JIT) delivery to reduce material waste and handling.



The steadily rising use of green technologies, such as solar and wind power generation, has led to a steady decrease in the cost of implementing them. It used to be necessary to provide hefty subsidies to entice people to use solar, but now that is the economically beneficial option. We can expect that to be the situation with other climate-sensitive technologies as well. The more you produce of something, the cheaper it gets, to the point where profit becomes the incentive for using that technology.

When the ozone hole was identified, we took action and were effective in reducing the level of CFCs eating away at the ozone layer, so now we need to apply the same kind of resolution to the problem of other greenhouse gasses.

Lighting the Way

There are big challenges facing us over the future years and decades, and big plans and goals are needed. But what we need to see are real, practical options for reducing the impact society is having on this planet's environment, and every contribution is a step in the right direction, however big or small it may be.

One such example is the Power Plants designed by VITAL Inc. (now known as Nash Hurley Architecture Studio) and for which TBD provided costing information.These are a novel net-zero energy exterior lighting system that is battery and solar powered. The efforts to keep restaurants and other businesses operating during the Covid-19 pandemic has demonstrated the need for adaptability, as businesses moved from inside the premises to the street, parking lots or other open area. The fact that lighting systems such as VITAL's Power Plants can be moved by two people and a hand-truck helps when areas have to be reconfigured quickly to meet changing needs. The design of the lighting system is modular, so it can be installed in different ways to meet different needs, such as for use as free-standing area lighting or as a wall-mounted light.

Having its own solar power source means that it does not have to use a distributed grid of power cables with the inevitable power-loss along the way. Not having to use a distributed power source also saves on the cost and energy involved in installing such a system, the need to maintain it, and (if you are in a fire danger area) a reduction in the possible trigger sources for the fires. And the lights stay on, even when the grid goes down.

Such a lighting system would not meet all exterior lighting requirements, for example along a highway. However, the same type of self-contained solar-powered lighting technology could be implemented.

Obviously, such lighting systems are not, by themselves, going to solve the problems of climate change, although it is a great example of a very stylish contribution towards achieving a sustainable climate. Such innovative thinking will be needed to reduce the impact we are having on the environment, and it demonstrates that it is possible to do good while also looking stylish and being cost effective.

Trees are great absorbers of carbon but, of course, these Power Plants are not real trees. However, technology for absorbing carbon from the air is being developed, and maybe, someday soon, we might see such technology incorporated in products like this.

As the Tao Te Ching says: "The journey of a thousand miles begins with a single step." Or, as some smart-aleck put it: "How do you eat an elephant?" "One bite at a time."

Our thanks to Nash Hurley Architectural Studio for their collaboration with this article, and for the image used.

Newsletter designed by Katie Levine