Vertical installation of solar panels

This monthly column is all about openly sharing expertise and knowhow with our readers, regardless of industry, product or service. The aim is to plant the seeds of inspiration, strengthen the knowledge base, and hopefully, lead to new opportunities and innovations.

While the column is being rolled out with the ideas of Prof. V.C. Malshe, an academician, researcher, innovator, consultant and businessman, it is open to one all. Simply write to editorial@chemicalweekly.com.

Installation of solar panels is a scientific procedure. Presently, solar panels are installed only on rooftops. Even the government is promoting rooftop solar plants for households. Typically, the panels are installed facing south, because we in the northern hemisphere receive sunlight for most of the day on surfaces facing south. The angle is a function of latitude of location. In India it may be ±10° degrees over 23°as we are about 10° above the equator. To get the best results, installers find out the direction of the sun, an angle where maximum sunlight can be captured during the day for most of the year.

I moved into a multi-storey building post-retirement. During my career as Professor and Hostel warden, I used solar energy for water heating and saved lakhs of rupees in the electricity bills for my employer, Mumbai University. The memory was fresh, so I wanted to install solar water heating in our society. (The discussion is on even today, after 18 years.) In the meantime, I had acquired a 17-Watt solar panel and was looking for a place to install it. It could not be done on the roof as the roof did not belong to me. One day, I placed it vertically in one of the east-facing windows of a relatively less used room (with the permission of my wife). I also bought some LED lights operating at 12-Volts, connected them to the panel directly and was surprised to see that these could produce light all through the day and up to late evening even after sunset.

I further invested in a battery that would charge during the day and the stored electricity could be used during the nights. But this was not a very efficient unit. So, I contacted my friend Arshad Mooljee, an electronic engineer, to suggest a solution. He very kindly assembled a devise with input from the solar panel and output to be connected to two 12-Volt lithium-ion batteries (12 V, 10 Ah). The unit also provided an output for 9 W, 12 V LED lamps. The lights can function for four hours every evening.

This was some time in 2011. Till then there was no talk of vertical installation of solar panels.

Of late, the prices of solar panels have fallen, efficiency has gone up and more people are recommending vertical installations. Because the panels are cheap, two-sided panels are also being used (even though these have very poorer efficiency). I have seen two large installations on the roads of Mumbai. I met owners of one unit and tried to find out the effectiveness of vertical solar



panels. They did not have much data because their purpose was to save glass for the façade. Solar panels were only a way of meeting this goal. There is another installation close to Kurla Station along the Ghatkopar-Sion Road. The solar panel appears to be powering the LED display partially (seen in the picture on the left).

I now see several publications recommending vertical installations. I saw the first such paper about two years ago. The logic is the same as growing plants on vertical surfaces – multi-storey cropping using the limited amount of light.





Efficiency of solar panels has improved considerably, and the latest versions are able to produce up to 5-kWh per day even with diffused light. The cost has also gone down significantly to allow users to use two side panels, one side entirely producing electricity with diffused light.

Initially the panel in my home was installed bending as much backwards as the window allowed. This was done to maximize the hours of illumination. There is a large playground next to the building and young people use it for running, playing cricket and other sports. Except for the rainy season, the air is full of dust. The panel required frequent cleaning. Though I assigned the chore to the household help, she rarely did it. This was leading to a reduction in efficiency. That prompted me to consider changing the angle of the panel with vertical to slightly bending forward. Now the dust deposits on the rear of the panel that does not impact electricity production.

Recently I found this interesting information. "It's efficient to install solar panels vertically because it gives you more space to work with. Considering the size, you can fit more panels along the railing. This keeps your installation costs lower. The size, along with



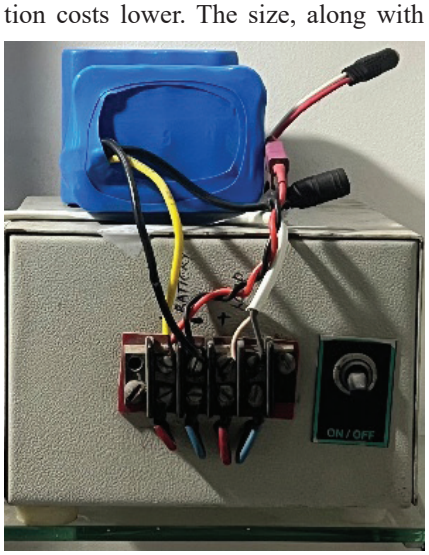




a vertical placement, also allows you to utilize more panels. This layout means you can install more panels at a lower cost. You'll recoup the expense quickly since you have more panels soaking up sun light." [https://solvoltaics.com/solar-panels-vertical-or-horizontal/]

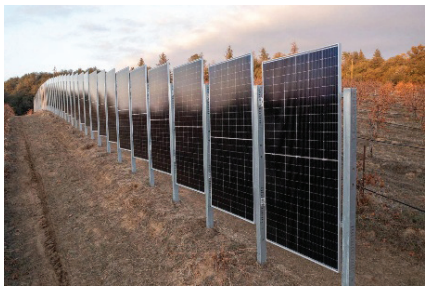
A recent publication describes all the aspects of vertical installation of solar panels. [Ghadeer Badran & Mahmoud Dhimish, *Scientific Reports*, Volume 14, Article 18380 (2024)]

The purpose of writing this article is not to promote the idea of vertical solar plants for individuals. It is the large housing societies who should consider these on South, South-East or South-West facing walls. There is potential to generate 20,000 or more units of electricity by using this otherwise useless











space in a 25-27 story building. I notice some buildings do not have any openings (like windows or gallery) on the South-facing wall. There is no structure obstructing light in the vicinity. Since the buildings are tall, the roof is small, and the capacity of the rooftop solar plant may not suffice to serve even the needs of a lift in the structure.

It is recommended that solar panels be cleaned every week to obtain maximum efficiency. This requires water, cleaning chemicals and manpower. In short, it costs money. Delays in cleaning lead to lower electricity production. It is possible to install panels facing downwards to prevent dust deposition, as shown in my window.

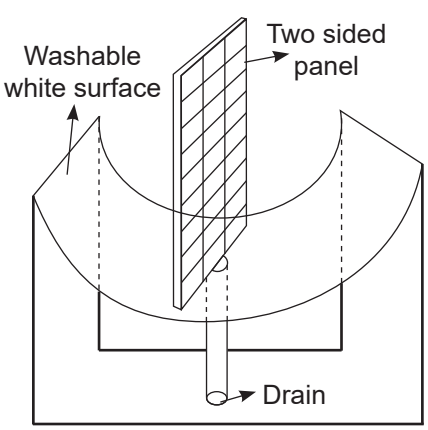
Vertical installation also insulates the walls from transmitting unwanted heat inside the home.

The energy efficiency of a vertically installed solar panel is lower by about 30%. That means, in place of generating 1,500 units annually, a vertical panel may generate 1,000-1,050 units per year. In spite of this, the opportunity that vertical installation present outperforms the potential from the roof. Whereas a rooftop solar plant may at the most generate 300 units per day, due to space restrictions, the vertical plant is capable of generating up to 2,500 units per day due to unhindered light for most of the day, most of the year. This is possible by using a larger number of panels on vertical walls. In addition, the reduced heating on the walls also helps the residents to reduce electricity consumption for air conditioning and save by not having to paint the huge vertical wall. The glass surface does not discolour, does not develop algae and deposition of dust can be avoided by inclining the panels forward by 2-3°, which also potentially reduces the maintenance cost.



Environmental dust pollution in India is much higher compared to other parts of the world. This is partly due to our pace of faster development and partly poor practices in construction. Covering unused land with wood chips as practiced in many developing countries can mitigate the problem to some extent.

All east, south and west facing walls can be covered with solar panels, even though the aesthetics of the buildings may be somewhat disturbed. Considering the financial benefit that will accrue, residents may agree to covering the exteriors. Authorities should also consider offering subsidies for vertical solar panels installation.



Some special arrangements may be considered for installation of bifacial solar panels (see above figure). If necessary, white parabolic reflectors with larger area than of the panel can be used for reflection. Since diffused light is also as effective, the reflectors need not be optically pure. Bright, non-stick, white surfaces that can be easily cleaned with air or water, can be used.

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