Solar Energy on Campus and Potential Improvements

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Energy defines the climate crisis as the main contributor to greenhouse gas emissions, but also the key to the solution. Greenhouse gasses that trap heat around the Earth are largely produced through energy consumption by burning fossil fuels like coal, oil, and gas. Science shows that these emissions must be halved by 2030 and net-zero by 2050 in order to avoid total climate catastrophe. To do so, clean energy production must overtake the use of fossil fuels as the planet's main energy source, and fossil fuels currently account for more than 80 percent of global energy production. Further, 80 percent of people on the globe live in countries that are net importers of fossil fuels, so they are dependent on energy sources that come from outside of their home nation. Renewable energy sources are abundant and replenishing, provided by natural resources like the sun, wind, and water. Currently, renewables generate about 29 percent of the world's electricity. They are becoming more cost efficient, as solar power's cost reduced by 85 percent through the 2010s. Moreover, the air pollution from fossil fuels cost $2.9 trillion in health and economic costs in 2018, including premature deaths, child asthma, preterm births, and work absences. Renewables are healthier because they have limited impacts on air quality, releasing significantly less fine particulate matter and nitrogen dioxide than fossil fuels [1].

Historically, LMU has been a leader in renewable energy, and in sunny southern California, the feasibility for solar is clear. Former California Governor Arnold Schwarzenegger even signed a renewable energy initiative on the top of LMU's University Hall in 2009, depicting LMU's system as a model for future development (Figure 1). Between 2003 and 2005, LMU upgraded their energy production by installing $4.5 million worth of solar panels on the roofs of three buildings: Gersten Pavilion, University Hall, and the Von der Ahe Library. This spread 81,000 square feet over the rooftops and generated 1,100,000 kilowatt hours (kWh) annually. At the time, this marked the largest solar system in all of Southern California, and the largest of any university in the world. They deployed this system for cheap, approximately $325,000 total, because of rebates from the city. 10 years later, in 2015, LMU deployed 7,982 square feet of solar panels to the rooftop of the Life Sciences Building, which generates 200,000 kWh annually. In total, including other small solar energy producing systems on-campus, LMU produces up to 1,335,000 kWh per year, and the rooftop systems simultaneously insulate and protect the buildings from UV radiation, saving heat and maintenance costs. It is estimated that the solar systems save the university more than $210,000 per year [2].

Figure 1: Gov. Arnold Schwarzenegger and Secretary of the Interior Ken Salazar signing energy initiative atop LMU's University Hall in 2009 [2].

LMU participates in a report called The Sustainability Tracking, Assessment & Rating System from Stars that ranks colleges and universities on their sustainability performance. LMU currently ranks gold, the second highest ranking, scoring 81.82 points out of 100. They were rewarded 0.49 out of 4.00 points for the category titled Clean and Renewable Energy. Their percentage of total energy consumption from clean and renewable sources is listed as 12.24%, with their solar photovoltaic energy making up 14.10% of all electricity use [3]. At Green LMU, we want to improve upon this ranking, not just because we want extra points for an assessment, but because implementing sufficient clean energy is at the core of our values. This initiative embodies the essence of what we stand for – a commitment to environmental stewardship that is vital to our planet's future. Moreover, implementing more clean energy systems could provide financial advantage through President Biden's Inflation Reduction Act (IRA). The law allows clean energy tax credits for higher education institutions that do not pay Federal income tax, which qualifies LMU, through a feature called Elective Pay. Universities can get up to $27.50 per MWh "for qualified clean energy produced and sold if prevailing wage and apprenticeship requirements are met", and they can get between 6-30% credit for qualified investments [4]. The new programs incentivize institutions like LMU to improve the sustainability on campus, having both climate benefits and financial savings.

The solar panels that LMU currently houses on the roof of University Hall are Shell SP70 Photovoltaic Solar modules which contain 36 series connected 125 x 125 mm PowerMax® monocrystalline silicon solar cells (Figure 3). The frame is made of torsion and corrosion-resistant anodized aluminum. The surface is made with highly transparent tempered glass on a pyramidal textured surface, which protects well from weather. At its maximum, the panel generates a power of 70 watts at 16.5 volts. They are expected to last 25 years, and were designed for grid connection and industrial applications [5]. See Figure 4 for the exact dimensions of each panel, and Figure 5 for the panel's power data.

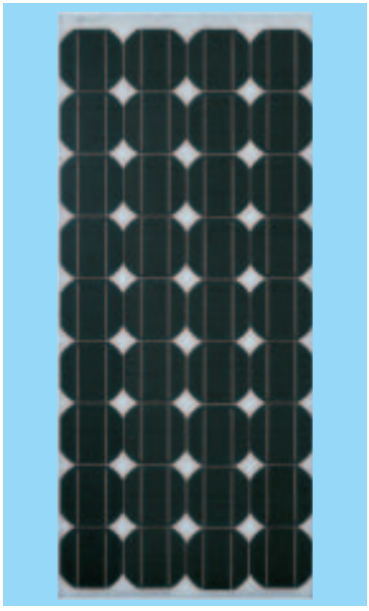
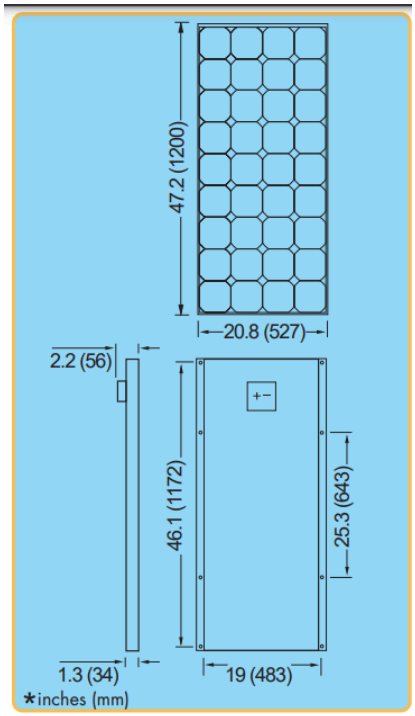


Figure 3: Shell SP70 Photovoltaic Solar module [5].



Outside dimensions (in)	47.2 x 20.8
Thickness (inc. junction box) (in)	2.2
Thickness (exc. junction box) (in)	1.3
Weight (lbs)	16.7

Figure 4: Dimensions of the Shell SP70 Photovoltaic Solar module [5].

Despite LMU's great track record with solar, other schools, especially in California, are improving their clean energy production faster than us. Santa Clara University, a Jesuit school of roughly the same size as LMU, produces 1,469,000 kWh annually through solar, with plans to add almost 2,000,000 kWh to that count in the coming years. They have tested other forms of renewables on campus, including a wind turbine that produces 1,500 kWh annually, and a solar thermal installation. Moreover, they are designing a smart microgrid which creates a network of their electricity generating systems on campus, which can produce energy during power outages and reduce energy consumption and cost through data tracking [6]. Similarly to Santa Clara, Stanford has recently achieved goals in clean energy, including 100% renewable electricity (though the majority of this electricity is purchased from third parties). They constructed two solar energy sites off campus to power their school, and have 11 on campus solar sites that produce 4.1 megawatt alternating current [7].

The potential improvements to solar and clean energy on LMU's campus are abundant. The life span of the solar panels on University Hall is approaching, and an upgrade to those panels with new technology can produce significantly more power and save money. Further, solar systems can be designed and constructed on other sites on campus, like the rooftops of the five freshman dorms surrounding Founders Pavilion, or the future renovations of Seaver and Pereira Hall [8]. They can even design a microgrid that links the renewable energy sites on campus, controls these systems to maximize efficiency, and manages the energy storage for future use, or during a power outage. The opportunities are clear and ample, and it is time that LMU starts planning for the future of clean energy infrastructure on campus.

References

[1] United Nations. (n.d.). *Renewable energy – powering a safer future*. United Nations Climate Action. https://www.un.org/en/climatechange/raising-ambition/renewable-energy

[2] Loyola Marymount University. (n.d.). *Alternative Energy*. Green LMU. https://admin.lmu.edu/greenlmu/initiatives/alternativeenergy/

[3] STARS: A Program of AASHE. (n.d.). *Loyola Marymount University*. The Sustainability Tracking, Assessment and Rating System. https://reports.aashe.org/institutions/loyola-marymount-university-ca/report/2024-03-01/AC/curriculum/AC-2/

[4] *A Clean Energy Future for America's Colleges and Universities*. U.S. Department of the Treasury. (2024, February 20). https://home.treasury.gov/news/featured-stories/a-clean-energy-future-for-americas-colleges-and-universities

[5] *Shell SP70 Photovoltaic Solar Module Product Information Sheet*. Shell Solar. https://reenergyhub.com/files/hersteller/Shell_Solar/pdf/Shell_Solar_SP170_EN.pdf

[6] Santa Clara University. (n.d.). Renewable Energy. Center for Sustainability. https://www.scu.edu/sustainability/operations/energy-climate/renewable/

[7] Stanford University. (n.d.) Renewable Energy. Sustainable Stanford Energy System Innovations (SESI). https://sesi.stanford.edu/renewable-energy

[8] King, J. (2022, November 22). LMU unveils new renovation plans to Seaver and Pereira Hall. Los Angeles Loyolan. https://www.laloyolan.com/news/lmu-unveils-new-renovation-plans-to-seaver-and-pereira-hall/article_7a108dbc-cad1-537c-b937-86c71e1500d9.html