

EXECUTIVE SUMMARY

The Charles Pankow Foundation Design Competition challenges students to address the design and integration of the electrical and lighting systems for a high performance 30 story high-rise located in San Francisco, California. Our lighting and electrical design process for 350 Mission Street was driven by the design goal of achieving a near net-zero building while keeping in mind the functionality of the spaces. One underlying theme that influenced many of the design choices we made was the user's experience.

Our vision:

“A net-zero energy building is a building that consumes no non-renewable energy that is produced off-site.”

To meet our first design goal of achieving near net-zero building design we implemented two driving strategies: on-site energy production and energy use reduction. In order to produce energy on site, we have designed a photovoltaic array for the roof of our building, integrating this design with the mechanical and structural aspects of the overall roof design. We have also included a combined heat and power system consisting of a group of 10 micro-turbines to provide energy to the building and to act as emergency power. The production of harmful greenhouse gas emissions from these micro-turbines has been mitigated through our partnership with the California Center for Algae Biotechnology, which will utilize the carbon emissions in the production of biofuel. These two building systems combined will produce over 1.11 million kWhr every year – about one third of our annual building energy use of 3.33 million kWhr.

Our second strategy, energy use reduction, prompted design criteria which led our building to perform close to our near net-zero goal. We aimed to minimize the lighting power density, hoping to end with a total building LPD of at least 25% less than the allowable amounts provided by ASHRAE 90.1 2010. Our final design has a power density which is 38.3% lower than what ASHRAE allows. We have also included photosensors to diminish over-lighting of spaces when daylight is available, and vacancy sensors to reduce the amount of energy used in unoccupied spaces. By adopting these two strategies, we managed to reduce the amount of nonrenewable, offsite energy consumed by 350 Mission to less than 28% of the code-allowable baseline.

While near net-zero was a main concern when creating our design, we also wanted to create an inviting and interesting space for the patrons. We achieved this through a lighting design in the lobby and a typical office floor which uses creative and aesthetic application of geometry to provide sufficient light levels based on task as well as help to produce an unconscious understanding of the space. The design of the lighting systems depended on, and had to integrate with the mechanical and structural systems. The mechanical systems in the plenum dictated lower ceiling heights in several spaces, eliminating pendant options in those areas. By choosing recessed fixtures, we needed to further integrate with mechanical and structural systems in the plenum to avoid any clashes, i.e. recess depth of a fixture colliding with or becoming too close to a duct or structural steel member.

Further, to encourage community acceptance and excitement surrounding our building, while also meeting the code, we designed our building to a LEED Platinum level. This demonstrates our commitment to a sustainable building, benefitting not only the owner and tenants, but the environment and the community as a whole.