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AIANY Joint Testimony - City Council Committee on Environmental Protection

Good afternoon, Chair Richards and members of the City Council Committee on Environmental Protection. My name is Stefan Knust. I am an associate at Ennead Architects and a member of the American Institute of Architects New York Chapter's Committee on the Environment (COTE). I am here to offer testimony on several site-sourced and renewable energy technologies.

AIANY is the largest AIA component in the country with more than 5,000 members. AIANY and its members are dedicated a sustainable and resilient city today and in the future. AIANY is partaking in a sustained push for systems that reduce carbon emissions in the built environment and create healthy spaces for New Yorkers to live and work. In order to achieve the Mayor's 80x50 goals, both public and private sectors must adopt these technologies in new and existing buildings. AIANY and COTE are prepared to help implement these technologies on a large scale.

Passive House Standard & Principles

As architects, we must begin any conversation about on-site renewable energy with the acknowledgement that the most important energy to focus on is the energy that you do not use. Today's energy-conserving buildings – new or existing – must make the most of passive strategies before considering active strategies, including on-site renewables. From a cost (and carbon mitigation) perspective, significant reductions to annual and peak demands for heating and cooling energy can be achieved with a proven design and construction standard that also results in high quality comfort and resiliency – buildings built to last.

The Passive House standard is built on basic building science with respect to heat gains and losses through the building envelope. Continuous insulation with minimal thermal breaks and tested air tightness – not visually inspected – are key to achieving the promised results. A study by the US Army Corps of Engineers found that some existing buildings can lose up to 40% of their heating energy through air leakage alone. The 2015 International Energy Conservation Code (IECC) includes requirements for envelope commissioning (currently optional under LEED v4, Enhanced Commissioning), which will begin to require air-tightness testing of our building enclosures. We, in NYC, should not wait to enact these requirements. Architects in NYC are already demonstrating how to do it in our cities today.

Solar (PV or solar, on rooftops or building-integrated)

Solar technologies are mature and cost effective for buildings throughout the five boroughs, for both new and existing buildings, but they could be employed more extensively than they currently are.

Grid-connected photovoltaic modules are an excellent and increasingly cost-effective means of providing zero-carbon electrical generation capacity. PV panels do not have to belong to a specific building. They are an asset to the entire grid and thus should be positioned to make best use of the capital expenditure.

In order to achieve success with PV, we must work to loosen some of the architectural restrictions on PV in the NYC Zoning and Building Codes. Solar panels are a permitted obstruction only if under 4' above the top of roof, restricting the ability to do a large solar canopy on the roof, for example.



There is also a FDNY requirement for access on roofs under 100' high, which can restrict a lot of roofs from housing PVs. There are clearly legitimate issues with FDNY access and safety, but maybe the architectural community can work with the department to find efficient and safe solutions.

NYC also has the opportunity to promote real building-integrated photovoltaics (BIPV). “True” BIPV remains a very small market, but there is potential for it to become one of the largest and most inexpensive sources of solar energy. In a dense city like NYC, BIPV is especially important as there are relatively more vertical and less horizontal surfaces available for PV than in less dense environments. Although, by its nature BIPV will often have significantly less output than rooftop PV due to its non-optimal orientations, we could all benefit from a program to support BIPV installations, i.e. BIPV material displaces a conventional construction material and the output requirement could be waived and/or some additional subsidy granted.

Permitting is significantly more onerous in the US than in other countries, such as many in Europe, which significantly increases costs. NYC could take the lead and look to European models for ways of improving. This could reduce the cost of PV installations by as much as 50%. Streamlined approvals for grid-tied PV systems that island in the case of a power outage would also help enormously with issues of resilience. PVs can operate during a blackout, on private buildings and public shelters to create safe havens during and after major storms and blackouts. Coupling PV systems at emergency shelters with cell phone towers could support improved communication during emergencies as well. We should also consider making “PV-ready” a requirement for roofs of new buildings and for roof replacements.

The greatest barrier remains the cost associated with the initial installation; however, once installed they need little maintenance. Additional financing options should be explored. Consider incentives for (PV) production such as via extended property tax abatement program or FAR bonuses.

Wind

Wind energy is generally not a good strategy in NYC because the turbulence caused by the highly varying geometry of the ground-plane can result in significant reduction in energy generation and rapid fluctuations of generation that can cause stability problems for the grid. Wind generation is much more cost-effective and much less de-stabilizing for the electric grid when its location has strong stable winds, as is not usually the case in urban areas. As the technology matures, this should be revisited for urban areas.

Micro-Grids

AIANY believes that micro-grids hold much promise to more effectively utilize our limited and expensive resources and would like to work with the Council to address the current legal and regulatory barriers that exist to their adoption. By piloting micro-grids on City-owned properties, NYCHA superblocks, university campuses, and other opportunities where a single owner has several buildings on a continuous lot, lessons from these efforts could inform efforts to address regulatory issues. Eco-Districts are looking in to how to overcome these obstacles from a neighborhood scale.

Electrical micro-grids are an excellent means of developing two-way communication instantaneous and predictive communication between the electrical customer and the supply grid. Currently, this communication is only one-way and instantaneous. It occurs when a customer puts more load on the grid. Micro-grids allow the utility to communicate both current and future predicted overloading issues to the customer and allow the customer to communicate predictive loading information to the utility. Micro-



grids provide both customers and the utility with information and control capability to make positive responses to real-time generation capacity and distribution loading issues.

Thermal micro-grids refer to routing waste heat from various building processes, such as space cooling or commercial refrigeration, to low-grade heat sources, such as service water heating. By pairing buildings with high annual cooling requirements such with buildings with significant requirements for low-grade heat, both buildings increase their energy efficiency.

Heat Pumps

Heat pumps are a mature technology that should be supported to improve the energy efficiency of the building stock. Because some of these systems can heat and cool a building with only electricity and be highly efficient, they are beneficial when trying to reduce carbon emissions in the region.

Ground source heat pumps are more efficient than traditional cooling systems and reduce the need for roof-top equipment, such as cooling towers. For heating, they are especially useful and help to reduce local air-borne pollution and eliminates annoyances associated with cooling tower drifts.

Modern air-source heat pump technologies have the capability of producing heat at ambient temperatures well below New York City minimum design temperatures. Buildings can have the efficiency benefit of heat pump operation across the entire range of external conditions. Some heat pump systems have an inherent capability of heat recovery, so that for a system serving zones with simultaneous heating and cooling requirements, those zones requiring the secondary conditioning mode are conditioned with minimal use of energy. In this way, heat extracted from office building interior zones in cooling mode can be routed to offset winter heat losses in perimeter zones with little extra expenditure of energy. In addition, the electric energy source of air source heat pumps is more easily de-carbonized than the energy source for gas or oil-fired conditioning equipment, as renewable generation assets are added to the utility grid.

Water source heat pumps are beneficial in most building types if there is a free source of low-grade make-up heat available. The problem with most occupancies is that all zones demand heat at the same time. As a result the circulating loop temperature drops and a back-up boiler comes on to maintain the temperature of the circulating loop. With this system, much of the time, you wind up buying the heat twice. Once in the form of electricity for the heat pump to extract heat from the circulating loop and once in the form of fossil fuel to fire a boiler to make up the heat extracted from the loop; by the heat pumps. If there is a reliable source of low grade heat, such as the ground, source heat pumps become an excellent strategy for recycling that heat.

In order to promote the widespread adoption of heat pump systems, the City should maintaining a database of information on subsurface conditions to support better engineering of these systems. Collecting data on the system specs and operations performance of existing systems would provide greater knowledge of the potential of these systems and push the industry to further develop the technologies.

Energy Storage

As storage system technologies improve their efficiency and reduce their negative environmental toxicity, the City will have the opportunity to support their integration into the electrical grid of NYC. The fire department and utility companies will need training and safe guards, but this should not hamper the use of



these technologies to provide grid stability and resiliency to NYC neighborhoods. Additional work must be done to ensure the safe installation and operation of these systems.

Thermal storage is very beneficial because it enables asynchronicity between thermal loads and thermal sources. In other words, the thermal source (heating or cooling) does not have to track precisely the thermal loads it is meeting. Through use of storage, the size of the thermal source can be reduced, because the demands of a peak load can be met over an extended period of time, rather than instantaneously. Thermal sourcing can also be accomplished at a time more beneficial for production, such as during a period with lower energy prices, or during a period with more beneficial conditions (producing cooling at night when the temperature to which the extracted heat is rejected is lower, enabling increased cooling efficiency). Thermal storage can occur across a variety of time periods. Cooling storage systems (ice or chilled water) typically occur over a diurnal period, storing cooling produced at night for use during the following day. Ground coupled heat pumps, on the other hand, utilize annual storage, storing the heat rejected during summer cooling in the ground for use as a heat source for winter heating.

Electrical storage is most employed currently as a means of transitioning between alternate electrical sources, often due to unexpected capacity reduction in one of the sources. Examples include uninterruptible power systems that provide a seamless transition between loss of utility power and dispatch of local stand-by generation assets. Electrical storage is finding an increasing role in stabilizing electrical grids that must deal with rapidly fluctuating renewable generation assets. Electrical storage also provides a means of power factor correction allowing both customers and the utility to make better use of their distribution assets. At this point, electric storage is often too expensive for use by private customers for demand control and response. Emerging technologies have seen limited use by utilities for grid stabilization, and, as the percentage of renewable generation assets in electric grids increases, will likely see much greater utilization.

Energy Recovery

Energy recovery systems allow waste heat/energy to be productively utilized, thus reducing waste and improving the efficiency of the system. Heat exchangers and other systems are already in use in high performance buildings throughout NYC, and we should continue to find cost effective ways to implement these technologies wherever possible.

Energy recovery schemes have a place at different scales within buildings. Energy recovery devices between ventilation and exhaust are required for certain types of densely occupied spaces, requiring intensive ventilation. The Building Code also requires building that are occupied 24-hours a day and that have both a significant hydronic heat rejection load (cooling tower) and a significant service hot water load to utilize heat recovery between the cooling heat rejection and service water heating systems. The ability of cogeneration systems to utilize the waste heat from electricity generation to meet various heating requirements in a building is a pre-requisite for the economic success of these systems. Other opportunities for cost-effective energy recovery, above and beyond these code-required situations also exist.

Architecturally, however, energy recovery implementation can be challenging. Often the devices are sizable, and in a real estate market such as NYC, space is constrained. Much more attention to energy recovery is needed as the applicability is wide-spread and should be a priority in the region for both existing buildings and new construction.



The following individuals have contributed to the testimony, submitted on behalf of the AIANY Committee on the Environment (COTE):

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