File #: LB 16-034, **Version:** 1

DATE: May 17, 2016

TO: Mayor and City Council

FROM: Director of Utilities and Environmental Services

SUBJECT
Zero Net Energy Policy for Municipal Buildings

RECOMMENDATION
That Council adopts the attached draft resolution (Attachment I) to establish a Zero Net Energy Policy for municipal buildings.

SUMMARY

This report discusses adoption of a policy recommended by the Council Sustainability Committee that, if adopted, would require new municipal buildings, as well as significant retrofits of existing municipal buildings to be designed and constructed as zero net energy (ZNE) buildings. This policy would be consistent with and implement current General Plan policies and would help prepare Hayward for upcoming changes to the state Building Code.

BACKGROUND

A ZNE building is one where the value of the energy produced at the property is equal to the value of the energy it consumes, averaged over the course of a year. More specifically, the California Energy Commission (CEC) defines ZNE as follows:

> "A Zero-Net-Energy Code Building is one where the net amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single "project" seeking development entitlements and building code permits, measured using the California Energy Commission's Time Dependent Valuation metric."

Benefits of ZNE buildings are listed in the State's *California ZNE Communications Toolkit* (Attachment II). In addition to the benefits listed, many ZNE buildings utilize operable windows and daylight for lighting needs, which can result in buildings that are more comfortable for occupants. Calculations using the Time Dependent Valuation (TDV) method are based on a series of annual hourly values for electricity cost and monthly costs for natural gas. TDV encourages building designers to design buildings that perform better during periods of high energy cost.

While the CEC is California's primary energy policy and planning agency and is responsible for

forecasting future energy needs, promoting energy efficiency and conservation, and developing renewable energy resources, the California Public Utilities Commission (CPUC) regulates privately owned electric, natural gas, telecommunications, water and transportation companies. The CPUC's Codes and Standards program works with the California Building Standards Commission to continuously improve the Title 24 Building Energy Efficiency Standards.

As the regulatory body overseeing regular updates to the state Building Code, the CPUC in 2008 adopted a Long Term Energy Efficiency Strategic Plan, which includes the following goals:

- all new residential buildings will be ZNE by 2020
- all new and 50% of existing state-owned public buildings will be ZNE by 2025
- all new and 50% of existing commercial buildings will be ZNE by 2030

Municipal buildings fall under commercial codes, so would be subject to the ZNE requirement starting in 2030. California's Building Codes are updated every three years. The above goals are expected to become requirements as the codes are updated. For example, the goal for all new residential buildings to be ZNE by 2020, is expected to be included in the 2020-2022 Code, which will be adopted in 2019. California's ZNE goals are a part of the state's overall strategy to achieve the greenhouse gas (GHG) reductions required by AB 32 (also known as the Global Warming Solutions Act of 2006). Since 2008, the State has been actively working to achieve the ZNE goals by gradually increasing the state's building energy efficiency standards (Title 24). ZNE requirements will be phased into future versions of the California Building Standards Code, so there is no need to adopt a resolution to implement the ZNE requirements for residential and commercial buildings. Municipal buildings are subject to commercial building standards and new municipal buildings will likely be required to be ZNE starting in 2030.

In April 2012, Governor Brown issued Executive Order B-18-12 requiring all new State buildings and major renovations beginning design after 2025 be constructed as ZNE facilities with an interim target for 50% of new facilities beginning design after 2020 to be ZNE. The Order also requires State agencies to take measures toward achieving ZNE for 50% of the square footage of existing state-owned building area by 2025.

To achieve ZNE, a building must first be designed to be very energy efficient, and then include sufficient on-site renewable power generation, typically solar photovoltaic and solar hot water. An example ZNE home is shown in the diagram in Attachment III and includes, extra insulation, high performance windows, LED lighting, a smart thermostat, high efficiency appliances, and a solar photovoltaic system. While the CEC's definition of ZNE allows use of natural gas if it will be offset by production of renewable energy, most ZNE buildings being constructed today are using all electric appliances so that they can be "carbon free".

In Hayward, the City Council has required a high level of energy efficiency in new construction in private and public construction. In July 2008, Council adopted an ordinance requiring all new municipal building or Renovation projects that equal or exceed 20,000 square feet in area or $5 million in construction costs to be LEED Silver certified. LEED (Leadership in Energy and Environmental Design) certification requires a high level of energy efficiency and green building materials, but it does not require renewable energy. Such was the case with the recently completed Fire Station 7 and the airport administration building. These buildings were built to LEED standards, but did not include installation of renewable energy.

General Plan Policies - Hayward's General Plan, adopted on July 1, 2014, includes the following policies and implementation programs related to zero net energy in municipal buildings:

NR 2.5 Municipal Greenhouse Gas Reduction - The City shall reduce municipal greenhouse gas emissions by 20% below 2005 baseline levels by 2020, and strive to reduce community emissions by 61.7% and 82.5% by 2040 and 2050 respectively.

NR-4.10 Public Renewable Energy Generation - The City shall ensure that all new City-owned facilities are built with renewable energy, as appropriate to their functions, and shall install renewable energy systems at existing facilities where feasible.

NR-4.11 Green Building Standards - The City shall require newly constructed or renovated public and private buildings and structures to meet energy efficiency design and operations standards with the intent of meeting or exceeding the State's zero net energy goals by 2020.

PFS-2.3 Sustainable Practices -The City shall serve as a role model to business and institutions regarding purchasing decisions that minimize the generation of waste, recycling programs that reduce waste, energy efficiency and conservation practices that reduce water, electricity and natural gas use, and fleet operations that reduce gasoline consumption.

PFS-2.7 Energy Efficient Buildings and Infrastructure - The City shall continue to improve the energy efficiency of City buildings and infrastructure through implementation of the Municipal Green Building Ordinance, efficiency improvements, equipment upgrades, and installation of clean, renewable energy systems.

Sustainability Committee - The Council Sustainability Committee had directed staff to bring ZNE to the Committee for review and consideration of a recommendation to Council for adoption of a policy. On September 10, 2015, staff presented a report to the Committee recommending:

- all new City buildings that begin design after 2025 be ZNE
- all existing City buildings for which renovations exceeding 50% of the building's value and that begin design after 2025 be ZNE
- lesser improvements to existing City buildings should include efficiencies and technologies that facilitate achieving ZNE by 2030.

The timeframes in staff's recommendation were consistent with the State's adopted policy. After review and discussion of the recommendations, the Committee expressed a strong desire to see the requirements go into effect as soon as possible. The Committee recommended that the policy be implemented beginning in either January 2016 or January 2017.

Given the fact that the state's ZNE requirements for commercial buildings have not been adopted yet, the Committee noted that it may be more feasible to do ZNE if the generation does not have to be all built on-site. That is, for buildings where it is not feasible to install sufficient renewable energy on-site, the shortfall may be provided at another City property. The Committee voted unanimously to recommend that Council adopt the policy included in the attached resolution.

Several cities in Alameda County have policies or ordinances similar to Hayward's, requiring new

buildings to be LEED certified, but none have ZNE policies. Some cities have included ZNE requirements on a per-project basis. The City of Berkeley completed a new ZNE library in early 2014. Hayward's new 21st Century Library will be all electric and will be the City's first ZNE building. The City of Fremont is contemplating ZNE for their new civic center, and the City of Albany is considering ZNE for a new maintenance center/corporation yard.

The only jurisdiction in California that has a ZNE policy is Santa Barbara County. In February 2014, the Santa Barbara County Board of Supervisors adopted a resolution requiring all new County-owned facilities and major renovations beginning design after 2025 be constructed as ZNE facilities.

DISCUSSION

To carry out the General Plan policies listed above and to achieve the City's GHG emission reduction goals, all new municipal buildings will need to be ZNE and existing buildings will need to be renovated to be ZNE. As stated in General Plan policy PFS 2.3 above, "the City shall serve as a role model to business and institutions". If the City can demonstrate successful construction and operation of ZNE buildings, then private developers may follow suit before mandated to do so.

The technology and the knowledge necessary to create ZNE buildings are available now. While there are additional costs associated with construction of a ZNE building, there are also very real benefits to doing so, including life-cycle cost savings, setting an example for others, and helping to meet the City's GHG emission reduction goals. In addition, it is more cost-effective to design a new ZNE building than it will be to retrofit an existing building. There are, however, several challenges associated with achieving ZNE. In order to get input from professionals in the field, staff contacted an architectural firm with experience in designing ZNE municipal buildings. Their response was that a ZNE policy would be a very ambitious and admirable goal, however the City should consider the following:

- Different building types (offices, libraries, maintenance facilities, etc.) have significantly different levels of energy use intensity (EUI), there is growing data available to illustrate what building types are realistic candidates to achieve ZNE.
- Renovations with tight budgets/small scope may prove particularly difficult to achieve this goal, as there is a significant financial effort required to improve overall existing building performance.
- There are other "flavors" of benchmarking that can establish projects as "ZNE Capable" or "High performing buildings" that prepare you for potential better future renewable energy technology.
- Although there are other alternatives (wind, geothermal, hydro), generally speaking PVs are the primary viable option for onsite power generation. Cities do have a unique position to negotiate alternate energy contracts with utilities, leveraging multiple buildings into an aggregated service contract.
- The more stories the building, the more challenging ZNE becomes due to limited roof area for PVs proportional to floor area.
- Some sites are shaded by geography or other buildings limiting solar power potential.
- Although the cost of PVs has been dropping over the last decade, the construction market is volatile and costs could rise unexpectedly to coincide with a project.
- There is a corresponding increase in design and engineering effort that needs to be taken into

consideration.

- Plug loads have as much to do with achieving this goal as the building design - one donated "energy hog" refrigerator could blow the energy budget on a smaller project.
- Projects with intense "Process Loads" (such as large trash compactors and other high demand equipment), represent a challenging issue for ZNE.

The proposed policy would apply to all new buildings and significant retrofits of existing buildings. As currently proposed, Fire Stations 2 through 5 will have approximately 70% of their energy needs met by on-site solar photovoltaic systems as a result of the improvements being made with measure C funds. While the Utilities & Environmental Services Department is in full support of the currently proposed retrofits, if the proposed policy were already in place, these fire stations would be required to be retrofitted such that they become ZNE. That is, either provide 100% of the value of the energy needs on-site, or construct any deficit on an off-site location.

While the CEC's definition of ZNE (provided in the Background section) addresses both electricity and natural gas, staff recommends focusing on electricity use, but also minimizing the use of natural gas appliances. In order to meet our long term GHG reduction goals, the use of natural gas appliances (for space heating, water heating, cooking, etc.) will need to be minimized or eliminated. Many ranges in City facilities (including all fire stations) use natural gas, which is more desirable for cooking and can be offset with equivalent electricity production.

As recommended by the Sustainability Committee, staff recommends that Council adopt the attached resolution requiring:

- all new municipal buildings designed and constructed after January 1, 2017 be ZNE
- all new and existing municipal buildings for which renovations exceed 50% of the building's value and are designed and constructed after January 1, 2017 be ZNE
- lesser improvements to existing municipal buildings should include efficiencies and technologies that facilitate achieving Zero Net Energy by 2030.

As suggested by the Committee, for projects where the site, energy demand, or other aspects of a city building may make it infeasible or prohibitively expensive to achieve ZNE onsite, staff recommends that the building or site shall provide as much renewable energy as is feasible and the balance of the energy demand shall be offset by newly installed renewable energy facilities at other City-owned properties.

FISCAL IMPACT

The costs associated with transforming the City's buildings to ZNE will be determined as each project is designed. Costs will decrease over time as the cost of solar photovoltaic panels continues to decline and as more builders gain experience constructing ZNE projects. As noted above, ZNE requires a combination of high energy efficiency as well as the installation of renewable energy. When the 2016 Building Codes go into effect on January 1, 2017, the additional efficiency needed to reach ZNE will be reduced.

According to the New Buildings Institute, several studies have found the incremental cost of ZNE buildings to be up to 15% more than conventional construction costs (

<http://newbuildings.org/sites/default/files/ZNE_CommsToolkit_FAQ_CA.pdf>). This incremental cost is for design and construction only, and does not consider the life-cycle cost savings of lower energy costs to operate the building over time.

In the case of Fire Stations 2 through 5, Engineering & Transportation Department staff indicated that the cost increase associated with ZNE would be in the range of 26 to 32% when compared with conventional construction. This added cost would result in a payback periods ranging from forty-two to seventy-one years. Fire Station 1 was built in 1996 and does not include renewable energy. The improvements to Fire Station 1 are not related to energy efficiency or renewable energy and as such, solar PV and energy efficiency measures are not included in the retrofit project.

The percentage of incremental cost depends on which energy efficiency improvements are included in the calculation. If the costs for new windows, roofs, and mechanical systems are considered part of the standard retrofit, then the cost increase for ZNE may be in the range of 8 to 11% with payback periods ranging from fifteen to twenty-two years. It is important to note that even if the payback is a long period of time, the added cost of ZNE may still pay for itself during the service life of the building even if a simple PV panel replacement would be necessary after twenty-five years.

For residential construction, according to the CPUC, "Recent studies have indicated that the efficiency components of a new ZNE home have an incremental cost, after incentives, of just $2-$8 per square foot." (http://www.californiaznehomes.com/#!faq/cirw <http://www.californiaznehomes.com/>). The studies further indicate that "custom home builders who are developing ZNE homes right now indicate that there are nominal additional costs and that the key issue to achieve ZNE is design and quality construction."

SUSTAINABILITY FEATURES

Energy: Electricity/natural gas/other fossil fuels.

The proposed policy would minimize electricity use, minimize use of natural gas, and in some cases, completely eliminate or avoid the use of natural gas and other fossil fuels. A ZNE policy would be consistent with the General Plan policies listed in the Background section of this report.

Air: Air emissions of pollutants.

Minimizing the use of electricity supplied from the grid and the use of fossil fuels will result in a corresponding reduction in pollutants including GHG gas emissions.

Purchasing: Consistent with the City's Environmentally Preferred Purchasing Policy.

The City's EPPP seeks to minimize the City's contributions to climate change and pollution and to protect and conserve natural resources. ZNE buildings will be consistent with these goals and the EPPP in general.

NEXT STEPS

If Council adopts the attached resolution, staff will ensure it is implemented beginning in January 1, 2017.

Prepared by: Erik Pearson, Environmental Services Manager

Recommended by: Alex Ameri, Director of Utilities and Environmental Services

Approved by:

Fran David, City Manager

Attachments:

Attachment I	Draft Resolution
Attachment II	Fact Sheet: ZNE for Policymakers & Local Governments
Attachment III	Diagram of a ZNE Home