Tucson/Pima County

Net Zero Energy Code

Green House Gas Emission Reduction Report
December 1, 2011

Summary

The Net-Zero Building Energy Code can be an implementation strategy for ten of the action measures listed in the City of Tucson, Community Economic Security and Climate Action Analysis[1] report. These ten measures combine for 22.6% of the green house gas reduction potential identified in the report. The Net-Zero code itself has the potential to contribute another 12% reduction in green house gas emissions from the 2020 business-as-usual GHG emissions projection if the Net-Zero code is adopted as a mandatory code. If the code is adopted as a voluntary code, the potential reduction is estimated to be 2.1%. It is recommended that the Net-Zero Building Energy Code be a primary implementation strategy for the building related action measures.

City of Tucson, Community Economic Security and Climate Action Analysis – Action Measures

The climate action report by the Westmoreland Associates[1] submitted to the City of Tucson provides an analysis of carbon reduction potential of 33 action measures in three categories: General Energy Efficiency Options (noted as E#), Local Government Policy Options (noted as G#) and Transportation Policy Options. Ten of the action measures, listed in Table 1 below, are characteristics of a net-zero energy building. These ten measures combine for 22.6% of the green house gas reduction potential identified in the report making the Net-Zero Energy Building Code a key tool for implementing the action measures.

Table 1

2.0%	E10 Energy efficiency through new construction permitting
0.7%	E2, E3, E16, E17 Rental Housing Energy Efficiency Initiative
0.5%	E13 Appliance Efficiency Initiative,
0.5%	E14 and E23 Community Climate Challenge
5.04%	G22 Expand the Green Building Program
3.7%	G8 Mandatory Cool/Energy-Star Roofing
3.7%	G2d Residential Thermal
3.2%	G2A Commercial PV
2.0%	G14, G14a, G14b Expanded Residential Energy Efficiency
1.3%	G2e Residential P
22.64%	Total Green House Gas Reduction potential

[1] Westmoreland Associates. City of Tucson. Office of Conservation and Sustainable Development. *Community Economic Security and Climate Action Analysis*. Tucson: 2011. Web. <http://cms3.tucsonaz.gov/files/ocsd/CMS1_037899.pdf>

Additional Carbon reduction based on implementation of the Net-Zero Energy Building Code

The Net-Zero energy code introduces the concept of Energy Use Intensity (EUI) as a primary metric to measure energy use. This is analogous to miles per gallon for a car. The climate action report uses "percent better" than business-as-usual as a way of determining the avoidance of energy use in buildings. While this is the common methodology used in the past, the percent better methodology does not provide the anticipated energy use of a building. Anticipated energy use is essential when planning a net zero building, there for the use of the EUI metric. For the purposes of this analysis of additional GHG emissions reductions, EUI targets for net-zero buildings were converted into approximate "percent better". Net-Zero energy buildings are approximately 50% better in their energy use than buildings meeting the 2006 IECC code standard. This energy use is then offset by photovoltaic (PV) panels.

Action Measure G22 assumes a 28 % improvement in energy efficiency over the 2006 IECC. Therefore with the net zero code, it is anticipated that there will be an additional 22% improvement in energy efficiency and corresponding GHG emissions reduction. The following scenarios were created using the methodology of the Westmoreland report:

> **Adopt the Net-Zero code as mandatory for all new construction:**
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> If the Net-Zero Energy Code becomes mandatory and all new homes and commercial construction is net-zero, then the additional GHG emissions reduction due to energy efficiency is 92,000 tCO2e or 4% towards the emissions reduction goal. The installation of PV as part of the Net-Zero code would further reduce the emissions by 210,000 tCO2e or 9% over and above G2a and G2e which are the PV installation measures. This results in a total reduction of 302,000 tCO2e or 11% of the reduction goal.
>
> **Adopt the Net-Zero code as voluntary and incentivize**:
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> If the Net-Zero code is adopted as a voluntary compliance path in the 2012 IECC as currently recommended, then a participation rate for new homes can be applied to the above numbers. For example a participation rate of 10% results in the following: 9,200 tCO2e or 0.4% towards the emissions reduction goal based on energy efficiency and 21,000 tCO2e or 0.9% of the goal based on PV installation. This results in a total reduction of 30,200 tCO2e or 1.1 % of the reduction goal

Action Measure G14 is an energy efficiency program for existing homes. It is likely that if this program is implemented with a net-zero retrofit component that included incentives, that a portion of the anticipated 15,000 homes in the program will elect the net-zero building option. Assuming that 10% of these homes elect, or are incentivized, to participate in a net-zero remodel, an additional 25,809 tCO2e will be saved equating to 1.1% of the reduction goal.

Net-Zero is not Carbon Neutral

A common misunderstanding is that a Net-Zero Energy Building is also a Carbon Neutral Building. For example, consider the following explanation for Carbon Neutral:

> A building that is Carbon Neutral uses no fossil fuels in its operation, creates no direct greenhouse gases, and, as a result, does not contribute to global warming. The energy it uses may be produced on site or may be drawn from a utility grid but it must be "clean," produced by wind turbines, photovoltaics, or other renewable energy system. *Thus, a building that is both Carbon Neutral and Net Zero Energy produces at least as much renewable energy as it uses each year* [emphasis added].[2]

This definition repeats the common misunderstanding that net-zero is also carbon neutral. Carbon neutral is defined as:

> **Carbon neutrality**, or having a **net zero carbon footprint**, refers to achieving net zero carbon emissions by balancing a measured amount of carbon released with an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference. It is used in the context of carbon dioxide releasing processes, associated with transportation, energy production and industrial processes.[3]

Net-Zero does not equal carbon neutral because when the building's photovoltaic systems (PV) are not producing adequate electricity to power for the building systems, at night for example, the building uses energy from the grid produced by carbon emitting coal fired power plants. During peak PV power production, the building puts power back into the grid, equal to what it used. This provides power for some other load on the electric grid and on the surface, offsets carbon use. However if we look at the scenario where all buildings are net-zero energy, there is still the need to produce energy at night via coal fired power plants. (Research into power storage to capture daytime PV production is ongoing, but a solution to this problem will not occur in the immediate future). The carbon produced by the coal plant needs to be sequestered or offset for the building to also be carbon neutral. This is one of the key reasons why energy efficiency is of paramount importance.

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[2] *Carbon neutral and net zero*. (2011, November 15). Retrieved from http://www.betterbricks.com/design-construction/reading/carbon-neutral-and-net-zero

[3] *Carbon neutrality*. (2011, November 15). Retrieved from http://en.wikipedia.org/wiki/Carbon_neutrality