THE URBAN CLIMATE INITIATIVE
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Architecture 2030

An initiative to reduce energy consumption, create jobs, and incrementally phase out CO₂ emissions in the urban built environment by mid-century.

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EXECUTIVE SUMMARY
Keeping global average temperature increases under 2°C compared to pre-industrial levels – the threshold by international consensus – will require phasing out fossil fuel generated CO₂ emissions by mid-century. Urban areas are responsible for over 70 percent of global energy consumption and CO₂ emissions, mostly from buildings. With a staggering 82 billion square meters of building construction projected to take place in urban areas over the next two decades, there is an unprecedented opportunity to address emissions in the built environment worldwide.

The Urban Climate Initiative provides the framework for government entities to put in place incremental building sector actions to be taken over a fifteen-year timespan that will ensure phasing out CO₂ emissions in the built environment by mid-century. It utilizes fundamental building construction intervention points, building energy conservation codes, and renewable energy applications as primary implementation tools.

When fully implemented, the actions outlined in The Urban Climate Initiative will save property owners and occupants energy and money, as well as create thousands of local clean energy and construction jobs.

INTRODUCTION
The United Nations Framework Convention on Climate Change (UNFCCC) conference will convene in Paris in 2015. The goal is to reach a new agreement to prevent irreversible climate change, applicable to all countries, by keeping global average temperature increases under 2°C compared to pre-industrial levels. Meeting this consensus threshold requires phasing out CO₂ emissions from worldwide power and industrial sectors by mid-century, and all greenhouse gas (GHG) emissions from energy systems by the second half of the 21st century.

Today, more than half the world’s population lives in urban areas – 3.9 billion people¹. This is expected to increase to more than 5 billion by 2030. Urban areas are responsible for over 70 percent of global energy consumption and CO₂ emissions, mostly from buildings. By 2030, a staggering 82 billion square meters (883 billion square feet), an area roughly equal to 60 percent of the total building stock of the world, will be built or rebuilt in urban areas worldwide. This projection provides an unprecedented opportunity to set the entire global built environment on a path to peak fossil fuel CO₂ emissions in the near-term, with a complete phase-out of fossil fuel CO₂ emissions by mid-century.

Urban areas both contribute to and are affected by climate change. Natural hazards such as drought, temperature extremes, wildfires, and flooding, are all expected to increase with climate change. A recent study of major coastal cities conducted by the Organization for Economic Co-operation and Development

(OECD) found that climate change, sea level rise, rapid urbanization, and subsiding land are putting coastal cities at risk, with average global flooding losses increasing from $6 billion per year in 2005 to $52 billion a year by 2050\textsuperscript{2}.

If GHG emissions continue at their present rate, temperatures in urban areas across the planet will rise to levels with no recorded precedent by the middle of this century. By this time, “the coldest year in the future will be warmer than the hottest year in the past,” according to a recent paper published in the journal *Nature*\textsuperscript{3}. In this scenario, extreme heat events will be a source of increased health risks and impacts for many urban areas.\textsuperscript{4} These climate conditions will have compounding health impacts on the elderly, people with disabilities, and the poor with limited mobility. Those with the least means to relocate will be the most at risk.

The good news is that we already have the knowledge, technology, and policy reference points to avoid these outcomes. *The Urban Climate Initiative* implements the action items contained in Architecture 2030’s *Roadmap to Zero Emissions*\textsuperscript{5}, which charts a path for urban areas to phase out fossil fuel CO\textsubscript{2} emissions by 2050. In 2014, Architecture 2030 submitted the *Roadmap* to the United Nations Framework Convention on Climate Change (UNFCCC) and Organization for Economic Co-operation and Development (OECD).

There is also great resolve among design and planning professionals to phase out CO\textsubscript{2} emissions. In August 2014, the International Union of Architects (UIA), with member organizations representing over 1.3 million architects in 124 countries worldwide, unanimously adopted the 2050 Imperative, a declaration to eliminate CO\textsubscript{2} emissions in the built environment 2050\textsuperscript{6}.

The intent of *The Urban Climate Initiative* is to simplify and quantify a flexible, measured approach to reduce CO\textsubscript{2} emissions from the building sector, utilizing fundamental building construction *intervention points* (see APPENDIX A), *building energy conservation codes*, and *renewable energy applications* as primary implementation tools.

Since buildings are responsible for a major portion of urban energy consumption and CO\textsubscript{2} emissions, *The Urban Climate Initiative* focuses on the building sector. It can be implemented as is, or form the core of a comprehensive urban strategy.

to phase out fossil fuel CO₂ emissions in the built environment. It can also be implemented by governments at all levels – municipal, state, and national. A comprehensive urban strategy will include reducing GHG emissions from all sectors, including transportation, water, solid waste, and power production.

THE URBAN CLIMATE INITIATIVE
In urban areas and cities, buildings are responsible for a major portion of fossil fuel CO₂ emissions and electricity consumption. Due to the disproportionately large percentage of CO₂ emissions attributed to buildings, and in order to ensure phasing out CO₂ emissions in urban built environments by mid-century, local governments should establish and implement a program of building sector mandates and incentives. This program has the potential to create thousands of additional construction and clean energy manufacturing, distribution, sales, and installation jobs. Specifically, The Urban Climate Initiative recommends:

1. Building Energy Conservation Codes
All new buildings, building renovations, and all existing building purchases meet the following Building Energy Conservation Code (BECC) site building energy use intensity reduction targets:

- Beginning in 2016, update or adopt a building BECC – the 2015 International Energy Conservation Code for residential buildings (IECC 2015), and ASHRAE 90.1 2013 for commercial buildings, or equivalent.
- For minor building renovations, meet the energy use intensity requirements of the BECC for that portion of the building undergoing renovation.

2. Building Energy Conservation Code Updates
In 2020, 2025, and 2030, update the BECC to reflect the following energy use intensity reduction targets below IECC 2015 for residential buildings and ASHRAE 90.1 2013 for commercial buildings:

- 40% in 2020,
- 70% in 2025, and
- Zero-net-energy in 2030.

3. Building Energy Conservation Stretch Codes
Develop and adopt voluntary BECC stretch codes in 2016, 2020, and 2025 that meet the following energy use intensity reduction targets below IECC 2015 for residential buildings and ASHRAE 90.1 2013 for commercial buildings as follows:

- 2016 – 40% and 70% stretch codes,
- 2020 – 70% and zero-net-energy stretch codes,
- 2025 – zero-net-energy stretch code.

Note: For new buildings and major renovations, provide lucrative incentives for meeting stretch code reduction targets. Examples of incentives may include Floor Area Ratio (FAR) or density bonuses, fast track permitting and reduced permitting fees, rebates, tax credits and abatements, and attractive financing options such as reduced rate construction loans and mortgages (in the U.S. this includes Property Assessed Clean Energy financing or PACE, and On-Bill Utility Loan Repayment where available). Tax income from additional annual efficiency construction should be used to offset potential incentives.
4. Building Energy Conservation Code Compliance
Compliance with the BECC and stretch codes can be met using any combination of the following strategies:

- Constructed energy efficiency improvements (e.g. building envelope improvements, equipment and lighting efficiency upgrades, shading, daylighting, passive heating, cooling and ventilation strategies, etc.).
- Meet BECC minimum building prescriptive efficiency standards, and offset the remaining energy reduction needed by generating on-site renewable energy (e.g., solar, wind, biomass, geothermal, etc.).
- Meet BECC minimum building prescriptive efficiency standards, and offset the remaining energy reduction needed through the purchase of renewable energy (from non-CO₂ emitting sources) generated off-site, with a minimum 5-year purchase agreement.

Note:
Allow a new building purchaser(s) to enter into a 5-year minimum contract to buy renewable energy (from non-CO₂ emitting sources) within the first year of a building purchase in order to offset the BECC energy reduction target. For this option, establish a set of minimum efficiency requirements for existing buildings that do not disrupt building occupancy.

5. On-Site Renewable Energy Generation
On-site renewable energy generation systems can reduce energy costs and decrease exposure to fossil fuel price volatility.

Compliance with the BECC and the adoption of BECC stretch codes will create a demand for on-site renewable energy generation including rooftop solar hot water heating and solar electric systems, as well as local manufacturing, distribution, and installation work.

Incentivizing urban residents, business-owners and developers to install on-site renewable energy systems can be accomplished by:

- Promoting existing government, utility, and non-profit incentive programs
- Providing low-interest loans
- Waiving permit fees
- Adopting zoning and installation-friendly ordinances
- Implementing net metering
- Providing rebates, tax credits and exemptions

6. Comprehensive Urban Strategies
With buildings responsible for a major portion of urban energy consumption and CO₂ emissions (consumption and CO₂ emissions will vary by location), The Urban Climate Initiative focuses on the building sector and can be implemented as is, or form the core of a comprehensive urban climate strategy. See APPENDIX C: Sustainable Urban Development for organizations and resources for developing a comprehensive urban climate strategy.
APPENDIX A: BUILDING CONSTRUCTION INTERVENTION POINTS

With strategic changes, the building sector can be transformed into a major part of the solution for addressing the climate crises. However, to be effective, it is critical to understand how residential and commercial buildings can change over time. In particular, when developing programs to effect change, it is important to recognize each sector’s optimal intervention points, i.e. points where major transformations can most easily take place. Programs to reduce energy consumption and CO₂ emissions in buildings that do not recognize these intervention points, or fail to take advantage of them, face unnecessary obstacles and costs, and even potential failure.

Intervention points occur over the life of a building, from its inception to its demolition, and can be summed up as follows:

Optimal intervention points for residential buildings occur during:

- Building design – schematic design, material, and building systems selection
- Existing home purchases
- Home financing
- Rebuilding (after a natural disaster)
- Undertaking a major renovation

For commercial buildings they occur during:

- Building design – schematic design, material, and building systems selection
- Existing building purchases
- Building or space renovations
- Rebuilding (after a natural disaster)

Schematic design, the first intervention point, is the time when the energy consumption and CO₂ emissions pattern of a building is set for its useful lifetime, or until it undergoes a major renovation. Other intervention points occur at the times when construction/renovation takes place, typically when a building (or portion of a building) is purchased, changes occupancy, or needs major repair.

Building energy code policy, design tools, and financial incentives are key for effecting change at these intervention points. The financial incentives for the sector may include attractive financing, tax deductions or credits, Floor Area Ratio (FAR) and density bonuses, and reduced building application fees and rebates. It is also important to note that planning decisions and coordination at all scales, from the region to the city and district, can have large economic, energy, and CO₂ emissions implications as well.

Building renovation should not be confused with weatherization. Renovation is more extensive than weatherization and can include demolition, structural work, interior and exterior work, and upgrades to specialty work (e.g. electrical, plumbing, lighting, HVAC, etc.). Renovation is an intervention point where a major building transformation can take place.
APPENDIX B: CASE STUDY, NEW YORK CITY 80 x 50

The following Urban Climate Initiative plan analysis was prepared for New York City (NYC). It helped inform NYC Mayor Bill de Blasio’s recently announced plan, One City, Built to Last: Transforming New York City’s Buildings for A Low-Carbon Future.

NYC contains over one million buildings with an estimated total gross floor area of 5.75 billion square feet. NYC’s buildings are responsible for approximately 71% of the city’s emissions, and 94% of the city’s total electricity consumption.

During the past year in NYC there were approximately:
- 68,000 alteration (renovation) building permits issued,
- 43,000,000 square feet of new building construction,
- 3,700 commercial property sales,
- 22,500 one, two, and three family residence sales.

The total number of residential sales, and commercial building sales, anticipated to take place between 2015 and 2050, is slightly less than the current number of buildings citywide. If the Urban Climate Initiative is implemented, over 90 percent of New York City’s future building stock will be designed, renovated, and constructed to varying degrees of high performance efficiency standards ranging from a 50 percent improvement to net-zero-energy by 2050.

New York City’s emissions in 2005 were 59.2 MtCO\textsubscript{2}e (the baseline), and in 2012 they were 47.9 MtCO\textsubscript{2}e, showing a decrease of 19 percent or 11.3 MtCO\textsubscript{2}e.

Incorporating the recommendations to the NYC Energy Conservation Code would reduce Building Sector emissions by 91 percent, or 30.8 MtCO\textsubscript{2}e, by 2050. Emissions reductions would come from building efficiency gains, and on-site and off-site (utilities) renewable energy production.

To meet a citywide 80 percent emissions reduction by 2050 (below the 2005 baseline), a 5.26 MtCO\textsubscript{2}e reduction would be required from the power, transportation and waste sectors.

Between 2015 and 2050, the NYC Urban Climate Initiative will create $5.8 billion dollars in construction each year (2013 dollars), and create approximately 65,966 new jobs* annually as follows:
- Construction industry jobs: 26,141
- Indirect jobs: 20,930
- Induced jobs: 18,895

Also, the demand for off-site renewable energy production will be a significant source of additional manufacturing and installation jobs.
The Initiative will generate over $500 million in city tax revenue annually. This is money that can be used for a number of programs including renovating New York City's public housing stock for energy efficiency, and creating incentives for the uptake of stretch-codes.

Analysis assumptions:
- Average building floor area of residential properties sold in 2013 is 2,120 square feet.
- Average building floor area of commercial properties sold in 2013 is 22,786 square feet.
- Additional efficiency renovation construction cost for purchased buildings = $35/square foot of building floor area.
- Additional efficiency upgrade cost for new code standard compliance = 5% of construction costs.

Data Sources:
- NYC Department of Buildings; NYC Department of Finance; Political Economy Research Institute (job estimates).

*Indirect jobs are jobs created in industries such as transportation, administrative services, etc. Induced jobs are jobs created when workers spend their earnings on retail, fuel, food, etc. Assumes 25 percent of annual building purchases will buy renewable energy to meet the energy code requirements.
APPENDIX C: RESOURCES

Additional resources for developing a comprehensive sustainable urban strategy include, but are not limited to:

- **Comprehensive Urban Strategies**
  - The 2030 Palette – A free, highly accessible web-based platform, providing strategies for de-carbonized, sustainable planning and design to individuals, firms, and institutions engaged in transforming the built environment (http://2030palette.org/).
  - Local Government Climate and Energy Strategy Series – a U.S. Environmental Protection Agency overview of GHG emissions reduction strategies that local governments can use to achieve economic, environmental, social, and human health benefits. The series covers energy efficiency, transportation, community planning and design, water consumption, solid waste and materials management, and renewable energy (http://epa.gov/statelocalclimate/resources/strategy-guides.html).
  - ICLEI Local Governments for Sustainability – an association of over 1,000 metropolises, cities, and urban regions dedicated to promoting global sustainability through local action (http://www.iclei.org/).

- **Urban Planning and Transportation**
  - Institute of Transportation and Development Policy (ITDP) – ITDP focuses on Climate & Transport Policy, Cycling & Walking, Outreach & Awareness, Public Transport, Sustainable Urban Development, and Traffic Reduction.
  - Reconnecting America – a national nonprofit that integrates transportation and community development.
  - The Bicycle Partnership Program – assists local authorities, civil society organizations and other partners in creating or improving a local process making it possible to use a bicycle as a means of transportation. (http://www.bikepartners.nl/index.php?option=com_frontpage&Itemid=1).
  - Congress for the New Urbanism – an organization promoting walkable, mixed-use neighborhood development, sustainable communities and healthier living conditions (http://www.cnu.org/).
• Water and Wastewater
  o International Water Association – a global source of knowledge, experience and leadership for urban and basin-related water solutions. (http://www.iwahq.org/1nb/home.html).
  o Constructed Wetland Association – promotes the use of constructed wetlands for pollution control including wastewater treatment, surface water run-off management, habitat enhancement and protection of our natural water resources (http://www.constructedwetland.co.uk/).

• Solid Waste
  o Municipal Solid Waste – practices that reduce the amount of waste needing to be disposed of.
    http://www.epa.gov/epawaste/nonhaz/municipal/
    http://www.epa.gov/statelocalclimate/local/topics/waste-mgmt.html
APPENDIX D: INTERIM STRETCH CODES

The Urban Climate Initiative (Initiative) provides the framework for government entities to put in place incremental building sector actions that will ensure phasing out CO₂ emissions in the built environment by mid-century. The Initiative sets forth voluntary building energy code performance improvements, or stretch codes, between 2016 and 2030, for 40 percent, 70 percent, and one hundred percent reductions in building fossil fuel energy use compared to a fixed baseline.

Progress on this pathway is measured and based on total building energy use, demonstrating reductions from a baseline and progressing to zero-net-energy by the year 2030. To create and implement a baseline and the voluntary stretch codes called for in the Initiative, Architecture 2030 recommends using the performance paths in:

• ASHRAE 90.1 2013, NORMATIVE APPENDIX G: PERFORMANCE RATING METHOD for commercial buildings (including addendum bm), and the
• 2015 IECC, Section R405: SIMULATED PERFORMANCE ALTERNATIVE, and Section R406: ENERGY RATING INDEX COMPLIANCE ALTERNATIVE for residential buildings.

COMMERCIAL BUILDINGS – ASHRAE 90.1 2013

NORMATIVE APPENDIX G: PERFORMANCE RATING METHOD

ASHRAE 90.1 2013, as well as the 2012 International Green Construction Code and ASHRAE 189, describe methodologies to achieve higher performance levels for commercial building designs than required by the code. In addition to a series of prescriptive requirements, these model codes incorporate a performance pathway that describes an energy modeling methodology to demonstrate performance beyond the code using ASHRAE Normative Appendix G.

To create the stretch codes for the 40 percent, 70 percent, or zero-net-energy building performance reduction targets called for in Initiative, use the performance method set out in “Normative Appendix G” of ASHRAE 90.1 2013 (including addendum bm), and require that the annual percentage improvement of the “proposed building design” be equal to or greater than the “baseline building design" as follows:

• A 40% or greater improvement for the 40% Stretch Code
• A 70% or greater improvement for the 70% Stretch Code.
• A 100% improvement in order to meet a Zero-Net-Energy Stretch Code.
The percentage improvement of the proposed building design is calculated in accordance with the provisions of Normative Appendix G using the following formula:

\[
\text{Percentage improvement} = 100 \times \frac{\text{Baseline building performance} - \text{Proposed building performance}}{\text{Baseline building performance}}
\]

Notes:
Improvements to unregulated loads (plug loads and other equipment) may be included in the proposed building performance calculations. These loads can be modeled using the procedures in the COMNET Standard for calculating plug load performance baseline and improvements. Proposed improvement strategies should be clearly documented.

In lieu of using annual energy costs simulated for the baseline and proposed building designs, annual building energy use intensity at the site (site EUI) in kBTU/square foot/year may be used.

As outlined in The Urban Climate Initiative, once the mandatory efficiency provisions set out in Normative Appendix G are met, site-generated or purchased renewable energy can be subtracted from the proposed building design’s annual energy consumption prior to calculating the percentage improvement.

The New Buildings Institute will soon release a prescriptive path to meet the 40% Stretch Code target based on their Advanced Buildings New Construction Guide.

**RESIDENTIAL BUILDINGS – 2015 IECC**

**SECTION R405: SIMULATED PERFORMANCE ALTERNATIVE**

To create 40%, 70%, or zero-net-energy building performance reduction targets (below the 2015 IECC benchmark*) or stretch codes for residential buildings, use the method set out in Section R405 of the 2015 IECC and require that the annual percentage improvement of the “proposed residence design” be equal to or greater than the “standard reference design” by the following:

- A 40% or greater improvement for the 40% Stretch Code
- A 70% or greater improvement for the 70% Stretch Code.
- A 100% improvement in order to meet a Zero-Net-Energy Stretch Code.

The percentage improvement of the “proposed residence design” can be calculated in accordance with provisions of Section R405 using the following formula:

\[
\text{Percentage improvement} = 100 \times \frac{\text{Standard reference building performance} - \text{Proposed residence performance}}{\text{Standard reference building performance}}
\]
As outlined in The Urban Climate Initiative, once the mandatory efficiency provisions set out in Section R405 are met, site-generated or purchased renewable energy can be subtracted from the proposed residence design energy consumption prior to calculating the percentage improvement.

In lieu of using annual energy costs simulated for the baseline and proposed building designs, site energy use intensity (site EUI) in kBtu/square foot/year may be used.

SECTION R406: ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

To create 40%, 70%, or zero-net-energy building performance reduction targets (below the 2015 IECC benchmark*) or stretch codes for residential buildings using the 2015 IECC method set out in Section R406, require the Energy Rating Index (ERI) of the rated residential design to have an ERI equal to or less than the appropriate value listed in the following table when compared to the ERI reference design:

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>2015 IECC</th>
<th>40% STRETCH CODE</th>
<th>70% STRETCH CODE</th>
<th>ZNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52</td>
<td>31</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
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</tr>
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<td>0</td>
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<td>53</td>
<td>32</td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

As outlined in The Urban Climate Initiative, once the mandatory efficiency provisions set out in Section R406 are met, site-generated or purchased renewable energy can be subtracted from the proposed residence design energy consumption when calculating the ERI.

*Notes:

The Energy Rating Index (ERI) is a numerical integer value that is constructed such that the ERI reference design has an Index value of 100 and a residential building that uses no net purchased fossil fuel or fossil fuel generated energy has an Index value of 0. The ERI considers all energy used in the residential building.
CONTACT
For more information contact:
Edward Mazria
Architecture 2030
+1 505-988-5309
mazria@architecture2030.org
www.architecture2030.org