



ONE PLANET  
CITY CHALLENGE 

# ENERGY EFFICIENCY SERIES

# UNLOCK THE POWER OF ENERGY EFFICIENCY

We are in the midst of a climate crisis. In order to limit global temperature rise to 1.5°C, we not only need to shift to renewable energy, we also need to drastically reduce our energy consumption by using energy more efficiently. And cost-effective technologies and policies to do so already exist; their full and immediate implementation could bring us 40% of the way towards achievement the Paris Agreement goals.

Beyond climate, maximising energy efficiency should be a no-brainer: it is not only good for the environment, it also brings about significant cost savings, greater energy security, as well as greater health and well-being for societies. The problem is that these technologies and policy measures are being sorely under-utilised. So how can we ramp up action?

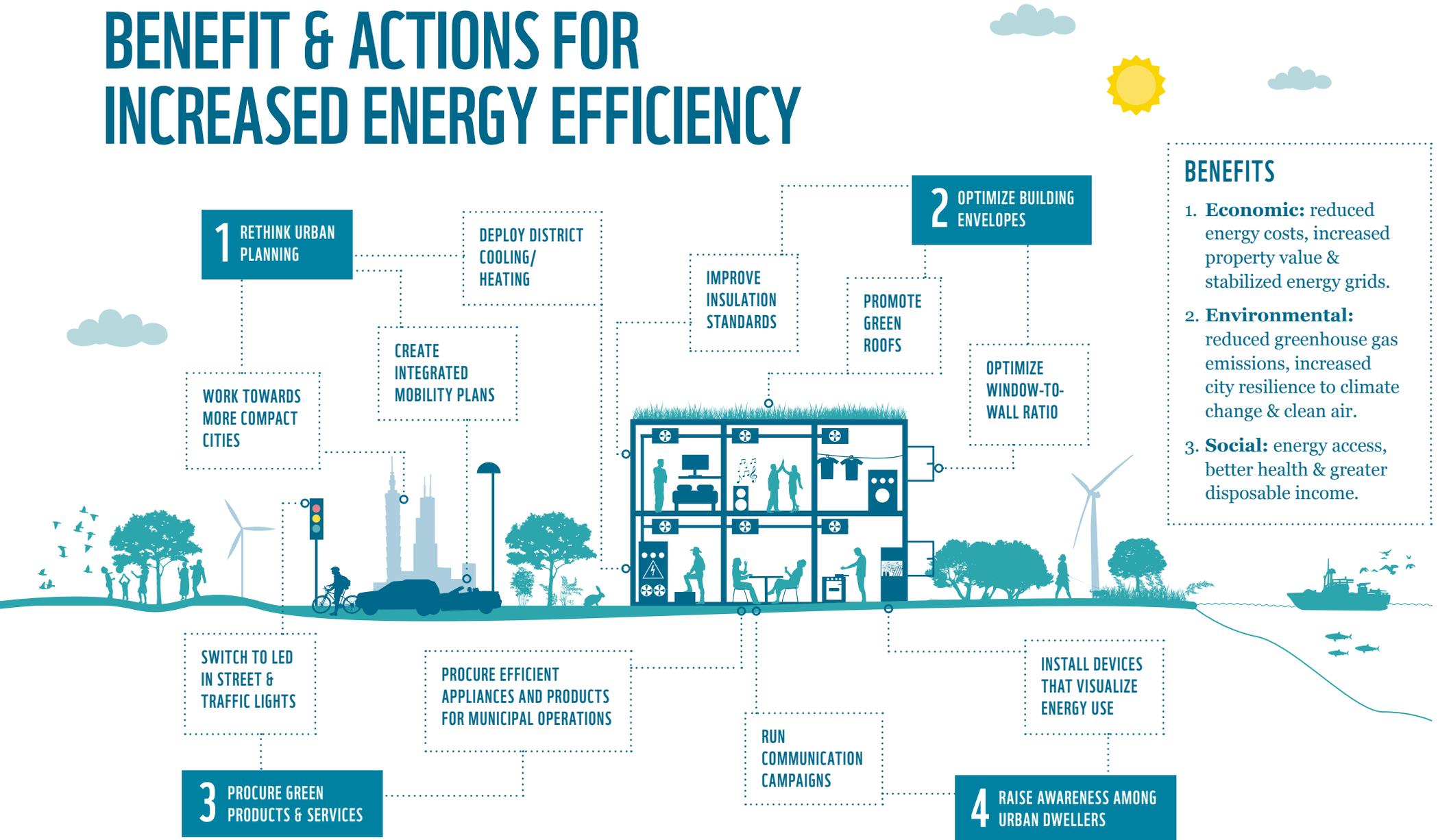
Cities have a key role to play in championing energy efficiency. They consume over two-thirds of global energy and are responsible for over 70% of global CO<sub>2</sub> emissions. At the same time, they are also spear-heading climate action and have the greatest power to generate concrete action on the ground.

With this factsheet series on energy efficiency, we hope to empower local governments to work on energy efficiency within their city walls. The series provides some ideas of quick-win actions as well as some more systemic considerations related to urban planning for city officials to take into account as they work on their strategies for a low-carbon and resilient future.



***Jenny Calder***  
*WWF's Global Expert  
on Energy Efficiency*

# BENEFIT & ACTIONS FOR INCREASED ENERGY EFFICIENCY



## BENEFITS

- Economic:** reduced energy costs, increased property value & stabilized energy grids.
- Environmental:** reduced greenhouse gas emissions, increased city resilience to climate change & clean air.
- Social:** energy access, better health & greater disposable income.



**ENERGY EFFICIENCY SERIES**

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**URBAN PLANNING  
TO REDUCE  
CLIMATE IMPACT**

## *The first step to efficiency: good urban planning*

Cities can lead the transition to climate resilience. In 2018, 22 cities signed the World Green Building Council's Net Zero Buildings Commitment to achieve net-zero carbon for all new buildings by 2030 and all buildings by 2050. This commitment makes local governments responsible to spearhead low-carbon policies and actions that keep global temperature rise below the important 1.5°C threshold.

How can it be done? For example: by maximizing energy efficiency in urban plans and implementing renewable energy systems; and by championing sustainability initiatives that protect citizens and the environment.

OPCC will continue to spotlight and reward cities that implement these policies and actions in the building sector.

## *Local policies, strategic goals, and programs*

### **GHG REDUCTION**

[Tokyo's Environmental Master Plan](#) aims by 2030 to reduce this megacity's emissions 30% compared to 2000 levels. A metropolitan government plan,

it includes several actions and programs, such as Tokyo Green Building and Tokyo Carbon Reduction Reporting. Tokyo also signed the [Net Zero Buildings Declaration](#) in 2018.

### **LOCAL CODES**

**Vancouver** goes further than Canada's national codes with its stringent [2019 Vancouver Building By-law](#). This set of codes will reduce energy use and the carbon footprint of city buildings and help Vancouver's ambitious goal to be designated as the "Greenest City in the World" by 2020.

### **STAKEHOLDER INCLUSION**

The city of **Rotterdam** is working with stakeholders – such as the port, housing authorities and the Province of Zuid-Holland – to implement the [Heat Transition Plan](#). This plan targets individual buildings' performance as part of a citywide clean energy policy. Included is an emissions-free district heating system planned by 2050. [Rotterdam Climate Proof](#) additionally involves business and property owners in the climate adaptation strategy of different colored rooftops. Blue roofs are designed to retain water, green roofs foster biodiversity, yellow roofs produce renewable energy, and red roofs add social value.

# 2030

*is the year in which 22 cities globally commit to have all new buildings be net-zero carbon. By 2050, all buildings in those cities will be net-zero.*





**32,200 tons CO<sub>2</sub>**  
*saved annually in Buenos Aires,  
Argentina from switching to LED in  
street and traffic lights, with a central  
management system.*

### ENERGY MANAGEMENT SYSTEM

To know and understand energy consumption is a first step in improving efficiency. In **Turin, Italy** a partnership with the Polytechnic University since 2014 has facilitated [implementation of an Energy Management System](#) for the entire city stock of public housing. City authorities can identify and address weak spots in the housing's energy systems and make informed technical and policy decisions to improve efficiency.

### LED LIGHTING

**Buenos Aires, Argentina**, is the first capital city in Latin America to get the energy savings and quick investment return of switching to LEDs in street and traffic lights. These LEDs are connected to a management system that allows city managers to see and analyze performance data of connected lights and also control them remotely. From 2020 the system is expected to consume 50% less energy than conventional lighting and save 50% of maintenance costs while reducing CO<sub>2</sub> by 32,200 tons annually.

### RENEWABLE INCENTIVES

**Coimbatore** is part of [India's National Solar Cities](#)

[Program](#) which aims to reduce energy consumption 10% in participating cities within five years.

**Coimbatore** will install solar photovoltaic panels (PVs) on all its municipal buildings, and at least 59 other cities are part of the program.

### *Building and site certification*

#### NET ZERO

**Costa Rica** has a climate action plan that strives for new buildings to be net zero carbon by 2030. The city of **San José** with its [Municipal Green Building Policy](#) adds the additional requirement that new municipal buildings be certified LEED Silver at a minimum.

#### SITE CERTIFICATIONS

The Im Lenz '2000-Watt Site' is a live-work redevelopment in **Lenzburg, Switzerland** that combines revitalization of an industrial wasteland with sustainable resource use. [2000-Watt certifications](#) are two-tiered certifications, ensuring buildings are constructed efficiently and use no more than 2000 watts of energy per capita.

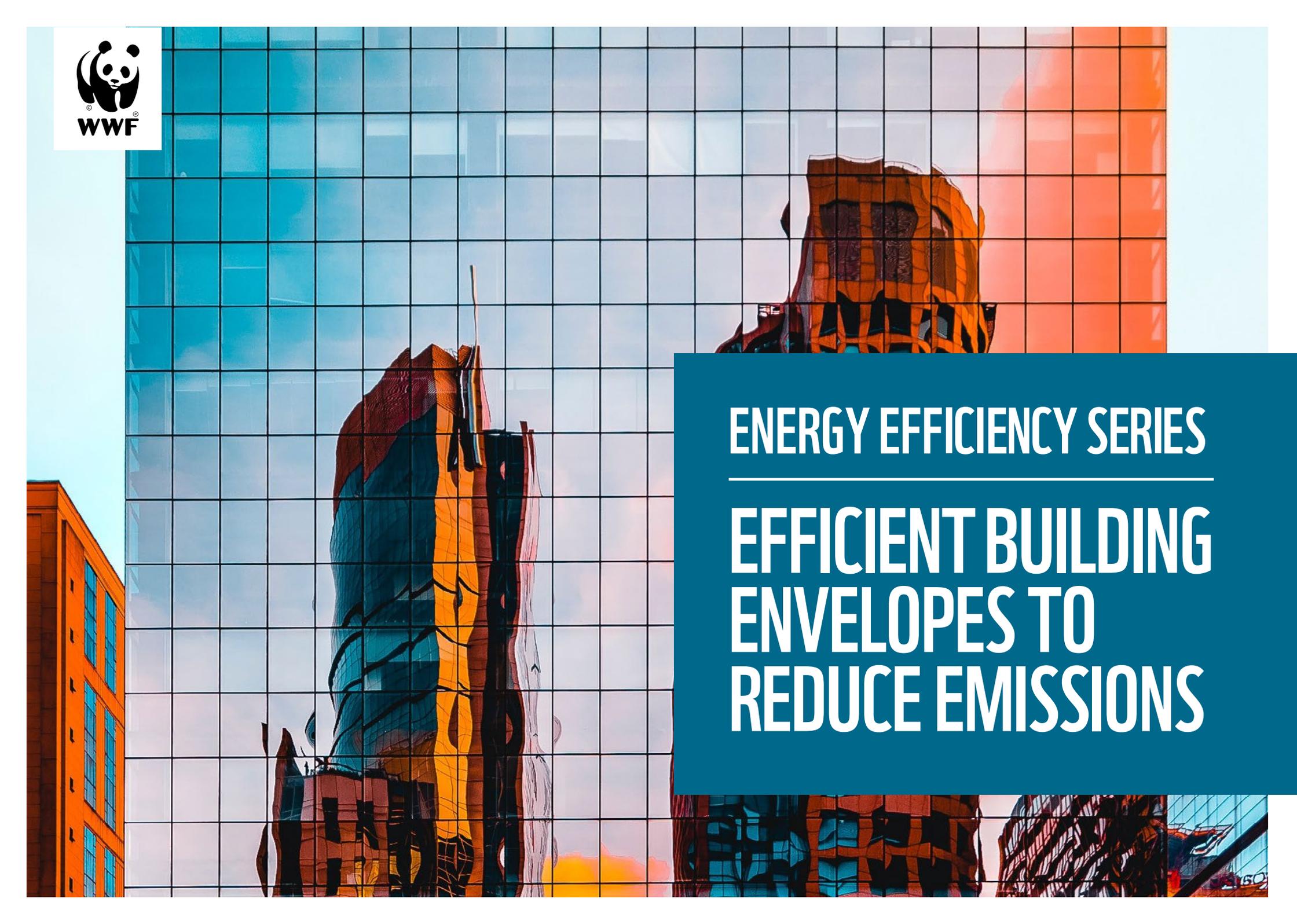
## ***Case study Quito, Ecuador***

**Quito, Ecuador** developed [an eco-efficiency urban plan](#) to ensure structured and sustainable city growth that limits sprawl. Density is promoted through construction of mixed-use buildings close to public transport options to avoid long commutes that exacerbate emissions. Buildings that follow the plan can add more floors than city codes permit if they limit water use to 35%, energy consumption to 30%, and other environmental, landscaping, and technical inputs to 35% of benchmarks.

### ***Tools and resources***

- Find further explanation of [Quito's plan](#).
- Read about [Quito's high-rise IQON building](#).
- And compare [Quito's plan to actions in other C40 cities](#).



A photograph of a modern glass skyscraper with a grid-like facade. The building's surface reflects the sky and other buildings, creating a complex pattern of colors and shapes. The overall scene is brightly lit, suggesting a clear day.

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**EFFICIENT BUILDING  
ENVELOPES TO  
REDUCE EMISSIONS**

## ***Better building envelopes for better cities***

The construction industry is an advantageous area of focus for cities' climate action plans, as the [sector produces nearly 40% of the world's direct and indirect greenhouse gas \(GHG\) emissions](#). A building's 'envelope' or exterior shell impacts the comfort and quality of the indoor environment as well as its overall energy consumption. City planners, architects, and engineers thus face the challenge of designing optimized building envelopes to decarbonize this sector.

Policy frameworks and the engagement of experts in the field are both important tools to encourage innovative solutions tailored to the needs, opportunities, and climate conditions of individual cities. Properly implemented, innovations to the efficiency of building envelopes promise significant economic savings, increased property values, and improved well-being for citizens. More efficient building envelopes are also crucial to help limit global temperature rise to 1.5°C and increase resiliency in OPCC cities.

## ***Local policies, strategic goals, and programs***

### **CODES AND CERTIFICATIONS**

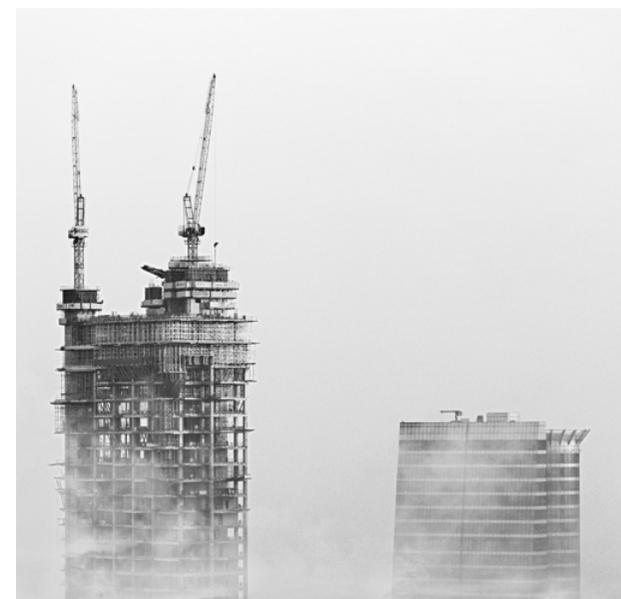
Stringent construction requirements and higher standards in building codes are a first step. For example, all new government buildings in [Zurich, Switzerland](#) must pursue a [Minergie-Eco](#) energy efficiency certification, while in [Durban, South Africa](#) new buildings need to set targets for energy consumption reductions.

### **INCENTIVES AND FINANCIAL MECHANISMS**

Green leases can accelerate efficiency improvements of building envelopes by creating an agreement between landlords and tenants to work together to save money and implement investment actions. Landlords can pass part of the cost of efficiency investments on to tenants who achieve lower operating costs, while landlords enjoy return on investment from building upgrades. Tenants and landlord at [Cherry Street Plaza in Chardon, Ohio, the United States of America](#) share the utility savings of green lease improvements.

# 40%

*of global greenhouse gas emissions are produced by the construction industry.*





# 40,000

*micro photovoltaic power plants will be installed in homes through 2020 in Seoul, Korea.*

## ***Passive design measures***

### **IMPROVE INSULATION STANDARDS**

Adequate insulation improves buildings' thermal regulation – it helps avoid extreme heat gains and losses. Because it achieves these outcomes in a passive manner, improving insulation reduces energy demand both for heating and cooling. In [Morelia, Mexico](#), airtight insulated envelopes ensure a comfortable indoor environment and reduce energy consumption in new city row houses.

### **LIMIT WINDOW-TO-WALL RATIO**

Buildings with fully-glazed façades are HVAC dependent and tend to be highly exposed to solar radiation. Ideally window area should not exceed [30 per cent](#) of a wall façade. [Smart GHAR III](#) housing in [Rajkot, India](#), reduced glazing areas to prevent heat from entering the building.

### **INTRODUCE SOLAR SHADING**

Shading is a passive and inexpensive way to reduce summer heat loads. Examples include vegetation with seasonal variation and envelope elements that reflect natural light.

### **OPTIMIZE NATURAL VENTILATION**

Façade design allows natural ventilation at night to cool the building and reduce peak daytime temperatures in summer. The [Deutsch Schule](#) in [Madrid, Spain](#), uses efficient shading and cooling for the building's thermal mass via air flushing around the envelope at night.

### **IMPLEMENT GREEN ROOFS**

Roofs are buildings' main receivers of solar radiation and heat, thus cooling them off is an effective and low-cost envelope strategy. In [New York City, the United States of America](#), the [NYC CoolRoofs](#) initiative applies reflective roof coatings at no or low cost to owners and residents on eligible non-profit and affordable housing buildings.

### **RENEWABLES IN DESIGN**

Photovoltaic (PV) panels and solar collectors can be integrated in the envelope design to produce energy and reduce peak consumption in buildings. In [Seoul, Korea](#), the [Sunlight City project](#) installed photovoltaic panels on about 10,000 buildings increasing the city's renewables capacity to 320 MW with plans to add as many as 40,000 micro PV power plants in homes during the course of 2020.

## CASE STUDY RAJKOT, INDIA

The Indo-Swiss Building Energy Efficiency Project (BEEP) developed a green affordable housing project called [Smart GHAR III](#) in **Rajkot, India**. A workshop during the early design phase led to features that reduce peak summer temperatures up to 5°C. Innovations include insulation of the building envelope, external movable shades on windows to reflect heat while letting natural daylight through, and natural ventilation assisted by a fan on top of the central air shaft between flats.

# 5<sup>0</sup> Celsius

*reduction in peak summer temperatures from features created in the Smart GHAR III project in Rajkot, India.*





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# GREEN PROCUREMENT TO SPEED EFFICIENCY

## ***Cities' power to shift the market to efficiency***

Public authorities carry significant power to influence markets. In 2015, public procurement of goods and services [accounted for as much as 12% of GDP](#) in OECD countries. These public entities - including cities! - can stimulate critical demand for sustainable goods and services which otherwise would be difficult to get onto the market. With that power comes a responsibility to procure sustainably.

Sustainable public procurement implies cities will choose products and services based on their ability to be cost-effective throughout their lifecycle (i.e. not just via upfront costs) and generate economic, environmental, and social benefits for society. Energy efficiency is an important component of sustainable public procurement because it helps limit global average temperature rise to 1.5°C. Beyond this climate consideration, procuring efficient solutions also brims with economic, environmental, and social benefits for cities.

## ***Economic benefits***

### **CHEAPER**

Energy efficient products tend to be the cheapest option in the long run: they generate lower energy bills and require less maintenance than their less efficient equivalents. Buying desktop PCs and displays with an efficiency performance 60% higher than the Energy Star Standard allowed **Italy's Consip SpA12** to save € 2,300,000 on electricity during the length of the equipment's procurement contract.

### **PROMPTS INNOVATION**

To push energy efficiency as a key procurement criteria helps cities stimulate innovation in sectors that, from a technological perspective, have evolved only marginally over decades. This in turn can trigger action from other stakeholders, both businesses and individuals.

# € 2,300,000

*in savings for Italy from buying PCs and displays with an efficiency performance 60% higher than the Energy Star Standard (during the length of the equipment's procurement contract).*





# \$ 5,500,000

*saved per year in Madagascar by governmental distribution of over 500,000 energy saving lamps.*

## ***Environmental benefits***

### **REDUCE POLLUTANTS**

Energy efficient products - particularly vehicles - reduce outdoor concentrations of air pollutants, consume less energy, and emit less greenhouse gases throughout their lifetime. **China** can save 1,057 terawatt hours of electricity (equivalent to the annual production of 403 mid-sized coal plants) by 2030 by raising the energy efficiency of 9 appliances to that of the most efficient model currently on the market.

### **SAVE RESOURCES**

With their longer shelf life, energy efficient products allow for more sustainable resource management.

## ***Social benefits***

### **ACCESSIBILITY**

Cities can drive down the upfront cost of efficient products, thereby making them more accessible to lower-income families.

### **STABILIZE GRIDS**

Cities can reduce the risk of power black-outs by reducing overall load on the grid. Distribution of over 500,000 energy saving lamps in **Madagascar**

allowed the government to save \$5.5 million per year in reduced peak load and fossil fuel imports. The [Lumitsits program](#) also generated an annual savings of \$33 per household on electricity bills in a country in which 75% of the population lives on less than \$1.90 per day.

## ***Getting procurement right***

If procurement criteria are too stringent, few products will comply, which can lengthen procurement time. If criteria are too loose, low-quality products with short lifetimes may proliferate. Europe's [Topten.eu](#) service has created [product-specific procurement guidelines](#) that include estimates of energy savings in kWh/year and monetary terms. The guidelines also supply technical criteria that can be directly inserted into procurers' tenders and are calibrated to the most energy-efficiency products in local markets. The guidelines are based on independent, market-based research in 20 countries in Europe, Asia, and Latin America. Adapting these guidelines to the local circumstances of other cities is a relatively straightforward task. If, as a city, you are interested in developing guidelines specific to your local context, please contact Jenny Calder ([jcalder@wwf.fr](mailto:jcalder@wwf.fr)).

## ***Tools and resources***

Join a city network on public procurement via the [Global Lead City Network on Sustainable Procurement](#).

Find out more about how to implement sustainable public procurement via:

- [ICLEI \(2016\), The Procura+ Manual: A Guide to Implementing Sustainable Procurement](#)
- [European Commission \(2016\), Buying Green! - A Handbook on Green Public Procurement](#)

See what best practice other cities are putting in place via the [Sustainable Public Procurement Platform](#).





**ENERGY EFFICIENCY SERIES**

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**AWARENESS  
WILL PROMPT  
PEOPLE TO ACT**

## ***Behavior change matters***

Policy changes and technological innovations will indeed reduce energy consumption in our cities and societies, but raising awareness to shift mass behaviour towards more efficiency also has a critical role to play.

### **QUICK AND LOW COST**

In many cases, behavior changes are some of the quickest and most low-cost ways to save energy at scale and reap the associated economic, environmental, political, and social benefits. After a week-long awareness-raising campaign on energy efficiency, staff at WWF Peru reduced consumption in its **Lima** office by about 40% solely through behavior changes like switching off appliances and lights when the services they provided were not necessary.

### **PROTECT AGAINST REBOUND**

Stakeholders must understand energy efficiency to ensure technologies or policies are effective. Without raising awareness on the need to reduce overall energy use, efficiency investments can lead to a rebound effect: i.e. lower bills encourage users

to consume more energy or purchase more energy-intensive goods and services.

### **REINFORCE THE LONG TERM SAVINGS**

Efficiency solutions tend to cost more upfront. Consumers who understand the principles of efficiency and the long term savings are in a better position to make prudent and well-informed financial decisions about efficiency investments. City authorities are in prime positions to raise awareness and educate citizens on these principles and help us all shift toward efficient behaviors.

## ***Principles for positive change***

### **KNOW YOUR AUDIENCE**

While there's no 'one size fits all' in efficiency awareness raising, it is essential to know target audiences and to closely tailor campaigns to these groups. Understand their concerns, adapt messages accordingly. One strength of energy efficiency is that it has many benefits that can make it attractive to different sub groups. The table on the next page illustrates a few of these benefits and their respective audiences.

# 40%

*energy reduction at WWF Peru Lima office through behavior changes like switching off appliances and lights – after a week-long awareness-raising campaign on energy efficiency.*



## BENEFITS OF ENERGY EFFICIENCY FOR DIFFERENT STAKEHOLDER GROUPS

| BENEFIT  | TARGET GROUP  |
|--|---|
| <b>ENERGY SAVINGS</b><br>Energy efficiency can lower energy bills.   | This message is universally attractive and thus is a key element to put forward in campaigns aimed at city dwellers.  |
| <b>REDUCED GREENHOUSE GAS EMISSIONS</b><br>By reducing energy needs, energy efficiency reduces the climate impact of the energy production sector. | Audiences concerned with the environment, such as organizations/environmental NGOs.   |
| <b>IMPROVED GRID STABILITY</b><br>By reducing the overall load on the grid, energy efficiency contributes to grid stability.                       | Communities which suffer from regular grid black outs, and electricity providers.   |
| <b>HEALTH AND WELL-BEING</b><br>Energy efficiency improves indoor and outdoor air quality.   | City dwellers that regularly suffer from air pollution, and building users.   |
| <b>ENERGY ACCESS</b><br>By lowering the lifetime cost of solutions, energy efficiency allows vulnerable populations to access vital services.      | City dwellers for whom access to energy (and associated services, e.g. cooling) are a priority.   |
| <b>DISPOSABLE INCOME AND STANDARDS OF LIVING</b><br>By spending less on energy bills, consumers have more disposable income.                       | Most audiences will be receptive to an increase in disposable income. This is particularly important in societies in which poverty alleviation is a priority. |

### NARROW THE FOCUS

Energy efficiency is often perceived as overly complex and technical. It does not easily capture peoples' imagination. While solar panels or wind turbines can be seen, touched, and imagined, energy efficiency remains an intangible concept. To ensure that energy efficiency is easy to understand, communication activities will in many cases need to be narrowed down to focus on a specific area such as heating or cooling, or mobility.

### KEEP IT SIMPLE

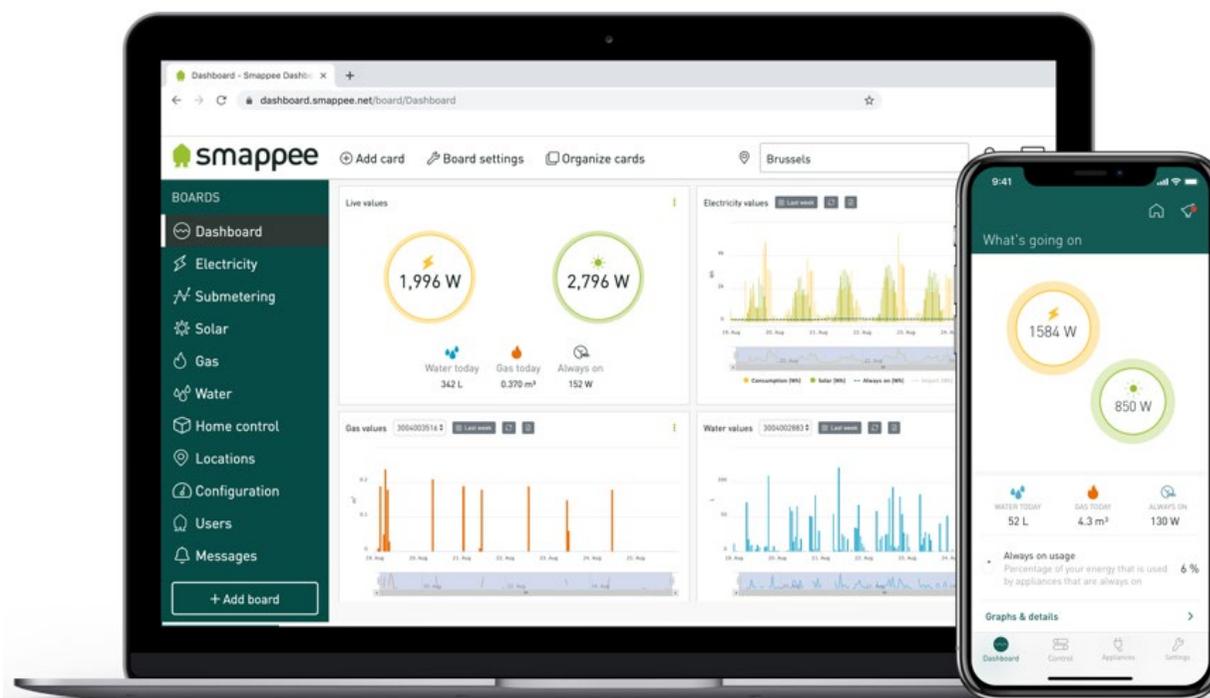
Beyond simply explaining the issues at stake, awareness-raising activities should provide concrete actions that people can easily put into practice. This often involves producing simple, easily shared, and attractive guidance material. In **Switzerland**, simple guidelines raise awareness on the energy intensity of cooling offices and commercial buildings. These guidelines are useful to integrate in broader communications campaigns..

### MAKE IT TIMELY

Identify key timing for campaigns to ensure success. For example, a campaign for people to adopt more energy-efficient cooling behaviors will be more impactful right before the summer begins.

## Case study iconic buildings

**Lima, Peru's** bright yellow Palacio Municipal is a beautiful neoclassical building in this capital city's centrally-located Plaza Mayor. Palacio Municipal's grand, arched balconies and imposing box bay windows recall earlier eras in Peru's colorful past. Through a WWF partnership with local building managers in Peru as well as partner work in Chile, Columbia, and Vietnam, Palacio Municipal and three other iconic structures will get energy efficiency makeovers. Using audits and smart visualization tools such as [Smappee](#), building managers get recommendations of energy-lowering actions. In addition, demonstrating the resulting savings in public campaigns helps show people how effective efficiency actions can be.



Examples of visuals from Smappee's data visualisation tool used in the WWF Peru office (Photo credit: Smappee.com)

# OUR MISSION IS TO CONSERVE NATURE AND REDUCE THE MOST PRESSING THREATS TO THE DIVERSITY OF LIFE ON EARTH.



Working to sustain the natural world for the benefit of people and wildlife.

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