

# Sustainable living and green community

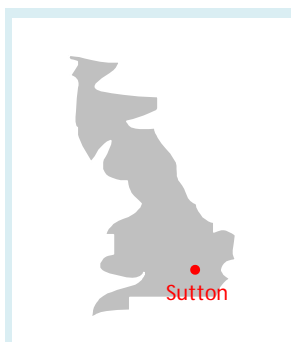
Beddington (Sutton), UK 



## Beddington Zero Energy Development (BedZED)

The BedZED (Beddington Zero Energy Development) is the UK's first and largest carbon-neutral eco-community and is located in Sutton, a residential town 40 minutes southwest of London. It is the UK's first large-scale, mixed use sustainable community with homes, office space, a college and community facilities. The BedZED design concept was driven by the desire to create a net-zero fossil energy development, one that will produce at least as much energy from renewable sources as it consumes. Only energy from renewable sources is used to meet the energy needs of BedZED; it is therefore a carbon neutral development, resulting in no-net addition of carbon dioxide to the atmosphere [1]. BedZED is designed to minimise its ecological impact, both in construction and operation processes and to help residents consume only their fair share of the earth's resources. It exemplifies an innovative, zero-energy and sustainable housing approach on a multi-unit scale. It represents an inspiration for sustainable neighbourhood and low-carbon housing development in future urban contexts [2].

### Country/ City Profile



Country		City	
Population (2014)	64,510,376 [3]	Population (2014)	195,625 [5]
Land area (km <sup>2</sup> )	243,610 [3]	Land area (km <sup>2</sup> )	43.85 [5]
GDP per capita (2014, current international \$, at purchasing power parity)	39,136 [4]	GDP per capita / GDP per capita at purchasing power parity	n/a
Region	Europe	Region	south-east side

### City's physical geography

Location	<ul style="list-style-type: none"> <li>✓ It is located on the southwest side of London</li> <li>✓ It is one of the greenest London boroughs with 420 hectares of green space and more than 80 parks and open spaces</li> <li>✓ Very low altitude (approximately 50 m above sea level)</li> </ul>
Climate	<ul style="list-style-type: none"> <li>✓ Temperate climate with an annual temperature of 9.6°C</li> <li>✓ Rainfall is considerably below England's average (1971-2000) level of 838 mm, and every month is drier overall than the England average</li> </ul>

### Initiating context and background

It is extremely important that all EU States accelerate their effort to comply with the EU "nearly zero-energy buildings" requirement in the *Energy Performance of Buildings Directive* ("all new buildings must be nearly zero energy buildings by 31 December 2020") [6].

From the beginning, the design team thought on sustainable urbanism and a renewables integrated building design, through a holistic approach in order to meet environmental challenges in cities. The design scheme was the culmination of many years of debates and ideas testing. Many of the discussions revolved around fully harnessing renewable natural resources, achieving closedloop material use, site resource autonomy, social involvement, and how to respond to ever-increasing lifestyle expectations [7].

Today, BedZED seeks to offer its occupants the opportunity to live and work with a completely carbon-neutral lifestyle, making this choice attractive, cost-effective, and appropriate to modern living. It offers solutions to many sustainability lifestyle issues in a practical and replicable way [7].



Source [10]

## Project description

BedZED's new-build development of 83 mixed tenure homes, plus some 3,000 m<sup>2</sup> of live/work, workspaces, retail, and leisure uses, occupies an urban brownfield site in South London. The great majority of BedZED's houses and flats are passively solar heated using multi-storey glazed sun spaces facing south. The homes are all very highly insulated but also well ventilated using the distinctive and colourful wind cowls on the roofs where fresh outside air is drawn into the building and pre-heated by outgoing stale air via heat exchangers [2].

A gas-fired communal boiler supplies hot water for the entire development via an underground mini-district heating system. A large hot water tank in each home helps to keep it warm in winter as well as to store hot water. BedZED's buildings use concrete to store heat in blockwork and floor and ceiling slabs, helping to maintain a comfortable and even temperature night and day throughout the year [2].

Extensive photovoltaic panels (777 m<sup>2</sup>) on the roofs and incorporated into south facing windows supply some of BedZED's electricity. Any surplus PV power is exported into the local grid. In addition, the 107 kWp of PV integrated into the south-facing BedZED façades is sufficient to power 40 electric cars. Charging points have been installed and occupants can have free parking and charging if they use electric cars [2].

In building BedZED, the partners tried to get the construction materials from as close as possible and to make maximum use of recycled materials. This helped reduce environmental impacts from transport and benefitted the local and regional economy. Just over half (52%) of the construction materials by weight were sourced within 35 miles, considerably closer than the construction industry average. The bricks used on the outside walls came from just 20 miles away. The other main exterior surface material, i.e. timber cladding, is green oak sourced from woodlands in neighbouring Croydon and Kent. Just over 3,400 tonnes of construction material, 15% of the total used in BedZED, were reclaimed or recycled products. Nearly all of the steel in the building is reused, much of it coming from refurbishment work at Brighton Railway Station. Reclaimed timber was used for the interior partitions and some flooring [2].

BedZED's renewable energy was originally generated by a biomass Combined Heat and Power (CHP) plant using locally sourced woodchip to generate both heat for hot water and electricity. The plant was operational for a long period but now generation is stopped. If the biomass CHP plant would be still operational and consequently BedZED would be zero carbon as designed, the average resident would have an ecological footprint of 4.32 global hectares (2.4 planets' worth) and a carbon footprint of 8.9 tonnes. However, the ecological footprint of the present 'average' BedZED resident is 4.67 global hectares and a carbon footprint of 9.9 tonnes [8].

## Implementation process

BedZED was developed by the Peabody Trust, one of the largest housing associations in London, in partnership with Bill Dunster Architects (ZedFactory), and ARUP and BioRegional Development Group, environmental consultants. The design development was the culmination of many years of ideas testing between ARUP and the architect Bill Dunster. Then, BioRegional Development, a charity dedicated to bringing sustainable business into the commercial market, recognized the project's potential. They secured funding from the World Wildlife Fund (WWF) for marketing the concept, located the potential site in Beddington, and introduced the Peabody Trust, an innovative housing association, as funder/developer. During the implementation of the project, advanced detailed design showed the proposals' potential in terms of sustainability that, at the end, was considered as an important value by Sutton Borough Council [7].

Consequently, a planning proposal was submitted in February 1999, with outline approval given in July and full approval gained in November 1999. Construction started in May 2000 with phased occupancy during 2002 [7].

The total development costs for BedZED sum up to € 17 million: construction costs (€ 14 million), taxes (€ 2.5 million) and planning and audit costs (€ 0.5 million) [9].

## Results

### Performance data (2007) [8]

AVERAGE ELECTRICITY CONSUMPTION	<ul style="list-style-type: none"> <li>✓ 3.4 kWh/ person/ day</li> <li>✓ 2,579 kWh/ dwelling/ year</li> <li>✓ 34.4 kWh/ m<sup>2</sup>/ year</li> </ul>
CO <sub>2</sub> FROM ELECTRICITY	<ul style="list-style-type: none"> <li>✓ 1.4 kg CO<sub>2</sub>/ person/ day</li> <li>✓ 1,079 kg CO<sub>2</sub>/ dwelling/ year</li> <li>✓ 14.4 kg CO<sub>2</sub>/ m<sup>2</sup>/ year</li> </ul>
AVERAGE HEATING AND HOT WATER CONSUMPTION	<ul style="list-style-type: none"> <li>✓ 5.2 kWh/ person/ day</li> <li>✓ 3,525.8 kWh/ dwelling/ year</li> <li>✓ 48.0 kWh/ m<sup>2</sup>/ year</li> </ul>
CO <sub>2</sub> FROM HEATING AND HOT WATER	<ul style="list-style-type: none"> <li>✓ 1.4 kg CO<sub>2</sub>/ person/ day</li> <li>✓ 1,079 kg CO<sub>2</sub>/ dwelling/ year</li> <li>✓ 14.4 kg CO<sub>2</sub>/ m<sup>2</sup>/ year</li> </ul> <p><i>With CHP in operation, this equates to:</i></p> <ul style="list-style-type: none"> <li>✓ 0.1 kg CO<sub>2</sub>/ person/ day</li> <li>✓ 88.2 kg CO<sub>2</sub>/ dwelling/ year</li> <li>✓ 1.2 kg CO<sub>2</sub>/ m<sup>2</sup>/ year</li> </ul>



Source [10]

## Lessons learned

Buildings are key to generating social advancement and prosperity, yet are one of the largest consumers of natural resources and generators of pollution and waste. Zero-energy development is difficult and challenging, but BedZED, despite the fact that some of the technologies have not proved effective, shows a way in which to pursue this important aim. The BedZED development design meets very high environmental standards, with a strong emphasis on roof gardens, sunlight, solar energy, reduction of energy consumption, waste water recycling, and green areas for the community.

BedZED households use 2,579 kWh of electricity per year which is 45% lower than the average in Sutton. While the biomass CHP plant is not in use, BedZED uses gas to power the district heating system. On average, households use 3,526 kWh of heat (from gas) per year, that is 81% less than the average in Sutton. In addition, residents only use 72 litres of mains water per day, topped up by 15 litres of recycled or rainwater.

In terms of materials, BedZED is built from natural, recycled, or reclaimed materials. In particular, all the wood used is approved by the Forest Stewardship Council (FSC) and others comparable internationally recognized environmental organizations.

Another key lesson from this project is the importance of considering not just the building itself but how to design communities to help residents live in a sustainable way. In this context, BedZED represents a great first step in the mainstreaming of a sustainable lifestyle and a possible way for developing green buildings and low-carbon cities.

## References

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- [10] Photos and images: <http://www.zedfactory.com/> ; <http://www.bioregional.com/>

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