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BedZed Case Study

Aside from car use and buying exotic foods, the single biggest impact each of us has on our environment has to do with the way we use and run our buildings. Most buildings (in general) behave like gas guzzling cars and consume energy at astounding rates to heat, cool, light, secure and maintain themselves and creating waste profusely in the process. In the U.S. buildings account for 1/3 of all energy consumed and produce 35% of the country's carbon dioxide (the chief pollutant blamed for climate change).

It's obvious then that an ecological building must be designed differently than a building that consumes energy from outside itself (for example, the national grid) and ejects its waste for disposal outside itself (for example, the local authority). So what are the priorities in designing an ecologically responsible building? We can begin to understand them through an analysis of the Beddington Zero Energy Development (BedZed).

BedZed is a prototype development of shared housing and workspace units that has been designed to achieve zero net carbon dioxide emissions from the buildings. They do this by avoiding the use of fossil fuel. What are fossil fuels and how are they relevant? These fuels are in the form of coal, gas and oil and when they are burnt to heat and cool our buildings they emit an amount of carbon dioxide that cannot be captured by plants. The

following energy saving strategies have been implemented in BedZed to achieve zero carbon dioxide emissions:

1. Providing an on site CHP (Combined Heat and Power) plant to generate electricity and heat
2. Selecting materials that have been sourced where possible ideally from within a 35 mile radius of the site. This strategy is in place to minimize the transport of people and equipment
3. Operating an on site pool car to reduce car ownership and journeys
4. Using airtight methods of construction
5. Incorporating wind cowls that have been developed specifically for natural ventilation with heat recovery

Of the previous list, the most innovative strategy is the presence of a CHP plant on the premises. This plant operates off of 850 tonnes of wood chips a year. The chips

are sourced from the London Boroughs of Sutton and the fuel comes in the form of small logs or chips. The wood, through a process of heating at a very high temperature, gives off a gas which is filtered and then used to power the engine, thus generating electricity. The heat from the engine is used to produce hot water. This process is carbon neutral because when the wood is used and burnt in the CHP unit, a similar amount of carbon dioxide reenters the atmosphere. Therefore the CHP will provide electricity, heat and hot water with little or no impact on the global environment. In addition, the total embodied energy of the CHP plant itself is around 145,000kwh with equivalent carbon emissions of around 75,000kgs, however the CHP will produce around 726,000kwh of electrical energy per year.

Sustainable materials were an integral part of the design process as well as their source location. Local brick, concrete aggregate, and precast floor planks can all be sourced 35 miles of the site, ensuring that all bulky materials have a reduced embodied energy. Adopting the 35 mile radius limit for local sourcing of materials ensures that BedZed will use local materials, respect the local market conditions and respect the existing townscape. In addition, 15% of the materials used were reclaimed or recycled. For example, the use of aluminum, a material with a high-embodied energy was minimized while reclaimed steel was favoured. Other examples of reclaimed materials are structural steel and timber for internal wall partitions. By using these, resources have been saved from being land filled, the sites embodied

energy has been reduced and cost savings have been made too. Other examples of recycled materials include crushed glass (sand) which can be used as bedding for paving slabs, and crushed aggregate for use in the sub-base.

BedZed also saves energy by providing a car pool service to reduce car ownership and journeys.

The idea of the service is to create carbon neutral transport. This service operates off of south facing PV panels that generate enough electricity to power up to 40 electric cars for 10,000 miles a

year. One car in a car pool displaces four to five privately owned vehicles. In addition, an average family in the UK emits 4 tonnes of Carbon Dioxide traveling each year and 8 tonnes on food prep, packaging and food miles. While it is important to provide this service, it is also important to meet the cars annual electrical requirements from renewably sourced energy and in BedZed's case they achieve this through 14 square meters of photovoltaic panels. The panels turn solar power into motive power and enable the driver to travel 8,500 miles per year on solar energy. In the end, the car, battery conversion price and the photovoltaics still cost less than the cheapest fossil fueled people carrier, and have equal functionality in an urban area.

Another energy saving technique the BedZed incorporates is the use of airtight construction methods. All of the buildings are super insulated and have south facing glazing to provide useful heat gains in the winter. The high levels of insulation greatly reduce heat losses through the building fabric and it follows that ventilation heat losses become

very significant. Standard houses let outside air leak in through the cracks and openings, such as between window frames and walls. The use of super insulation and high performance windows and doors means the heat loss through the walls, roof, floor and windows is minimized. This also means that the heat loss due to cold air coming into the house from outside becomes insignificant. It follows that this air leakage is one of the most critical factors in making a low energy house work without a heating system. At BedZed the general construction consists of plastered block work party walls at 6.5m on center supporting precast concrete plank floors. Perimeter cavity walls are of load bearing block work, 300 mm of thermal insulation and an external face of brickwork. The windows are wood framed and triple glazed. In addition, typical UK building requirements state that air permeability is not to exceed 10 cubic meters per hour per square meter of external surface at an applied pressure difference of 50pa. Air permeability results at BedZed however are down to 2-3 cubic meters per hour per square meter of external surface at 50pa differential pressure.

The final strategy implemented that makes BedZed a zero energy development is the use of a wind driven natural ventilation system where outgoing stale air pre heats incoming fresh air. In this system fresh air is drawn into a smaller funnel and is transported via pipes or ducts to the ventilation outlets just above the living room and bedrooms. Warm stale air is removed from the kitchen and bathroom and is taken by separate air ducts back up to the wind cowl. This air passes

the cold fresh air coming in and although the two air streams do not come into physical contact, the outgoing air gives its warmth to the fresh air coming in, thus “preheating” the fresh air. This transfer of warmth takes place in a heat exchanger and the stale air then passes outside via the other, larger funnel on the wind cowl. People want to breath fresh air that is devoid of pollutants and this system allows the air ventilation to be controlled and implemented thus providing a clean environment to breathe in.

BedZed is a testament to the difference between good, sound ecological building design and all others because it goes to great efforts to eliminate its dependency on the local authority for energy. The drawback to this ambitious carbon neutral lifestyle is that it is only achievable if there are sustainable technologies to support it and people willing to buy into a very different way of life than most of us are used to. This quote from a content resident highlights the effect that such an environment has on the individuals that claim this lifestyle as their own and recognize its potential as a way of life.

“So it suits slightly lazy eco-warriors such as Marleen Stumpel, who bought a three-bedroom maisonette last year. ‘I guess I’m like most people,’ she says. ‘I want to do things for the environment, but I have a busy life. So I want it to be really convenient. I want it on a plate.’ And so it is: if you want the whole Good Life thing, it’s there (there’s even a green lifestyles officer on site). ‘But you don’t have to get involved,’ says Stumpel. ‘Most of the green stuff you don’t even notice.’”

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