Earthships as Public Pedagogy and Agents of Change
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The dream is this: envisage a building that is, without exaggeration, a passport to freedom, where it is not necessary to work to pay utility bills, because there are none. Your home effortlessly heats itself in winter and cools itself in summer, harvests water every time it rains and recycles that same water for multiple uses. Whenever the sun shines and the wind blows, electrical energy is pumped into your house and stored for your use.

The water recycling system allows for the cultivation of numerous edible plants within the building itself, and you are able to live happy in the knowledge that your footprint on the earth produces a negligible level of carbon emissions and uses only bountiful and renewable resources that are flowing freely from nature to sustain your life.

The building you live in looks after you and cares for your needs. Ecological living through earthships is not about privation but about an improvement of the quality of life for its inhabitants and their descendants.

Background
Earthships are not whacky, “way-out” or extremist buildings from the lunatic fringe. They should not be regarded as the domain of hippies, sock and sandal wearing folk, assorted eco-nuts and survivalists.

This chapter looks at what earthships are, rather than what they are not. In brief, earthships are a serious, rational, and well-designed architectural response to some of the challenges that face humankind in the 21st century. They are also visually arresting, charismatic, and extremely comfortable for those who live in them; indeed, they are often described as low carbon living in luxury. Not only do earthships address the fundamental question of how to provide safe shelter for their inhabitants, they have a thorough and holistic engagement with vital issues of sustainability, notably zero carbon and zero waste living, through recycling and reusing waste, energy saving and generation, water harvesting and recycling, and even food production.

Recently, the agenda surrounding sustainable architectural practice in the UK has moved on so enormously as to necessitate numerous revisions to keep pace with the many developments. In terms of the need for action to reduce carbon emissions, arguably the most notable of these
is Sir Nicholas Stern’s (2007) review on the economics of climate change. Stern states that there is a pressing economic need to find global solutions to climate change—potentially the greatest and widest ranging market failure the world has ever seen, which could, he argues, shrink the global economy by a fifth. He concludes that there is an absolute imperative to make significant reductions in manmade carbon production.

Zero carbon buildings, such as earthships, enable us to see how this reduction might take place: it is this, as much as anything else, which makes the earthship an essential building for study.

**Origins of the Earthship**

The original inspiration for designing earthships came from news stories. Mike Reynolds, the American architect who invented the earthship concept, said that he was “basically responding to the news” when he had the idea to design a radically new type of structure (quoted in Telfer, 2003, p. 18). The news in the early 1970s told him there were huge environmental problems being faced along with a “major energy crunch” (quoted in Telfer, 2003, p. 18). His solution was to design a building made largely from waste materials—principally old car tires—that aimed to take full advantage of natural resources: earth, sun, wind, and rain. He chose a highly challenging environment in which to do this—the high mountain desert of Taos county in New Mexico, about 2,000 m (7,000 ft) above sea level with extremes of temperature varying between 40°C (104°F) in the summer and –10°C (14°F) in the winter, and with an annual precipitation of only approximately 300 mm (compared to approximately 550 to 700 mm in London, for example).

Earthships have evolved from being a specific design solution to a particular set of climatic conditions in the New Mexican desert, to a paradigm that has been adapted to different climates across the planet.

And that includes here, in the UK. At the time of writing there are two fully functioning earthships in the UK, in Kinghorn Loch, Fife, and Brighton, East Sussex: both non-residential demonstration prototypes that were developed between 2000 and 2006. However, a significant development of between nine and 16 earthships (also in Brighton) built for residential use has been proposed and planning permission is being sought.

The earthship that has evolved over 30 years of trial and error in the unforgiving environment of New Mexico is a totally off grid construction, unconnected to electricity, gas, water mains, or sewage systems. In essence it has to look after itself out there in the big bad desert. And it does it remarkably well, anecdotally maintaining an interior ambient temperature throughout all seasons (and without any kind of electrical air conditioning system) of between 18°C and 23°C. Mike Reynolds, on a visit to the UK in 2006, told a story about some visitors he had taken to one of his earthships. “I took some people from Colorado into this room last week and it was 100°F (38°C) outside and they...”
were sweltering getting out of their cars to walk to the building and in the room they thought we had an air conditioning system. When they found out we didn’t, they wanted an earthship!  

Sustainable space heating and passive ventilation, impressive as they are, are not the only admirable features of earthships. And this is a significant point—earthships offer a holistic version of sustainability rather than just a zero carbon footprint. The building also harvests its own water, which is then recycled to make it fulfill as many uses as possible, and generates its own electricity from micro-renewable sources. The greywater planters that form the basis of the water recycling process also offer the opportunity to grow food, including bananas, grapes, tomatoes, and herbs—even in the harsh winters of New Mexico. In essence, then, the earthship is an almost wholly autonomous, self-reliant building that uses waste materials in its construction and has a zero carbon footprint in its day-to-day running. After construction it is also extremely cheap to run with no utility bills to pay at all.

Earthships contain an implicit critique of “conventional architecture,” both a repudiation of aesthetics above functionality and a passionate argument against the concept of building shells that are almost wholly uninhabitable without services being piped in. The earthship form is dictated by function, though that does not mean they are ugly—human comfort in every sense is the prime consideration. Mike Reynolds, who has devoted his life to the development of earthships, is so disenchanted with what he views as architecture that he prefers to call himself a “biotect.” However, he may well agree with Le Corbusier who famously said that “Life is right and the architect is wrong.”

Buildings are meant for human habitation; they are meant for life, and our lives, in turn depend on the environment in which we live. Earthships explore the relationship between humans and the natural world, linking life to the elements of nature that sustain our lives. The attractions of earthships seem clear but Mike Reynolds says that the planning establishment, certainly in the United States, has been difficult to win over. “It’s hard for the Architects’ Board of Examiners when I’m building buildings out of garbage and I’m running sewage through the living room: there are a lot of things they’ve got problems with.” However, he adds that the culture is changing. “But now,” he says, “because of the condition of the planet, they’re beating a path to the door.”

What is the Future of Earthships?

To date, only two earthships have been built in the UK, and neither of them fulfills the primary intended use of earthships—as residential buildings. The paucity of earthships in the UK has been noted by commentators such as Sutherland Lyall in AJ Specification: “Unlike proselytisers for many nice architectural ideas,” he writes, “the promoters of earthships do not make wild claims. They do not say earthships are going to solve the current housing shortage… Nor will earthships solve the first-time buyer problem… Nor would earthships make a serious dent in the used car tire mountain” (quoted in Larsen, 2006, ¶ 4). So if all this is true, what, in fact, is the relevance and importance of earthships in a UK context, and what is going to be their future here? Well, Lyall himself goes on to say that “nevertheless this first English example…has potentially important lessons for the design of sustainable architecture in general,” and it is this that strikes at the heart of what is significant about earthships (quoted in Larsen, 2006, ¶ 4). The earthship is as much as anything a provocation at a time when the architectural and building communities in the UK most require provocation. On almost every tenet of sustainability in construction, it provides an example of what can be achieved and what more could be achieved with significant investment and political will. This has enormous relevance at a juncture when sustainable living, of which architecture is a significant part, is arguably the greatest—and most
urgent—challenge facing society in general as the potentially catastrophic consequences of climate change become truly apparent.

**Earthships as Provocative Agents of Change**

A “nice architectural idea” may not be the most apt description of an earthship, a structure that is seen by some in the architectural profession as an ugly carbuncle that should be sent back across the Atlantic and consigned to the desert of New Mexico forever. But the earthship is not a building that is trying to fit in. It is emblematic of a new paradigm that has to become increasingly prevalent not just in the UK but globally, if there is to be a genuine effort on the part of mankind to drastically reduce carbon emissions into the atmosphere and to live more sustainably in general. The earthship also offers an architectural alternative to human alienation from the natural world which is embodied in the majority of present housing; an alienation which in itself is arguably the cause of much of the environmental damage being wreaked on the planet. In both these senses earthships point towards a necessary future for architecture.

The earthship is a performance-based sustainable structure that needs to deliver all the basic comforts and amenities to its inhabitants because it does not have the backup of being connected to infrastructure. This divorce from centralized utilities means that the building has to have well-developed survival strategies. These are not without flaws, but the UK earthships offer a showcase for these strategies and concepts, many of which will need to be used in various forms by other zero carbon sustainable new builds in this country.

What follows is a rundown of the individual aspects of UK earthships that provoke, provide inspiration, and offer a testing ground and a challenge for architects, developers and building professionals alike.

**Zero Carbon Homes**

“Zero carbon building” is becoming a truly zeitgeist phenomenon, an anthem in print and sound bites. The architectural press is saturated with zero carbon stories—for instance, Trevor Butler (2007), head of sustainability at the Building Design Partnership, wrote in *Building Design Magazine* in January 2007, “zero carbon is becoming mainstream” (p. 15)—and certain parts of the government seem very enthusiastic about zero carbon homes. The need to reduce carbon emissions in order to try and slow down the runaway train that is climate change is also acknowledged by many key figures in the construction industry. But nonetheless, there remains a scarcity of projects on the ground that are actually demonstrating the principle of a zero carbon build. Brighton and Fife can offer an inspiration in practical terms along with some of the few other pioneer sustainable building projects for how to achieve this goal. This inspiration may be seen as being particularly powerful because of the grassroots nature of the Earthship Brighton and Earthship Fife builds that show what can be achieved with relatively few organizational and structural resources. However, the earthship is also a reminder that other sustainability goals as well as zero carbon can, and should, be incorporated into zero carbon buildings.

**Site Harmony and One Planet Living**

The idea that a building cannot only function adequately by solely using the resources that are available to it onsite, but in a way that provides comfortable living for its inhabitants, is a challenging one for architects and developers. This also relates to problems with centralized
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infrastructure. The earthship uses abundant site-available renewable natural resources to the building’s maximum advantage with minimal impact to the environment through a number of sustainable strategies that make best use of the elements, particularly the sun, but also the wind and the rain. This means that the building has a one planet eco-footprint that negates the insatiable thirst for energy, water, and other resources that is the present unsustainable norm for most housing. The earthship provides ideas to designers and developers as to how this can be achieved, and empowers householders with a connection to their natural environment, ownership of their building services, and low running costs.

Critique of Infrastructure

It is highly unlikely for a number of reasons that more than a handful of the significant number of new homes being built over the next 20 years will be offgrid. Nonetheless, the earthship offers a very plausible alternative to the slavish reliance on centralized solutions that characterizes our present housing. There are many problems associated with large scale infrastructure: principally that it is inefficient and has significant carbon emission and resource depletion problems associated with it. Infrastructure has also effectively led to a dependence culture, which means that our homes are, on their own, weak and vulnerable without their various connections. If, as is predicted, severe weather events become increasingly common due to climate change, there will be more and more disruption to central infrastructure-supplied utilities in times of drought, floods, and high winds. The earthship suggests a housing model that at the very least significantly reduces its dependence on grid-based solutions so that it can more effectively self-deliver space heating through passive solar and thermal mass, self-provide clean water with rainwater harvesting and filtration, and self-generate electricity from whatever source is most suited to the site. That also means that running costs are negligible, which could, perhaps, provide a solution for the weak and vulnerable in society who are at risk from extremes of heat and cold and cannot afford the energy hungry means of ameliorating extreme temperature through either air conditioning or heating. Whether people will be able to afford to live in such a home, though, is a question for developers, housing associations, and local authorities.

Embodied Energy Materials

Anecdotally, it seems that the most provoking thing about earthships to many people is the fact that they use old car tires as an integral part of their construction. This is not just a provocation to the building industry but to the whole of society in terms of demonstrating the potential usefulness of many materials, such as tires, that are simply thrown away each day and considered waste. This also forms a strong critique of the wastefulness that is endemic in the majority of developed countries such as the UK and throws down the gauntlet of re-use. And the construction lesson here is centered on using low embodied energy materials wherever possible. Through the first UK earthship builds’ exploration of the legislative and regulatory framework, the opportunity for future builds to use similar techniques will benefit from a more certain knowledge of what is involved and possible. But the fact of building with tires also captures something else about earthships—their innovative quirkiness and charisma. It could be argued that this design approach should serve as an inspiration to other designers of zero carbon buildings in terms of being open minded, performance driven, and unafraid of trying something new. Tires are certainly not used gratuitously in earthships or even celebrated; they are simply integrated with the structural and thermal performance of the building and then vanish behind
a veneer—a highly positive design solution. These are exciting times for zero carbon design and there are significant opportunities for incorporating high performance standards in new forms of architectural expression to create similarly charismatic buildings.

**Demand Reduction and Renewable Supply**

Demand reduction is the first step in making all resource pathways sustainable, as amply demonstrated in earthships. The second step is ensuring that supply is from renewable sources and that it is capable of matching the real need that does exist. The overwhelming focus in earthships of making use of resources such as the sun for passive solar heating is emblematic of numerous strategies to try and keep occupant demand for utilities as low as possible. This is an expression of the idea of site harmony. Instead of the paradigmatic crisis at present of most housing failing to take anything significant from encounters with the elements, the earthship provides inspiration by illustrating how buildings can easily benefit from harnessing what is useful from the sun, wind, and rain. This not only finds its expression in demand reduction but on the supply side as well, with microgenerative technologies making use of the energy potential of the sun and wind, and rainwater harvesting supplying the occupants with fresh water.

**Passive Solar, Thermal Mass, and Thermal Performance**

The major form of demand reduction employed by the earthship and other zero carbon buildings is that of passive solar heating, thermal mass, and super insulation that massively reduces the conventional space heating requirement, which on average forms just under 60% of domestic UK energy consumption by end use. The earthship offers one model of these principles in action, and the Earthship Brighton and Earthship Fife demonstration projects offer good opportunities to examine the efficacy of the approach taken. For any zero carbon building in a temperate climate to achieve its aspiration, cutting heat demand is the most fundamental factor to get right; it is therefore worthy of significant study. It should be noted, though, that other models, e.g., super insulation combined with sustainable space heating such as biomass combined heat and power, may also be able to supply the same end result of effective renewable thermal performance without solar orientation, although there are other factors involved here, e.g., carbon implications of biomass transport.

**Water Harvesting and Recycling**

It is likely that due to the consequences of climate change, not only will there be more drought in the future, but more unpredictable weather in general that will feature very intense rain. The Environment Agency Sustainable Development Unit stated in June 2001, that “major floods that have only happened before say, every 100 years on average, may now start to happen every 10 or 20 years” (quoted in BBC, n. d., ¶ 3). In these conditions, homes that have the capacity for water storage will benefit from being able to harvest water at such times of intense rainfall conditions for use when the resource may be scarce. Given the recent history of drought, particularly in certain areas of the UK, it would seem that innovation is required to try and ameliorate this growing problem. This is particularly the case in southeast England where the main demand for new housing meets the historically worst hit area in the country for drought. The earthship offers a way forward in terms of its intensely economic use of water that does not drain the centralized supply at all. Once again, it is a provocation to society in general, and to legislators in particular,
about valuing a vital resource as well as an opportunity for testing the efficacy of the earthship harvesting and recycling systems in a UK environment. It would seem, then, that earthships are extremely provocative and hard to ignore on a number of different fronts, while the integrated nature of their approach offers a compelling vision of where residential building may go in the next 20 years. Thus we can see the veracity of Lyall’s comment that earthships have “potentially important lessons for the design of sustainable architecture in general” (quoted in Larsen, 2006, ¶ 4). Their relevance is as evolved models of sustainable building that have been developed over a period of 30 years and that now form part of the (admittedly small) vanguard of zero carbon sustainable building in this country. It is likely that this vanguard will in turn form the basis of future residential sustainable models. In terms of the operation of various systems, the present earthships also offer great opportunities for testing, e.g., with thermal performance, which will be of great use to future earthship and other sustainable builds.

Toward 2016

As the stated target from a number of senior government figures for achieving the zero carbon building milestone, 2016 deserves to stand as a major goal for the architectural and construction industry in the UK. Can it deliver on trying to slow down climate change and lay the foundations for a sustainable engagement with the planet rather than the crash course it has been on up to this point? That depends more than anything on political will to provide a framework of regulation and fiscal incentives that will encourage zero carbon development on a mass scale. At this stage there are no easy answers as to whether significant momentum will be achieved in the construction industry towards zero carbon: despite all the extremely positive talk there remains a paucity of the required meaningful action on the ground.

The momentum that is needed is not just about solving a statistical problem based on achieving zero carbon but about realizing the fundamental requirement for paradigmatic change on all levels to try not to conquer or tame nature but to harness it positively and realize the necessary human connection with the natural environment. High carbon emissions are just one symptom of a failure to integrate buildings effectively with natural systems and the design of new buildings should surely be aiming not just to reduce carbon outputs but to have a more holistic engagement with sustainability in general. The earthship is emblematic of the type of change required in attitudes towards design, as it eloquently showcases the way in which humans can gain from their environment all the fundamental resources necessary for domestic life, in a sustainable and benign way. That is a valuable lesson in itself that all designers, developers, planners and self-builders can learn from, as well as those involved in other forms of ecologically destructive activities.

And in this sense earthships will still be a guiding influence in 2016, serving as a pioneer example of the need to change the ways in which we build homes. Most predictions would suggest that the symptoms of climate change will become increasingly manifest in the coming years so that by 2016 there may be a significant amplification of many of the negative problems that are already occurring. Of course, there is a requirement for global action as well as that in the UK, but the onus on developers here is clear: there is now a moral obligation to act responsibly in terms of building impacts on the environment. Mankind’s role is surely that of guardians of nature rather than owners of it. Building has always had a responsibility of legacy; that responsibility is now of the gravest kind—it has a significant role to play in protecting the very nature of the planet on which we live both for our own generation and for the generations yet to come.
Notes


3. Le Corbusier is originally supposed to have said: “Vous savez, c’est la vie qui a raison, l’architecte qui a tort,” and is quoted in Boudon (1979). The statement is said to have been Le Corbusier’s reply upon learning that the housing project he had designed at Pessac had been altered by its inhabitants.


References


