

Energy & Sustainability

## Limit and License

Architectural historians Barnabas Calder and Daniel A Barber have both recently published books exploring the influence of energy on architecture. In conversation for AT they discuss this growing field

**Barnabas Calder** What got you interested in the history of energy and architecture? I got into it in 2015, after a publisher asked me for a general history of architecture. I reflected on the most important issues facing architecture, and energy use was transparently the biggest: the only one where architecture's contribution could be decisive in maintaining life on Earth.

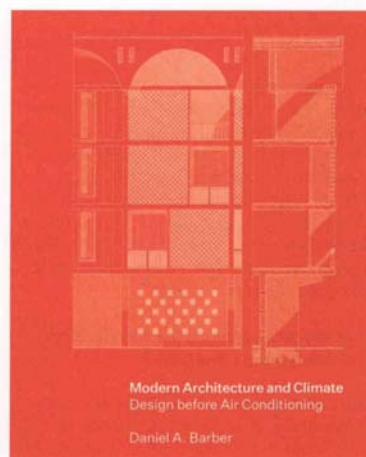
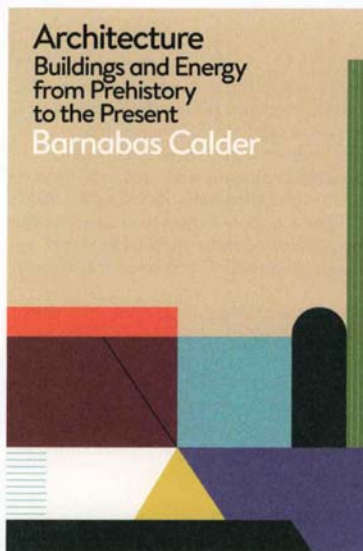
So much architectural research is focused on sustainability, but not much in history apart from the brief story of green architecture or studies of vernacular building which try to learn technical lessons about passive climate control and local materials. Yet energy access has been the single most powerful influence on architecture at every period in human history, from the mammoth-bone huts of the Ice Age steppe – built of food waste to keep in the precious warmth of the fire – through to modern air-conditioning systems.

**Daniel A Barber** My path was a bit the other way round: I decided to study architectural history because I thought it would be a good arena for the discussion of environmental issues. When I first started a post-graduate programme at Yale in 2003, I assumed there was a robust discussion on architecture and environment – and there was, but it was not seen as a crucial part of the discourse.

If architects in general were not interested, architectural historians were even less so – though there were some great people looking into these issues. Once I started prying open the box of architecture and environment as a historical theme, it became clear that there was a rich archive just waiting to be explored.

One piece of the historical archive I came across in the library at Yale was the catalogue for a 1958 competition for a solar house, called 'Living with the Sun'. I was perplexed to see interest in solar house design before the 1970s, when there was interest relative to the oil crises. That set me off on my dissertation research at Columbia, which eventually became a book, 'A House in the Sun: Modern Architecture and Solar Energy in the Cold War'. Interest in solar house heating went back to before the second world war, and was later catalysed by concerns about energy supplies and population growth. Interest in solar houses was a sort of interdisciplinary arena for a broad discussion about energy anxiety, how lifestyles would change with different energy sources, of strengthening alliances through resource management, but also as a prelude to a more focused global environmental discourse.

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**Barnabas Calder** When you look through an energy lens the past can look surprisingly different. The vast monuments of the Roman Empire are morally repugnant to modern eyes — produced using slave labour to celebrate a militaristic political system. Yet in energy terms, even a beast of a building like the Baths of Caracalla was built far more sustainably than almost all of today's most effortfully ethical and green architecture.

Janet DeLaine's remarkable research has shown that 76 per cent of the volume of the baths' materials consisted of stone and minerals extracted within 20 kilometres of the site. Brick and lime required significant heat to produce, provided by burning wood, but while they are so visible on the ruins they composed only 5.9 per cent of the volume. Of course, Roman architects avoided heat not from ethics but because they lacked significant fossil fuels. Yet it offers both hope and a challenge to our generation that such immense, robust projects could be built of local materials and with low heat inputs.

If you compare that with your research on the insoluble challenge of heating the Dessau Bauhaus, it offers a completely inverted architectural history: the heroic modernists held to represent progressive values and technological innovation are, in energy terms, the very last models we should be emulating.

Do you share my pessimistic sense that the aesthetic ghost of modernism is a barrier to sustainable architecture? I know your research has uncovered early experiments on modernist passive cooling and solar energy which may offer a more cheering view.

**Daniel A Barber** That is well put: we are haunted by a spectre. But there is at least some potential for it to be a friendly ghost, if not a guiding spirit. The legacy of modernism might be either an opportunity or an obstacle to progress. On the obstacle side, the received legacy of modernism is a general focus on representation and aesthetics in determining the value of architecture, and a reliance on fossil-fueled building systems, in part based on the premise of a universal condition, that every building everywhere should be conditioned to a certain norm. There is a sort of path dependency that has emerged such that it requires a huge effort to push back against this industrial practice; BREEAM and LEED metrics simply aim to repurpose it — to build more or less the same kind of building, just with a more efficient system. All of the formal debates of post-modernism, equally, are reliant on heavy carbon loads; we are still reaching for a real alternative.

But to turn to the other legacy of modern architecture, therein lies some potential for change. The Bauhaus sought new terms for architectural value — not only resistance to ornament, but the creation of a different kind of interior space that would foster a different kind of social relation. The premise was that design could be transformative. We risk falling into another kind of aesthetic heroism, but there is something worth recovering here — the idea that what we need is not just a new kind of building, but a completely different discussion, based on new values, where architecture is sensitive to questions around energy and climatic adaptation.

If we can be inspired by modernism's insistence that things can change, one of these changes likely involves a look 'back' to 'vernacular' and 'traditional' strategies, to think about what would work in the future. This is one of the reasons I look forward to your book, for its broad historical sweep that helps us see the thread of energy from ancient times to the present. It also opens up another topic, around questions of retrofit and what to do with existing building stock. Beyond the basic premise that the most sustainable building is the one that is already built, I wonder if you developed some insights on how to focus practice towards the energy condition of existing buildings?

**Barnabas Calder** The key lesson I've learned on existing buildings is that we need to keep them unless there's a pressing reason not to. The current condition of the construction and property industries is dependent on chasing economic growth through a cycle of demolition and construction which sees serviceable blocks of flats or offices being demolished and replaced every few decades by something essentially similar — a kind of nightmarish fast fashion for buildings, with an enormous carbon cost. This tends to be greenwashed by claims about improved operational energy performance. Yet in almost all cases the problems with the demolished buildings' energy performance would have been resolvable with changes to envelope and services rather than complete replacement, whose carbon cost will take decades to be repaid in lower operational costs.

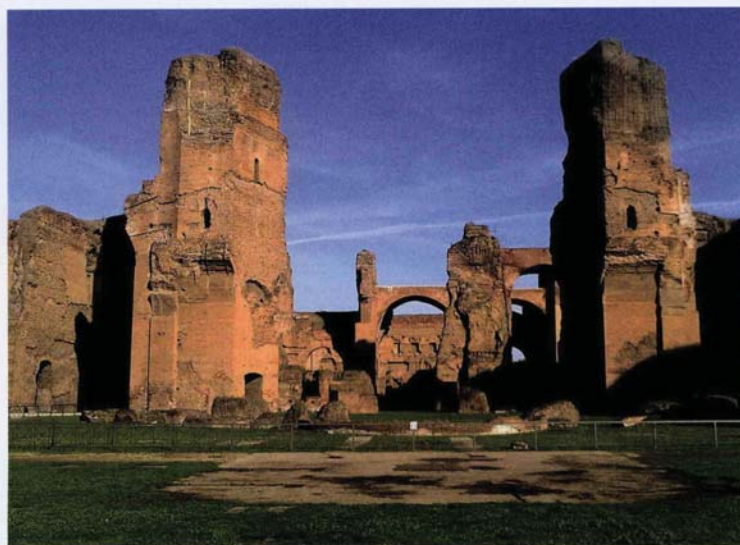


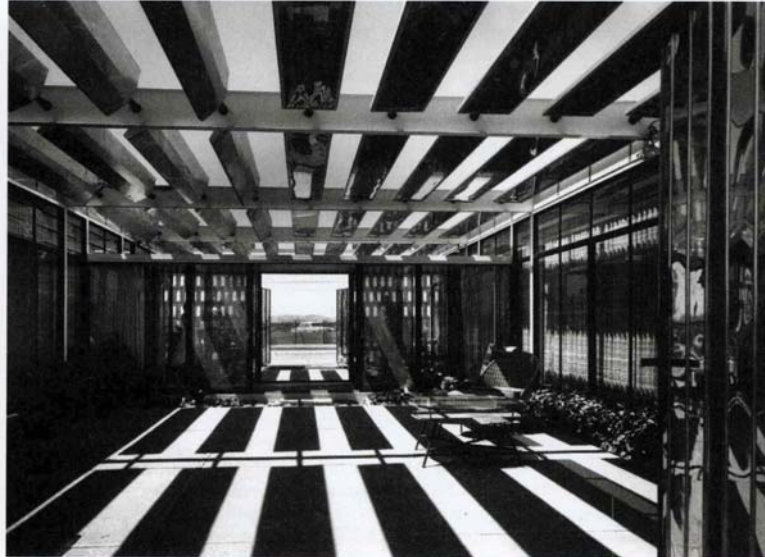
**Left**

'Architecture: Buildings and Energy from Prehistory to the Present', by Barnabas Calder (Pelican, 368pp, £20); 'Modern Architecture and Climate: Design before Air Conditioning', by Daniel A Barber (Princeton University Press, 336pp, £50).

**Right, above**

The Baths of Caracalla, Rome, and the single-glazed curtain walls of the Dessau Bauhaus. Its open-plan halls were made habitable in winter by coal-fired stoves.





Moreover, new construction energy costs are overwhelmingly carbon-intense — concrete, steel, glass, and transportation of materials — while operational energy comes in large part from partially sustainable electricity supplies.

Before any demolition takes place, an independent life-cycle carbon assessment should be mandatory, proving when and how the replacement will repay the devastating carbon cost of demolition and construction. In a large number of cases this break-even point will come long after climate scientists warn us that the new building will be below sea level. Yet the UK government has just brought in new rules allowing permission-free replacement of any building that the developer keeps empty for six months first.

You appeal for designers to see climate not as an obstacle but an opportunity. What key lessons, big or small, would you like today's architects to learn from the mid-century exploration of climate-conscious design?

Daniel A Barber As someone trained in a starkly critical approach, the notion of applied knowledge emerging from historical research is anathema: everything is situated, contingent upon its historical condition. And yet... in the midst of the crisis we face, new sorts of multi-disciplinary collaborations and methodological experimentation is as necessary as ever, and the idea of a sort of 'applied history' doesn't sound as ridiculous as it used to. If we accept that modernism is a carbon-architecture, then in trying to move past the carbon age, knowledge of pre-carbon practices are worth paying attention to.

The progressive ethos of modern architecture sought to overwhelm any and all vernacular, regional, traditional practices that preceded it. Yet, we now see that these modern practices, rooted in ever-increasing use of carbon, are not the model. Indeed they become the foil — the means by which we think about how to operate otherwise. The amount of accepted practices and principles that we must unlearn can be overwhelming: material choices, approach to site, conceptions of the public and its need, relationship to development.

My emphasis is squarely on relationship to climate, but others are making related arguments in the context of race, gender, and equity. When historians look back at architecture and its history at the end of this decade they will see huge shifts in the terms and tone of the discussion, as new priorities become more clear and take centre stage.

More specifically, I think there are two things to take from the climatic modernists in the 1940s and 50s. First is the basic premise that buildings can be finely tuned to their climatic conditions. Then, architects were trying to do this without adequate tools — that is, before the computer. Today, we have a huge apparatus of climate-adaptive knowledge, from orientation and shading to materials and variable inhabitation, all able to be coordinated and tested through modeling.

The second specific aspect of the story — thinking in particular of some of the shaded buildings in Rio de Janeiro built in the 1940s and 50s — is a recognition of the flexibility and adaptability of the relationship between people, buildings, and climate.

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This relationship was on the minds of Brazilian architects who were part of a more general push to 'modernise' their country. They took design approaches to modify the interior with complex, carefully tuned shading systems, which were hyper-aware of changing solar patterns and also of people's changing expectations and desires.

How can buildings again mediate between the experience of the interior and knowledge of climatic conditions? What are the terms and prospects for adaptability and flexibility, for thinking about how we determine what counts as 'comfort', how we attain that standard? Since the end of the 1950s, both air-conditioning and the standards that require it have led to a professional and technical apparatus focused on a normative, stable built interior. Obviously, there are places where this stable condition is needed — hospitals, for example, possibly museums and archives. Aside from these cases, people can live and be comfortable in a wide range of interior conditions. Societies are willing to adjust their expectations of how to live when placed in the context of a public good.

**Left, below**

MMM Roberto, Edifício Mamãe, Rio de Janeiro, 1945 (ph: Faculdade de Arquitetura e Urbanismo, Univesidade Federal do Rio de Janeiro); Solar House by Peter Lee, winning entry to the 1958 Living with the Sun Competition; MES, Rio de Janeiro, 1943, by Lucio Costa, Oscar Niemeyer, Carlos Leão et al (ph: Daniel A Barber).

**Far right**

Cork House, Berkshire, 2019, by Matthew Barnett Howland with Dido Milne and Oliver Milton, is built from solid cork blocks (ph: MBH).



Barnabas Calder Something I appreciate about discussing this with you is that you haven't given up hope that we'll find a fix. Sometimes the scale of the challenge of zero carbon against such a short timescale feels overwhelming to me, but I think you're right that a long perspective can offer some rays of hope, and important perspectives for considering our own immediate future.

Writing about 14,000 years of world history has the obvious disadvantages of trespassing on lots of fields, but I've been treated with immense generosity by the real experts in the subjects of my chapters. The thing that makes me feel that a global, long-term approach to the topic is worth the struggle is that the very big shifts in the past make starkly clear how weird the present is. Victorian architecture feels remote, but it's still an architecture of heavy carbon inputs. When you compare the past two centuries to fourteenth-century Mali, for example, or to Achaemenid Persia, all our assumptions about material production and transport, about construction methods and operational energy costs, suddenly feel utterly bizarre. Before abundant fossil fuels, the richest, most powerful clients of the world operated within limitations that are easily disguised by the size and pomp of their buildings, but which were real and absolute.

**“Lessons offered by low-energy architecture of the past are very appetising; the ingenuity with which agrarian craftspeople pushed the capabilities of their materials is heart-lifting”**

Some of the lessons offered by low-energy architecture of the past are very appetising. Considered in detail, the ingenuity with which agrarian craftspeople pushed the technical capabilities of their low-energy materials is heart-lifting. Look at the nail-less joints of the world's carpentry traditions, aimed at avoiding the disproportionate charcoal consumption of producing iron nails, but raised to a level of craft and art that touches the emotions. Look at the staggering structural accomplishments of Roman, Byzantine and Gothic masons using largely unreinforced masonry. Look at the light footprint with which pre-Columbian Mayan cities could support populations of tens of thousands in careful harmony with their rainforest ecology. Whatever the energy limitations, robust, beautiful architecture is achievable.

Other lessons feel like more of a warning to us, as we think through our energy systems for the coming century. Energy systems tend to bring with them their own constricting political tendencies. Farming societies were almost inescapably hierarchical, tending to concentrate power and energy in few hands.

Even the 'democratic' experiments of classical Athens were limited to an oligarchy of male citizens. Coal, with its high demands for skilled labour, improved the lot of the industrial working classes worldwide, with social housing projects and public educational architecture supported by left and right. Oil has supported a new oligarchy of billionaires and their corporations, with urban public space from the coal age under pressure from vast corporate wealth.

As we design our renewable energy systems, the politics they embody — of equality or monopoly — will have lasting implications for the relations between people and regions. What do you think we should be urging architects to do to make their commitment to zero carbon a reality? I think my two big ones would be a genuine commitment to reuse and retrofit — never demolish if you don't really have to — and stop using concrete and steel. Architecture's role in shaping the aspirations of a society also has potential to help shape aspirations for smaller, more carefully-made spaces, more reuse of what's already there, and the beauty of not pushing for endless growth. The beauty of small and sustainable seems me to be shown at its best in the Cork House by Matthew Barnett Howland with Dido Milne and Oliver Wilton, in research collaboration with the Bartlett School of Architecture, the University of Bath and others. Its low-footprint and calm aesthetic look like a future I'd love to live in.

Daniel A Barber Most times in history likely felt weird, on these terms, to people living through them but we are nonetheless at a very specific hinge point when there is a lot of excitement relative to changing the way we live and build, paired with a remarkably ossified and obstinate set of industry practices and regulatory mechanisms that we can't quite seem to collectively break through.

I generally agree with the two imperatives you mention — retrofit and a resistance to steel and concrete. A few years ago Bill de Blasio, mayor of New York City, announced that the city was moving forward with its own Green New Deal, and went off script to decry the absurdity of steel and glass towers in the age of climate change, saying, in effect, no more in my city. He had to immediately walk it back when the building industry responded with a collective guffaw — how are we expected to build, to maintain economic growth, to keep the city running?

And now we have the phenomenon of the pencil tower — super skinny residential towers that reach high into the sky, requiring not only excessive amounts of structural girding but also even more intense HVAC systems to accommodate their fully sealed condition. In fact, the zoning loophole that allows for the height is that mechanical systems are not counted as floor area, so these buildings have incentive to include massive HVAC systems over multiple 'floors' in order to get taller and taller — a sort of feedback system given that the extreme heights require serious conditioning on the interiors.

My point is, the 'building industry' — of architects, city planners, engineers and contractors among others — is still moving forward with carbon-heavy projects; and moreover, buildings have become so essential to the premise of endless economic expansion that to question their continued growth is to question the foundation of late capitalist society. So we have all of these ridiculous towers, in cities around the world, luxury apartments or Class A office space in steel and concrete, fully sealed and conditioned, that sells off of green credentials through the addition of a thin solar film, or a turbine at the top, or some other form of sustainability theatre that ignores the carbon premise of the building itself.

In the face of all of this, and this sense that these systemic, embedded, infrastructural conditions of carbon profligacy are difficult to disrupt, I cultivate my hope, such as it is (I often refer to myself as an 'apocaloptimist'), through attention to the aspirations that you identify at the end. Which is to say, 'we' (architects, engineers, policy makers, critics historians and so on), or at least some of us, basically know 'what to do' — we have the simulation softwares, we have the technical knowledge, we have the rich legacy of material experimentation. We can cultivate connections to sociologists and economists and others who can help clarify these big picture effects. We have the tools and skills, and we also have the imagination.

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**“Architecture’s role is to show different ways of life in a post-carbon future and make them desirable. This is not a world of austerity, but one of collectivity and community”**

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Architecture's role in shaping the aspirations of society — as you so aptly put it — is in this imaginary, in showing different ways of life in a post-carbon future and making them desirable. This is not a world of austerity, but one of collectivity and community, of a different pace of work and leisure, of a markedly different relationship to the city, forms of transportation, attention to seasonal differences, etcetera. In other words, the contours of this new way of life are still to be determined; or better, to be cultivated by architects and others interested in imagining these futures. I see history, especially the history of environmental practices in the field as, hopefully, fanning the flames of this imagination; in showing how architects have struggled with similar challenges in the past, even very far back in the past, we can begin to see architecture as a social and cultural practice deeply embedded both in the techniques of climate and energy management, and in cultivating aspirations for an as yet unknown future. ↗



**Left**

Pencil towers — slim and super-tall — have become an ever more common sight on the skyline of New York City in the last decade. Early examples include 432 Park Avenue (far left), designed by Raphael Viñoly and completed in 2015. The 426-metre-high tower has a height to width ratio of 15:1. Residential floors are gathered in six groups of twelve, separated by double-height plant storeys.

Pencil towers now under construction include 111 West 57th Street, also known as the Steinway Tower, designed by SHoP Architects. Rising to 435 metres, it has a height to width ratio of 24:1.