TRANSCRIPT

Milton Keynes: Energy capital UK?

PHILIPPA TIPPER:
Have you ever worried about global warming? Have you wondered about when climate change started to be recognised, and how it could affect us all? And closer to home, have you sold a house recently or had a property to let? Then you'll have to have had an energy performance certificate. Are you building a house? You'll know that the building regulations insist on plenty of insulation. These energy efficiency measures, which are now part of everyday life, had their origins in the new city of Milton Keynes as a result of a collaboration that started in the 1970s between two organizations, The Open University and the Milton Keynes Development Corporation.

And two individuals, an academic and an architect, engineering graduate. This is the story of what happened. First, the academic. Peter Chapman, who everybody knows as Jake, got a first-class honours degree in physics and a PhD from Cambridge. Whilst there, he was encouraged by Steven and Hilary Rose to set up a Cambridge branch of the British Society for Social Responsibility in Science, an organization they had set up a few years earlier.

PETER CHAPMAN:
The British Society for Social Responsibility in Science. It just rolls off the tongue, doesn't it? But I was quite attracted to the idea of science being not just something that was done in laboratories, but actually helped people live their ordinary lives. We had our inaugural meeting, as one does as a student society. The room was packed. I was amazed. Everybody else liked the idea as well. But all the speakers that I had got were about biological things. So at the end, somebody said to me, "You're a physicist. What's this got to do with physics?" And I have no idea where the words came from.

I said, "It's energy." He said, "Oh, all right." And I thought, well, I better do something. So I started to read books on energy. And I read this book by a famous physicist who at the time was promoting nuclear energy. It was going to be so abundant and so cheap that we could have a nuclear reactor in every town. And then the next sentence hit me like a ton of bricks. He said, "We could produce so much energy, we could equal the amount of energy we get from the sun." Hello. Sun's energy coming into Earth keeps it warm.

Double the amount of energy, it's going to get warmer. Oh. And from that time onwards, I thought, I've got to explore this. I started to understand where energy came from and all that sort of stuff. And I published an article in New Scientist about a couple of articles. Essential thing was you can't release more heat on the surface of the Earth than about 1% of what we get from the sun without wrecking our climate. So if there's a limit on how much energy we use, we've got to think carefully about how we use it.

PHILIPPA TIPPER:
At Cambridge, Jake's work was research-based, but he was interested in teaching. In 1970, he joined The Open University as a lecturer in physics.

PETER CHAPMAN:
Even though I was wanting to focus mostly on teaching, as an academic, I was expected to carry on doing some research. And so when I started to think, well, what can I do? I thought, I know. I'll start an energy research group. And I started it in 1972. Now, the Gods have been very kind to me. Because in 1973, all hell broke loose. The OPEC, the oil price rises, three-day working week, miners threatening to strike. Everybody was suddenly interested in energy. Who knows about energy?

Oh, this weird guy at The Open University with a big beard has just started a thing called the energy research group. I started to have people almost offering me research grants to look into if there's a limit on the amount of energy we can use. Then let's figure out how to use it more effectively. Quite honestly, I just don't think that energy reserves are sufficient to allow demand to continue to increase in the way that we've experienced it, say, since from 1950 up to 1973.

I think the point is that in that period from 1950 to 1973, we were able to increase the demand for fuels because we were exploiting a continuous set of new resources. But now the time is coming when the new resources available to us are more difficult to come by, more expensive, more costly, more difficult to exploit, and I don't think that they will sustain that same historical growth in demand. It was probably in 1973 that somebody from Penguin Book, Gerald Leach.

I even remember his name. He was interested in energy as well, and he knew something about what I was doing. And he said, "Look, Penguin might be interested in a book. He was one of their commissioning editors." And so I said, "OK, I'll think up something." And over the year of 1974, I pretty well did the research to underlay Fuel's Paradise. That was then published in 1975, which is exactly 50 years ago.

TADJ ORESZCZYN:
The Fuel's Paradise was one of the motivating reasons, I guess, why I was keen to come to The Open University. It was an exceptional book. It brought a completely new perspective for some people on how you thought about the problem of energy.

PETER CHAPMAN:
I explained in some depth that there was a limit to energy use on the planet. And it was one of the first times it had been written in a general understandable way, not in a New Scientist article or not in some magazine, but here it is in a book.

PHILIPPA TIPPER:
Meanwhile, at the Development Corporation, a new architect had joined in 1971. Fresh from working for Richard Rodgers and being involved in designing a radical house for Roger's parents, John Doggett joins the corporation's industry group and designs the prototype for advanced factory units with its infamous all-yellow interior. But John had other the interests.

JOHN DOGGETT:
We were looking for a simpler life, people being off-grid. That was then leading to, yes, but how do I heat myself? How do I get hot water? All those things. And so I seem to be the person when this was going to happen. I was in the right place and was known for being interested in this sort of thing. I worked directly for the Deputy General Manager, was Don Ritson, who was keen on this stuff.

DON RITSON:
I would add, I had one extra department which was known, I think, amongst the architects as the department of silly ideas. And this is where people who had ideas that were, I think the modern phrase is, thinking outside the box, but that's what they were doing. They would come along and say, "Why can't we do this?" And I would try and back them or promote them in some way, which is how we got the Buddhist monks to come and build the Peace Pagoda. Because it came out of the silly ideas. A lot of silly ideas didn't take off, but the energy conservation unit did.

JOHN DOGGETT:
Other organizations in the corporation could ask for advice on something. But one of the first ones came in. Part of the problem was that the corporation was using a lot of oil for heating it, building at Wavendon. I think we might have proposed it, that we'd do an energy survey on the buildings. And what we discovered was said that if we did certain things, we could save a lot of money. One of them was to insulate the building. But there were other things about the running of the boilers. It did the work, and it had a payback of 18 months.

It turned out. And that was startling. So it put us in tremendously good stead with everybody else, because we were half-believed before we started. Then it went into another one, which was buy insulation cheap. The government was running a training course for unemployed kids. We said, well, we could use them to install this stuff. They were draft stripping an insulation and cylinder jackets, and insulation in the loft. It was good for everybody, and we worked out that it would save something like £150,000.

PHILIPPA TIPPER:
Whilst Jake Chapman was working with his energy research group and writing Fuel's Paradise, the Development Corporation had an approach from the Regent Street Polytechnic.

DON RITSON:
We were approached by a Professor Shockley from one of the universities in London, and he got a grant from the EU to see whether at our latitude a house could be heated, not just for hot water for domestic use, but to actually provide heating from some sort of energy. He asked if-- He would finance it all and pull everything back afterwards, so that was fine. And we took a house on Bradville. That was a monopitch roof facing South.

PETER MARTIN:
I got a call from Don Ritson, and basically he said, "We'd like you to be the tenant of the solar house, which was to be opened at Easter, 1975." They wanted a corporation employee family because they wanted to be able to arrange visits to the solar house. The bread and butter of it was a coach tour, stopping at the end of the road, and people gawping at the solar panels.

DON RITSON:
The house that was chosen was particularly suitable because at Bradville there was a monopitch roof system, which had twice the area facing South as a dual pitch one, so you could put an awful lot of panels on it.

PETER MARTIN:
And they were actually refrigeration panels. Nothing like a solar panel existed in those days. So the nearest they could get a flattish panel that they could run water through was a refrigeration panel. They painted them black. And that's your collector. It was heating water. The wardrobe spaces were taken up with 1,000 gallons of water storage in vast steel boxes.

DON RITSON:
After a lot of tinkering, it worked pretty successfully, I think 60% of the heating was provided by the solar panels, so in that respect, it was successful.

PHILIPPA TIPPER:
Back at The Open University, Jake Chapman is looking at ways to turn the theories he wrote about in Fuel's Paradise into practical action.

PETER CHAPMAN:
Before I finish my work with the energy research group, I started a very fruitful collaboration with the Milton Keynes Development Corporation. It suddenly seemed to me obvious. Here's a new town being built on my doorstep. How about talking to them about ways of trying to improve the efficiency of their houses they're building? The Director of Milton Keynes Development Corporation, a man called Fred Roche. He noticed half of all the visitors to Milton Keynes, remember, Milton Keynes is still mostly grass fields, came to look at the solar house.

Oh, oh, there's something in this. Maybe if we build more solar houses, we-- So he was really open to the idea of energy being important. Obviously, 1973 had made it very clear. And they were building a city that didn't have any regard for energy use at that time. I went to a dinner with the Dean of Science, a man called Mike Pence. And there was only one other person present at the dinner. It was Fred Roach. I'd never met him before. I didn't even know who he was.

Then I was invited to go and see him in his office. And he said, would you like to come and work for the Development Corporation? And I said, well, actually, no, I'd prefer to stay an academic. He said, I thought you'd say that. So he said, how about working part time? I said, fine. And then that was the beginning of the collaboration that I had with John Doggart and all the other-- there were some very good planning directors there that I interacted with over a number of years.

JOHN DOGGART:
With the linkage with The Open University, things which have been done really almost off-piste stuff became to become something that we had to take this seriously.

JAKE CHAPMAN:
And we started to develop projects. We'd think of something like, well, could we build passive solar houses in Milton Keynes? It was an architecturally good idea at the time. And so between us, I think it was between us, we cooked up a scheme.

Now, John would do all the architectural stuff and say, well, the houses would have to be south-facing, they will be this size, we'd do a whole estate and dida, dida, dida. And I would help by saying, well, we can get support from this government department. Here's how to write a research proposal. Here's the arguments for getting the money out of them. And here's what we would need to monitor in order to prove our case.

PHILIPPA TIPPER:
Their first big collaboration was the Pennyland estate.

JOHN DOGGART:
The whole estate was facing south, plus or minus 40. The question that then arose was how far away do you put houses from each other. Because if you put them too close, one house overshadows another according to the height. There was a guy called Bob Everett.

He did the work of calculating at what distance away the buildings could be to lose, I think, 10% and then 20% of its energy according to various heights of one-story, two-story, three-story. So the old people's housing was single-story could go nearer to the ones that were two-story. And the three-story had to be well back.

JAKE CHAPMAN:
It's a good story. So there were two houses at estate. One had insulation, passive solar design, low-energy boilers. This was bought standard building regs. And we monitored them both. Well, it turned-- the energy consumption here was less than half of the standard building, less than half. The extra cost of building the houses were about £200. The annual savings were £150 a year. This was mind-blowing.

However, when we looked at the data, we discovered it had nothing to do with passive solar. And the reason was these great, big, open windows, people put net curtains up. And the net curtain pushed the sunlight back. So they weren't passive solar houses anymore. But what made the difference was the insulation and the lightweight boiler. And nobody knew that it could do that. For 200 quid, you could halve the running costs of a house.

The people at the building research establishment paid a lot of notice to this result. So this is the start. That was how we collaborated. John was always doing the architecture and feeding it through the Development Corporation. And I was doing the data collection of what we had to do, how to make the research, application, and stuff like that. And it was very productive, very productive.

PHILIPPA TIPPER:
At the same time as Pennyland was happening, a further project started at Great Linford.

JOHN DOGGART:
There was another small estate that was also used to look at houses, not in large numbers but individual houses to see how they worked in great, great detail-- where did the energy flow through, how much did it actually goes through the walls, how much did it go through the floor, how much did it go through the roof, how much with ventilation. And The Open University did all that.

PHILIPPA TIPPER:
The hard data, gathered from Linford and Pennyland, led to the corporation upping the standards it expected from its housebuilders.

TADJ ORESZCZYN:
They insisted on buildings being built better than to the building regulations. And that was an innovation that a local area could decide to build buildings at a better quality level than the national standard. The Development Corporation were the first organization to, in effect, utilise Jake's energy rating system to set better standards.

PHILIPPA TIPPER:
For John, change was afoot in 1981.

JOHN DOGGART:
I was wanting to increase the size of my unit. And a guy came up, called David Tarrant. And I was showing him around. And at the end of it, I said, David, I'd like to offer you a job here. And David looked at me, and he said, John, I came up to ask if I could offer you a job, which is, join me in running Energy Conscious Design office. So we do architecture with energy as a part of the conscious design of it.

It sort of led me to think, well, look, I might have done as much as I can do here. Certainly, I didn't want to leave completely. So I negotiated. I spent, particularly in the first year or two, I spent a couple of days a week in doing Milton Keynes stuff, and three days a week in London or the other way around.

PHILIPPA TIPPER
One very significant project that John got involved with in Milton Keynes in 1981 is very relevant to our story. HomeWorld 81 was a housing exhibition of 36 houses with the aim of demonstrating new trends and technologies in housing and showing what houses might look like in the year 2000. John and his colleagues at Energy Conscious Design were invited to design one of the houses.

FEMALE PRESENTER AT HOMEWORLD 81:
It's a house designed and built under the auspices of the money programme. We're calling it Future Home 2000, very much a house of the future, but incorporating all the most advanced technology that industry has to offer right here and now.

JOHN DOGGART:
We were very keen indeed to promote the idea that we were using far too much energy and that we had to cut it down.

MALE PRESENTER AT HOMEWORLD 81:
As you may remember, we hope that our house will be able to save 60% of all fuel bills. Yet at the same time, it has to be a compact family house.

JOHN DOGGART:
There are other things that the house had. For instance, the thing called double glazing, we all think that's all normal now. But 40 years ago, it wasn't very well known and certainly not the one that we used on HomeWorld, which makes it much, much more efficient. We did something with the controls. We're all used to button controls now. But there were no button controls in those days. But the whole lot of other things in the house, which just weren't around at that time, were there.

For instance, there were low-energy lights there. People had tungsten bulbs. Now they don't. Some of the things didn't happen in 20 years are only just happening in 40 years, like the home office. The idea that you didn't have to go to work every day in order to do work, that was an idea that we've floated. Then that's something that even after 20 years, after 2000, had not arrived in any way.

PHILIPPA TIPPER:
Meanwhile, at The Open University, Jake is developing software.

JAKE CHAPMAN:
The then head of the systems department had a budget surplus and Apple II computers. These little things had just come out. And he said, I'm going to buy some. Anybody want one?

I said, yeah, I'll have one. And I thought it was fascinating. And I learned how to program it. It was very, very primitive. But you could now put in data and estimate the running cost for the house, how much it would use for heating, how much for hot water, how much for electricity use.

1983, I started a business with one of my ex-research students. We called it Energy Advisory Services. And the idea was, we were going to give the best advice that was available about how you could insulate your house or improve the energy efficiency of your house. We got better and better at refining this program.

And the reason why we got better was because of all the data we collected in Milton Keynes. We knew from the data in Milton Keynes that a house of this size used this much energy, a house of this size used this much energy. So we were able to calibrate the program against the data from Milton Keynes.

And we had a portable computer. Well, you had to be pretty strong. It was called an Osborne. It was about the size of a suitcase. And it weighed at least 20, 30 kilos. You wouldn't want to carry it upstairs too often. The screen was this big. The keyboard was built-in. And it had two floppy disk drives. But we could run a program on it.

And the software was developed to make it easy to do an audit of somebody's house. And in front of them, we would show them, we're putting in the data, how many windows you got, how much wall insulation, and all the rest, and look, it said that your fuel bill is £850 a year. Is that about right?

And do you know what? Most of the time, they say, that's amazing, that's right. So now they know that we know what we're talking about. And I say, OK, so now watch what happens when I put 200 mil of extra loft into it, your fuel bill goes down to £700. Is that worth it? They're sold.

They trusted the output because it tallies with their fuel bills. Change the loft insulation. They can see the savings they're going to make. Thank you very much. Job done. There were people willing to buy the software. There were a lot more people willing to buy the software than householders interested in paying £100 for an audit.

But when somebody phoned up and said, can I buy a copy of the program you've got, how much would you be prepared to pay for it? £500. Oh, OK. So now I'm starting to realise there's a business here to be had with the software rather than with the advice. The architects at Milton Keynes, they paid attention to what they learnt themselves when they were using the software more than us telling them. So selling the software could also accomplish my goal of having more energy-efficient houses.

PHILIPPA TIPPER:
A new key figure now enters our story. Steve Fuller was a member of the Milton Keynes Development Corporation's planning department. His work was crucial in making the Development Corporation's senior management and board aware of the initiatives in energy efficiency that had been taking place and how they might be exploited by the corporation.

STEPHEN FULLER:
I'd always been interested in the environment. But I'm interested in energy as part of environmental issue that led on to worrying about climate change and biodiversity and all that.

And I wanted to get involved in something tangible that followed my interest, rather than sitting back in corporate planning in the back room.

And sitting down with a good mate of mine, called John Doggart, he began telling me about these isolated initiatives, passive solar, Pennyland, and all these projects, that he'd been working up with The Open University. And I thought, Milton Keynes has got a lot of these projects going. I said, John, why don't I, with your help, actually produce a report called Energy Projects in Milton Keynes?

PHILIPPA TIPPER:
The reaction to Steve's report was very positive.

STEPHEN FULLER:
So I was sent off to the States to talk to the government people and look at the various projects to see if any capitalised on our experience. And I came up in Minneapolis, St. Paul, with a project called the Energy Park. By now, I was quite familiar with government demonstration projects. I said, why doesn't Milton Keynes designate an area called Energy Park?

PHILIPPA TIPPER:
The headline-grabbing part of the Energy Park was Energy World, a demonstration project promoted by the Development Corporation of 50 low-energy houses, which opened in 1986. And Steve was made the project coordinator.

STEPHEN FULLER:
There were a number of architects who were very interested in solar energy, who had links with developers. And they managed to persuade the developers that it was something worth getting involved in.

JAKE CHAPMAN:
And John said, we could use this program for vetting the houses-- who want to build Energy World. We could find out how good they are. Oh, right. What a good idea. So I then started to figure out what sort of metric, how are you going to measure, what measure are you going to use. And after a lot of humming and hawing, it became obvious what's going to interest people is the cost, the cost of running this house.

So what we were going to do, we were going to develop a metric based upon the running costs for the house. And we developed a thing called the Milton Keynes energy cost index. This was used to vet the houses going into Energy World. Now, here comes the big lesson for me because, suddenly, architects want to get hold of the program. They want to test their design before they submit it. So the architects are now learning how to use this program. And I and John and lots of other people have been haranguing architects, put more insulation in, use better heating systems, use control systems, to no effect. They said, bugger off. We know how to build houses better than you do. And they do, of course.

However, once they start to use this program, oh, putting a conservatory on it only saves 1%. If I change the boiler, it changes 13%. Oh, and if I put loft feature, another 10%. So they've learnt, by using the program, what John and I have been trying to bash into their heads for years. And that's a really important lesson. People find out for themselves. And then they do it.

FRANK HENSHAW:
Mrs. Thatcher came to open the door to the official opening of the Energy Park. And we were sitting down to lunch afterwards. And she said, you see, you've got things right in Milton Keynes. I mean, here you have this example of a public body which is providing all these opportunities for the private sector to do what we've seen today. And I said, yes, I said, but actually, we're doing a bit more than that. She said, such as?

I said, well, the development you've seen today at Energy World is there because, through pilot projects which demonstrated that they would work. We have demonstrated to private house builders that you can indeed improve insulation standards and reduce energy consumption in housing and still sell the houses. I said, once, through pilot schemes, we'd shown that, the private developers came in. Without that earlier demonstration, who knows? Oh.

PHILIPPA TIPPER:
After Energy World, the Development Corporation received inquiries from a number of housing developers to have an indicator like the Milton Keynes energy cost index to apply to their houses to demonstrate their energy efficiency to buyers.

STEPHEN FULLER:
Development Corporation and I strongly advocated it. I said, look, Development Corporation isn't in this business. What it should set up is a charitable agency that could actually develop the programs, train assessors, but they were independent assessors.

We got Marie Archer to be chair of the National Energy Foundation. And we had this lovely situation, for instance, these academics from the OU, in t-shirts and jeans, suddenly turning up wearing suits because they realised that there was a business opportunity here.

JAKE CHAPMAN:
The National Energy Foundation was interested in this software and developing it into what they were going to run as the national home energy rating scheme. So I was going to become a software supplier to the National Energy Foundation.

The development of energy ratings for houses was quite a significant change. And what was really significant about it was that everybody involved accepted it. Up until then, there had been fierce arguments about what was the most efficient fuel for use. Was it gas or electricity or whatever?

And so the gas industry, the electricity industry, NHBC, BRE, the Building Research, they all accepted this bit of software that I produced as being pukka. They all believed the outputs. And that was a major milestone because now, suddenly, there was a way of measuring the energy performance of any dwelling in the United Kingdom.

Now, the National Energy Foundation is a charity. There's a limit to what a charity is allowed to do legitimately, commercially. As this national home energy rating scheme got more and more successful, they realised they couldn't carry on owning it entirely and run it because it wasn't appropriate for a charity. So I said, I'll buy off you.

So there wasn't any money exchange. We did a share swap. I became part owner of the National Home Energy Rating scheme. The National Energy Foundation was a part owner. And together, we formed a company called National Energy Services, which I became the

chief executive officer, the managing director. So Energy Advisory Services bought the NHER scheme and became National Energy Services. And that happened in 1994.

The model that we had got, which was really widely recognised as working extremely well, we could predict the energy performance of houses really well by now. And we could also tell you whether you're going to have condensation in it. There was all sorts of stuff. It was widely used in the UK.

And of course, the more widely used something is, the more people say, well, could you do this as well. Or there's a bug here. So we would have to fix things. And that would require more programmers and a bit more sales. And yeah, it was a proper business.

PHILIPPA TIPPER:
Whilst the principle of energy rating homes was widely accepted, to what extent were the lessons learnt being translated into updated building regulations, in insulation, for example?

JAKE CHAPMAN:
I wanted to know the answer to that as well. And part of what I learned was that for sustainable change, it's got to go slowly. If the building regulations have been changed, bang, like that, and the builders have been told, you've got to put cavity wall insulation, you've got to put double glazing in, you've got to put this level of loss in, they wouldn't have been able to do it competently.

Their workforce was not up for it. They didn't know how to do it. They had to learn. And for a whole workforce to learn how to build houses differently takes decades, not years. So that was part of it. There's also the political inertia. The housebuilders are going to, well, if you're going to tell me how to build a house, I'm going to put less money into the Conservative Party, aren't I?

This is how the world works. So there are loads and loads of pressures and changes. Sustainable change has to happen slowly. If you try and make change happen too quickly, it will fall over at some point. It just takes time. But when it happens, it's permanent. That's the other thing.

Now, builders know how to put floor insulation in. They know how to put cavity insulation in so that the house doesn't get damp. And the important thing is, when you're building a house, you want it to last for 60 years, maybe 100 years. You don't want it to fall over because you put the cavity wall insulation in wrong and the wall is now crumbling because it got all wet. So there are other factors other than just this cost-effectiveness and energy.

PHILIPPA TIPPER:
In 2001, Jake Chapman took early retirement from his job as Professor of Energy at The Open University and his job as CEO of National Energy Services. He went on to be a consultant, promoting a different way of public policy-making based on systems theory, working for a wide range of clients, including the cabinet office, the Welsh government, Metropolitan Police, and the National School of Government.

After being acquired by Kingfisher PLC in 2011 and a management buyout in 2016, the company name was changed from National Energy Services to Sava. The company today sees its purpose as to create innovative qualifications and software that empower people and organizations to make a positive impact towards making buildings better, a purpose that founder Jake had as well.

After leaving the Development Corporation, John Doggart continued working for Energy Conscious Design, heading the environmental design of two of the houses at Energy World and developing BREEAM, the Building Research Establishment Environmental Assessment Method, the first national environmental assessment method for buildings in the world.
In 2007, John set up SuperHomes with the aim of spreading awareness of how existing household CO^2 emissions could be reduced by at least 60%, even in hard-to-treat homes, and to inspire other homeowners to act. In 2014, SuperHomes became part of the National Energy Foundation.

Some 50 years ago, a collaboration began in Milton Keynes between two organizations, Milton Keynes Development Corporation and The Open University, and two individuals, Jake Chapman and John Doggart, which was groundbreaking in so many ways.

TADJ ORESZCZYN:
It was relatively unusual in those days for that type of collaboration to work because, traditionally, academics want to be in their ivory towers and do the things that they want to do and don't want to be constrained by the real world. But I think Jake, and John as well, understood the importance of bringing together the academic and the practical. Both sides were prepared to understand the value of the real world and the academic world collaborating together.

PHILIPPA TIPPER:
The experience of being involved in this pioneering work made a lasting impression on others too.

TADJ ORESZCZYN:
I think, Jake, I think, simply the act of setting up the Energy Research Group had a knock-on impact. So I set up the UCL Energy Institute, which is probably now the biggest energy institute in the UK. I wouldn't have done that had Jake not set up the Energy Research Group. Many of the people who were at the Energy group, Research Group, then went on to establish other things. Pete Warm, who worked with Jake, and then set up his own company, actually delivering energy-efficient buildings. Lots of people went and spent some time at ECD, working with John Doggart. So I think there is a lot of alumni from the original Energy Research Group that then went on to do quite significant pieces of work elsewhere.

PHILIPPA TIPPER:
Mark Barrett is also at UCL, where he is Professor of Energy and Environmental System Modelling. And Professor Nigel Mortimer was former chair of Sustainable Energy Development at Sheffield Hallam University. The tools that were developed in Milton Keynes have had a profound and lasting effect on energy conservation and building standards not just in the UK but all over Europe and further afield.

More than 50 exemplars of low-energy houses were built and displayed in two widely publicised exhibitions. Together with a large housing estate and several houses for sale, these houses were extensively monitored and the data used to confirm and improve energy estimation accuracy, both in the UK and abroad, and show that energy saving was incredibly cost-effective.

TADJ ORESZCZYN:
The energy rating system has now become the main policy tool for the UK government. They want to bring all the houses up to a C rating by 2035. So if we didn't have that rating, you couldn't have that type of policy for existing homes, and you wouldn't know how to police it. The definition of fuel poverty, which has been a policy aim in the UK, to eradicate fuel poverty, the tools started to get used for that because the tool calculates how much energy to maintain comfortable conditions you would need to spend, how much money you would need to spend on that energy.

PHILIPPA TIPPER:
We're living in a world where the effects of climate change are going to be dominating our future. And solutions to deal with it will become ever more important. The journey that began 50 years ago in Milton Keynes from the 1970s onwards laid the foundations for these solutions.

It's led to an energy rating scheme that is at the core of government policy to address the issue. It has dramatically improved the energy efficiency of new build housing. And it has inspired academics and architects to devote their life's work to lessening our demand for energy. Milton Keynes can justifiably claim to be Energy Capital UK.

JOHN DOGGART:
All the things I've talked about, I feel really good about because they were fun. Every one of those was fun. Now, that's a lot of density of fun, really. And the speed, the speed and density of fun because we were making decisions at a hell of a quick rate-- that was a very youngish person - that is wonderful.

JAKE CHAPMAN:
The energy performance certificate that, now, everybody who lets a house, leases a house, buys a house, sells a house, has to have was a version of the software that I wrote. So when I started TEAS, The Energy Advisory Service, somebody came to me and said, what's the ambition for your business? And I said, to get a million homes energy rated. He said, well, what about money? I said, no, no, my ambition is to get a million homes energy rating.
And while we were running the national home energy rating, we were totting up how many homes have we energy-rated. And we were getting close to a million. It's mostly through the HBC. But of course, with the EPC, that's the Energy Performance, every bloody house in England has ever been on the market has got an energy rating on it. Thank you very much! Job done!