



## Innovation: designing for a sustainable future

*Power generation in Woking.*

Narrator

At first glance Woking is not the most obvious place to look for radical innovation, but the Borough can justifiably claim to have the most innovative energy policy of any Council in the UK.

It has a private wire network, an energy distribution system independent of the National Grid. It's green and it's profitable and supplies consumers in both the private and public sectors.

The electricity in the Woking grid is provided by innovative technologies including the world's first commercial hydrogen fuel cell and the UK's largest collection of solar photovoltaic cells. But the principal providers are the small combined heat and power or CHP plants that are dotted around the Borough.

The man who devised the system is Woking's Energy Services Manager, Allan Jones.

Allan Jones

It all started, I suppose, back in 1989 when I first came to the Council and I wrote a report on global warming which was new to most people, you've got to appreciate it was 2 years before the Rio Earth Summit. And it really educated Councillors about where emissions were actually coming from, it wasn't just transport, it was talking about power stations too, the majority of emissions in the UK come from UK power stations and that really set the kind of scene for an energy efficiency policy. Didn't think we were doing anything particularly innovative at the time it just seemed a sensible way of dealing with things.

Narrator

The Council set aside a quarter of a million pounds for capital investment.

Allan Jones

So that initial quarter of a million pounds just looking at the Council's own buildings projects has saved the Council something like over 5 million pounds from that initial quarter of a million pound development. And that is invested in something like 70 projects, a whole range of energy efficiency projects and co-generation renewable energy projects.

Narrator

This co-generation plant is tucked away in the town centre's main car park.

Allan Jones

Over here we have the district heating, the district cooling pipe network, you'll see there's several different circuits going to several parts of the town centre supplying mixed buildings, offices, leisure complexes, bowling alley, night club; a whole range of different types of buildings you expect to find in a town centre.

Narrator

It's 1 of 2 combined heat and power plants in the central part of the town. Between them they supply a quarter of the premises with heat and electricity.

Having much higher efficiency than conventional systems they make a significant contribution to the Borough's reduced net carbon dioxide emissions. They're part of Woking's larger distributed energy system linked up to consumers by private wire connections.

Allan Jones

This is what we call a distributor generation system so we are able to mix different types of generation into our private wire network. The private wire network is designed as an active network so that enables us to do that. One other advantage that you get with a private wire network is the ability to operate in island generation mode in the event of the failure of the Grid. So this gives us local security of supply as well as reducing CO2 emissions. As far as our own building stock is concerned, about 84% of our energy consumption comes from these distributed energy stations. I have a target to achieve 100% by 2010.

Each of our energy stations has several levels of supply. Over here we've got the back-up boilers that acts as the kind of third level of energy production. In the CHP station that produces heat and electricity. We then have a very large-scale thermal store; it's about six storeys high. That can provide thermal energy for up to 48 hours without any energy input at all.

On the thermal energy side, we have three levels of resilience; on electricity we have the CHP, we also have a connection to the local distribution network, so we can continue to supply electricity which is actually coming from our other energy stations, and the third level is the ability to operate in island generation mode in the event of a failure of the grid.

Narrator

There are sixty or so energy generation centres spread across the Borough. Each one is seen as a separate energy island meeting local energy needs and each island is linked to all the others through the private wire network.

This energy island provides heat and power to 55 households, a medical practice and a community centre. Solar cells provide a significant proportion of the energy input.

Allan Jones

This is Brockhill solar photovoltaic; there are over 36,000 solar cells on this project generating electricity from the sun. It works in conjunction with combined heat and power which gives us complimentary reverse summer/winter profiles so we are always able to generate maximum electricity all the year round. The photovoltaics will generate maximum electricity in the summer and the combined heat and power will generate maximum electricity in the winter.

Narrator

Woking has the largest concentration of solar photovoltaics in the country with more than 10% of the total UK installed capacity. But solar energy is not a cheap option, so how can Woking afford it?

Allan Jones

Photovoltaics are expensive. They are coming down in price but they are still an expensive technology for generating electricity. However there are several ways of financing them. One you can do by dilution economics, which essentially means because of our own generation networks we are able to achieve much higher value for the electricity. There is an element of economics in those projects which you can recycle to finance ultra green technologies like solar photovoltaic's or fuel cells and that's essentially what we have done in Woking. We also have a second mechanism for financing these sort of projects, it's that profits generated in the previous year can be recycled back into these ultra green technologies so that we can actually increase the pace of installation of these ultra green technologies quite significantly by taking that approach.

Narrator

What about the costs to the energy consumers?

Allan Jones

Particularly at the residential customer end, who pay the most for their electricity, we can supply them at a competitive price against Grid price electricity simply because most of the cost of electricity supplied to residential customers is not electricity, it's all your transmission

and distribution losses and your transmission and distribution user system charges. That's what goes to make up the majority of the bill for a domestic householder. A typical coal fired power station has an electrical efficiency of about 30 - 35%. Most of the energy that it generates is wasted up into the atmosphere through those huge great cooling towers. The average losses throughout the UK on the national grid and the distribution networks is about 9% BTI statistics. So by the time that electricity gets to your home, particularly down here in the South, you could have as little as 21% of the energy that's been burnt at the power station.

With combined heat and power, because it's local and it's smaller scale you're able to recover the heat as well as the electricity and use that for heating buildings, providing hot water services and even air conditioning and refrigeration via technology called heat-fire absorption cooling. That will increase the efficiency between 85 to 90%.

So, although the costs of generating the electricity might be higher, when you take all of these costs into account we can actually supply electricity to a residential customer at a lower price than the Grid can.

Narrator

Knaphill is another small-scale suburban energy island. It supplies just 35 premises and homes using photovoltaics and CHP.

Allan Jones

This is just really an example of how the system has grown organically. This CHP station was put in about 1996-97. And then, in 2001, the Vine and the Knaphill Health Centre were constructed, and we convinced them to connect to the district heating/private wire network rather than the Grid. Getting people to sign up for something like that inevitably means you have to educate them on a subject they never gave any thought about before. And sometimes people become very enthusiastic about green energy. And so, shortly after connecting them, we actually put the photovoltaics on the new health centre and the community buildings.

Narrator

Woking's innovative energy strategy forces them to plan their investment decades into the future.

Allan Jones

The important thing that we're doing here is what you really can't see: which is the infrastructure under the roads. And that's because putting in district heating, district cooling and island generation networks they're going to be around for many years: sixty years or more. Whereas primary energy generators get changed out about every fifteen years. And so, in fifteen years time, if you're looking at a new gas-fired CHP system. It's more likely that that can be replaced by a renewable hydrogen fuel cell system or a biomass system. And not only will those technologies be a lot cheaper than they are today, but when we come to re-finance, of course, we're not re-financing the infrastructure just the primary generation technology. So our innovative means of financing these projects will have even more ability to finance those ultra-green technologies.

Narrator

Allan's prime example of an ultra-green technology is the world's first commercially operated hydrogen fuel cell. It powers two large sports complexes in the town's park.

Allan Jones

From this fuel cell we have two heat networks: a high-grade heat network and a low-grade heat network. The low-grade does all the hot water systems in the swimming pool: we've got three swimming pools here, and so we can go straight into the hot water chlorifier. And we also have our district heating system over here, which the high-grade goes into, and that forms part of our extended district heating, district cooling private wire network. The private wire network is a high voltage network and is about half a kilometre long between these group of buildings and the next lot of buildings that are supplied.

We haven't just put a fuel cell sitting in isolation here. Its actually part of an integrated network with all the other technologies and other free combined heat and power systems, heat-fired absorption cooling, thermal storage, even solar photovoltaic's embedded in these buildings themselves. So it's a mixed technology approach that enables us to achieve this self-sufficiency all the year round. And also acts as one of our big generators as far as the wider Borough services are concerned, where it balances out the other island generation systems that we have.

Narrator

And there are other new technologies waiting in the wings.

Allan Jones

We're working on advanced biomass waste energy projects, using thermal combustion technologies as opposed to incineration: which the council doesn't support.

We're also looking into small, medium and large-scale wind projects. And we're consulting with the local community about the acceptance of those technologies, as well as continuing with our photovoltaic programme. We've also recently begun a project on geothermal heat pumps. So we're looking at the whole range of sustainable and renewable energy technologies because this is about balancing the electrical and thermal loads together. And different types of projects, or different types of buildings present different opportunities, if you like to mix different technologies together to achieve this independence from the Grid.

Narrator

But none of this can be achieved without the political will to make it happen.

Allan Jones

A number of things came together in Woking. It may well be that other local authorities might have the officers that are keen to implement something like this, but don't have the support from chief officers or politicians. Or, you could have politicians that are keen to see something happen but don't have the officers in the organisation to make it happen. So, I think in Woking, what essentially happened is that you had a number of things come together. You had officers that could actually implement these projects. You had the support of chief officers and more importantly you had the support of politicians.

We developed our private wire networks, so that we could capture the true economic value of sustainable energy. You can call that innovative but it, you know, just seemed a logical thing for us to do. I think that's the same, you could say, about any innovation. It's the way that you think about projects. You don't look at these technologies in isolation. We look at them together with other things. And that's what I think probably true innovation is. It's about just looking at things that much differently. And not being so fixed and rigid about how you do things.