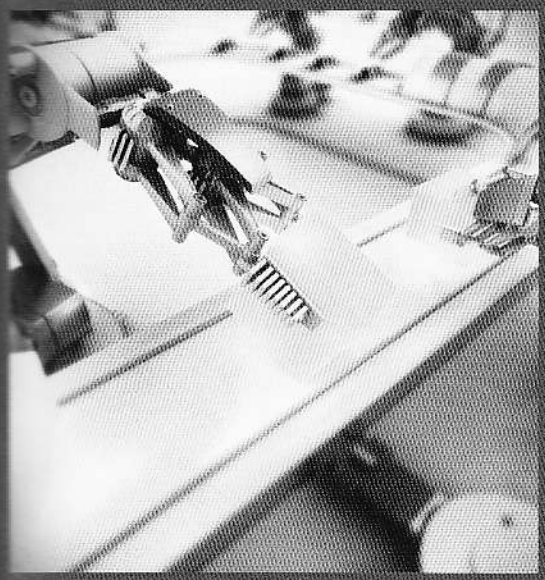
WORK

Printers have replaced production lines and no-one commutes



Back in 2011, millions of people travelled tens of kilometres every day to work. 'Commuting' (now an archaic word) was the result of a mania for transport that had developed since the arrival of the railways in the 19th century.

Over the last 100 years, the economic argument has shifted. Thanks to high-speed data transfers, it is now possible to take the work to the people, not the other way around. In an extension of conference video calls prevalent in 2011, coupled with social network technologies, rooms 'full' of people otherwise scattered around the planet are convened, giving all the social benefits of face-to-face contact without the travel costs.

Even manufacturing has been distributed. Much of it now relies on a technique called '3D printing' – a kind of photocopying of solid objects, in which computer-controlled machines build up a component by spraying on layer by layer. Advantages of the technique are its flexibility – one system can turn out any part required – and its ability to construct more complicated and intricate shapes than any other primary manufacturing technology. In 2011, this was foreshadowed by experiments such as the 'Reprap' project, the Replicating Rapid-prototyper, devised at the Buckinghamshire Chilterns University College in England. The most significant challenges arising from this technology proved to be intellectual property rights issues.

Of course, some collection and larger-scale assembly is often required. But the principle of such technologies is that, just as food is grown as closely as possible to its point of consumption, so artefacts of all kinds are manufactured as close as possible to their point of sale and use.

More will come. Trials continue in 'programmable matter', in which tiny wirelessly programmable blocks can combine to make objects and then separate to be reused: a chair morphs into a lawn mower as required. The ultimate dream is nanotechnology, in which garbage might be rebuilt into useful items: waste food turned into industrial diamonds. But for now, the sheer slowness of nanotech processes has kept them from widespread acceptance; it takes as long to 'grow' a mobile phone as it does to grow a potato.

ENERGY

We still have power stations like they did in 2011, it's just that they're out in space these days

A city is still a city. However transformed, London is still a great sink of energy. But the way we meet our cities' energy needs has changed radically.

It was the growing scarcity of oil – and the unacceptable way the last dregs were being mined – that forced the creation of a new energy strategy. 'Generation distribution' is the catchphrase. In London, every block, every home is a source of energy, from photovoltaic cells, rooftop wind turbines, even biofuel crops in the back yard. Every home is connected into a local microgrid, from which you can draw energy when you need it, store spare energy in hydrogen fuel cells in your basement and even sell power back when you have a surplus.

The microgrids are connected up to larger regional, national and international grids. These are supported by key nodes that were initially existing-technology power stations, including hydrocarbon-burners and nuclear power stations, but these have been phased out in favour of orbital-station power receiver nodes. These are panels of solar cells in orbit, converting the energy of sunlight to microwave radiation, which is beamed to the ground. There it's picked up by big centralised antennae that look like radio telescopes. But 'rectennas' are a cheap technology that allow microwave energy to be converted to DC electrical energy. So reception can be distributed among small local stations to avoid power transmission costs on the ground. By 2111, the technology's risks, such as pollution from launches and the danger of cooking wildlife or people in the microwave beams, have long been solved.

The modern energy supply, moderated by high-quality artificial intelligence, is now distributed, flexible, robust at every scale, clean and more than sufficient to support high rates of economic growth.