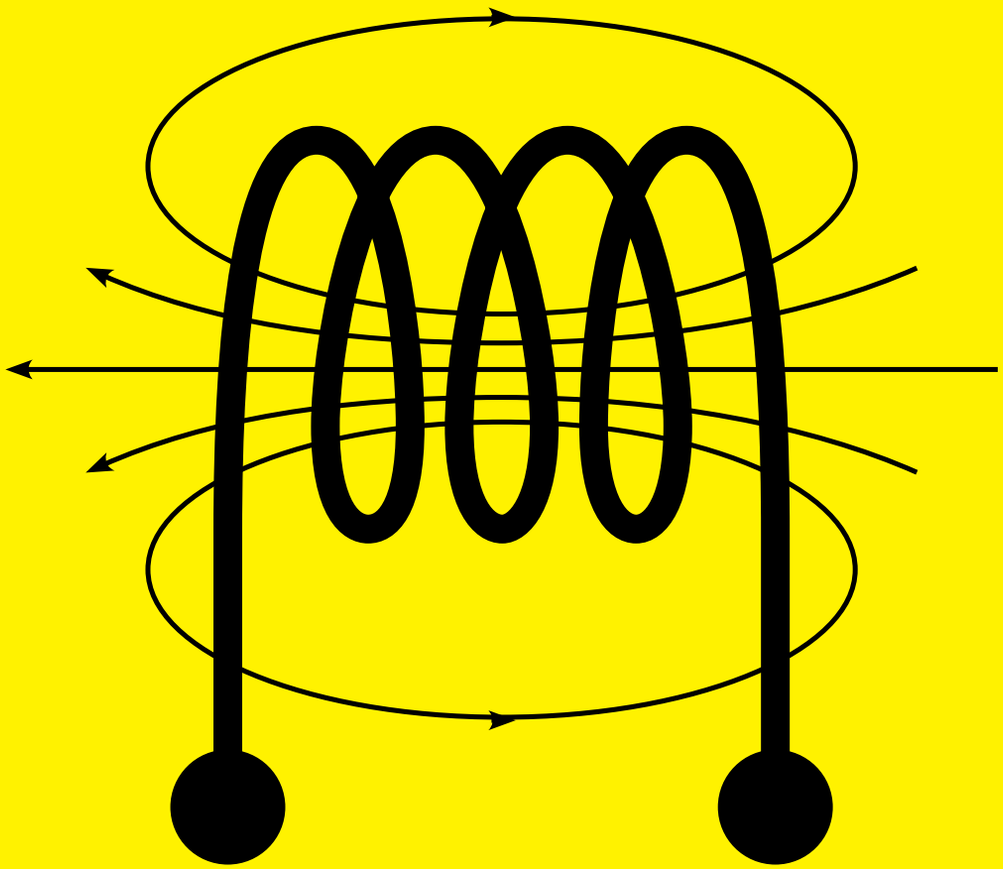


TECHSPEDITIONS #2

WIRELESS ELECTRICITY

Battery dead? Charger at home? No problem. Get ready for gadgets that can tune in wirelessly for a top up...

JARGON BUSTER

Inductive coupling
First-gen wireless tech using a magnetic field to induce a low charge over distances of just a few millimetres.

Energy harvesting
Gathering energy from the world around you, much as solar cells harvest sunlight.

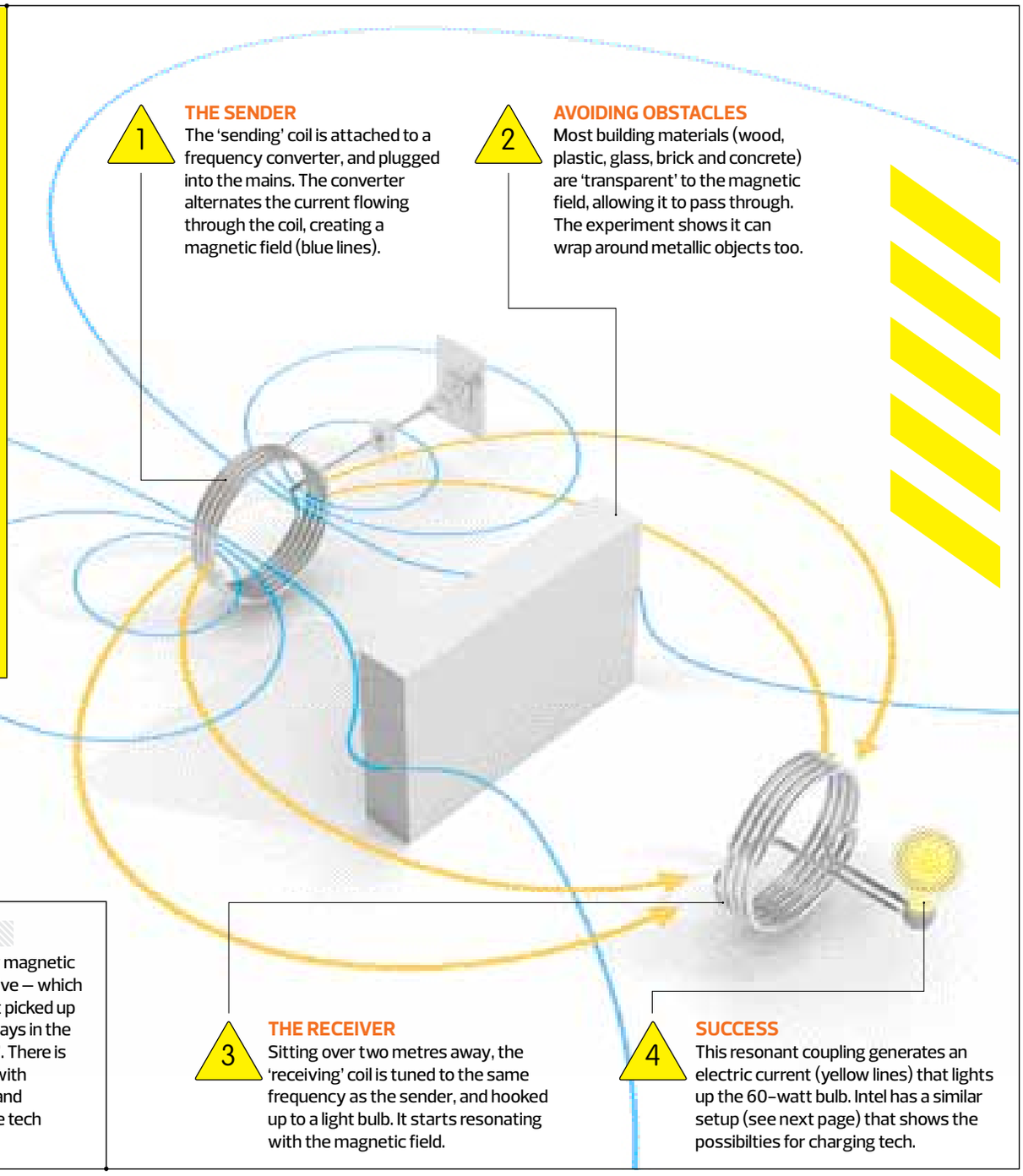
Wireless resonant coupling
A form of inductive coupling using tuned transmitter and receiver coils to beam energy over several metres.

Power lasers
Think death rays shining on solar cells, except with infrared lasers and ultra-miniaturised photovoltaic diodes.

We live in a glorious world of music streaming, wireless headphones and mobile internet. But when it comes to powering our tech, we're still helplessly tethered to our lithium ion apron strings. Wouldn't it be handy if a wireless revolution could start beaming energy straight into our gadgets without the need for sockets or chargers? Incredibly, this is actually happening. We sent Mark Harris to test the magnets, radio waves and laser beams that are shaping our new cable-free future…

How it works

A big breakthrough in wireless power came in the form of this 2007 experiment from MIT's Professor Marin Soljačić, which worked at an impressive 40 per cent efficiency. Based on wireless resonant coupling (see Jargon Buster), its resulting patents were used to found WiTricity (witricity.com). The company is now working on bringing the tech to consumer gadgets, which it expects will start arriving as early as 2012.



1 THE SENDER
The 'sending' coil is attached to a frequency converter, and plugged into the mains. The converter alternates the current flowing through the coil, creating a magnetic field (blue lines).

2 AVOIDING OBSTACLES
Most building materials (wood, plastic, glass, brick and concrete) are 'transparent' to the magnetic field, allowing it to pass through. The experiment shows it can wrap around metallic objects too.

3 THE RECEIVER
Sitting over two metres away, the 'receiving' coil is tuned to the same frequency as the sender, and hooked up to a light bulb. It starts resonating with the magnetic field.

4 SUCCESS
This resonant coupling generates an electric current (yellow lines) that lights up the 60-watt bulb. Intel has a similar setup (see next page) that shows the possibilties for charging tech.

BUT IS IT SAFE?

The field generated by magnetic coupling is non-radiative – which means the energy not picked up by the receiving coil stays in the vicinity of the 'sender'. There is very little interaction with biological organisms, and scientists consider the tech to be completely safe.

WIRELESS POWER – COMING SOON

Charging pads

Over 80 companies including Nokia, HTC, Sony Ericsson and LG have formed the Qi consortium (wirelesspowerconsortium.com) to standardise induction coupling charging. The range is still virtually zero, but on the plus side at least all Qi chargers will work with all future Qi-compatible gadgets.

Energy harvesting

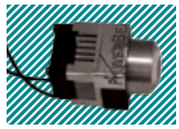
US start-up Powercast (powercastco.com) has designed miniature radio-harvesting modules that can power sensors in awkward-to-reach spots, and scavenge energy from nearby GSM mobiles. The Powerharvester P2110 is already being built into smart grid and security installations.

AR contact lenses

University of Washington professor Babak Parviz (ee.washington.edu) has made contact lenses containing tiny antennas, which safely collect radio waves and translate them into electrical power. Early prototypes have shown that semi-transparent, augmented-reality lenses are possible.

Laser charging

Powerbeam (powerbeaminc.com) is working with a big consumer electronics brand on a product for Christmas 2012. Expect laser-powered surround sound speakers, digital frames or ultra-lightweight TVs. The best bit? You get to line up the laser system with a Terminator-style red laser pointer. Cool.



IN ACTION

LAB#1

Intel Labs

Seattle, USA

Who?

Intel isn't just the world's largest manufacturer of semiconductors, microprocessors and smug geek adverts – it's a research hotbed brainstorming the future of computing. It's working on augmented reality, cloud computing and, of course, wireless power.

What is it doing?

Intel's researchers are beavering away on a wireless power system that could mean the end of hot, heavy chargers. They've developed a resonant link system (see jargon buster) that works with over 90 per cent efficiency in real world conditions. The ultimate aim is to get a single transmitter charging several gizmos at once.

What does it make?

Intel's first wireless demo uses the background electromagnetic soup all around us. Anyone living in a city is constantly exposed to radio frequency signals from TV channels, wireless networks, radio stations and so on. Professor Joshua Smith from the University of Washington showed me a tiny weather station that's harnessing energy from a local TV station three kilometres away. It's getting enough energy to sense and record humidity and temperature, while another TV-powered device then transmits that data in a split-second radio burst to a "nearby computer" (scientist code for secret National Security Agency databanks).

One problem with harvesting ambient energy is the miniscule amounts of power involved. Even though the TV tower is broadcasting a million watts of energy, Intel's device gathers just 60 microwatts. That's 10,000 times less power than is needed for a mobile phone call.

Intel also has a wireless resonant coupling link system. With two sci-fi-esque circular antennas, Smith beamed tens of watts over a couple of metres of thin air. Cue lightbulbs across the room lighting up and laptops running happily without batteries. All pretty mind-blowing.

While other companies have resonant energy tech, they usually need to line up everything precisely. Intel's set-up automatically adjusts itself to work however you hold the antenna. There is one problem Intel hasn't licked yet, though. As I leave, the lightbulb flickers and dies: Smith's system has a range of just twice the size of the transmitter coil. Or perhaps it's the black helicopters closing in...

COMING SOON

Laptop charging

Due: early 2012

With Intel's wireless charging tech built into a table, users will be able to charge up devices automatically without even thinking about it.

Metal heart

Due: 2013

Smith has demonstrated a heart pump that can be powered wirelessly from outside the body. The patient simply wears a vest with batteries – or sleeps in a resonant energy bed.

LAB#2

LaserMotive

Seattle, USA

Who?

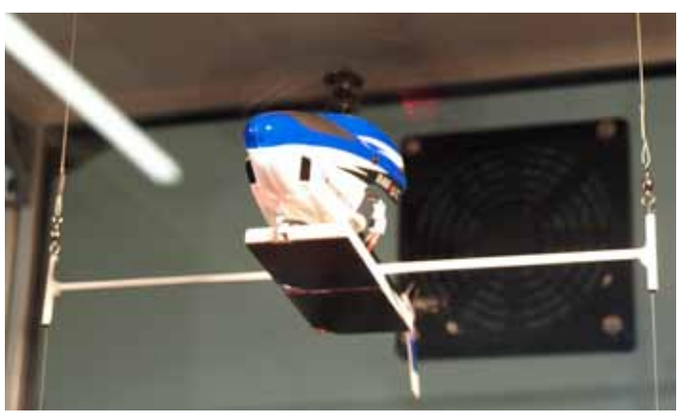
LaserMotive is a start-up led by wireless energy expert Dave Bashford, the brains behind Philips' cordless toothbrushes, and Tom Nugent, a scientist who worked on advanced fusion rockets and then developed an amazing mosquito-zapping photonic fence for bonkers billionaire Nathan Myhrvold.

What is it doing?

The company was formed in 2007 to exploit a new generation of cheap, powerful lasers. Bashford and Nugent won a NASA competition to power a cable-climbing robot – by firing a laser at it and converting the light into electricity. They're now busy turning their $900,000 prize money into a business beaming laser power at flying drones, robots and mobile phone towers.

What does it make?

LaserMotive's cramped lab in a light industrial unit outside Seattle must have more lasers per square inch than any other place on earth. There are the twin 2.25kW lasers that LaserMotive used to win the NASA prize, connected to a mirror that automatically tracks its tiny robot target up to one kilometre away. There's also an infrared laser system to keep a Parrot AR.Drone quadricopter in the air "basically forever" according to Nugent. As I peer in for a closer look, Nugent proudly says, "This is some of the first eye-safe laser technology around. Even if the helicopter moves and the photovoltaic panels flash light at your eyes, you won't be blinded." Time to take a step back.



By powering quadricopters – and soon police and military drones – with lasers, they can fly faster and higher and don't need to land to recharge or refuel.

LaserMotive is also talking to mobile phone companies. Nowadays, a cell tower on a remote mountaintop might need an expensive line of pylons marching up the hillside. In the future, LaserMotive's lasers will simply beam in the power from miles away.

Nugent already has systems that are 30 to 40 per cent efficient and says that doubling those numbers is within the realms of possibility. Sadly, however, he thinks "powering an entire city with lasers probably won't make sense." Well, maybe not economically. But give me a pair of good sunglasses and I'd move there in an infrared flash.

COMING SOON

Laser-powered TV drones

Due: 2013

Nugent expects broadcasters to invest in camera-equipped laser drones that will hover outside nightclubs or peek in the upstairs windows of A-listers' houses.

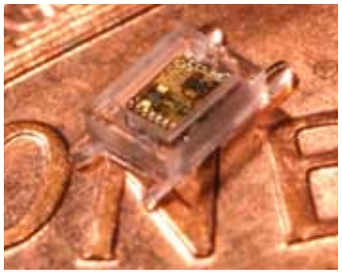
Space elevator

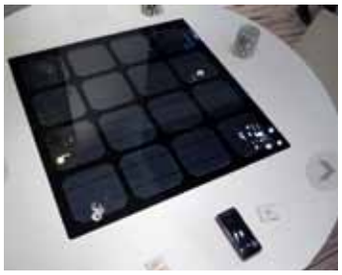
Due: 2090

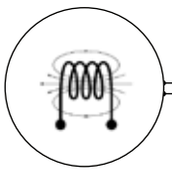
NASA intends to deploy a space elevator: a 24,000-mile cable stretching up into orbit. Remotely powered robots will climb the cable using only sustainably generated electricity.

WI-LECTRICKERY

THE FUTURE OF WIRELESS ELECTRICITY







1 Body internet

£tba (due 2015) | nanowerk.com

You'll soon be able to do an internet search on your own body, getting live levels of blood sugar, vitamins and (sorry) cholesterol from tiny 'smart dust' sensors harvesting energy from your mobile phone.

2 Energizer Qi charger

$70 (US only) | energizer.com

A small docking station providing up to 5W of power for future Qi phones and cameras – and the couple of lucky gadgets today that have Qi sleeves (iPhone and BlackBerry Curve).

3 Solar charging

£tba (due late 2011) | panasonic.co.uk

Energy harvesting meets Qi wireless charging in the Panasonic solar table, coming later this year – probably just as the summer sunshine fades away. Simply slap down your mobile to bask in the glow of cable-free tree-huggery.

4 Wireless EVs

£tba (due 2014–2015) | nissan.co.uk

WiTricity expects its wireless charging units to be found in the second generation of battery electric vehicles, such as the successor to this year's Nissan Leaf. Its charger can already deliver over 3300W – enough to recharge a Leaf as quickly as today's plug-in home chargers.

WIRELESS POWER PREDICTIONS

Harry Ostaffe, VP, Powercast

You'll soon be able to harvest energy from mobiles or a Wi-Fi router

"Hardware already in today's handsets can be adjusted with software to temporarily transmit on unlicensed frequencies and send power. There are five billion mobile phones in the world, so everybody has portable power sources that can transmit energy up to several feet away."

Tom Nugent, Founder, LaserMotive

Laser power beaming will revolutionise disaster relief

"The US Navy is interested in our systems for its fleet. The intention is that, after an earthquake, say, they would be able to airdrop a receiver into the disaster zone to be powered from a ship nearby, enabling emergency communications or field hospitals."

David Graham, CEO, PowerBeam

Wireless power will be mainstream in less than ten years

"By 2020, wireless power will be as much as part of our environment as mobile phones. We transfer power using invisible infrared lasers and photovoltaic cells. Our range is up to 100m and there's no upper limit to power: if you want double the power, you simply need to double the number of lasers and photovoltaics."

Joshua Smith, University of Washington and Intel

Wireless power is developing at a rate of knots

"We couldn't have done 10 years ago what we're doing today, and Moore's Law means tomorrow's electronics will need less power, giving longer ranges. In time, we want devices to harvest power from mobile phone towers and send data back using those towers' networks."