

The Telegraph

## Holy Grail of energy policy in sight as battery technology smashes the old order



[AMBROSE EVANS-PRITCHARD](#)

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Once renewable energy can be stored for use on demand, Britain could become self-sufficient in its energy usage CREDIT: CHARLOTTE GRAHAM/REX SHUTTERSTOCK

The world's next energy revolution is probably no more than five or ten years away. Cutting-edge research into cheap and clean forms of electricity storage is moving so fast that we may never again need to build 20th Century power plants in this country, let alone a [nuclear white elephant such as Hinkley Point](#).

The US Energy Department is funding 75 projects developing electricity storage, mobilizing teams of scientists at Harvard, MIT, Stanford, and the elite Lawrence Livermore and Oak Ridge labs in a bid for what it calls the 'Holy Grail' of energy policy.

You can track [what they are doing](#) at the Advanced Research Projects Agency-Energy (ARPA-E). There are plans for hydrogen bromide, or zinc-air batteries, or storage in molten glass, or next-generation flywheels, many claiming "drastic improvements" that can slash storage costs by 80pc to 90pc and reach the magical figure of \$100 per kilowatt hour in relatively short order.

“Storage is a huge deal,” says Ernest Moniz, the US Energy Secretary and himself a nuclear physicist. He is now confident that the US grid and power system will be completely "decarbonised" by the middle of the century.

The technology is poised to overcome the curse of 'intermittency' that has long bedevilled wind and solar. Surges of excess power will be stored for use later at times when the sun sets, and consumption peaks in the early evening.

This transforms the calculus of energy policy. The question for the British government as it designs a strategy fit for the 21st Century - and wrestles with an exorbitant commitment to Hinkley Point - is no longer whether this form of back-up power will ever be commercially viable, but whether the inflection point arrives in the early-2020s or in the late 2020s.

One front-runner - a Washington favourite - is an [organic flow battery](#) at Harvard that uses quinones from cheap and abundant sources such as rhubarb or oil waste. It is much cheaper and less toxic than current flow batteries based on the rare metal vanadium. Its reactions are 1,000 times faster.



Harvard professor Michael Aziz working on his revolutionary 'rhubarb battery' CREDIT:HARVARD

Professor Michael Aziz, leader of the Harvard project, said there are still problems to sort out with the "calendar life" of storage chemicals but the basic design is essentially proven. "We have a fighting chance of bringing down the capital cost to \$100 a kilowatt hour, and that will change the world. It could complement wind and solar on a very large scale," he told the Daily Telegraph.

The latest refinement is to replace toxic bromine with harmless ferrocyanide - used in food additives. The battery cannot catch fire. It is safe and clean. "This is chemistry I'd be happy to put in my basement," he said.

The design is delightfully simple. It uses a tank of water. You could have one at home in Los Angeles, Lagos, Buenos Aires, Delhi, or Guangzhou, storing solar power in the day to drive your air-conditioning at night. It could be scaled up for a 500 megawatt wind farm.

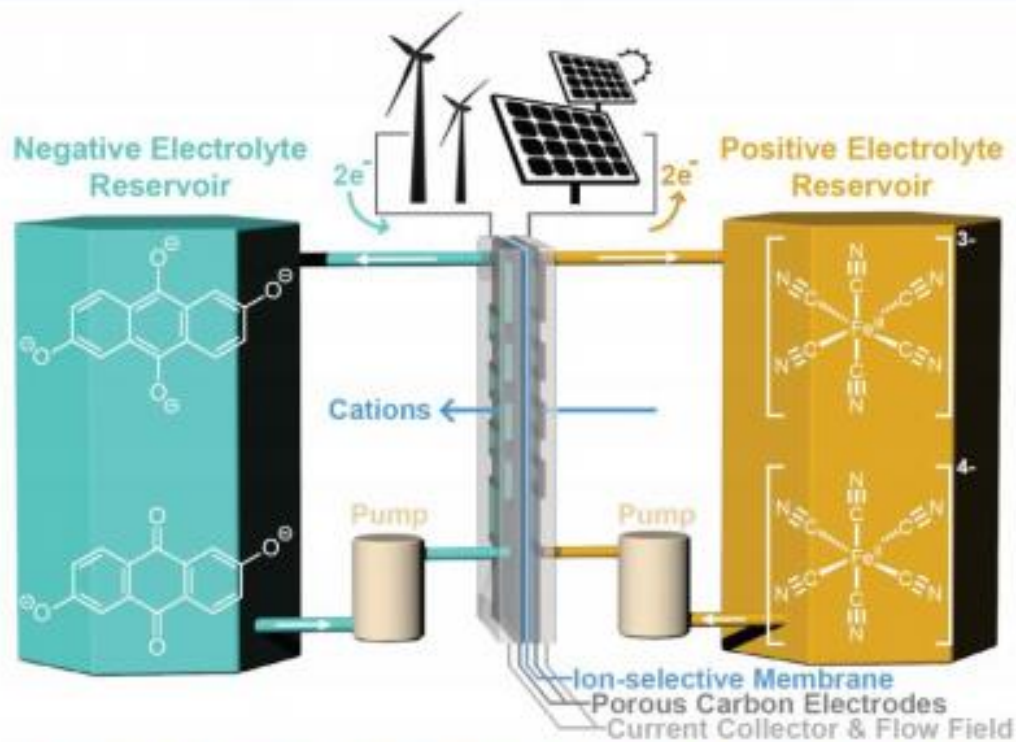


Figure 1: Schematic Diagram of the Harvard Organic Flow Battery

The Harvard organic flow battery. It can run off rhubarb CREDIT: US ENERGY DEPARTMENT

Italy's Green Energy Storage has the European licence. It is [building a prototype](#) with the Kessler Foundation at Trento University, backed by EU funds. "We have a chemistry that is ten times cheaper than anything on the market," said Salvatore Pinto, the chairman.

"We are speaking to three utilities in Europe and we will install our first battery as a field test next year," he said.

It is a race. Tim Grejtak, an energy expert at Lux Research, said Lockheed Martin and [Pacific Northwest](#) labs are both working on their own organic flow batteries, while others are developing variants with designed molecules.

I do not wish to single out this particular technology. I cite it as an example of how fast the picture is evolving as the world's scientific superpower mobilizes in earnest, and investors start to chase the immense prize. Consultants Mckinsey estimate that the energy storage market will grow a hundredfold to \$90bn a year by 2025.

Once storage costs approach \$100 per kilowatt hour, there ceases to be much point in building costly 'baseload' power plants such as Hinkley Point. Nuclear reactors cannot be switched on and off as need demands - unlike gas plants. They are useless as a back-up for the decentralized grid of the future, when wind, solar, hydro, and other renewables will dominate the power supply.

I will be writing about the economics of offshore wind in coming days but bear in mind that renewables generated 18pc of UK power last year, and this is expected to double by the late 2020s as wind and solar capacity reach 50 gigawatts (GW). Once the power can be stored for overnight use, there will be extended periods in the summer when no base-load is needed whatsoever.

Perhaps the Hinkley project still made sense in 2013 before the collapse in global energy prices and before the latest leap forward in renewable technology. It is madness today.

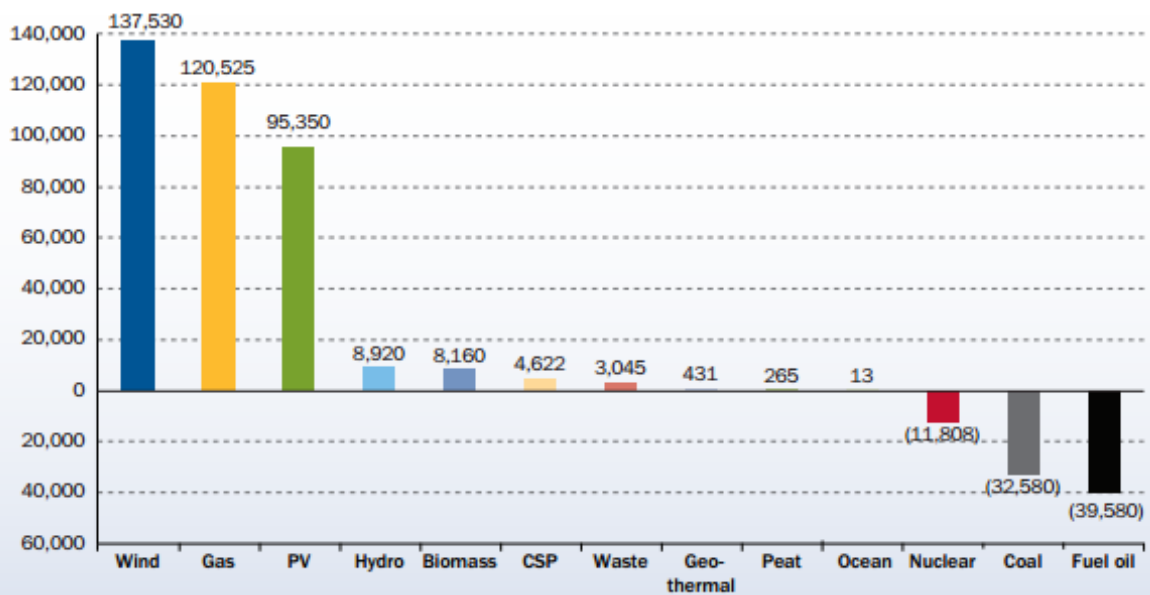


The latest [report](#) by the National Audit Office shows that the estimated subsidy for these two reactors has already jumped from £6bn to near £30bn. Hinkley Point locks Britain into a strike price of £92.50 per megawatt hour - adjusted for inflation, already £97 - and that is guaranteed for 35 years.

That is double the current market price of electricity. The NAO's figures show that solar will be nearer £60 per megawatt hour by 2025. Dong Energy has already agreed to an [offshore wind contract](#) in Holland at less than £75.

Michael Liebreich from Bloomberg New Energy Finance says the Hinkley Point saga will be taught for generations as a case study in how not to run a procurement process. "The obvious question is why this train-wreck of a project was not killed long ago," he said.

FIGURE 6: NET ELECTRICITY GENERATING INSTALLATIONS IN THE EU, 1995-2015 (MW)



Total installed power capacity

All the extra power capacity added since the mid-1990s in Europe has been renewable CREDIT: EWEA

Theresa May has inherited a poisonous dossier, left with the invidious choice of either offending China or persisting with a venture that no longer makes any economic sense. She may have to offend China - as tactfully as possible, let us hope - for the scale of the folly has become crushingly obvious.

Every big decision on energy strategy by the British government or any other government must henceforth be based on the working premise that cheap energy storage will soon be a reality.

This country can achieve total self-sufficiency in power at viable cost from our own sun, wind, and waters within a generation. Once we shift to electric vehicles as well, we will no longer need to import much oil either. Rejoice.

