What are the key technologies in the Coalition's low emissions roadmap, and can they deliver?
Royce Kurmelovs The Guardian Sun 27 Sep 2020

From clean hydrogen, energy storage and low-carbon materials to carbon capture and storage, and soil carbon
The Coalition government this week released its much-anticipated Low Emissions Technology Statement that targeted five different technologies for rapid development: clean hydrogen, energy storage, low-carbon materials (steel and aluminium), carbon capture and storage and soil carbon. The plan was immediately criticised by many experts for shunning proven renewable energy generation, but others were cautiously optimistic. Here we take a closer look at some of the key technologies mentioned and whether they can deliver.

'Clean' hydrogen
It may be a colourless gas, but the industry has a colourful way of talking about hydrogen. In the simplest terms, "brown hydrogen" is turning coal into gas from which hydrogen can be extracted.
An alternative method, and the one the government is spruiking, relies on creating hydrogen using natural gas via a process known as steam-methane reforming (natural gas is primarily made up of methane).

How does it work?
In this process, high-temperature steam (up to 1,000C) reacts with methane under pressure (equivalent to about 25 atmospheres) in the presence of a catalyst, such as nickel, to produce hydrogen, carbon monoxide, and a relatively small amount of carbon dioxide – emissions which the government is hoping can be captured and stored underground.
This method of hydrogen production has been around since the 1930s, so it is relatively well understood, and is now used in more than 90% of all hydrogen production worldwide.
"Green hydrogen" is made using an electrolyser to run an electrical current through water separating it into hydrogen and oxygen. The electricity needed is provided by renewable energy such as wind or solar, eventually allowing for the creation of carbon-neutral industrial products including green steel.

Why does this matter?
It is not possible to decarbonise by electrifying everything. Some industrial processes such as steel or glass making require extremely high temperatures. While this process has relied on coal in the past, hydrogen can serve as a replacement. Hydrogen also has promise as an aviation fuel and in other modes of transport.

What's the catch?
The government wants to generate hydrogen for under $2 a kilogram as fast as possible. Though it claims agnosticism as to method, it says hydrogen in Australia will be made by coal or natural gas in the short-term and then "underpinned" by carbon, capture and storage (CCS) to deliver "clean hydrogen". Dr Emma Aisbett, associate director at the Australian National University's Grand Challenge Zero-Carbon Energy for the Asia-Pacific, says this may be harder to achieve than the government anticipates as the price of gas grows with demand.
"On the one hand they're saying they need to get the price of gas down, but on other hand they're planning to increase demand that will increase the price of gas," Aisbett says.

The other issue the damage it may do to "brand Australia".
"Truly green hydrogen is already in use and is likely to become cost-competitive with hydrogen produced from gas in the near future, particularly in locations such as Australia which have the ability to produce very cheap renewable energy," Aisbett says. "So within a decade we can expect investments in CCS for capture of carbon from reforming fossil fuels could be redundant."

Carbon capture and storage
The basic principle of CCS is simple enough: carbon dioxide is extracted directly from the atmosphere or siphoned off from an industrial by-product and bottled up in a void deep within the earth.
Has it been done?
Internationally the International Energy Association says there are 20 commercial CCS projects worldwide, with 30 more in development amounting to a $27bn investment. While the field has become heavily politicised it does have potential uses. According the Intergovernmental Panel on Climate Change, such "negative emissions" technologies are needed to help remove carbon dioxide from the atmosphere.

The catch?

Price. The government aims to reduce the cost of CCS to $20 a tonne, but fossil fuel companies have been working on CCS for decades and not come near this.

Done poorly, the process of capturing, transporting and locking away carbon dioxide may generate more CO2 than what it stores. Then there are questions about long-term responsibility, especially given the potential for leaks.

The places where CCS is most successfully used are actually in oilfields where pumping carbon dioxide back into the field helps extract more oil, which is not exactly helpful in acting on climate change.

On top of this, there are inherent limits. There are a finite number of geological formations that can be used for CCS, making them a scarce resource that should only be reserved for the most essential industrial processes that are hard to decarbonise – in other words, probably not hydrogen fuels or electricity generation.

Soil carbon

"Soil carbon" refers to the amount of decomposing plant matter in soil. Gardeners and soil scientists know this "organic matter" as a measure of soil quality, but thinking about soil as a carbon sink may offer another way to soak up CO2. Some projections suggest it has the potential to trap 9bn tonnes of CO2 each year globally. But this process takes time, and can be quickly undone. Some calculations suggest 150bn tonnes of soil carbon has been lost since the advent of agriculture.

How does it work?

While Tuesday's statement talks about soil carbon, more specifically it aims to bring the price of measuring organic matter down below $3 a hectare on the basis it may better open ways to use soil to lock away carbon. One approach is to develop fine-tuned sensors that sit permanently within the soil to collect data in real time, which can then be used to generate accurate models of the landscape.

The attraction of the government to soil carbon is partly political. The cost of measurement was a factor that made its emissions reductions fund – that pays farmers to increase the carbon stored in soil – uneconomic. Dr Annette Cowie, principal research scientist in New South Wales Department of Primary Industries' climate branch says while achieving a cost of $3 a hectare is unlikely, driving down the cost is necessary as until it changes farmers and soil scientists are flying blind.

"Organic matter is hard to build up and easy to lose," Cowie says. "We have the technical capacity to measure it easily, but not cheaply.

"Soil carbon is quite variable. It changes depending on geology and geography. [Right now] you need to collect a lot of samples to get a good reading, multiple samples per hectare and then send it all to a lab."

The verdict

By focusing purely on short-term developments, the Coalition is pinning its response to climate change on a sudden technological breakthrough – without doing the necessary heavy lifting. As an exercise in green industry policy – where government attempts to drive industrial and technological development – this is welcomed in some quarters. The problem is that the Coalition remains wedded to ideas like CCS and so has set aside $18bn as an implicit subsidy for fossil fuel industry.

"Wind and solar are mature technologies that can produce energy cheaper than coal or gas," Aisbett says. "The remaining market failures inhibiting emissions reduction are mainly around how to integrate, store and use this cheap, clean energy.

"This is where government policy and taxpayer resources should be directed. The emphasis on the use of dirty, expensive energy from gas, and ways to make it more expensive though slightly cleaner in the technology roadmap is not technology neutral and not an efficient use of taxpayer money."