Science needs to continue so we're not guessing on climate, renewables policy

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There may not be a silver bullet to curb the short-term thinking that often stymies the making of progressive policy on renewable energy and climate issues, but Stewart Brand, believes that's no reason not to continue to try to cast one for the future.

It's something that the acclaimed author and founder of the US-based Long Now Foundation has been trying to do since the mid-1960s, when he started a one-man campaign to have the US National Aeronautic and Space Administration release the then-rumored satellite image of the entire Earth as seen from space.

It was a straight-forward effort. Mostly, it consisted of Brand distributing buttons that asked a very reasonable Space Age question: "Why haven't we seen a photograph of the whole Earth yet?"

He later explained that he thought the image of our planet might be a powerful symbol; a way to illustrate that the shortening of the human attention span in the last half of the 20th century was mismatched with the pace of the planet's spiraling environmental problems.

These days Brand's "work-around" to the short-term thinking dilemma is to engage in big, charismatic projects like the 10,000 year clock he and others are striving to build in a mountain-side in the US state of Nevada.

During a recent interview with Renewable Energy Magazine, Brand openly questioned whether modern democracies can really cope with climate change.

As the conversation continued for this, the second part of a two-part feature, he was asked what, exactly, he thinks the problem is, and whether democracies just plain cave in to the short-term too readily.

"Maybe," he said after some deliberate consideration.

"The US Founding Fathers had some serious thoughts and worries about that. It was one of the reasons they created the US Supreme Court, with its longer terms for members," Brand continued. "Obviously that's not a perfect solution, but it is an attempt to deal with the issue.

"So too, is our 10,000 year clock – there's even talk of building one in Washington, DC, so that the politicians can see it out their window as they legislate," he said.

Seeking a geo-engineered fix for carbon

For Brand, geo-engineering in one form or another may well be man's last best chance to get a handle on the climate issue and preserve a livable planet.

Freeman Dyson, the quantum physicist recently profiled in these pages, once proposed that planting a trillion trees could solve the problem of excessive carbon emissions in the atmosphere.

Asked how his view of geo-engineering differs from Dyson, Brand said it's not so much a matter of differing, as it is of still looking at a wide range of options that might work to tamp down the amount of carbon in the atmosphere.

"You see, there are two or three kinds of geo-engineering, and his, in a sense, is the third kind," he explained. "Which is to say, basically, let's let the natural processes of carbon fixation work.

"After all, it's something the plants do all the time and the oceans do all the time, and so what advocates of this school of thought say is, 'if we are standing in the way of those processes -- which we do with more and more agriculture replacing forests -- then we should back off and use more intense agriculture, let the natural systems do their job.'

"Bio-Char, in the sense of pyrolyzing agricultural waste, is kind of a further step in that direction," he continued. "And when it comes to all these various forms of carbon sequestration, basically everybody says, 'Geez, if you can find a way to make that work, that's just great. Let us know if it works out.'"

Because he refuses to have blinders on and is so in tune with working scientists, the serious theories Brand brings to the table during an extended conversation might strike some as seriously out there.

"The main one people get worked up about is the prospect of making artificial volcanoes," he said.

The theory grows out of observations made following the June 1991 eruption of Mount Pinatubo in the Philippines.

It was the second largest volcanic eruption of the 20th century, killing 800 and leaving more than 100,000 homeless. It also spewed an estimated 15 to 30 million tons of sulfur dioxide and other gases into the atmosphere, and that's what interests some climate scientists.

The cloud of volcanic ash ultimately extended into the stratosphere and spread across the globe. As a direct result, the average temperature in the Northern Hemisphere in 1992 and 1993 was reduced 0.5 to 0.6°C and the entire planet was cooled 0.4 to 0.5°C.

Overall, the cooling effects of the Mount Pinatubo eruption were greater than those of the El Niño that was taking place at the time or of the greenhouse gas warming of the planet that had occurred up to that date.

"So climatologists say, 'Hell's bells, we can do that,'" Brand said. "'It won't cost much money.' 'We can put three million tons of sulfur dioxide a year into the atmosphere in various ways, airplanes, blimps and what not.' "If you do that every year, you can cool the entire planet three degrees Celsius," he said. "In fact, it would mean you could go ahead and double the amount of CO2 in the atmosphere, from the nearly 400 parts-per-million that we're at today to 800 parts-per-million, and temperatures would remain pretty much as they are today.

"Now, you wouldn't like that world," he cautioned. "Because what you'd have is a situation where the ocean would continue to get more acidic and the rainfall patterns would change and everybody would hate that;

but it is better than getting into a runaway situation where the average temperature of the planet is five degrees warmer that it is today.

“That’s a world that’s not very congenial to civilization, at least not the one that we know,” Brand said. “But those are the kinds of choices we may face in this century.”

While the proposal is certainly audacious, Brand said it’s important that research continue, if for no other reason, ultimately, than, “that we are not guessing… about whatever it is we ultimately decide to do on climate change”.

“And the work, the research, is how you ultimately arrive at a sense of which things are more realistic and which are less so,” he said.

To illustrate, Brand pointed to an earlier, but no less ambitious proposal to address global warming: global shading. Put simply, the proposition called for sending a series of spacecraft out to the Lagrangian points – the positions in an orbital configuration where a small object affected only by gravity can theoretically remain stationary relative to two larger objects – and shading the Earth from there.

“Then somebody did the math and said, ‘In theory you *could* do that, but the horrific cost and the rest of it just takes your breath away,” he said.

“So then you’re back to things like sulfur dioxide in the stratosphere and other theoretical fixes,” Brand continued. “For instance, for a time fertilizing the ocean with iron looked kind of promising, but it probably is not working out because it just doesn’t scale very well.”

Another, as yet unproven idea, Brand referred to comes from Russell Seitz, a Harvard physicist, who has proposed pumping millions of tiny bubbles, or micro bubbles, into the ocean to lower temperatures and increase reflectivity.

To date the concept has only been made real as a computer model, but Seitz has said his early findings suggest that micro bubbles could potentially double the reflectivity of water to one part per million by volume, cooling the planet by up to 3 degrees Celsius.

“It might work,” Brand said.

Of course, there are still a number of unanswered questions about the scheme, not the least of which is how to make bubbles that last long enough to be spread over large areas of water.

Another concept on the drawing board is that of “cloud whitening,” a process through which scientists hope to take advantage of natural cloud dynamics.

One of these is the fact that clouds in the right place and elevation tend to cool the Earth beneath them by reflecting the sunlight that would otherwise reach the surface and heat up the ground.

(By comparison, high clouds tend to trap heat that would otherwise escape into space, making the Earth beneath them warmer.)

The other is that whiter clouds are naturally more reflective than darker ones.

“I’m working with the guys who are exploring this possibility – well, let me rephrase that, I’m going to their meetings – and there’s some promising stuff there and there are existence proofs,” Brand said.

Scientific proof of man's ability to make clouds "whiter" or more reflective comes in the form of satellite photographs of ship tracks on the world's oceans.

Based on those photographs, the properties of clouds appear to change dramatically when ships go by. Scientists believe that the clouds are whiter due to the aerosols emitted as the ships burn fuel. Every cloud droplet has an aerosol embedded in it, and when an extra aerosol is added from a passing ship, the cloud molecules grow brighter.

In simple terms, scientists have proposed creating nice clean nuclei for water droplets by atomizing sea-water. The tiny bits of seawater rise, quickly evaporate to minute salt particles, and those becomes the nuclei of water droplets, whitening the low stratocumulous clouds, reflecting more sunlight, cooling that part of the ocean and atmosphere.

"This concept looks particularly clean and green – especially when compared to dirtying up the stratosphere -- but it remains to be proven and it remains to be proven at scale," Brand said.

"The main thing that climatologists are saying is that in order to really find out if this stuff effects climate, we're going to have to begin to do some of these experiments at enough scale to get climate scale responses," he said.

"Of course, they'll still be as local as we can make them – for instance, limiting experimentation to the Arctic region – but until we do that, we are guessing about the effects on a very complex, nonlinear system of climate," he added.

Climate models are improving

Among Brand's most famous books is *How Buildings Learn: What Happens After They're Built*. Published in 1994, the tome considers the evolution of the world's building stock and how buildings adapt to changing requirements over long periods.

With that perspective in mind, Brand was asked how scientists can assure climate change responses -- or even large scale clean-energy installations -- age well.

"Well, when it comes to climate change, the answer is that the models are getting better," Brand said. "Freeman [Dyson, a critic of current climate science] is right to suspect them. And he's correct in his contention that they don't include biotic processes well enough yet – although there's a new model coming out of the Hadley Centre for Climate Prediction and Research in England that looks like it will."

"But that said, the existing models have not included aerosols well -- although we are poised to get better data with NASA's impending launch of the Glory satellite -- and they have not included clouds well because there's still a lot of uncertainty about them," he said.

"So detail by detail, these things are being sorted out and that will continue, probably at increasing pace," he continued. "My guess is that because it is such a large and important mystery, the science will still be surprising us for a couple more decades.

"But in the meantime, you don't want to do nothing in terms of working on the various greenhouse gas issues," he said. "In the interim, we should all be trying to find out if there's any low hanging fruit we can get a handle on."

Brand said history has proven ameliorative projects do work.

“For instance, because someone decided to address its issues, the Thames is clean enough to fish in today; And in Los Angeles, the air is clean enough to see the mountains outside the city,” he said.

“People my age who grew up in LA didn’t know there were any mountains,” Brand laughed. “They never saw them. And my wife, who is 50-something, remembers coming home wheezing and coughing and her eyes streaming, and how her mother told her to stay inside. Everybody went through that in those days, and it was just because of the stuff coming out the back end of automobiles.

“As it turned out, there was one guy who said, ‘This is what it is,” ‘It’s actually correctable’ and ‘Here’s how you do it.’ And he set the whole process of cleaning up the air in motion,” Brand said. “As a result, some laws were passed, and the car companies bitched and moaned and complained, and California finally said, ‘If you want to sell cars in this state, you are going to have to do this stuff.’ And they did. So now, we can see the mountains and people can breathe. So they are fixable, these things.”

Meeting the energy challenges of a developing world

While Europe has certainly done a lot of serious research and deployment in regard to solar and wind energy in particular, Brand said his sense is that when it comes to things like clean energy and genetic engineering, the clustering of the industries will occur in the developing world.

“What I’ve seen there is that these countries are developing so fast and are so aware of this stuff and are getting a requisite number of engineers and scientists, that they can either just go ahead and pirate our IT or create their own,” he said.

“By way of example, look at where the cutting edge is in terms of genetically-modified agriculture; it’s in places like the Philippines, China, and increasingly in parts of Africa, and (the US) is just dragging along and doing variations on the two things we’ve done for years: herbicide resistance and pest-tolerant corn and stuff like that.”

Likewise with energy tech, he said.

“What would be useful to do, and I haven’t done it, is ask, ‘Where exactly in China is this stuff happening?’ ‘Are there regions that are specializing in one thing or another?’ China is famous for doing that.

“The same goes for India,” Brand continued. “Are there specific regions in India that are deciding how to make thorium based nuclear reactors happen?’ I know they are taking thorium seriously because they have a lot of it, and that they’d like to have their own proprietary energy technology to sell to the world; so the question is, how are they going about it?”

The conversation then turned to an entirely different kind of clustering: cities and what their evolution might mean for the future of renewable energy.

“The great thing about cities is that they lend themselves to multiple perspectives,” Brand said. “In places like the US, environmentalists have been saying for a long time that sprawl and suburbs are kind of sick, in terms of their impact on the landscape and actually problematic, socially and economically. They are places where people are perpetually tired of chauffeuring their kids around all day, every day, all week, every week.

“Therefore, if you can have a city where the kids can bike or take public transit or walk to the things that they want to do, that’s pretty cool,” he said. “Paris has worked that out. It’s a child-friendly city with squares everywhere with carousels in them and good schools hither and yon. “Vancouver is working hard on it as well,” he continued. “There they now have serious low-cost housing downtown, mostly in high rises, good schools… and those things are clearly green in standard environmental terms in the US because it means

fewer people living in sprawl, less driving, and the culture can be closer to town and parks can be closer to town and all that."

But in the developing world it is a completely different story.

"There, it's just people trying to get the hell out of the sustenance agriculture poverty trap and get to town where they can get some kind of job," Brand said. "They'll move to any city in the world there's a possibility of an opportunity.

"The main thing that happens is that it liberates the women, and as soon as it does, they have seriously fewer kids, they get freed up from what they did in the countryside – which is typically, either carrying around water or fuel or pounding that damn millet – and they get to actually have lives," he said.

"Now, that can mean several different things," he continued. "For instance, it can mean getting rid of the jerk they are married to if, in fact, he's a jerk; It can also mean getting an education for their kids, because if you're only having one or two children, that begins to make sense."

At the same time, the properties they are leaving behind are quickly being surrendered back to nature. According to a recent report from the UN Food and Agriculture Organization, as a result of the increasing migration to cities in the developing world, 55 times more tropical rainforest is growing back as second growth as is being cut down as primary growth.

"Now how good that second growth is depends on whether there's some primary growth around so you get the biodiversity coming back properly," Brand said. "The great thing about tropical rain forests is they move quickly, as anybody who has ever tried to maintain a garden in the tropics knows -- The forest is always chewing at your fence, struggling to get in."

The problem with the growing prosperity of the developing world, almost all of which is located in the Southern Hemisphere, is that it is placing new and accelerating demands on the world's energy budget that current power options are hard pressed to meet.

"The reality is the global south is hot and full of people, and as soon as they can afford it, the global south wants air conditioning," Brand said with a chuckle. "And you are not going to do that with distributed solar collectors –you can't fit enough on a single roof to handle the load.

"So they are going to want grid electricity, and, as things stand now, grid electricity is going to come from coal," he continued. "I mean, we're talking about a situation in which we're going to have to generate giga and giga and giga watts of power -- and, as a byproduct, produce giga and giga and giga tons of greenhouse gases – to help people get from poverty to prosperity, from relying on getting around by foot to getting around by scooters and ultimately cars, from their sitting around smoky fires to have electricity in their homes and light for their kids to read and watch television by."

Brand mentioned attending a recent conference in Germany where the situation was illustrated in broad relief.

One of the speakers at the event was Saul Griffith, the prolific inventor and founder of Makani Power, which is developing airborne wind turbines to extract energy from powerful, consistent winds at altitude.

Griffith posited that meeting the energy demands of the rising developing world will require the production of an additional 13 terawatts of clean energy within the next 25 years.

Then Bill Gross, CEO of the high tech incubator IdeaLab, spoke and said the way the numbers look now, it might require the creation of an additional 35 terawatts of clean energy by mid-century.

“You hear these things and you just go, ‘Oh my God,’ you know?” Brand said. “It’s just mind boggling, especially when you consider that all of civilization, right now, runs on about 16 terawatts of energy -- and much of that isn’t electrical energy, it’s also fuel in your gas tank.”

“So what do you do?” he asked rhetorically. “That’s the question that dearly needs to be answered. I mean, even with everything we have now: wind, solar, geothermal, nuclear, hydro-power, the numbers just don’t add up to 13 terawatts, let alone 35 terawatts.

“That’s why I start to cast my desperate eyes to things like experiments currently taking place at the Lawrence Livermore National Laboratory in California with laser inertial fusion energy, which is a concept that combines aspects of nuclear fusion and fission,” he said.

“We should know about that technology’s viability by the end of the year and if it works, I say jam on that, because it’s something new that really looks clean,” he added.

In a sense it sounded as if Brand was saying the renewable energy of the future may well be one we don’t know yet.

“That’s my best hope,” he said of the suggestion. “Because the one’s we know only add up to what we need with terrible difficulty.”

For additional information:

Stewart Brand’s web site