ESR NEWSLETTER
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Contents

1.Introduction

This newsletter starts with something different, namely translation of an interview with Jens Beckert, Director at the Max Planck Institute for the Study of Societies and Professor of Sociology in Cologne.

On the brighter side, it also includes a number of items on positive actions that are helping improve people's lives, and on technologies that can, or have the potential to contribute to reducing future emissions.

2. "How can we just go on living like this, even though we have known for three decades what is threatening us?"

Extracts from a translation of an interview with Jens Beckert (with some relatively small translation changes: Ed.) by Florian Schoop, NZZ (New Zurich Newspaper) website, 11 March 2024

Jens Beckert is Director at the Max Planck Institute for the Study of Societies and Professor of Sociology in Cologne. Previously, he taught in New York, Princeton and at Harvard University, among others. His new book "Sold Future" ("Verkaufte Zukunft") has been nominated for the Leipzig Book Prize 2024. In it, the renowned German sociologist explores the question of why we as

a society are not succeeding in stopping climate change – even though we have known for decades how dangerous global warming is. His analysis comes to a sobering conclusion: that the fight against climate change is in danger of failing.

The 56-year-old compares the emission of huge quantities of greenhouse gases to a tanker that has a stopping distance of many decades. The fact that the ship takes so long to come to a halt is mainly due to the large number of people on board. Some want to brake sharply, others just want to keep going. In addition, there is the question of whether the tanker can be stopped at all – or whether it will simply break apart.

"Verkaufte Zukunft" has been nominated for the Leipzig Book Fair Prize 2024

Mr. Beckert, after reading your book, I thought: That's it, we're done. Do you know why? Yes, unfortunately the result of my research does not give much hope. It's gloomy, pessimistic. I point out the seriousness of the situation – and the need to act immediately. Because our options are now very limited to get the problem under control at all, we must be prepared for a temperature increase of 2.5 to 3 degrees by the end of this century.

You paint a very bleak picture for your children's generation, to whom you have dedicated your book. Unfortunately, yes. My children were an important motivation for the book. They are still in school and could live until the year 2100. Actually, I'm writing about the future of my children and the generations to come. I was emotionally affected when I realized what we were really heading for – and what it would do to my children.

As a sociologist, why did you study climate change? I was surprised at how little the social sciences have dealt with this topic. Above all, I was concerned with one question: How can we simply continue to live like this, even though we have known for three decades what threatens us? I find that very surprising. One might think that people who are threatened are defending themselves against this threat. But that doesn't happen – or still happens far too little.

You call attempts by people to make their everyday lives more climate-friendly "symbolic substitute actions". Sounds pretty disrespectful. That may be the case. But as a scientist, I'm not interested in generating goodwill. I want to describe precisely and analytically what the problem is. "Symbolic substitute actions" is a pretty good description of what is happening.

What exactly do you mean by that? Take a look at CO_2 compensation certificates, for example. They are popular because you can still get on a plane and travel to Thailand instead of staying at home. You are aware of climate change, and you also want to do something about it. But you only do so much that it doesn't hurt. The main thing is that it doesn't throw your own life overboard.

Why is that? We humans arrange things in such a way that we feel comfortable – for example, when we mentally offset climate-damaging

behaviour with good deeds. This shows that we exhibit green behaviour when it costs as little as possible and is not too inconvenient.

But we also live in structures that often do not allow us to behave in a way that is appropriate for the climate. After all, our societies are set up in such a way that our lives are associated with high energy consumption.

Nevertheless, there are more organic products, not least because of consumer pressure. Companies are forced to invest in renewable energy or biodegradable packaging. That was different 20 years ago. I'm not saying that nothing happens. My point is simple: it's not enough. Especially since economic development in Asia and Africa will gain enormous momentum in the coming decades. This is good for the standard of living - it will lift many people out of poverty. But it also leads to a massive escalation of the climate problem.

Okay, so what then? Do we need a revolution? Or the return of the planned economy? I have a hard time propagating simple solutions. Very left-wing authors say that the moment has come to abolish capitalism. But then you also have to ask: How is this supposed to be a feasible plan? Where are the actors around the world who are able to implement the radical system change at all – and then pursue an effective climate policy? There are good reasons why there is a need for less growth and less consumption. But if you think about it politically, there are no majorities to push that through. A realistic climate policy must look at what is possible and focus on it.

So let's focus on what's possible. On what is more broadly based: green growth. It says: We don't have to do without much, but simply consume in a climate-neutral way. Sounds good. It does. But the measures are far from sufficient. If we continue as before, emissions will also continue to rise significantly by the end of the decade. For a true green transformation, we would have to triple spending on climate protection. As a thoughtful realist, I say that we are on the right track, but we are investing too little.

I'll try to be a positive realist: the expansion of renewable energy suppliers is progressing, there are more and more electric vehicles, photovoltaic systems, homeowners switching to heat pumps. You know, when I was working on my book and reading articles about great developments, I sometimes wondered: Am I writing the wrong book? But if you take a closer look, you can see how much of these descriptions are empty promises – or small successes that are hyped up.

Maybe you're just too pessimistic. After all, the world has already shown with the ban on CFCs that it can solve environmental problems globally. That's an interesting comparison that comes up again and again. But unfortunately it is not true. The CFC problem was far less complex. It was about banning a single chemical. You just bought a new fridge, and that was it. Entire economies were not called into question here.

Let's sum up: shrinking the economy is not realistic and green growth is too slow. We cannot count on the power of the consumer. All that remains is fatalism. I can well understand if one comes to this conclusion. But it's not my reaction at all. I say that we must recognise this situation as a reality.

So we need climate adaptation instead of fighting climate change? We need both, because climate change is always going on. We should do as much as we can to combat global warming. At the same time, we have to be prepared to live with warming.

How is that supposed to work? On the one hand, by giving companies more incentives to invest in green growth. On the other hand, citizens should be active actors and not (see themselves as) victims of governments' climate decisions.

But I see something else right now: a great suppression of the topic. It starts with the aforementioned fatalism and ends with the alleged climate lie. The social explosive (potential) is huge. I can't disagree with you here. We see a strong polarization on this issue. But there are other developments as well. In a small village in the German state of Rhineland-Palatinate, the local council has unanimously decided to build a new, innovative heating technology for the entire village.

Nevertheless, you yourself write that social stress is likely to be exacerbated by a warmer earth. What do you mean by that? Extreme weather, rising sea levels, all of this brings massive destruction. Global warming is associated with existential losses. This leads to conflicts; to distribution struggles.

Let's sum up: That's it, so we live with it. No, that would be exactly the fatalism I would like to reject. We have to adapt to global warming, but at the same time we have to use the options we have left: triple investment in green growth and not determine climate measures from above, but let them develop with much more involvement of the population.

3. Ocean heating 2023

Extracts from an article by Emma Farge, Reuters Sustainable, March 21, 2024

GENEVA, March 19 (Reuters) - Every major global climate record was broken last year and 2024 could be worse, the World Meteorological Organization (WMO) said on Tuesday, with its chief voicing particular concern about ocean heat and shrinking sea ice.

The U.N. weather agency said in its annual State of the Global Climate report that average temperatures hit the highest level in 174 years of record-keeping by a clear margin, reaching 1.45 degrees Celsius above pre-industrial levels.

Ocean temperatures also reached the warmest in 65 years of data with over 90% of the seas having experienced heatwave conditions during the year, the WMO said, harming food systems. The report showed a big plunge in Antarctic sea ice, with the peak level measured at 1 million km² below the previous record - an area roughly equivalent to the size of Egypt.

WMO Secretary-General Celeste Saulo later told reporters that ocean heat was particularly concerning because it was "almost irreversible", possibly taking millennia to reverse. Ocean heat was concentrated in the North Atlantic with temperatures an average 3 degrees Celsius above average in late 2023, the report said.

Climate change, driven by the burning of fossil fuels, coupled with the emergence of the natural El Nino climate pattern, pushed the world into record territory in 2023. WMO's head of climate monitoring, Omar Baddour, told reporters there was a "high probability" that 2024 would set new heat records, saying that the year after an El Nino was typically warmer still.

Saulo said she hoped the report would raise awareness of the "vital need to scale up the urgency and ambition of climate action". "If we do nothing, things will become worse and that will be our responsibility."

4. Our reliance on fossil fuels

Article downloaded from Reuters Sustainable website, 22 March 2024

Responding to calls for abandoning the phasing out of oil and gas at CERAWeek, Roy Bedlow, founder and CEO at UK-based investment firm Low Carbon, said:

“This week we heard from oil and gas executives at CERAWeek in Houston that the global push to overhaul our energy system to slow climate change is ‘visibly failing’ and that it disregards the impacts on consumers who are dependent on cheap, reliable fuel.

“This statement ignores the true costs of continuing our reliance on fossil fuels including subsidies associated with hydrocarbons and the negative health and environmental impacts on the people they say are reliant on cheap energy.

“Furthermore, as we have seen with the war in Ukraine, our over-reliance on fossil fuels puts us at the mercy of hostile actors and is the reason there was a significant increase in energy prices in 2022. Oil and gas assets are anything but cheap or reliable.

"The large-scale deployment of renewables on the other hand, represents the only viable route to achieving energy security and independence.

"Renewable energy delivers economic security by helping bring down energy bills for consumers and driving new job creation. This is backed up by the International Energy Agency's own data which shows that pursuing net-zero policies could create 14 million new jobs by 2030."

"In short, pursuing an energy policy that is reliant on fossil fuels following the hottest ever recorded year on this planet would be a betrayal of future generations.

"Instead of self-serving denial focused on profits, everyone in the energy industry needs to feel the urgency to deliver the energy transition as soon as possible."

5. "Plastics producers have deceived the public about recycling"

Extracts from an article by Dharna Noor, Guardian website, 15 Feb 2024

Plastic is notoriously difficult to recycle. Doing so requires meticulous sorting, since most of the thousands of chemically distinct varieties of plastic cannot be recycled together. That renders an already pricey process even more expensive. Another challenge: the material degrades each time it is reused, meaning it can generally only be reused once or twice.

In the 1950s, plastic producers came up with an idea to ensure a continually growing market for their products: disposability. At a 1956 industry conference, the Society of the Plastics Industry, a trade group, told producers to focus on "low cost, big volume" and "expendability" and to aim for materials to end up "in the garbage wagon".

Over the following decades, the industry told the public that plastics can easily be tossed into landfills or burned in garbage incinerators. But in the 1980s, as municipalities began considering bans on grocery bags and other plastic products, the industry began promoting a new solution: recycling.

The Society of the Plastics Industry established the Plastics Recycling Foundation in 1984, bringing together petrochemical companies and bottlers, and launched a campaign focused on the sector's commitment to recycling. In 1988, the trade group rolled out the "chasing arrows" – the widely recognized symbol for recyclable plastic – and began using it on packaging. Experts have long said the symbol is highly misleading, and recently federal regulators have echoed their concerns.

In 1994, a representative of Eastman Chemical spoke at an industry conference about the need for proper plastic recycling infrastructure. “While some day this may be a reality,” he said, “it is more likely that we will wake up and realize that we are not going to recycle our way out of the solid waste issue.” Over the past several years, industry lobbying groups have promoted so-called chemical recycling, which breaks plastic polymers down into tiny molecules in order to make new plastics, synthetic fuels and other products. But the process creates pollution and is even more energy intensive than traditional plastic recycling.

Two years ago, California’s attorney general, Rob Bonta, publicly launched an investigation into fossil fuel and petrochemical producers “for their role in causing and exacerbating the global plastics pollution crisis”. In 2023, New York state also filed a lawsuit against PepsiCo, saying its single-use plastics violate public nuisance laws, and that the company misled consumers about the effectiveness of recycling. The public is also increasingly concerned about the climate impact of plastic production and disposal, which account for 3.4% of all global greenhouse-gas emissions.

6. How Burkina Faso builds schools that stay cool in 40C heat

From an article by Èlia Borràs in Burkina Faso, Guardian website, 29 Feb 2024

If architects are people who like to think their way around challenges, building schools in Burkina Faso must be the dream job. The challenges, after all, are legion: scorching temperatures in the high seasons, limited funds, materials, electricity and water, and clients who are vulnerable and young. How do you keep a building cool under a baking sun when there is no air conditioning?

Architect Diébédo Francis Kéré grew up in the small village of Gando and knows the challenges well. He and other architects such as Albert Faus are finding ingenious ways to use cheap materials to make sure that the schools and orphanages that they have built around Burkina Faso are cool, welcoming places.

Kéré, who won the Pritzker prize in 2022, has spoken movingly about the support he was given as a child by the whole community, with everyone giving money towards his education as he left the village and eventually gained a scholarship and studied in Germany. “The reason I do what I do is my community,” he said. Gando primary school, built in 2001, was Kéré’s first construction after completing his studies. “At first, my community didn’t understand why I wanted to build with clay when there were glass buildings in Germany, so I had to convince them to use the local materials,” Kéré has said. Men and women came together to build the school, merging traditional techniques such as clay floors, beaten by hand until they were “smooth as a baby’s bottom” with more modern technology to seek better comfort.

The Noomdo orphanage was another of his projects. “The Kéré building provides us with good thermal comfort because when it’s hot, we’re cool, and when it’s cold, we’re warm inside,” says Pierre Sanou, a social educator at the orphanage near the city of Koudougou in the Centre-Ouest (centre-west) region of Burkina Faso. “We don’t need air conditioning, which is an incredible energy saving,” says Sanou. Temperatures in this region of the world remain at about 40C (104F) during the hottest season.

The Noomdo orphanage, where metal plates above the rooms protect them from direct sunlight and rain. Photograph: Iwan Baan/Kere Architecture

“Kéré builds with local materials from our territory like laterite stone and uses very little concrete,” says Sanou. Kéré’s buildings in Burkina Faso are earthy. They start from the ground and take into account that concrete is a material that needs to be transported to the site, is much more expensive and generates waste. “They are permeable buildings that seek the movement of natural air and protection from the sun. For example, they are built with very strong walls and very light roofs so that the cool air that enters from below pushes the hot air out from above,” says Eduardo González, a member of the Architecture School of Madrid.

One particularly ingenious innovation is his use of the ancient idea of raised and extended metal roofs. The rooms of Noomdo are covered by a shallow barrel vault resting on a concrete beam but with openings. Above, a metal plate protects the roof from direct sunlight and rain. Additionally, it lets out the hot air. González says the technique can be found in the vernacular

architecture of the Persian Gulf. In Burkina Faso, he says Kéré integrates it into his projects and “gives this technique a contemporary image”.

Gando primary school, built by Kéré in 2001 with local materials, merging traditional techniques with more modern technology. Photograph: Enrico Cano/Kere Architecture

The orphanage, shaped in a semicircle, also takes into account the privacy of its users, most of whom are minors living in extremely vulnerable situations. While on one side there are boys’ dormitories, on the other side are girls’, with administration serving as a nexus between them. To maintain the privacy and security of the children, the building is designed with three visibility zones. The first is the entrance door, where a common room and kitchen are located. In the background, there is the interior common space where entry is permitted only with authorisation, and finally, the interior courtyards of the dormitories. “There are spaces to rest and be calm,” says Sanou. There are no fences or barbed wire.

Nearby, the Bangre Veenem school complex designed by Faus in the village of Youlou uses similarly ingenious ways to cool the building. Ousmane Soura works as an education adviser at the school. “Before building the school, [Faus] came to speak with the traditional authorities to obtain permission to build and to find out if there were sacred places that are sometimes not obvious or visible to people who don’t know them,” says Soura.

The school complex accommodates everything from nursery to high school, including a professional school. It is built with bricks made from laterite stone native to the area. Laterite is shaped with a mould, dried in the sun, and becomes a brick of very intense red colour. “They are more resistant to bullets than concrete blocks, which have two holes in the centre,” says Soura.

Faus also managed to minimise material transportation and use the territory’s own materials. Even the quarry workers were from the area. “It’s a very beautiful material. When families see the buildings, they want their children to go to school,”

says Soura. There are even teenagers who meet inside the classrooms to talk after class or during vacation periods. The complex is an open space.

Burkina Faso ranks 184th out of 191 countries in the Human Development Index and as of late 2020, only 22.5% of its population had access to electricity, according to data from the African Development Bank. “Students can come at night to study and charge their phones because there is light thanks to solar panels,” Soura says.
“Students are more focused because we have a good temperature in class. If the students, the administration, and teachers work well, and the environment is favourable in class, the results will be better. You know that hot weather disfavours students’ learning, and if we’re hot in class, we all feel tired, and eventually children prefer to sleep.”

7. The African tree-planting project making a difference

From an article by Jonathan Watts, 13 March 2024, Guardian: Down to Earth

In a world of monoculture cash crops, an innovative African project is persuading farmers to plant biodiverse forest gardens that feed the family, protect the soil and expand tree cover.

Could Trees for the Future (TREES) be a rare example of a mass reforestation campaign that actually works? The United Nations Environment Programme (UNEP) certainly thinks so and last month awarded it the status of World Restoration Flagship.

Since it was founded in 2015, the programme has planted tens of millions of trees each year in nine countries ranging from Senegal and Mali to Tanzania and Kenya. In less than 10 years, it has reportedly restored a combined area of more than 41,000 hectares, which is about seven times the size of Manhattan.

This includes part of the African Union’s Great Green Wall initiative, a planned 8,000km-wide barrier of vegetation to hold back the deserts that are encroaching across the Sahel region. Organisers say this will be the largest natural structure on the planet, though it is still very much a work in progress.

Trees for the Future has ambitious plans to use reforestation to combat poverty. By 2030, it aims to create 230,000 jobs and plant a billion trees.

A commitment to restoration is essential, according to Inger Andersen, executive director of UNEP, who noted it was no longer enough to merely protect what was left of Africa’s fertile land. This continent will be home to a quarter of the world’s population in little more than a generation and many areas have already degraded into semi-barren drylands.

While there is no doubt about the need for reforestation, there are historical reasons to be sceptical about the effectiveness of such programmes. Expectations are often too high. A 2019 study suggesting the climate crisis could be significantly eased by planting a trillion trees across the world was later debunked as unrealistic because there was not enough suitable land. Many governments have launched mass tree-planting campaigns, but after the initial day or two of publicity, there is rarely sufficient irrigation, protection and other follow-up to ensure seeds and saplings grow into trunks and branches. Often such national initiatives are little more than greenwashing distractions from far greater forest destruction elsewhere.

The protection of primary forests is a priority for the global climate, local biodiversity and regional water cycles. Those functions, built up over centuries, cannot be fully replaced by new plantations and restoration projects. But TREES and similar programmes can help to alleviate ecological and economic problems in already degraded areas.

At Kesouma, on the edge of Lake Victoria in western Kenya, organisers say they have supported 17,000 smallholder farmers with training, seeds, tools and grants to plant “forest gardens” instead of the monocultures that left their plots exposed and sucked dry of moisture, carbon and nutrients.

The area is subdivided into groups of 20 smallholders, represented by a lead farmer, who is paid a stipend of 3,000 Kenyan shillings every month. All members regularly meet for reporting, training and access to the tools and seed banks to nurture a forest garden. Individual plots, which cover 1 hectare on average, are said to have about 5,800 trees of multiple varieties.

On the outer perimeter there is a “protective wall” made up of three ranks of *Acacia polyacantha* (white thorn). Behind this is a cluster of tightly-spaced agroforestry trees that grow quickly and can be used for firewood and fodder. In the centre is a mix of vegetable gardens and orchards of mangoes, avocados, oranges, apples and other fruits. The aim is to provide sufficient nutrition to feed a family with a small surplus crop to sell at the market.

In one pilot area in the Lake Victoria basin, incomes are to be further bolstered by cash from carbon credits provided by the US firm Catona Climate based on gains in soil organic carbon, which is measured by experts from the University of Nairobi and Wangari Maathai Institute of Peace and Environmental Studies.

Monitoring is a key element in any reforestation programme, as is maintenance, particularly in remote areas. Major projects in China and Africa – including the Great Green Wall – have tried to address this by dropping seeds by plane in uninhabited areas. With species often unsuited to the terrain and irrigation impossible, this has often resulted in wasted efforts. In that regard, forest gardens seem more promising, though the scope is limited. Farmers usually live in or near their fields and have a financial incentive to ensure the quality of the soil and the healthy growth of a variety of trees.

Vincent Mainga, the Kenya director of TREES, said the project would expand rapidly now it has the endorsement of UNEP. “This is a massive restoration movement using regenerative agriculture,” he said. “This model is very easy to adopt. We work with the farmers for four years. After that, they can understand all the components and they can use what they learn from our technicians to produce thriving farmlands, usually with a surplus. It is self-sustaining.”

8. The ‘15-minute city’ has taken off in Paris

Extracts from an article by Helena Horton, Guardian Environment reporter, 6 Apr 2024

Carlos Moreno, a jovial and owlish professor at the Sorbonne University, came up with the phrase “15-minute cities” and has been quietly getting on setting them up in Paris. Moreno has been working with the Paris mayor, Anne Hidalgo, to make its arrondissements more prosperous and pleasurable to live in. He says there are 50 15-minute cities up and running, with more to come.

“We have an outstanding mayor, who is committed to tackling climate change. She said the 15-minute city will be the backbone for creating a new urban plan. The last time Paris had a new urban plan was in 2000, so this road map will be relevant for the next 10 or 15 years at least,” he explains. “I said to Hidalgo, the 15-minute city is not an urban traffic plan. The 15-minute city is a radical change of our life.”

Moreno has written a new book, The 15-Minute City, about his theory, which is being implemented in cities from Milan to Buenos Aires. In it, he explains his theory, which is quite simple. When many modern cities were designed, they were for men to work in. Their wives and family stayed in the suburbs, while the workers drove in. So they have been designed around the car, and segmented into different districts: the financial district, the cultural area and then the suburbs. They have also often been segmented into wealthier and poorer areas; in the less prosperous area to the north-east of Paris, Moreno says up to 40% of homes are social housing. In the wealthier west of Paris, this drops below 5%.

Moreno thinks this segregation leads to a poorer quality of life, so his proposal is to mix this up, creating housing developments with a mixture of social, affordable and more expensive housing so different social strata can intermingle. He also wants to bring schools and children’s areas closer to work and home, so caregivers can more easily travel around and participate in society. He also thinks office should generally be closer to homes, as well as cultural venues, doctors, shops and other amenities. Shared spaces such as parks help the people living in the areas to form communities.

An example of this is the new Îlot Saint-Germain development in one of Paris's most chic neighbourhoods. It is situated in the old defence ministry, and flats with sweeping views of the Eiffel Tower go for a social rent of €600 a month.

The city has also been regenerating the Clichy-Batignolles district in the less prosperous north-west of Paris to have a green, village-like feel. About a quarter of it is taken up by green space and a new park. "As a 15-minute district, it is incredible," says Moreno. "It is beautiful, it has proximity, social mixing, 50% of the inhabitants live in social housing, 25% in middle class and 25% own their homes."

Many of his proposals are dear to the culture of the French. In a large, wealthy metropolis such as Paris, it is easy for small shops to be choked out by large chains. The city of Paris, in its new plan, has put measures in to stop this.

"We have a commercial subsidiary of the city of Paris which has put €200m into managing retail areas in the city with rates below the speculative real estate market. This is specifically to rent to small shops, artisans, bakeries, bookstores. This is not only a good investment because it creates a good economic model, but it keeps the culture of the city of Paris," says Moreno. This is in keeping with the 15-minute city plan as it keeps local shops close to housing, so people can stroll down from their apartment to pick up a fresh baguette from an independent baker. "It creates a more vibrant neighbourhood," he adds.

Hidalgo inevitably faced a large backlash from the motorist lobby. "The drivers were radically very noisy, saying that we wanted to attack their individual rights, their freedom. The motorist lobby said she (the mayor) cannot be elected without our support, that they are very powerful in France," Moreno says. But Hidalgo called their bluff: "She often says 'I was elected two times, with the opposition of the automotive lobby'. In 2024, nobody requests to open again the highway on the Seine, no one wants the Seine urban park to be open for cars."

In his book, Moreno talks about the concept of a "giant metronome of the city" which causes people to rush around. He wants to slow this down, to allow people to reclaim their "useful time" back from commuting and travelling to shops and cultural areas. Moreno says this is happening with or without him; after the Covid crisis many offices are selling up their large spaces in the financial district and moving closer to residential areas. People are choosing jobs they can work remotely from or that are situated closer to their homes.

9. UNSW team creates synthetic methane using only sunlight

Source: Energy Source and Distribution magazine, February 28, 2024

Engineers at UNSW have developed a way to produce synthetic methane from carbon dioxide using only sunlight. The research team's process involves utilising light and heat to induce a reaction which creates synthetic methane from CO_2. Their research, published in *EES Catalysis*, could help to reduce reliance on fossil fuels.

"Methane is the major component of natural gas, and already widely used as a source of fuel, but is also a powerful greenhouse gas. Creating synthetic methane using only the natural resource of the sun is a cleaner and greener alternative for usage in heavy transportation, shipping, and other specific industries where gas usage is essential," Dr Emma Lovell explains.

"By employing specific catalysts and support materials, we have demonstrated a new pathway for visible light to drive the conversion of CO_2 into methane. This not only contributes to the reduction of carbon emissions, but also adds value to the captured CO_2 by creating a valuable chemical product."

Led by the team from the School of Chemical Engineering, Professor Rose Amal, Dr Priyank Kumar, Dr Emma C. Lovell, Yi Fen (Charlotte) Zhu, Associate Professor Jason Scott, Dr Bingqiao Xie, and Dr Jodie A. Yuwono, their work not only tackles environmental concerns, but also leverages renewable energy to power the conversion process.

"Being able to directly use sunlight reduces the costs required for energy generation to facilitate the reaction. This alleviates one of the major challenges in the pursuit and application of CO_2 derived fuel, which is contingent on the availability of low-cost, low carbon energy inputs," PhD candidate Zhu says.

The transformation of waste CO_2 into synthetic fuel creates a circular fuel economy. This means it creates a closed-loop system addressing environmental concerns and lessening reliance on fossil fuel extraction. This approach fosters sustainability by reusing carbon emissions and mitigating impact on the environment.

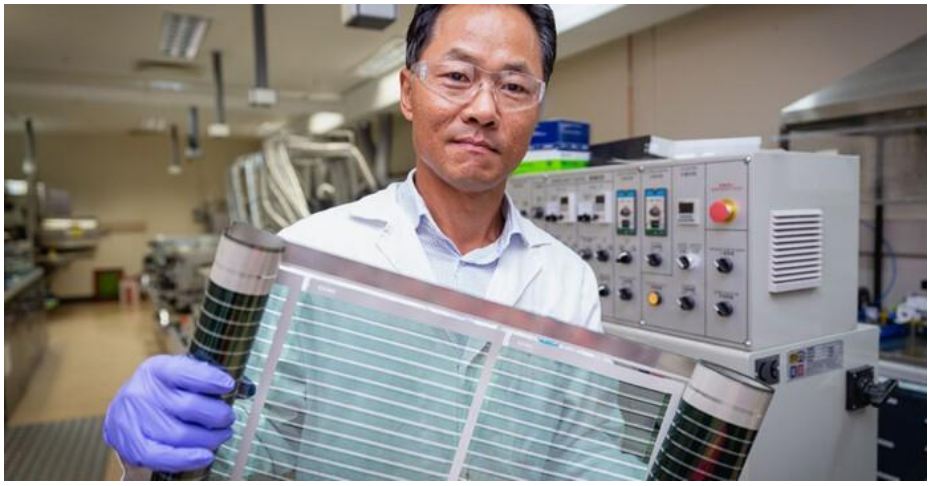
Affordable energy generation also plays a crucial role in this process as the direct and efficient utilisation of sunlight offsets power consumption and associated overhead costs for the reaction. This leads to reduced production costs for synthetic fuel, making it more economically viable and accessible.

Finally, the diverse chemical applications of this research extend beyond fuel production. The team is currently applying the findings to visible light-assisted CO_2 conversion into other high-value chemicals, potentially impacting a wide range of industries, from fuel production to pharmaceuticals. This versatility highlights the potential for broader innovations and solutions stemming from sustainable energy research.

“One of the most promising aspects of this research is its potential impact on industries like fuel production, cement manufacturing, biomass gasification and pharmaceuticals. I would say it represents a more sustainable fuel alternative by closing the carbon loop,” A/Prof. Scott says. “In terms of converting the CO_2 into value-added products, this represents a much cleaner alternative than products which currently rely on fossil-fuel derived precursors for their manufacture.

10. Printed solar cells

Source: Energy Source & Distribution magazine website, March 13, 2024



Dr Doojin Vak with the printed solar cells (Image: CSIRO)

Scientists from Australia’s national science agency, CSIRO, have led an international team to a clean energy breakthrough by setting a new efficiency record for fully roll-to-roll printed solar cells.

Printed onto thin plastic films, this lightweight and flexible solar technology will help meet the growing demand for renewable energy by expanding the boundaries of where solar cells can be used. Where silicon solar panels are rigid and heavy, the printed solar cells are highly flexible and portable, meaning they can be deployed in previously unimaginable ways across construction, mining, space, defence and personal electronics.

CSIRO's renewable energy systems group leader Dr Anthony Chesman said the achievement was the result of more than a decade's research and development. "CSIRO's thin and light-weight solar cells are now on the cusp of emerging from the lab to create clean energy in the real world," Dr Chesman said. "We've solved several engineering problems to achieve record results across a large surface area of interconnected modules.

"Roll-to-roll printing allows for the solar cells to be manufactured on very long, continuous rolls of plastic, which can dramatically increase the rate of production. "As these methods are already widely used in the printing industry, this makes their production more accessible for Australian manufacturers.

The results were achieved in collaboration with researchers from the University of Cambridge, Monash University, the University of Sydney and the University of New South Wales, and have been published in the leading journal *Nature Communications*.

Lead author and CSIRO principal research scientist Dr Doojin Vak said an automated system produced a comprehensive dataset that would pave the way to use machine learning in future research. "We developed a system for rapidly producing and testing over ten thousand solar cells a day—something that would have been impossible to do manually," Dr Vak said. "This allowed us to identify the optimal settings for the various parameters in the roll-to-roll process and quickly pinpoint the conditions that deliver the best results," he said.

Incorporating an advanced material called perovskite, CSIRO's printed solar is different from the silicon solar panels found on Australian roofs. "Perovskites are a class of emerging solar cell material. They're remarkable because they can be formulated into inks and used in industrial printers," Dr Vak said. "We've also alleviated the need to use expensive metals, such as gold, in their production by using specialised carbon inks, which further reduces production costs," he said.

Acknowledging that perovskite solar cells currently trail silicon solar panels in efficiency and lifetime when produced at scale, Dr Chesman sees the application of flexible panels to be very different. "As these perovskite solar cells are printed onto plastic films, they are very lightweight, highly flexible and portable," he said.

"The rigidity and weight of conventional silicon solar panels can make moving them difficult. Our thin, lightweight solar can be easily transported anywhere there is sun. "We even sent the solar panels to space last week to test their performance, with a view to further optimise and ultimately provide a reliable

energy source for future space endeavours," Dr Chesman said. CSIRO is seeking industry partners to further develop and commercialise this technology.

11. Acqueous metal-ion batteries

Source: Energy Source & Distribution, February 22, 2024

Lithium-ion energy storage dominates the market due to its technological maturity, but its suitability for large-scale grid energy storage is limited by safety concerns with the volatile materials inside.

Lead researcher Distinguished Professor Tianyi Ma said their batteries were at the cutting edge of an emerging field of aqueous energy storage devices, with breakthroughs that significantly improve the technology's performance and lifespan.
"What we design and manufacture are called aqueous metal-ion batteries—or we can call them water batteries," said Ma, from RMIT's School of Science.

The team use water to replace organic electrolytes, meaning their batteries can't start a fire or blow up, unlike their lithium-ion counterparts. "Addressing end-of-life disposal challenges that consumers, industry and governments globally face with current energy storage technology, our batteries can be safely disassembled and the materials can be reused or recycled," Ma said.

The simplicity of manufacturing processes for their water batteries helped make mass production feasible, he said. "We use materials such as magnesium and zinc that are abundant in nature, inexpensive and less toxic than alternatives used in other kinds of batteries, which helps to lower manufacturing costs and reduces risks to human health and the environment."

The team has made a series of small-scale trial batteries for numerous peer-reviewed studies to tackle various technological challenges, including boosting energy storage capacity and the lifespan. The batteries now last significantly longer—comparable to the commercial lithium-ion batteries in the market—making them ideal for high-speed and intensive use in real-world applications.

"With impressive capacity and extended lifespan, we've not only advanced battery technology but also successfully integrated our design with solar panels, showcasing efficient and stable renewable energy storage," Ma said.

Ma said the team's batteries were well suited for large-scale applications, making them ideal for grid storage and renewable energy integration—especially in terms of safety considerations.

As part of an ARC Linkage project, Ma's team is continually developing their water batteries in collaboration with industry partner, GrapheneX, a tech innovator based in Sydney.

12. Energy storage using salt, air and bricks

Extracts from an article by Roger Harrabin, Mon 1 Apr 2024, Guardian website

Energy storage has a dual purpose: it plugs gaps when the wind drops or the sun stops shining, and it allows users to buy cheap off-peak power and use it when they need it.

Until now, the focus of storage for industry has been mainly on giant conventional batteries. But there's growing interest in storing energy in the form of heat – and that's where the everyday ingredients such as air, salt and bricks come into the picture, because these materials are really good at holding warmth. A clutch of start-ups are now aiming to industrialise the practice.

Unlike much sought-after electrical battery components, salt is widely dispersed, easily extracted and able to store heat with minimal degradation or toxic by-products. It is estimated that the salt tanks can be re-charged thousands of times for up to 40 years – at least three times longer than other current storage options.

The Heatcube, developed by a Norwegian firm, Kyoto Group comes in the form of tanks filled with salt, installed at the site where the heat is needed. Heatcube's vertical salt tanks are charged by electricity during periods of low cost. Molten salt is particularly good at holding heat at temperatures up to 500C. One of Kyoto's main shareholders is the Spanish giant Iberdrola. Spain has more than a decade of experience using molten salt to store heat to be discharged at sunset to create steam that makes electricity overnight.

Dr Robert Barthorpe from Sheffield University, who studies storage options, says: "Molten salt is going to be an important part of the energy mix. It's a fantastic technology, offering high temperatures at industrial scale."

A California firm, Rondo, claims that its heat battery made from a pile of bricks can store energy at half the cost of green hydrogen and chemical batteries. Its system collects renewable energy and turns it into heat using electrical elements similar to those used in toasters. The firm says these bricks can be heated to 1,500C and are capable of storing energy for days with less than a 1% loss per day.

In the UK, firms are also turning to compressed air to store energy. Another system, using super-cooled liquid air, was devised by a back-yard inventor in Hertfordshire, Peter Dearman. The company that bought his innovation is Highview Power, which has begun work on a 300MWh facility near

Manchester said to store enough power for roughly 50,000 homes for five hours. “We need many different forms of energy storage – and I’m confident liquid air will be one of them,” Dearman says.

Highview has teamed with the energy company Ørsted to investigate how to combine storage with wind energy. The two companies say the technology can help to reduce curtailment – when wind power owners are paid to switch off their generators to balance the grid – as well as increase productivity, and help the move to a more flexible, resilient zero-carbon grid. Another firm using compressed air, Cheesecake Energy, employs an electric motor to drive an air compressor which creates high-pressure air, and heat. The battery can then be discharged by running the process in reverse to create electricity.

Other heat battery firms include the Norwegian company EnergyNest, which heats a specially formulated concrete, and Germany’s Lumenion, which stores energy in steel modules up to 650C.

A 2022 report from the consultancy firm McKinsey highlights the advantages of thermal storage, calculating a price of $65-$100 (£51-£79) a megawatt hour to produce steam heat from hydrogen; $45-$55 for gas with carbon capture and storage; and just $15-$25 for a heat pump with thermal storage.

Ross Rutherford
ESR Newsletter Editor
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