# A LEAP IN THE DARK:
# THE DANGERS OF BIOENERGY WITH CARBON CAPTURE AND STORAGE (BECCS)

Friends of the Earth International


Climate Justice allies protest about threats to food, land and water at COP24. © Richard Dixon/Friends of the Earth Scotland.

## INTRODUCTION

Bioenergy with Carbon Capture and Storage (BECCS) is a risky, unproven, costly, and dangerous distraction from the urgent and drastic emissions cuts needed to prevent catastrophic climate change. This brief outlines why Friends of the Earth International opposes BECCS, and describes the risks, costs and negative impacts of the technology.

The Paris Agreement's goal of 'net zero' carbon gave the green flag for negative emissions to feature in global efforts to combat climate change over the next decades. BECCS is the main technology being proposed to achieve 'carbon neutrality' (net negative emissions).

Relying on negative emissions to achieve any temperature goal is based on the assumption that it will be possible to remove large amounts of carbon dioxide (CO2) from the atmosphere in the future. In reality, neither BECCS, nor the technology of Carbon Capture and Storage (CCS) alone, have been proven to achieve this goal at the scale needed. Relying on BECCS is an unacceptably high-risk strategy for peoples and the planet. Climate policy must be based on decisive and immediate action to cut emissions at the source, rather than betting on unproven, high-risk strategies.

## THE THEORY BEHIND BECCS

**1.** Biomass crops capture carbon (through photosynthesis) as they grow.
**2.** The biomass is harvested and taken to a power plant, where it is burnt for energy. As it is burnt, the biomass releases carbon into the atmosphere.
**3.** Some of the carbon is then (re)captured during burning.
**4.** This carbon is then stored underground.

The idea is that, as it grows, biomass will continuously capture CO2 from the atmosphere. When the biomass is burned for energy, the waste CO2 will also be captured and stored underground, instead of being released back into the atmosphere. The assumption is that this will result in negative emissions.

## SUMMARY:

### WHY DOES FRIENDS OF THE EARTH INTERNATIONAL OPPOSE BECCS?

***1. BECCS is already distracting us from taking real action now.*** We have seen how carbon markets and offsetting have enabled rich countries and polluting corporations to delay radical emissions cuts and real transformation of our energy systems to state/community controlled sustainable renewable energy for all.[1] In the same way, the concept of 'negative emissions' is now enabling countries to further delay cutting emissions at source. BECCS has been presented as a convenient solution to the climate problem, allowing us to 'cancel out' today's emissions – and any further emissions – sometime in the future. This is, of course, false. Any sober reading of climate science tells us that action must happen now, not in 40 years' time. BECCS is no silver bullet.

The COVID-19 global pandemic has laid bare the failures of the current political-economic system to address both the climate crisis and the coronavirus crisis. The privatisation of public services, dismantling of workers' rights, and exploitation of women's labour by neoliberal doctrines have rendered our societies unable to provide the most basic needs to our peoples, and led to a devastating rupture between our societies and nature. The COVID-19 crisis has shown once more that the continuous destruction of ecosystems puts our global health at risk. In this context it is more urgent than ever to deliver real and just solutions. Governments must be compelled to act rapidly and decisively to end their dependence on fossil fuels. It is unjust that the rich and better-off of today put the burden of their pollution and the negative impacts of these technologies on people in the Global South and future generations.

***2. BECCS will have unimaginable social and ecological impacts.*** Providing enough biomass for BECCS, at the scale needed, would only be possible through deforestation, land-grabbing, and by converting large amounts of arable land into monoculture plantations. This means that BECCS will create competition for land among food producers, as more and more cropland will be dedicated to growing crops for fuel. In fact, it is estimated that rolling out BECCS at scale will require up to 3000 million hectares – around twice the amount of land that is currently already cultivated, globally.[2]

There is simply not enough arable land, globally, to grow enough crops for fuel without severely impacting on food production. If BECCS is implemented at scale, cropland will be taken from food producers and converted to an extent that will gravely escalate world hunger. Food prices will spike, and communities relying directly on land and local ecosystems will be acutely impacted. Such a shift in land use will also exacerbate existing environmental threats such as soil degradation and water stress.

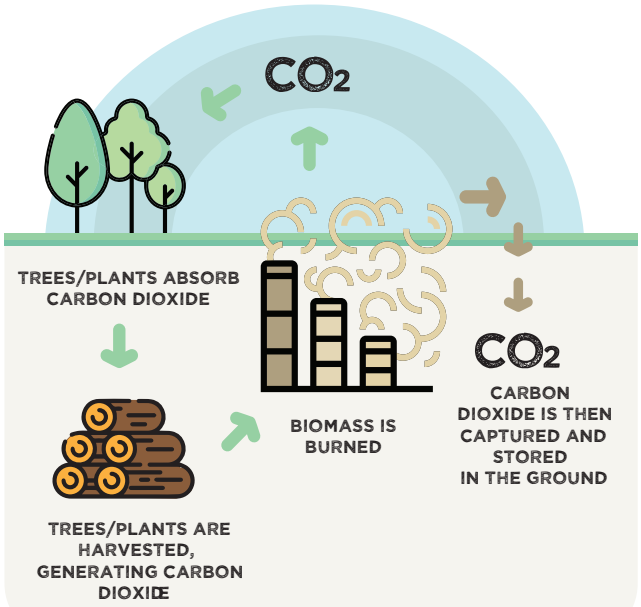
Small-scale food producers and peasants have been among the hardest hit by the COVID-19 crisis, and we have witnessed the devastating impacts of land grabbing on the ability of Indigenous Peoples to respond to the pandemic. As we are now faced with a looming major food crisis, we cannot afford to let BECCS further the vulnerability of our land and the people whose lives and livelihoods depend on it. The 2019 Intergovernmental Panel on Climate Change (IPCC) Special Report on Climate Change and Land states that if BECCS is pursued at the level "necessary to remove CO2 from the atmosphere at the scale of several billion tonnes of CO2 per year", it could "increase pressure on land" and cause "land degradation". The report also highlights research showing that deploying BECCS and bioenergy could lead to an additional 150 million people at risk of hunger. [3]

**3. *BECCS is unproven and ineffective.*** The problem of land availability is only the beginning. There are many unanswered questions that challenge the feasibility of BECCS, notably around: the energy penalty* associated with CCS; the net amount of CO2 that might be captured; the adverse impacts; the high costs, the risks of leakage. Compared to the proven effectiveness and absolute necessity of real emissions cuts, BECCS is steeped with uncertainty.

***4. BECCS opens the door to corrupt carbon offsetting.*** Carbon offsetting is when an activity to reduce or remove carbon (such as tree-planting) is designed to 'compensate' for emissions created elsewhere. Instead of actually reducing emissions, offsetting enables polluters to continue polluting.

emissions created elsewhere. Instead of actually reducing emissions, offsetting enables polluters to continue polluting. Friends of the Earth International opposes all offsetting and carbon trading.[4] There is a danger that the carbon removed or reduced by BECCS will be counted as 'offsets', to cancel out countries' continued fossil fuel emissions. This would mean no net reduction in emissions, defeating the purpose of BECCS as a negative emissions technology.

**BECCS IS INTENDED TO WORK LIKE THIS BUT THERE ARE SERIOUS FLAWS AND RISKS, THAT MEAN IT DOESN'T.**




## GLOSSARY OF TERMS

**BECCS:** The combination of Bioenergy and Carbon Capture and Storage (BE+CCS=BECCS).

**Bioenergy:** Energy produced through the burning of organic material. Friends of the Earth International opposes industrial bioenergy as a form of dirty and harmful energy.

**Biomass:** The organic material used as a fuel for bioenergy (sometimes called biofuel), e.g., wood, manure, sugarcane, and other crops used for fuel.

**CCS:** Carbon Capture and Storage. An (as yet unproven) technology that involves capturing waste carbon dioxide from a site (e.g., a bioenergy power plant or a coal power plant) and storing it, usually underground. Friends of the Earth International opposes CCS.

***Energy penalty:** The energy that is actually needed to power the CCS process (separation, compression, transmission and storage of CO2).

**Geoengineering:** An umbrella term for deliberate and large-scale intervention in the Earth's climate system, usually with the aim of slowing global warming. BECCS is a form of geoengineering. Friends of the Earth International opposes large-scale geoengineering.

**Negative Emissions & NETs (Negative Emissions Technologies):** The removal of carbon dioxide from the atmosphere. This either involves natural carbon 'sinks' (e.g., forests, soil, and ocean sediments) or geoengineering technologies (such as BECCS). The latter relies on geological storage, usually underground in depleted oil and gas reservoirs, saline formations, or coal beds.

**(Carbon) Sequestration:** Capturing, isolating and storing carbon dioxide.

**(Carbon) Sinks:** A natural environment that has the ability to remove carbon dioxide from the atmosphere (e.g., forests and oceans.)

## THE CLIMATE SCIENCE

The Intergovernmental Panel on Climate Change (IPCC) is the scientific body that provides the United Nations (UN) with objective, up-to-date, scientific information regarding the warming of the planet. The IPCC's 2014 *Fifth Assessment Report* (AR5) and 2018 *Special Report on Global Warming* of 1.5 (SR15) clearly demonstrate the urgent need for immediate, effective and far-reaching action to stop irreversible global warming.

According to the United States' National Oceanic and Atmospheric Administration (NOAA), carbon dioxide levels will not drop below the symbolic 400 parts per million mark in our lifetimes. We are facing the highest concentration of CO2 since the Pliocene era, three million years ago. Global average temperatures have already surpassed the 1°C warming mark above pre-industrial levels, and millions of people and many ecosystems are already experiencing devastating impacts.

Exceeding a global average increase of 1.5°C means we run the risk of crossing irreversible tipping points with unacceptable impacts for billions of people. Yet pledges made in the 2015 Paris Agreement are so inadequate that even if they were met, we will still be on course for warming of 2.9 to 3.4°C this century.[5] If we continue with business as usual, temperatures could rise by up to 5°C by the year 2100, and if all known fossil fuels are burned, that number will be higher still. [6]

## EMISSIONS REDUCTION PATHWAYS

In order to inform climate policy, the IPCC provides the UN with models for emissions reduction scenarios, or 'pathways', so that it is possible to determine what action is needed within a certain timeframe to curb global temperature rise.

The IPCC has modelled pathways to keep global temperature rise below both 2°C and 1.5°C. Unfortunately, the vast majority of 2°C pathways, and almost all 1.5°C pathways, rely on the use of Negative Emissions Technologies (NETs) to keep temperature rises below these thresholds. The 1.5°C pathways assume that up to 85% of all energy emissions will be removed from the atmosphere (up to 1000GtCO2). It is also assumed that most of this negative emissions activity will take place after 2050. BECCS is included in almost all 1.5°C pathways (101 out of 116).

## THE CARBON BUDGET

To keep overall temperature increases below 1.5°C (which will already cause terrible climate impacts), or even 2°C, we can only emit a finite amount of greenhouse gases from now onwards, to stay within the remaining 'carbon budget'. The carbon budget is the amount of CO2, in gigatons (Gt), that can still be emitted before the temperature limit is breached.

Estimates vary regarding the size of the remaining carbon budget. Even in 2018, the IPCC calculated that, for a 66% chance of remaining below 1.5°C of warming, we need to keep CO2 emissions below 420Gt.[7] However, the same report pointed to uncertainties in the size of the carbon budget, due to the ways in which temperature changes can trigger responses in the Earth's natural systems. Some of Earth's 'feedback loops' have not been factored in. Additional methane emissions resulting from the melting of permafrost, for example, may mean that 420GtCO2 is an overestimation, and the actual carbon budget is much smaller.

One 2018 study attempted to take many of Earth's 'feedback effects' into account. [8] The result was an estimated budget of between -192GtCO2 (that is minus 192, meaning that the budget has already been used up and exceeded) and 243GtCO2. The study pointed to a best estimate of just 67GtCO2 remaining in our budget. If true, this budget may already have been surpassed.

This means that there is practically no carbon budget left to divide. Our emissions must stop right away. The global community has failed to take the drastic emissions reductions needed, across sectors, in a fair way. Rich countries failed to fund mitigation in the Global South when there was still sufficient time to do so. Polluters have fudged, hidden, and denied the climate science for decades. Politicians are now pushing for unproven and harmful technologies that allow them to continue with business as usual while appearing to have the climate crisis under control. However, we will not keep temperature rise in check if we do not change our emissions patterns drastically.

Today we are witnessing temporary emissions reductions and corresponding air quality improvements as a result of the COVID-19 pandemic and the slowing down of our economies. However, it is crucial to acknowledge that these emissions reductions come at an enormous cost of lives and livelihoods loss, including for those workers in those industries left suddenly without employment. Our demands for emissions reductions can only be met if they are part of a just transition away from dirty energy pathways to new renewable community energy systems. The political systems that have enabled the current pandemic to happen are the same ones that have been wrecking our communities and ecosystems for decades. Therefore our ability to address both climate and health crises must be rooted in challenging the extractivist and profiteering systems that have taken us there.


Friends of the Earth on the streets of Madrid, Spain, during COP25, 2019. © Victor Barro / Friends of the Earth Spain.

## SEQUESTERING CARBON IN TERRESTRIAL SINKS

The Paris Agreement refers to carbon 'removals by sinks', which need not only include technological solutions. This could be interpreted as sequestration and storage of carbon by plants, trees and soils. This type of sequestration can happen through: forest restoration and reforestation (which generally is a useful practice if done properly and in consultation with local communities); or monoculture tree plantations and other large-scale biomass production (which is harmful for communities, livelihoods and local ecosystems).

It could be possible to restore terrestrial sinks in a way that enhances natural ecosystems and protects peoples' rights. It is estimated that reforestation and ecosystem restoration could achieve up to 150GtCO2 and 330GtCO2 of sequestration (respectively) over 60 years. This comes to a total of up to 480GtCO2.

Of course, these figures require further interrogation, and it is important that we define what forms of reforestation and ecosystem restoration might be beneficial and acceptable.

Nonetheless, further consideration should be given to these natural sinks and their potential for negative emissions, taking into account the rights of the peoples living on the land.

Although terrestrial sinks can sequester carbon, this by no means compensates for the release of CO2 when fossil fuels are burnt. Reforestation and restoration of plants and soils only repays the land carbon 'debt' that occurred historically through the degradation of these sinks in the first place. Limiting temperature rise means taking action both within the land sector and the energy sector, not assuming that one can compensate for the other. There is a difference between carbon that circulates biologically, as part of the natural cycle of plants and soils, and 'geological' carbon, that which is stored in fossil fuels, and released when burnt.

The amount of carbon stored 'biologically' is part of a dynamic balance between the atmosphere, the oceans, and land-based ecosystems. Releasing geologically locked carbon disturbs this delicate balance. Ultimately, if this dynamic is further interrupted, the biological ecosystem may cease to act as a sink, and instead become a source of carbon emissions.

It is highly uncertain whether or not artificial carbon removal will work. However, even as the carbon budget shrinks, BECCS is gaining further traction among policymakers, as polluters are simply not changing their polluting behaviour fast enough. BECCS and other NETs make the promise that even if we overshoot our carbon budget now, we will be able to remove CO2 from the atmosphere in the future and control climate impacts. This is very dangerous thinking. Each fraction of a degree in global temperature rise will cause worsening impacts, trigger feedback loops, and lead to further death and destruction - especially for those who are not responsible for the climate crisis. This is unacceptable.

**Friends of the Earth International believes that we need a system change approach, with truly radical and equitable emissions cuts now, so that we can avoid relying on negative emissions in the future.**

We must also stop deforestation, and restore forests and ecosystems in a way that respects peoples and nature. Land, forests and other natural resources should be managed by local peoples and by the communities that rely on them. This is an end in itself. We must recognise forests and land for their intrinsic value, rather than measure their value in terms of how much carbon they can absorb. Calculating figures on the CO2 absorption rates of nature can further contribute to the framing of nature as a commodity. However, as we enhance and protect natural sinks, such as forests, grasslands, peatlands and mangroves, *because they are valuable in themselves,* we can also enhance our planet's ability to absorb CO2.

## RISKS, COSTS AND NEGATIVE IMPACTS OF BECCS

The risks associated with BECCS include: unacceptable social and ecological impacts; the feasibility of the technology; the risk of leakage from stored CO2; questions surrounding the effectiveness of NETs in practice; double counting through offsetting; the energy penalty of the BECCS process; and the financial cost.

### 1. Unacceptable social and ecological impacts

The sheer amount of land required to implement BECCS at scale – up to 3000 million hectares, or twice the amount of land that is currently being cultivated – would acutely intensify food insecurity. It would mean changing all existing cultivated land to be used for BECCS, and then finding the same amount of land again, also to be used for BECCS. Where would this land come from? Where would food be grown? Deforestation rates would soar, and natural ecosystems would be displaced. More biomass means more monoculture plantations, which in turn would lead to the use of more agrochemicals and genetically modified organisms (GMOs). Biomass plantations would threaten further biodiversity loss at a time when critical thresholds have already been surpassed .[9]

The scale of monoculture plantations required by BECCS would almost certainly result in widespread grabbing of land from Indigenous Peoples and local communities. Climate change, industrialised agriculture and extractive industries have already placed significant stress on global land and water resources. Biomass production for BECCS would add a further strain on these resources.

The CCS stage of the BECCS process also places a burden on water resources. Implementing a CCS system at a power plant can significantly increase the amount of water required, especially for cooling purposes. When this water is returned to the source (e.g. the river, lake, or sea), the warm wastewater can have a further negative impact on the ecosystem. [10]

The vast majority of these impacts will be concentrated in the Global South, as fast-growing solid biomass is currently mainly produced in Africa and Asia.[11] BECCS will therefore further fuel global injustice.

### 2. The feasibility of the technology

Bioenergy is considered by many as a sustainable source of energy. This is based on the assumption that biomass is a 'carbon neutral' substitute for fossil fuels. The idea is that biomass absorbs carbon from the atmosphere as it grows, and the same carbon is later released in the bioenergy power plant. [12]It is assumed that, even without burning, this carbon would be released anyway as the biomass biodegrades. However, this assumption is based on biomass being a leftover waste product of normal agricultural or forestry activities – which is rarely the case in reality. When rapid growth biomass is cultivated and burned in large quantities in a short period of time – as happens in a bioenergy power plant – bioenergy becomes a net contributor of CO2 emissions on a scale comparable to fossil fuels. [13]

In addition to land constraints, it is estimated that there is an upper limit to the amount of biomass that can be produced for energy. Achieving the required output of around 250 exajoules per year would require doubling the total current harvest globally (that means all crops, feedstock and other materials).[14] The social, economic and ecological constraints involved make this goal seriously implausible. [15]Furthermore, one calculation establishes that using the world's entire current harvested biomass supply would only meet 20% of the world's energy needs in 2050. The numbers simply do not add up – even without CCS, bioenergy cannot deliver the scale of energy needed worldwide. [16]


**Deforestation to make way for palm oil plantation, Indonesia.** 

Even the most productive biofuels, on the most productive land, convert only a small fraction of a percent of solar radiation to ethanol (0.2-0.35%). This renders bioenergy a highly inefficient and ineffective source of energy. Some calculations show that, in many parts of the world, solar energy can be up to 100 times more effective than bioenergy. [17]

Regarding Carbon Capture and Storage (CCS): Between 2007 and 2017, the European Union spent €587 million in subsidies on CCS plants. [18] This investment, however, has not led to a single functioning CCS plant. Globally, at the end of 2019, there were only 19 large scale CCS plants in operation. [19] Many more projects are dormant, have been cancelled, or are only in pilot phase. [20]

Power plants fitted with CCS capabilities require 25-40% more energy to function than conventional plants. [21] The technology used in CCS can also lead to an increase in certain types of air pollution. In order for CCS to be effective, the sequestered CO2 would need to remain in storage for hundreds of years. Whether or not this is technically feasible is up for debate – the theory remains untested. It is even possible that the build-up of pressure underground may lead to small earthquakes. [22]

One of the few existing BECCS-based power plants currently captures 11-13% of the CO2 it produces. [23] In fact, capturing CO2 from coal is a much easier process – when it comes to bioenergy, the CCS technology is expensive and complicated. The process consumes around 30% of the power plant's energy output. At the Decatur BECCS plant in the United States, it is estimated that the process will emit almost four times as much CO2 as the amount sequestered.[24]

Absurdly, an additional risk has emerged that would undermine BECCS as a route towards negative emissions. There are fears that the CO2 captured through BECCS will be used to recover oil from depleted reservoirs. By injecting CO2 and creating a high pressure environment, oil that would otherwise be too expensive to extract can be recovered. This process is already taking place with 'normal' CCS, as CO2 is commonly stored in partially depleted oil fields, stimulating fossil fuel production.

Transporting biomass to BECCS plants also requires energy, further challenging the claim that BECCS is a 'carbon neutral' option. Questions remain regarding the global distribution of BECCS, as many energy-intensive cities are situated far away from biomass-producing regions. Additional emissions from moving biomass across these distances would also need to be taken into account in any carbon accounting.

### 3. The risk of leakage from stored CO2

Carbon dioxide that is stored underground has a high risk of leakage, and the consequences of a major leak could be catastrophic. Atmospheric CO2 levels could spike significantly, especially if a leak were to occur from a major storage site (or if several leaks take place around the globe).

CO2 leakage underground increases plant mortality, reduces vegetation growth, and creates severe, localised damage to ecosystems. Gradual CO2 leakage (or a large-scale leakage caused by catastrophic system failure) would not only cancel out any benefit of capturing CO2, but could severely damage the environment, contaminate groundwater and pose a serious risk to human health. [25]

For local communities living near storage places, the risk of a CO2 leak above-ground would be life-threatening. Leaked CO2 forms low-hanging clouds which can travel long distances. Such clouds have fatal consequences, as evidenced in the disaster at Lake Nyos, Cameroon, in 1986, when a lake overturn created a cloud of carbon dioxide that killed 1746 people. [26]

CO2 leakage would have to be kept under 1% per thousand years to enable acceptable temperature pathways. [27] This is highly improbable.

### 4. Questions surrounding the effectiveness of negative emissions technologies in practice

Global warming is caused by cumulative greenhouse gas emissions in the atmosphere – meaning all historic emissions, not just today's emissions. It is possible that dangerous tipping points will be breached before negative emissions technologies such as BECCS even start operating. Of particular concern is the possibility that we will exceed thresholds relating to sea ice, glaciers, ice sheets and permafrost. These themselves can create a positive feedback effect, which will cause further warming even if we suddenly stop emitting CO2. For example, higher temperatures are leading to the melting of the permafrost, which in turn will release methane (a greenhouse gas), which will further accelerate global warming. This is why timing is crucial: if we fail to reduce emissions now, we will trigger an even greater need for negative emissions later, which may be simply impossible. The risk of overshoot is far too great. **Once again – we need to reduce emissions at source, now.**

Scientists have shown that the potential of achieving actual negative emissions is far lower than the figures forming the basis for many climate models. It is clear that BECCS will never achieve enough negative emissions to return our planet to a safe concentration of atmospheric CO2.

### 5. Double counting through offsetting

In order to achieve net negative emissions, the world would need to aim for more negative emissions than real emissions. However, there is a risk that BECCS projects will also be counted towards offsetting fossil fuel emissions, which would move us even further from that goal.

CCS is already recognised as a mechanism that can provide offset credits under the UN's Clean Development Mechanism. Absurdly, BECCS is also being proposed as eligible for offsetting. This means that the same technologies we rely on to create 'negative emissions' in the future, are currently providing the carbon credits that allow polluters to continue polluting. This creates the incentive to carry on with 'business as usual' in two ways: firstly, by providing offsetting opportunities in the present; and secondly, by providing false promises for a carbon-negative future.

Offsetting does not result in real emissions reductions. Offsetting for BECCS would be even more disastrous, as the false safety-net of negative emissions in the future would open the door to further emissions.

### 6. The energy penalty of the BECCS process

BECCS would require the construction of numerous large-scale infrastructure projects. Infrastructure is needed for: the growing, harvesting and transportation of biomass; for new power plants with large CCS facilities; and for a new, inter-continental system of pipelines or ships to transport the liquefied CO2 from the power plant to suitable geological formations where it can be stored safely. The pipelines required would demand enormous quantities of high-quality steel (to avoid corrosion from the liquid CO2-stream), whose manufacture is hugely energy intensive.

The CCS energy penalty means that around 25-40% more biomass needs to be harvested for a BECCS plant than for a bioenergy power plant without CCS.[28] Building new centralised bioenergy plants will also require further quantities of energy-intensive cement and steel.

### 7. The financial cost

By 2050, the construction of BECCS infrastructure needed for 1.5°C and 2°C pathways would require investment of $138bn and $123bn per year for electricity and biofuel (respectively). In 2014, the IPCC's AR5 estimated the cost of BECCS from $60 to $250 per ton of CO2. This is a very high figure, even more so when compared to other forms of energy. Furthermore, the costs of capturing and storing carbon are also high – especially for bioenergy. At a time when climate finance is desperately needed to fund a just, global energy transformation, for adaptation and for irreparable loss and damage from climate impacts, it would be deeply illogical to invest in an unproven, expensive and risky technology like BECCS.

SunBiofuels jatropha plantation, Mozambique. © Nilsa Matavel.

## CONCLUSION

Friends of the Earth International believes that we must take rapid and bold action to tackle the root causes of the climate crisis, and its interconnected injustices. The COVID-19 global pandemic has proven once more that the solutions to the intersecting system crises lie with the people, not with the multinationals and corporations that have created these crises and continue to profit from them.

We can and must address climate change without using BECCS. Feasible and equitable solutions already exist, which will lead to sustainable societies, where all peoples have access to the resources they need to live a life a of dignity. We need a just transition, towards an equitable system that is accountable to people, not corporations. Neoliberalism and unsustainable overconsumption by corporations and global elites must end, fast.

The challenge is huge, but system change is the answer.


Justice groups bring the COP to a stop, COP24, Katowice, Poland, 2018. © Richard Dixon/FoE Scotland.

## REAL SOLUTIONS

BECCS is a dangerous distraction from the real solutions that require urgent action, now:

> **Drastic emissions cuts,** and a flow of finance from the global North to the global South, in line with the principle of fair shares; [33]

> **A just energy transformation** and an end to fossil fuels and other dirty and harmful energy;

> Universal access to **clean, democratically controlled and community-owned energy** based on truly sustainable, climate-safe and locally appropriate sources like sun and wind;

> **A just and climate-friendly food system** based on the principles of agroecology;

> **Community management** of ecosystems and forests;

> **No more deforestation;**

> **Ecosystem restoration and regrowth** that respects the lives and livelihoods of communities living on the land;

> **Reforestation** that restores real forests and respects the lives and livelihoods of communities living on the land;

**We need nothing less than system change – a new model of environmental, social, political, economic and gender justice – built on the power of the peoples.**

Herculano Macaringue harvesting lettuces on his plot outside Namaacha, Mozambique (above). Herculano is a member of the Association of Natives, Residents, and Friends of Namaacha (ANRAN) whose farming practices embody agroecology, working in harmony with nature and peoples' rights. The Association is supported by Gizela and comrades from JA!/Friends of the Earth Mozambique (pictured below.)



# NOTES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