Climate change is scary. It's possibly the biggest threat civilization has ever faced. To very briefly summarize human activity has increased carbon dioxide concentrations in the atmosphere. Increases in CO2 must have a warming effect on the surface because, physics. Earth is warmed by approximately one degree on average since the eighteenth century and our best models of the Earth's system can really reproduce this warming if human influence on the climate is included.mSo humans have definitely changed the global climate for the warmer by emitting CO2 and other gases like methane and we're continuing to emit those gases every year.The Intergovernmental Panel on Climate Change warns that if we don't limit further emissions, then we will see further warming but also rising sea levels more extreme hot weather events and increases in the frequency of both droughts and heavy precipitation This will result in society-wide changes and most probably extensive conflict over migration and resources If you're anything like me you're used to hearing about climate change in this tone Described in much the same way as winter in Game of Thrones winter is coming. It's coming There's nothing we can do to stop it It's definitely coming and when it gets here, it's going to be really put -owp nevermind too late Solutions to climate change are rarely discussed because well It's a very complex problem everyone on earth contributes to the greenhouse gas emissions which fuel climate change though not equally. These contributions take place on an individual level through our daily activities But take place through networks of actors: the companies we choose to do business with, the banks we trust with our money, the governments that we choose to elect. Our choices, in this regard, in the larger scale of the economy and political landscape have truly enormous repercussions. When people write articles on what we can do to mitigate climate change they very much focus on the individual actions we take, for example: not eating meat or using public transport and these are things we should be doing I'm not arguing against individual action to combat climate change, but consider that we are endpoint users in a vast network which we have ultimate collective control over; and a far more effective way of reducing our greenhouse gas emissions and preventing climate catastrophe is to change the workings of that network from the top-down Over the course of this video, I'm going to make three recommendations of what we, as voters and activists, can do to accomplish just that. To begin with consider a breakdown of where greenhouse gas emissions come from by sector. While agriculture, industry, and forestry all make modest contributions, the overwhelming majority of humanity's greenhouse gas emissions come from energy use Note that that's different from electricity generation. Energy use encompasses lots of things including Electricity generation, but also heating, cooling and cooking, transportation, manufacturing, and other miscellaneous uses of energy. If we're to beat climate change then, we need to revolutionize how we use energy in a general sense: transitioning away from fossil fuels like coal and gas to renewable sources such as wind solar geothermal and hydropower. The role of nuclear power is a... ...topic for a future video. Accomplishing a society-wide energy transformation is a daunting task but the world's energy experts have been thinking about this for a long time. The International nonprofit, REN21, Based at the UN Environment Programme has produced a document every year since 2005 called the global status report The GSR is written with contributions from energy experts politicians and researchers from around the world Assessing where we're at with the renewable energy transition The full report is available for anyone to read link in the description. Having read it, I want to make three arguments for what we should be focusing on to Accelerate the energy transition bring greenhouse gas emissions down and beat climate change. Firstly, targets need to be set by politicians for renewables uptake beyond electricity generation We're all familiar with the drive to replace coal-fired power stations with wind turbines, nuclear, and solar power plants Of the 197 countries in the world, 146 have targets for the use of renewable technology to generate electricity and these targets are working In 2017, 26.5% of energy used as electricity came from renewable sources However, as we saw earlier energy use means much more than just electrical power. In particular, It means transport and heating and the uptake of modern renewables in these sectors is much lower: 10.3% for heating and just 0.3% for transport. The likely reason? A lack of targets. Only 48 countries have renewable energy targets for heating and cooking and only 42 for transport. In order for the energy transition to happen across all sectors, Governments must commit to targets for renewable energy use in heating and in transportation So what can you do? Ask your local representative about this and vote for a political party that pledges to implement these targets Secondly, and I'm going to say this appropriately loudly, (wait for it) PHASE OUT FOSSIL FUEL SUBSIDIES There is a common perception that renewable energy is fine and dandy in principle, But just too expensive to make economic sense in reality. This is completely wrong. In this terribly formatted figure from the International Renewable Energy Agency, the cost per kilowatt hour of fossil fuel power generation is compared to that of various renewable power sources. In 2010 and 2017, almost all of the technologies shown are either cost competitive or substantially cheaper per kilowatt hour than traditional fossil fuels and getting cheaper. People assume that renewables are only used because of subsidies and incentives given to renewable power suppliers and this can't be further from the truth. Fossil fuels are subsidized significantly more than renewables. In 2016, 370 billion dollars were given in subsidies for fossil fuel use and only 140 billion given to renewables. If you factor in other externalities like health and pollution, then subsidies given to fossil fuels are an order of magnitude greater So despite renewables being increasingly the lowest cost option (In fact in some cases last year, it was cheaper to build new renewables generation than to maintain old fossil fuel capacity) money is still given to subsidize and develop fossil fuel use by governments The G20 has committed to phasing out "inefficient fossil fuel subsidies" but hasn't defined "inefficient" or done anything on the subject since saying so in... 2009 It is imperative that our Governments commits to rapidly phasing out fossil fuel subsidies stopping distortion of the power market and allowing the energy transition to take place Again, write to your local representative about this and vote for a political party that pledges to phase out these subsidies. Lastly, more money needs to be invested in renewable energy, in particular, in developing countries It's estimated by the International Energy Agency that to keep global temperature rise below 2 degrees Celsius, 12 trillion dollars must be invested in renewable power supplier between now and 2014. That translates to about five hundred billion dollars a year, or roughly twice what the world is currently investing. At the moment, we're not going to hit the targets set by the Paris agreements. We need to be more ambitious Interestingly, while most investment in renewable energy in 2017 came from developed countries, the top three being: China, the USA, and Japan, the highest spend per capita was in developing countries. It's estimated that 90% of people currently with our electricity access will gain this access through renewables mostly off-grid distributed renewables in developing countries. In this process will take approximately 50 billion dollars a year in private and public funds, and is essential to fund to continue development of these countries without committing to massive further emissions. As such, Projects in developing countries using renewable energy generation must be prioritized by development banks and by foreign aid And absolutely prioritized over projects using fossil fuels. Further investment in developed countries, which fell more than 18% in 2017 must continue. In particular, in the flexibility of energy infrastructure. Man, I really hope there's at least one Energy Minister that ends up watching this. Otherwise, that line was pointless So if you live in a developing country, vote for a political party which prioritizes investment in economically viable renewable energy over fossil fuels. Well, if you're lucky enough to have a say in where charity or development money goes, Prioritize investment in renewable energy access in the developing world. There are myriad aspects to the energy transition. I didn't even touch on the issue of cooking, or biofuels, or carbon taxes for example. This video could never hold all the answers to our climate problems Hell if it did, I will be holding a Nobel Peace Prize in my hands right now What I hope it's demonstrated is that there are specific meaningful actions you can take beyond the individual level to combat climate change Make your voice heard with your vote, Write to your local representative about these issues Share this video so others can learn from it too, and spread the word about these three points Which we should all be demanding from our governments Anthropogenic climate change is an issue that has taken a world to create and we'll take a world to unmake We've already damaged the planet in ways that will take thousands of years to repair but, through collective action, we can turn the tide Limit our greenhouse gas emissions and limit the further damage we do to the world of our children. The best time for action was 20 years ago the second best time... is now To do a smooth segue from such a serious topic into this video sponsor would be inappropriate So I'm just gonna say it as it is this video was sponsored by dashlane. dashlane is a tool which generates securely stores and Automatically fills out online forms with strong passwords If you're anything like me you probably use a small number of relatively weak passwords across a lot of websites and Have to reset them all the time because you keep forgetting which one you used where dashlane gets around this by creating Strong passwords and remembering them for you and not only are the passwords better remembered than they are in your brain. They're safer than they are in your brain. Everything gets encrypted by dashlane's patented security architecture So only you can access what your passwords are it syncs your passwords and online logins across multiple devices Works on Mac, Windows, iOS, and Android, and is trusted by more than 10 million users worldwide I switched over to dashlane and I doubt I'll ever switch back to remembering all my passwords manually It just makes the internet safer quicker and easier. You can try a 30-day free trial on one device Go to dashlane.com/simonclark and if you'd like to upgrade to premium then the first 200 people to use the promo code "simonclark" will get 10% off. Thank you for watching this video It's been a very important one to me. So I've taken my time to get this one right Please do share it widely. As this message is the most important message we could be spreading right now Please see the description for links and references and footnotes and thank you again for watching. I'll see you in the next one

Last week a paper was posted to Reddit outlining a new cheaper than ever process of removing carbon from the Earth’s atmosphere. “Great!” you might think, we have solved climate change, just give it a few years and we will be all over it. Like a cheap suit. But we have known that for the past ten years that human changes to the Earth’s climate are already irreversible. In this paper I am going to explain why and how but also what we can still do to defy climate change. The Earth is warming because we keep pumping carbon dioxide among other substances into the atmosphere, preventing as much energy from leaving the planet, causing an energy imbalance which warms the Earth. To prevent such warming, we have two options: either reduce the amount of energy coming into the Earth from the Sun or remove carbon dioxide from the atmosphere and increase the amount of energy that the Earth radiates into space. Both are quite possible, but solar radiation management is not to be cover by this paper. I am only going focus on the paper posted on Reddit.

The author outlines a new technique of extracting carbon dioxide from the atmosphere and converting it into an energy dense fuel. Good news. The new technique might work in practice combating climate change, but before doing so, let us understand what we are up against. Emmalin’s climate scientist Susan Solomon headed up a paper in 2009 titled “Irreversible climate change due to carbon dioxide emissions” and to simplify the conclusions of that paper in a sentence, the impact of carbon emissions persist longer than that of nuclear waste and emissions of carbon due to humans to date will alter the climate for over a thousand years to come. That is obviously quite alarming and that is not even the full picture, so let us break down those claims. To come to these conclusions, Solomon and co-authors examined how the climate is going to change in the future, based on a class of computer models known as MIX. That is Earth System models of intermediate complexity, like those used to predict the weather in the coming week. MIX represents the physics of how different parts of the Earth’s atmosphere talk to each other, how air heats up and moves around.

The Solomon paper used a particular bond called the burn 2.5 CC EMIC to see, among other things, how atmospheric concentrations of CO2 will change over the next millennium because CO2 emitted by humans and other natural resources like decomposition and respiration but removed from the atmosphere by plants and notably by being absorbed in to the oceans. Since, the rate at which these processes take place depends on the climate which of course depends on the CO2 concentration, it creates a complex feedback loop, so scientist use a computer model to simulate how these factors will interact. The authors found that after CO” concentrations peak in the 21st century by the 31st century, around 40% of the carbon emitted by humans into the atmosphere will still remain. That is to say that aounf 40% of peak CO2 concentration on top of the pre-industrial value of around 280 parts per million will still be around in a thousand years.

So, if we were to completely stop emitting carbon today with a concentration of around 410 parts per million, in the year 3000, the concentration would be around 330 parts per million. This might not sound so bad, but that is if we completely stop emitting today and never emit carbon again. A more realistic (but still optimistic) scenario is a peak of around 500 parts per million, almost double pre-industrial concentrations and a 31st century concentration of around 370 parts per million. This means that in the 31st century, the planet will still be nearly as warm as it was when CO2 concentrations were at their peak in the 21st century.

Global patterns of rainfall will be significantly altered leading to massive droughts and global average sea levels will have will have irreversibly risen but by a highly uncertain amount. In other words, even of we stop emitting carbon today, the climate the climate in a thousand years has already been altered notably being hotter and the longer we keep pumping carbon into the atmosphere, the worse those effects in the year 3000 are going to be. In short, climate change is by now locked-in. But what if we could remove carbon from the atmosphere, what if we could get ourselves back to that pre-industrial concentration of 280 parts per million.

The paper posted on Reddit by Keith at AU says that with their new technique a tonne of CO2 can now be extracted from the atmosphere for between $94 USD and $232 USD. So, let us be super optimistic and run with the cost of $94 USD per tonne. In 2017 humans emitted 32.5 Giga tons of CO2 and let us make a crude assumption that the world economy is not going to change from now. The emissions that carbon capture technology will have to offset to do this would cost very roughly 3 trillion dollars per year. Every year is roughly the equivalent of the GDP of the United Kingdom or about the 3% of the world’s economy. If the world wanted to remain carbon neutral and offset its carbon emissions using this technique, it would be the equivalent of building a new International Space Station from scratch every 19 days for the rest of time. In short, using this technology and the economics presented in the paper are not possible to offset the world’s emissions as they are.

But here are some positive takeaways, one is that this technology is still in relatively early stages and it is still quite possible that the cost of removing a tonne of CO2 will come down over the next few years. If this happens then maybe, we can afford to offset emissions in some meaningful way in the future. We can reduce the emissions that we need to offset by changing our economy and the recent REN21 Global Status Report indicates that we are making promising progress in converting to a renewables-based energy economy and reducing future carbon emissions, but we still have a long way to go; particularly when it comes to transportation.

I have not event talked about one-way processes driven by climate change like: species extinction. Simply I focused on how the climate in a thousand years has already been altered by our activities and how we are a very long way off even breaking. The best we can do now is to limit future emissions and future harm. As an individual you can make a difference by not eating meat, by using public transport, and by lobbying your government to support policies which curb emissions and industry. We can not just give up in changing our economy and trusting in some future technology to save us.