

References for *Music for a Warming World*

PART THREE - CHANGE

In the show we make certain claims about the data and conclusions of climate science, or quote from particular sources. Below you can find references for these claims and explanation, as needed. We endeavour to be as accurate as possible with our sources.

The original text from the show is in italics.

9 - One Last Cheer for Coal

Worldwide, coal supplies 29.7% of energy use and is responsible for 44% of global CO₂ emissions.

Data on coal supplies and emissions from www.c2es.org/energy/source/coal

In Paris, November 2015, 195 countries agreed collectively to limit global warming to well under 2 degrees Celsius. To achieve this commitment requires most fossil fuels, including most known coal reserves, be left in the ground. So, ipso facto, it is time to say goodbye to coal.

See: www.theguardian.com/environment/2015/jan/07/much-worlds-fossil-fuel-reserve-must-stay-buried-prevent-climate-change-study-says

Also see: Christophe McGlade & Paul Ekins, The geographical distribution of fossil fuels unused when limiting global warming to 2 °C, *Nature*, 517, 187-190 (08 January 2015) www.nature.com/nature/journal/v517/n7533/full/nature14016.html

This doesn't mean that saying goodbye is easy. For some communities with strong economic and cultural connections to coal, this transition will be painful. Coal has given us many great things. It powered the industrial revolution through fueling the steam engine, helped grow the economy and created much wealth. It also provided a distinctive cultural identity for many communities. Without coal, we would have been unlikely to have the lifestyles we have today (at least in the economically developed world).

Of course, coal has given us some problems too. It is dangerous work and many have died in its extraction, it has caused much ill health through air pollution and, of course, it is the major contributor to increased atmospheric CO₂ and global warming.

So it is time to say thanks to coal for all it has done, and bid it farewell.

10 - Leave the dead where they fall

Christine and Simon saw the [giant sequoia](#) in Yosemite National Park (California) for the first time in 2015. Simon found it a powerful, almost spiritual experience, being in the presence of the largest living entities on Earth. This got him thinking about how coal comes from the bodies of dead plants from millions of years ago.

In some ways, when we dig for oil, coal and gas, we're digging up the ghosts of the dead.

11 - Disinvest

The science is now very clear on the future of fossil fuels. To avoid a 2-degree average global temperature rise 82 % of current global coal reserves must remain in the ground. (See the [Guardian](#) and [Nature](#) articles on this)

The 2015 [Paris Climate Agreement](#) also signalled clearly that there is no long-term future for fossil fuels (See the [full agreement](#)). The commitment to keep global warming to 'well under' 2 degrees Celsius means it is not possible to burn all the current known fossil fuel reserves in the world. Most of it must remain in the ground.

The divestment movement encourages financial investors to withdraw their funds from fossil fuel investment, and in particular, from their funds being used to invest in new fossil fuel development, such as new oil field exploration or building new coal-fired power plants.

Investing in fossil fuels is also [increasingly financial risky](#). Given the inevitable reduction in the use of fossil fuels, there is growing concern in the investment community that financial assets will become 'stranded'; that is, lose their value as the world withdraws from fossil fuel use.

To see which institutions have currently committed to divestment [click here](#).

See [Market Forces](#) for more information in divestment

See our page on [Divestment](#) for how to divest.

12 – We Need A Miracle

Our World Has No Energy Crisis!

This statement is in principle correct, given that there is no shortage of energy sources in the world. This energy may not be all currently available at a price we are willing to pay, or even with our current technology, but we will never run out of energy sources, at least while the sun still burns brightly.

The world uses 18 terawatts of energy per year

This number comes from http://www.theworldcounts.com/stories/current_world_energy_consumption

It states: “Currently, our civilization consumes around 17.7 Terawatts of power taken from all sources of energy, namely oil, coal, natural gas and alternative energies such as solar, wind, hydropower and others”.

There is range of ways to measure world energy use. For instance, the International Energy Outlook 2016 (IEO2016) uses British thermal units (Btu), stating the world consumes about 600 quadrillion Btu (<http://www.eia.gov/forecasts/ieo/world.cfm>).

Another measure is tonne of oil equivalent (toe), a unit of energy defined as the amount of energy released by burning one tonne of crude oil. It is approximately 42 gigajoules, https://en.wikipedia.org/wiki/Tonne_of_oil_equivalent.

In 2013 the world’s energy consumption was 9301 Mtoe (IEA 2015 Key World Statistics)
https://www.iea.org/publications/freepublications/.../KeyWorld_Statistics_2015.pdf

The sun gives us this much every 90 seconds

The energy from the sun is enormous, but that does not even count other energy sources, such as wind, geothermal, tidal power and even nuclear (though the employment of nuclear energy is controversial, problematic and still very expensive.)

According to the a BBC report, we use around 15 terawatts of power while the sun supplies 165000 terawatts continuously
<http://www.bbc.com/specialfeatures/horizonsbusiness/wp-content/uploads/.../Energy1.pdf>

The 90-second calculation comes from Yuval Harari’s book, Sapiens: A brief history, Chapter 17, The Wheels or Industry.

There is an energy miracle taking place that no-one anticipated

A number of commentators have recently observed that the predictions of the growth of renewable energy have been, with very few exceptions, way too low. Most analysts and agencies did not, and perhaps could not, have expected this growth.

“The coming of the renewable energy revolution has long been heralded by many of the world’s energy market authorities ... But a new infographic published by Meister Consultants Group has shown that almost all of these expert predictions have vastly underestimated the scale at which the renewable energy revolution would happen”
<http://reneweconomy.com.au/2015/graph-of-the-day-renewable-energy-boom-underestimated-by-nearly-all-45906>

Al Gore makes this point in a 2016 TED talk titled ‘The case for optimism on climate change’ <https://www.youtube.com/watch?v=u7E1v24DIlk>

Also see this article:

<http://reneweconomy.com.au/2016/why-rise-of-solar-and-fall-in-costs-still-shocks-energy-experts-85878>

The Most Optimistic forecast in 2002: 1 gigawatt solar per year by 2010
By 2010 the world installed 17 times that amount. In 2015, 58 times

This is from Al Gore, where he commented, as in the point above, that the best projections 14 years ago were that we would install one gigawatt per year by 2010. When 2010 came around, we beat installed 17 GW. Last year, we beat it by 58 times over. This year, we’re on track to beat it 68 times over.

<https://www.youtube.com/watch?v=u7E1v24DIlk>

Price of solar energy in 1977 was \$76.67 per watt 2014 it was \$0.36

<http://thinkprogress.org/climate/2015/08/24/3693831/katrina-climate-progress/>
Source: Bloomberg, New Energy Finance & pv .energytrend.com

Also note that the cheapest way for a power company in Britain to produce Greenfields electricity, that is, a new production facility, is with an onshore wind farm, (Bloomberg New Energy Finance (BNEF).

<http://www.theguardian.com/environment/2014/oct/13/wind-power-is-cheapest-energy-unpublished-eu-analysis-finds>

Chile, August 2016, Solar power delivers cheapest unsubsidised electricity by any technology, anywhere, ever

‘In an energy auction in August 2016, Chile accepted a bid from Spanish developer Solarpack Corp. Tecnologica for 120 megawatts of solar at the stunning

price of \$29.10 per megawatt-hour (2.91 cents per kilowatt-hour or kwh). This beats the 2.99 cents/kwh bid Dubai received recently for 800 megawatts. For context, the average residential price for electricity in the United States is 12 cents per kilowatt-hour.

“Solar power delivers cheapest unsubsidised electricity ever, anywhere, by any technology,” BNEF Chair Michael Liebreich said on Twitter after this contract was announced.

<https://thinkprogress.org/solar-delivers-cheapest-electricity-ever-anywhere-by-any-technology-c2ef759ac33f#.cnhvmdsc2>

250 GW of power was installed globally in 2015
53.6% of this was from renewables

Although renewables produce a relatively small proportion of global energy requirements, currently around 7%, not unsurprising given the current fossil fuel infrastructure, the future trends look very different. In 2015 global investment in renewable energy overtook investment in oil, gas and coal. Renewables (excluding hydro) made up over half all gigawatt capacity installed in 2015 (53.6%). Total installed capacity in 2015 was 250 GWs

(BNEF Renewable Energy Trends 2016 Summary – Key Findings)
<http://www.bloomberg.com/company/clean-energy-investment/>

‘How much more miracle-y do you need your miracles to be?’
Michael Liebreich, Former Director, Bloomberg New Energy Finance

“We’ve seen the costs of solar come down by a factor of 150 since 1975. We’ve seen volume up by 115,000. How much more miracle-y do you need your miracles to be?”
Michael Liebreich, chair Bloomberg New Energy Finance advisory panel
<http://reneweconomy.com.au/2016/why-rise-of-solar-and-fall-in-costs-still-shocks-energy-experts-85878>

And good things keep happening:

‘The Second-Largest City In The U.S. Is On The Verge Of Being 100 Percent Renewable’
<http://thinkprogress.org/climate/2016/06/10/3786420/los-angeles-to-go-renewable/>

Final note. All these trends are extraordinarily positive, and the speed of change largely unanticipated. But even this speed of decarbonising is far too slow to keep the temperatures under 2 degrees Celsius, let alone 1.5 degrees, the aspirational target in the Paris Agreement.

Nevertheless, the fact that future change is hard to predict also provides room for hope, hope that the world can and will rapidly change direction from fossil fuels and meet future energy demands from clean energy.

13 - Moving a Big Sky

This song is about the poetry of the wind, but it is also a 'fictitious' conversation with someone who is deeply opposed to wind turbines.

Political controversy still surrounds Wind Energy in Australia. The National Health and Medical Research Council is funding two studies (worth \$3.2m) on the health effects of wind turbines (2016). Though no adverse effects have been found in the previous studies, they argue that 'existing research in this area is of poor quality and targeted funding is warranted to support high quality, independent research on this issue'.

<https://www.nhmrc.gov.au/media/releases/2016/nhmrc-awards-funding-wind-farms-and-human-health>

Liberal Senator John Madigan even called for a moratorium on wind farms till the study demonstrates no ill health effects. That is unlikely to happen.

<http://www.theguardian.com/environment/2016/mar/23/wind-power-senators-want-moratorium-on-turbines-until-health-studies-conclude>

14 - This Changes Everything

"Climate change is not an issue, it is a civilizational wake up call...
and this changes everything"

A major cause of our environmental and climate problems is poorly regulated global capitalism. We've turned nature into merely a commodity to buy and sell. We are addicted to the slavery of the endless economic growth cycle and end up exploiting indigenous and poor communities around the world, the very people who will suffer the most from serious changes to our climate system. And we haven't yet begun to see what the flow of climate refugees will look like.

These are Naomi Klein's argument in her book, [This Changes Everything: Capitalism vs the Climate](#)

'Climate change is not an 'issue'; it is a civilizational wake-up call ... And this changes everything' (Introduction, 2014, This changes everything; capitalism vs the climate, kindle version)

There is a large body of writing that views unrestrained capitalism as the source of our environmental challenges. Writers differ in the solution, but it is not clear there is a currently viable alternative to some form of capitalist economy (some form of relatively free market where profit can be reinvested into productivity improvement and innovation). However, it is clear that since the new economics of Reagan and Thatcher, capitalism has been poorly regulated (which is the point of neo-liberal economics). That has to change and global corporations require much tighter democratic oversight, accountability and regulation.

See *Climate Change, Capitalism and Corporations: Processes of Creative Self-Destruction*, by Christopher Wright and Daniel Nyberg, 2015, Cambridge Uni Press.
<https://theconversation.com/creative-self-destruction-the-climate-crisis-and-the-myth-of-green-capitalism-47479>
http://www.cambridge.org/gb/academic/subjects/management/business-ethics/climate-change-capitalism-and-corporations-processes-creative-self-destruction?localeText=United+Kingdom&locale=en_GB&query=&remember_me=on

On the duplicity of energy companies, see Exxon; *The Road Not Taken* (2015), on how one company covered up evidence for global warming. <http://insideclimatenews.org/content/Exxon-The-Road-Not-Taken>

Also see a new article in *Rolling Stone* on the extent of Exxon's knowledge of climate change:
<http://www.rollingstone.com/politics/news/did-exxon-lie-about-global-warming-20160630>

While Klein's arguments are powerful, the book is not without its limitations. For an interesting and compelling critique of her book, see Peter Dorman's 2016 review, *The Environmental Movement Needs to Get Radical: But What Does This Mean?*
<http://nonsite.org/editorial/the-climate-movement-needs-to-get-radical-but-what-does-that-mean>

Klein's main idea that climate change is perhaps our best opportunity to produce a fairer world is engaging and powerful. However, the book does not provide a solution to the problems of capitalism that she outlines, and is really more of a call to action than a serious attempt to articulate realistic policy or structural solutions. Her role is of course that of a journalist rather than an academic writer. Reconstructing the economy so that it provides economic protection (meaningful and well paying jobs) for people while at the same time reducing environmental harms is a very tough challenge. *This Changes Everything* does not provide that pathway. Its strength is not its analysis of the issues but its ability to connect the dots between the economy, social justice and climate change. If these links are correct, then climate change will change everything!

Trust the trickle down

This is reference to the idea that by deregulating the economy, people are freed to make money and that money would be spread around and trickle down to everyone. But, while a compelling idea in theory, in practice we have been sold a lemon. While there is less absolute poverty in the world today, the gap between the very wealthy and the rest has been growing. If wealth flows anywhere, it is to the 1%.

See <https://www.youtube.com/watch?v=QPKKQnijsM> for fascinating infographic on this reality.

The logic of profit

Businesses need to cover their costs, and if to innovate (grow), they need a profit to reinvest. There is nothing wrong with that. But the 'logic of profit' for the world's largest and most powerful corporations drives them to continually seek growth and resources to exploit. It is not that the people in corporations are 'bad' people, but rather the system has an inescapable logic; compete and grow or die. If this logic is not strongly regulated by the wider community, then there is little to stop these organisations from mining the last kilogram of coal or harvesting the last tuna in the ocean (the story is more complicated than that, but the logic still applies).