

Climate Truth: Seven Key Numbers for Sustainability and Local Action

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Local action on climate is both an essential and available path for ecological transformation. Local action does not require permission from Washington or from Paris. Action overcomes despair. Local action and planning for sustainability is essential to mitigate the consequences of emerging climate catastrophe and chart the path for a transition to a sustainable ecological civilization.

Seven simple numbers with global consequences can help guide local action and the pursuit of crucial ecological goals. They will serve as co-evolutionary force with global geophysical impact. Life on earth has meant life's co-evolution with the biosphere, for instance, creating the oxygen atmosphere and maintaining just enough carbon dioxide to keep the planet not too hot and not too cold. Co-evolution is the strongest survival factor. It is sustainability in action, the driving force behind life's ability to withstand periodic mass extinctions and once again thrive.

Self-conscious human activity has been able to pour enormous amounts of carbon dioxide and other green house gases into the atmosphere changing the climate. Now it is our time to self-consciously not only stop carbon-dioxide pollution, but to remove and sequester carbon in land and ocean biomass and into soil.

Our local responsibility with healing global consequence is to both slash greenhouse gas emissions, and to remove carbon dioxide by soil building, tree planting and a new global aquaculture producing enormous amounts of kelp and algae in the oceans to pull many gigatons of carbon dioxide from the atmosphere. Now is the time for humanity's self-conscious action to respond to and mitigate the consequences of pollution and habit destruction unleashed by industrial civilization.

The issue on the table is not to figure out how close to catastrophe we can get without upsetting the polluters, but to make a 180 degree turn from catastrophe and work toward both slashing carbon dioxide emissions at least 80 percent or more by 2040, and at the same time sequester many gigatons of carbon in soil and biomass through an exercise in global cooling. This will be the policy and investment basis for turning from business and pollution as usual to building an ecological civilization.

An ecological civilization will be one that nurtures and maintains the balance of the ecosphere with the intention of persisting on geological time scales, millions and millions of years. Human actions needs to attempt to reduce atmospheric carbon and ocean acidity from dissolved carbon dioxide become carbonic acid to pre-industrial levels.

For this to happen, economic growth must mean ecological improvement and the regeneration of ecosystems and the biosphere and a global convergence upon sustainable and just norms for all. The context of this is the global adoption of efficient renewable resource to replace fossil and nuclear fuels, installation of an ecological productive infrastructure, ecological agriculture, forestry, aquaculture and the pursuit of social and ecological justice.

This is an aggressive ecological economic growth and investment strategy that benefits everyone, that makes ecological conduct, social and ecological justice the basis for new ecological market rules, and an ecological definition of fiduciary responsibility. This is a plan to end global poverty, replace a war system with a peace system. This is based on the common pursuit of self-interest, and building an ecological global civilization that will be richer, greener, more peaceful, fairer, healthier and sustainable.

Renewable resources are already replacing fossil fuels at an astounding and accelerating pace. Fossil fuels in the ground, as well as both fossil fuel and nuclear plants are rapidly becoming stranded assets. Even Saudi Arabia is working to building a renewable economy. The issues we need to address are the nature of new market rules to accelerate this process and to support the distributed and fair ownership of assets in the efficient renewable and zero-pollution/zero-waste future that I will discuss in further detail in future articles.

The bottom line, is that the reduction of carbon dioxide to a sustainable 3 tons per person per year level combined with 3 tons of sequestration per person per year (and rising) is a recipe for an ecological global growth system that restores ecosystems, slashes pollution depletion and ecological damage and is predicated on the common pursuit of social and ecological justice. It is a high growth, high profit global system that equitably shares globally its benefits where the rich share investment capital and knowledge with the poor, and all pursue a global convergence on just and sustainable means for all. It relies on new ecological market rules, new legal requirements for fiduciary responsibility to make economic growth proceed within a context of leading to ecological improvement and supporting social justice. It means, over time, replacing a global war system with a peace system.

It means a much greener, much richer , much more peaceful world within the context of ecological economic growth and restoration of ecosystems and the pursuit of social and ecological justice, The conversion of market and planning must be toward ecological and just ends.

It's an enormous job in the aggregate. But we just have to focus on the here and now and a rather simple series of steps.

Seven simple numbers can help guide our path forward.

Number One: 21 Gigatons of Carbon Dioxide Emissions Per Year

21 gigatons a year, that's 21 billion metric tons. That's roughly the amount of carbon dioxide that the biosphere can handle and maintain the concentration of carbon relatively constant and keep our climate in the goldilocks zone, just right for ecosphere, for humanity, and for agriculture, fishing, and aquaculture that supports of 7.2 billion and rising population.

Carbon dioxide is both the most significant and long-lasting global green house gas.

Methane, nitrogen oxides, refrigeration chlorofluorocarbons (CFCs) also must be considered and included in our emission reduction planning and actions, but for now we will focus on carbon dioxide.

21 gigatons is a dynamic number reflecting responses to changing conditions of the ecosphere. Historically, events such as mass volcanic eruptions in the Eocene, some fifty million years ago, led to spiking of global carbon dioxide levels and global temperatures soaring in the Eocene thermal maximum.

All the ice melted, ocean levels were 70 feet higher, the Arctic and Antarctic tropical. This persisted until, some hundreds of thousands years later, a great mat of duck weed and micro-algae growing in the warm Arctic ocean pulled many gigatons of carbon dioxide from the atmosphere and returned the planet to a more familiar climate regime. The lesson is that the planet is likely to do just fine, eventually, without a mega polluting industrial civilization.

Number Two: 3 Tons of Carbon Dioxide Equivalents per Person Per Year

For 7 billion of us globally, 3 tons of carbon dioxide equivalents per person per year is a roughly sustainable 21 gigatons of carbon dioxide.

Unfortunately, for big polluters like the U.S., the average carbon dioxide output per person is almost 17 tons of carbon dioxide per person per year. This is far above the global average of about 7.5 tons of carbon per person per year. In a poor country like Mali carbon dioxide emissions per person per year are only .1 tons; Italy 5.3 tons (and falling) ; India 1.7 tons (and rising); China 7.5 tons (and rising), Australia 15.4 tons (slightly rising).

To get to a sustainable 3 tons in the United States, we have to reduce 14 tons of carbon dioxide per person per year. That's the challenge. The place to meet the global challenge is where we live, starting right now.

The oil and gas and coal to light and heat and cool our houses and power factories and our cars is extracted and sometimes shipped thousands of miles by a huge and enormously polluting and destructive global industrial system. Oil and gas and coal is burnt releasing about 50 billion tons of carbon dioxide pollution every year.

A sad fact of chemistry and physics is that one atom carbon under combustion combines with two atoms of oxygen therefore producing about 3.7 pounds of carbon dioxide gas for each pound of carbon in fossil fuel. The sun and the wind and water that can replace all fossil fuels and stop that carbon pollution is available with zero fuel cost.

One kilowatt hour of electricity, on average, in the U.S. releases 1.22 pounds of carbon dioxide. In 2017 coal and natural gas produced 2,481 billion kWh of electricity in the U.S. according to the U.S. EIA. Replacing them with renewable resources would mean more than 1.4 gigatons carbon per year or 3.9 tons of carbon dioxide per year for each of 350 million Americans. That's a meaningful bite out of the 14 tons per person carbon dioxide per year. 1.4 gigatons of carbon is also 4% of global excess 33 gigatons of carbon dioxide emissions.

Renewable electricity has two basic tasks for an ecological future:

- Replace all fossil fuel and nuclear electric generation;

- Expand use of much more efficient electric power to our cars and trucks, our factories and heating and cooling to eliminate fossil fuel combustion.

A six megawatt solar photovoltaic PV project that I originated is mechanically complete and will come on line later this year. It will produce 7.2 million kWh a year and offset almost 4000 metric tons of carbon dioxide a year and around 105,000 metric tons of carbon in 30 years that will have a small, but real impact on atmospheric carbon.

Locally for the 1,750 people in Beckett, MA, this means Becket, if it uses the power would cut its carbon dioxide by 2.2 tons per person per year.

Getting to a sustainable emissions of three tons of carbon dioxide per person per year in your community, we need to understand where we are now and make plans to where we want to take advantage of all available technological, legal, financial tools at hands. Start by conducting a local carbon inventory using available online tools such as the World Resources Institute that systematically allows you to understand your carbon profile, and use that as the basis for long-term step by step local plans. (See [this](#)) subscribe We may not control what happens nationally. With our neighbors, we have a great deal more say about our town.

Local planning for 3 tons of carbon per person per year and an ecological transformation means understanding the strongly positive effect of things like air to air heat pumps to replace fossil fuel heating and hot water; of improved building efficiency cutting infiltration and increasing insulation; of using electric vehicles that plug into your house and the grid; of district heating and cooling systems; of using organic wastes for compost to build soil and sequester carbon, for bio-digesters and syn (synthetic) gas production to displace fossil fuels; and replace fossil fuel electricity with renewably powered micro-grids and energy storage systems.; and on and on. As we adopt zero-pollution-zero waste production methods, and ecological agriculture, forestry and aquaculture we adopt a more sustainable future.

This is planning not for economic stringency, but for sustainable long-term economic growth that makes economic growth mean ecological improvement and sustainable communities.

Number Four: Fifty-four Gigatons of Carbon Dioxide Emissions Per Year Globally

In 2017, global carbon dioxide emissions were 54 gigatons. This means an excess of 33 gigatons of carbon per year above a sustainable 21 gigatons. This excess 33 gigatons is overwhelming produced by the “advanced” industrial economies, in other words, by the largest polluters with the largest economies. The excess 33 gigatons is decidedly not distributed evenly among the world’s seven billion people.

If carbon pollution was spread evenly, 33 gigatons of excess would mean an excess of about 4.7 tons of carbon dioxide per person per year. A substantial number, but well within the ability of “off the shelf technology” to handle rather easily.

What does the current excess of 33 gigatons of carbon dioxide a year mean to the atmosphere and to our climate and our future. 1 gigaton of carbon dioxide equals .127 parts per million atmospheric CO₂. Fortunately the earth and atmosphere recycle and sequester a substantial portion of this carbon dioxide. Some becomes biomass and then soil. Some dissolves in oceans and becomes carbonic acid that’s now steadily acidifying oceans and will

pose eventually a grave threat to marine plankton. Without ecological mediation of carbon the current yearly emissions of 54 gigatons with an excess of 33 gigatons increases global carbon dioxide levels by about 4.4 ppm a year. The actual average increase is now about half that or 2.25 ppm a year.

Around 450 ppm climate scientists of the IPCC predict we will reach the 2 degree centigrade temperature rise limit chosen by the Paris Climate accords as the limit on dangerous but tolerable. If we keep up emitting an extra 33 extra gigatons a year that's just 20 years or 2038.

What happens in the next 20 years is crucial for the future of civilization

There is typically a lag in how quickly climate change's consequences manifest. It takes time, for example, for ice to melt and for global currents to alter as ocean salinity changes, which can substantially slow the Gulf Stream with dramatic effects on climate in Europe and the United States. But once changes on geophysical scale become manifest chaotic dynamics rule as the ecosphere finds new semi-stable equilibrium that will almost certainly be far less favorable for existing human activities, most crucially agriculture.

Number Five: 286 Parts Per Million of Carbon-dioxide

In pre-industrial times carbon dioxide in the atmosphere was about 286 parts per million (ppm) of carbon (.0286%) . In July 2018 carbon dioxide reached 412 ppm, the highest level in 800,000 years. In 2017, carbon dioxide in the atmosphere rose at a rate of 1.91 ppm per year. You can watch in real time the fluctuating carbon dioxide measurements from the Mauna Loa observatory in Hawaii.

450 ppm is supposedly the "bad magic number" that will lead to reaching or exceeding the 2 degree centigrade temperature increase deemed marginally tolerable by the Paris Climate Conference.

The common global goal must be to return the atmosphere and global ecosphere to re-industrial conditions in the context of a global ecological civilization where economic growth means ecological improvement.

Number Six: Sequester Three Tons of Carbon Dioxide Per Person Per year in Soil and Biomass

Eliminating the 33 extra gigatons of carbon dioxide a year is not only the real number that our actions are measured in. We have simply run out of time to reduce emissions while global carbon dioxide levels increase. What we can do, while we reduce emissions and the rate of increase in carbon dioxide, is at the same time to remove carbon dioxide from the atmosphere and sequester it in soil and biomass.

Thus the job is two fold. While we are cutting emissions back to three tons, we have to pursue global cooling activities through agriculture and aquaculture to remove carbon dioxide from the atmosphere and sequester it in soils and biomass on land and sea working toward a similar 3 tons of carbon dioxide sequestered per person per year. This means removing 21 gigatons per year of carbon dioxide, or 2.7 ppm per year.

We need as soon as possible to be both cutting our emissions to approach 3 tons of carbon dioxide per person per year to a global 21 gigatons and at the same time remove carbon-

dioxide at a similar rate of 3 tons per person per year and therefore reduce atmospheric carbon by 21 gigatons per year or 2.7 ppm per year.

Ecological economic growth in part will mean the global transformation of agriculture, aquaculture, forestry so that they become the source not only of expanded and sustainable global food production but the basis for removal of many gigatons of carbon dioxide from the atmosphere to return global carbon dioxide to pre-industrial levels of 286 parts per million. Global carbon dioxide removal activities should have a per capital global target, for example, one ton per person per year or 7 gigatons globally per year. That must become apart of an ecological transformation strategy

Number Seven: Eight 4 Year Plans for Global Ecological Transformation 2018-2040

Starting with a local Town, City, or Neighborhood carbon inventory we can start to make comprehensive plans for:

- Reducing carbon emissions to 3 tons of carbon per person per year and declining through an efficient renewable energy transformation;
- Removing atmospheric carbon and sequestering in soil and biomass at rates of 3 tons per person per year and rising;
- Mitigation plans for climate change consequences;
- Ecological economic development to make the productive investments for renewable energy transformation, and for industry, agriculture, forestry that will make economic growth mean ecological improvement.

This plans should be conducted on the basis of goal setting and back planning from reaching the ultimate goals and concrete steps technically, physically, financially, regulatory, and educationally needed to get from here to there.

The planning horizon should be eight 4 year plans to move from business and pollution as usual to the beginning of an ecological transformation and escape from the worst affects of climate catastrophe.

Conclusion

Left to their own devices, global government conferences and the financial masters of the universe are unlikely to do what needs to be done to avert climate catastrophe, let alone to put us on the path toward a prosperous and peaceful ecological civilization.

We have the power now to start from where we are to make and implement plans for achieving a 3 tons of carbon dioxide per person per year sustainable global standard combined with sequestration in soil and biomass to remove carbon dioxide from the atmosphere. Overtime, through eight 4 year local plans, we can transform by 2040 our neighborhood, town, city far along the path toward an ecological future.

The next article from Climate Truth will be discussions of how to make and implement plans to build a sustainable local renewable resource economy, and how towns and local residents can finance, build and own renewable energy infrastructure and micro-grids to come, taking advantage of back leverage tax equity financing, using financial tools typically employed just by the wealthy applied for common good.

It's time for us to look up and open our eyes to creative and transformative possibilities. The

sun is rising,the wind blows, and water flows.

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Roy Morrison's latest Book is *Sustainability Sutra (Select Books, 2017)*.He builds solar farms.

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