

“Adapting to Adaptation: A Roadmap to how we will live in 2050”

Edward Church, Ph.D., Executive Director, Institute for Environmental Entrepreneurship

How to know where climate change leads us? Climate scientists have discovered, and elaborately described, dramatic changes in the Earth’s climate which will effect us all. Chemists, biologists and other scientists have joined with physicists and meteorologists in the next phase of the endeavor, projecting the effects of climate change on our planet.

What follows from those predictions are proposals for physical counter-measures to lessen or adapt to the effects. But, what happens after we take those counter-measures, mostly centered on ending our use of fossil fuels? Those adaptations will change the way we live.

The longer-term realities – for Millennials and their children – will be living with the disruptions of adaptations necessitated by climate change: adapting to adaptation.

In this short piece, we take a look at some of the changes ahead, and the reasons for them.

By 2050, American society will have accumulated decades of social and economic adaptations to climate change counter-measures. These will frame our lives. Understanding the outlines of life caused by adapting can give us a roadmap for the best steps to take today for that transition. For example, we know we will have to stop using fossil fuels, but what will that mean for our lives? The people of 2050 are depending on us to choose solutions that make the transition to their inevitable [post-carbon society](#) easier.

Many solutions to the physical problems of climate change are being pushed forward, but how to decide which to select? It is not enough to gauge which are the most “scalable” or which will make the most money in the short term. Our duty to our children and grandchildren is to make decisions now that can smooth and accelerate the transition.

If we project out to 2050, we will have to adapt along the lines of (1) abandoning fossil fuels, (2) adapting to real natural resource limits, and (3) rearranging how we produce, consume and live.

Let’s take these one by one.

**#1. No Fossil Fuels.** To reduce the [deadly greenhouse gases we produce](#), by 2050 we will have [abandoned fossil fuels](#), not just [coal](#). This means we will [find new ways](#) to accomplish transportation, heating, cooling and construction.

The trend toward reduction in fossil fuel use is growing. Government-mandated [reduction](#) in California, which will [increase](#), is a bellwether for the nation. And even without legislation, financial incentives to cities to pursue low-carbon policies are substantial, varying from [\\$17 trillion](#) to [\\$22 trillion](#).

**#2. Natural Resource Limits.** Parallel to adapting to climate change, we will also discover real natural resource limits in the coming decades. This will favor real reduction, and reuse, instead of recycling and waste.

Global accounting and business firm Ernst and Young [estimates](#) that by 2030, close to 1.5 billion people in India and China will become members of the middle class. These estimates are similar to those also offered by McKinsey for [China](#) and for [India](#). This emergence of middle classes in China and India would double the numbers of middle class consumers in the world today. While celebrated as fulfilling [consumer desires](#), comfort and safety, and business profits, it can be accomplished only by doubling the rate at which the Earth's natural resources are depleted.

Adding to the potential shortages created by this demand, global accounting firm Price, Waterhouse, Cooper [projects basic shortages](#) in crucial metals and minerals for manufacturing. An implication of these shortages is that many tech-based solutions will not be available, such as the wholesale substitution of electric cars for gasoline-powered ones. Moreover, many of the parts for any kind of cars are petroleum-based, as Richard Heinberg points out in one of his many-layered explanations of the need to [transition](#) to a post-carbon economy.

The global enlargement of a middle class, and of middle-class consumers, is in a way a repetition of the story of the anthropogenic causes of greenhouse gases. The two emerged together during the Industrial Revolution and are emerging together again. They changed the face of the planet once, and are doing so now. Global climate change and global resource depletion will force us to do everything differently.

**#3. Climate Change Effects.** We will rearrange where and how we produce, consume and live because of climate change calamities, including [droughts](#), [heat emergencies](#) and high temperatures effecting [crop growth](#), and [sea level rise](#).

Our adaptations will be designed to stave off further calamity. We can anticipate how our society and economy will adapt to these three adaptations and can choose which adaptations to promote today.

With the three points above in mind, folks in 2050 will hope that we refine and expand select emerging efforts today, to ease the transition to new practicalities of their day. New ways of living will become routine, some of which are offered here. We look at concrete processes, products and practices emerging today which will need to be encouraged if they are to be widespread when they are needed.

I have chosen several which will likely be practical in 2050; going forward, they should be encouraged and enlarged.

Life in 2050 will reflect the aggregation of responses to decisions made today and in the decades to come. It will be not only a post-carbon society, but a post-waste one as well. Our economy and society will be radically different in 2050. In short, we will be engaged in more locally-based, small scale production and consumption, in more compact communities, and more face-

to-face interaction, and, as I have [projected elsewhere](#), this can be a good thing. The principles behind these projections have been described above, and their implications outlined below.

Fundamental activities of an intertwined society and economy will shift. Below are discussed just a few – energy for comfort and light; transportation; food; and clothing. These categories of basic human needs are also reflected in the Environmental Protection Agency’s [estimation of green house gas emissions](#), mostly from fossil fuels.

Below are some of the destinations for 2050.

### **2050: Energy Will Be Renewable and Closer to Users**

The most obvious changes implied by adapting will be to end fossil fuel use at the sources of energy generation, which the Environmental Protection Agency puts at [31% of green house gas emissions](#). Business as usual for energy generation and use clearly [will not work](#). That may include phasing-out the electrical grid.

The Pew Charitable Trusts write that “A century-old centralized system is yielding to advanced, [distributed energy generation](#) capabilities – in which power is produced at or near the place where it is consumed.” Foremost among these will be [Micro-grids](#) (energy generation and transmission for a specific customer base), with energy generated by renewables including solar, wind and geothermal, will serve both regional and neighborhood-based needs.

As summarized in [an article](#) in GreenBiz, energy micro-grids are more resilient in the face of service interruptions caused by issues such as the [devastating storms](#) that have taken down utility infrastructure in recent years (or [hacking](#)). They can also provide reliable, continuous power supply, [reduce power cost](#), and enhance use of renewable energy sources.

While [most of the energy from coal-fired plants is lost](#) before it gets to consumers, local, sun- or wind-generated energy is much more efficient. Energy sent over long distances is [lost in transmission](#). Electricity will be produced close to where it is used, building-by-building or micro-grid-by-micro-grid. And, it will be from the wind and sun.

[Michigan Public Radio](#) reports on a [study](#) by Stanford University professor Marc Jacobson, which says every state in the U.S. could get 100% of its energy from renewable sources by the year 2050 – and save money in the process.

We will also reduce our need for energy. Zero net energy buildings, for example, are [proliferating](#), maximizing the effect of renewables and energy efficiency, which can dramatically reduce [buildings’ share of GHG production](#) and save [trillions of dollars](#), as can the wholesale [retrofitting](#) of existing buildings.

### **2050: We’ll Have More Mobility, Very Few Cars**

By 2050, we will have dramatically reduced the next great producer of greenhouse gases, transportation, [27% of U.S. GHG](#).

While global business consultants McKinsey have forecast [disastrous consequences](#) for projected increases in the number of private cars in the global south, in the developed world, there will be more mobility with far fewer cars.

McKinsey is among many planners forecasting ““[‘multimodal’ services](#)—those that facilitate journeys combining walking, cars, buses, bikes, and trains—as well as shared transportation services.” Combine this with work by outfits like Mobility Lab, and the [improvements in health and happiness](#) will encourage non-fossil-fuel-using transportation methods.

Copenhagen opened its [bicycle superhighway](#) in 2012, part of a more general European “[bicycle culture 2.0](#).”

Conventional urban planning for car-based American cities is being slowly shifted. Walking is inherently the primary means for human mobility, and [examples abound](#) for converting car-based American cities to be walkable in the coming decades. To achieve the reductions in fossil fuel use that is necessary, private automobiles will be rare by 2050.

What about ditching our current fleet of gasoline cars and replacing them with [electric ones](#)? I cited above the projections of natural resource limits; add to that the need to reduce fossil fuel-based manufacturing, and the prospect of the ubiquity of electric cars becomes problematic.

Public transit will expand the use of existing technologies in [electric buses](#) and [hydrogen-powered buses](#). When private cars are necessary (at a fraction of the number of today) they will be provided as a service, not through ownership. The use of individual cars is likely to be confined to [driverless, on-demand](#), [electric vehicles](#), or [hydrogen-powered cars](#).

### **2050: Our Food Will Be More Local, With A Much Smaller Carbon Footprint**

Reducing fossil fuel use, and therefore transportation by sea and air, means changing the ways we eat. First, we will stop wasting the food we have.

The United Nations Food and Agriculture Organization surveys food usage globally. [According to the FAO](#), one third of food produced is wasted, and in developed world, 40% is thrown away, mostly because of blemishes or irregularities. But if we throw less away, we can produce less, saving water and energy. We can also reduce the [3.3 gigatons of greenhouse gas emissions](#), from food loss and waste, due to the methane it generates during decomposition.

Then, we will abandon the most greenhouse gas-producing sources of protein, primarily beef, but [anything on four legs](#). Beef will be the first to go, as the BBC says beef is the [worst offender](#) of the GHG producing livestock sources of protein, citing the [Proceedings of the National Academies of Science](#). Proposals for a [carbon tax on livestock](#) are being floated. By 2050, these are likely to be part of larger [carbon taxing policies](#).

Our sources of fish protein will also change fundamentally, to land-locked fish farming. Ocean acidification from climate change is [depleting the basis of the aquatic food chain](#), especially

[coral](#). And further up the chain, commercial fishing in Alaska, which produces 50% of the US fish catch in 2009, is [threatened](#). Ocean fish will become less and less dependable as a source of protein. That will necessitate a shift to farming of [fresh water fish](#).

By 2050 a variety of [low-cost](#) or [larger scale](#) aquaculture and [commercial-grade aquaponics](#) operations will provide fish in [highly local](#) sources.

Eating farmed insects is a common practice in countries such as Mexico, the Philippines, and many African countries. It is becoming [increasingly popular](#) in North America and Europe as well. Various appealing forms of insects are available in popular restaurants in [San Francisco](#), or through [online marketplaces](#), and can be grown in [houses](#), [backyards](#) or in more [expansive venues](#).

[Meatless cheese burgers](#) are joining the well established cornucopia of [soy](#), [mycoprotein](#), or [tempeh](#) based plant protein.

We will rediscover foods we have rejected. The [Moringa plant](#), for example ounce for ounce, contains three times the iron of spinach, four times the calcium of milk, and more protein than sardines. Other, [easily grown plants with African origins](#), some thought of as [weeds](#), can easily be cultivated locally, with few resources.

Urban farming is so ubiquitous in the U.S. it has its own set of [nuances and controversies](#). It is common from [Boston](#) to [Kansas City](#) to [Los Angeles](#) to [the Bronx](#). It can even be done in used [metal shipping containers](#) and [on walls](#). Organic food, raised locally with a [low-carbon footprint](#), will be the majority of what is eaten in 2050.

### **2050: The Mantra for Our Consumer Goods Will Be Renew, Reuse, Recycle**

[Zero percent waste](#), through reuse, repurposing, recycling and [sharing instead of owning](#) will be the new fundamentals for a [circular economy](#), which is [emerging now](#), but will be business as usual by 2050. [Business accounting practices](#) will also incorporate climate change into their finances.

Our everyday clothing – much of which is manufactured in high-carbon plants in Asia and transported here by [high-carbon shipping](#) – is a prime example of practices based on [environmental damage](#) which [cannot be sustained](#) and will be replaced by 2050.

Sharing clothing has taken hold [online](#) on [social media](#) and [in person](#), as part of a larger [sharing economy](#) and culture. [Local clothing manufacturing](#) has created new, well-thought out [practices and terminology](#) of its own, in California and [across the nation](#).

[Reselling](#) used clothing will be common, as will large scale [recycling](#) of the materials used in clothing.

These are some of the adaptations we will make by 2050, as a result of not using fossil fuels, running up against genuine limitations in natural resources, and changing what and where we produce the elements of our lives in the face of climate extremes.

Today, practices and products are emerging – or re-emerging – which will fit well in the post-carbon society of 2050. They need to be encouraged, expanded and invested in, just as we understand the need to abandon carbon-intensive practices. That is the beginning of the roadmap.