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This month's Museletter continues with the theme of [Our Renewable Future](#). We begin with an article on the important distinction between a clean electricity future and a clean energy future. Next is a chapter from the [Our Renewable Future](#) book, which I co-authored with David Fridley, offering ideas for action.

Lessons Along the Path to 100 Percent Clean Energy

In early May of this year, Portugal ran on renewable electricity alone for [four consecutive days](#). And later that same month, on May 15, Germany [filled almost all its electricity needs](#) with solar, wind, and hydro power.

This is good news: it tells us we're making progress toward a zero-carbon energy system. But it also helps us see the challenges to a full renewable energy transition.

Many press reports said Portugal and Germany were getting all their energy from renewables during these short periods of abundant wind and sunlight. But it's important to remember that we're really talking only about electricity, which currently represents about 20 percent of global final energy usage. The other 80 percent of energy usage occurs mostly in transportation, agriculture, industrial processes, and in heating buildings, and currently requires liquid, gaseous, and solid hydrocarbon fuels. We have a big challenge ahead of us in electrifying those areas of energy usage.

In Germany on May 15, power prices turned negative several times during the day: utilities were effectively paying consumers to use electricity. This points to the existential crisis that renewables pose for conventional utilities—which, after all, need to sell power to pay for their sunk costs (grid infrastructure and power plants) and for the conventional fuels they still use. What can they do when there's just too much sun and wind? The sensible response would be to store the energy for later, but that implies still more infrastructure costs.

Electricity production in Germany in December 2014

~60 GW of conventional, 6.8 ct/kWh

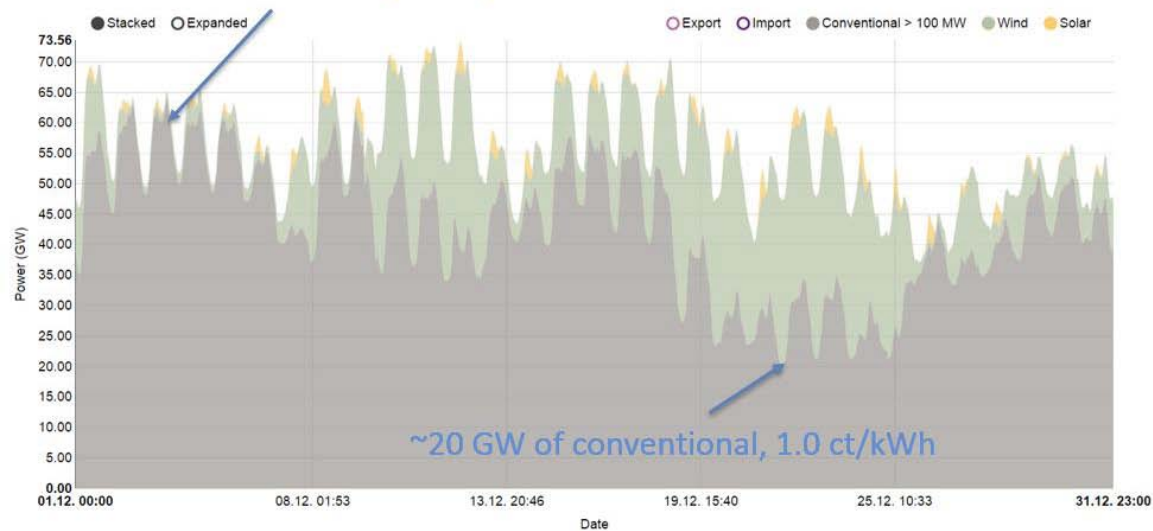


Figure 1: Electricity production in Germany, December 2014. [Source](#)

During many days in the year Portugal and Germany face a situation opposite from the one they encountered in May: there is no wind or solar power to speak of. Then conventional coal, gas, or nuclear power plants are still needed—and will be until a time in the future when there is enough storage and redundant capacity in place to buffer the intermittent availability of sun and wind. But getting there will require both investment and a restructuring of the economics of the power industry.

As co-author [David Fridley](#) and I conclude in our book [Our Renewable Future](#), the renewable energy transition will not consist of a simple process of unplugging coal plants and plugging in solar panels or wind turbines; it will imply changes in how we live, how much energy we use, and when we use it. Historic energy transitions (the harnessing of fire, the advent of agriculture, the fossil fuel revolution) changed societies from the bottom up and from the inside out. There's no reason to assume the renewable energy revolution will be any less transformative.

What We as a People Can Do

This is Chapter 10 of Richard Heinberg's and David Fridley's new book, [Our Renewable Future](#), now available from Island Press.

Sound national and international climate policies are crucial: without them, it will be impossible to organize a transition away from fossil fuels and toward renewable energy that is orderly enough to maintain industrial civilization, while speedy enough to avert catastrophic ecosystem collapse. However, world leaders have been working on hammering out effective climate policies for nearly a quarter of a century, and during that time greenhouse gas emissions have continued to increase. And the impacts of climate change are becoming ever more incontrovertible and perilous. Clearly, individuals, households, communities, and nongovernmental organizations cannot merely stand by and hope that political leaders somehow find the wherewithal at the last moment (if it is not already too late) to halt our descent into climate chaos. We must put all possible

pressure on those leaders to take politically difficult decisions to severely limit carbon emissions.

That will require collective action on a scale that has yet to be seen. The massive transformations in energy systems, government, and the economy that we have described are exceedingly unlikely to occur absent struggle and social action. Powerful interests invested in the extractive economy will not give up their advantages willingly. As Frederick Douglass eloquently said, "Power concedes nothing without a demand. It never did and it never will."

At the same time, we must also show that we as citizens are ready for climate policies by proactively reducing our reliance on fossil fuels and cutting our greenhouse gas emissions. In the process, we can road-test behaviors and technologies that are needed on a broader scale. Fortunately, many people, communities, and organizations have already started doing this, but more are needed.

Individuals and Households

Tackling the energy transition, climate change, and energy inequality will require collective action and policy. So the most important thing we can do as individuals is to support equitable solutions to climate change, and support local democracy and engagement in local decisions about energy.

Nevertheless, our personal actions and choices also reverberate through our communities and can back our words with the authority of personal experience. Start by doing what you can to reduce your use of energy in general, and especially of fossil fuels. That requires developing awareness and changing habits. How much energy do you use? Where and how? Find out by doing a personal and household energy audit. Don't just look at your electricity consumption (though that's essential); also examine your gasoline and natural gas usage. Then make a plan, using a footprint calculator.^[1]

Most likely, it will be a long-term plan that will be implemented in stages. In some cases, it will require investment—perhaps in superinsulating your house; perhaps in exchanging your current automobile for a small electric car; or perhaps in installing an air-source heat pump, a solar water heater, a solar cooker, a front-loading washing machine, a clothesline, and insulated cookware.^[2] If you rent your home, some of these purchases may be less feasible unless you can come to an agreement with your landlord to share costs and savings. If you live in an area where you have no choice but to drive virtually everywhere, you might consider moving to a more compact, mixed-use neighborhood that doesn't require you to spend so much energy just to meet your daily needs—and move into a smaller home with lower heating, cooling, and maintenance needs while you're at it.

Other parts of your plan will be devoted to changing habits: using public transit or bicycling more (if that infrastructure is available), reducing the frequency of shopping trips (and buying less overall), shortening showers, and turning off appliances when not in use. You might also consider what you eat: some food choices (such as beef) involve far more embodied water and energy than others (such as whole grains). Reducing carbon emissions means reducing both operational and embodied energy consumption—not just having more efficient machines, but fewer of them, and replacing them less frequently. It means eating lower on the food chain, wearing clothes longer before discarding them, and repairing goods that break wherever possible, rather than replacing them.

Support the expansion of renewable energy in your community by signing up to purchase clean energy through your utility. Not all utility companies offer this option, but many do. [\[3\]](#) Buy or lease solar panels for your home or business. Aggregate with your neighbors to find ways to get good deals on solar panels, or support community choice aggregation or “go solar” via shared/community solar programs where those are legal. Where those things aren’t allowed, get involved politically and make them legal!

Support relocalization efforts in your town by buying local wherever possible. That means making purchases at locally owned shops, and banking at locally owned banks and credit unions. But it also means looking for and preferentially buying locally grown food and locally made products. If you have pension funds or other investments, it is also possible to invest locally to support local economic development. [\[4\]](#)

Overall, get involved with local efforts to advance the transition to renewable energy. In over forty-five countries and over 2000 cities and towns around the world, Transition Initiatives inspire individuals, families, and neighborhoods to adopt strategies to reduce fossil fuel consumption, localize economies, and produce more renewable energy. [\[5\]](#)

Communities

Often the most important steps toward catalyzing the energy transition within communities takes the form of efforts to build public awareness about climate and energy. Such efforts can be driven by elected officials, but are more likely to gain traction if led or co-led by citizen groups.

There is also a growing movement to push cities, towns, and counties to make commitments to be 100 percent renewably powered (sometimes this concerns electricity only, sometimes the commitment is more broadly conceived). These are exciting new citizen-led efforts that you can join or start. For example, in Sonoma County, California, a group called the Center for Climate Protection [\[6\]](#) has helped create a local power provider, designed a pilot program for water and energy conservation, and persuaded leaders of all the cities in the region to sign on to stringent greenhouse gas reduction targets. Many other communities have aggregated this way in the states where it is legal. Even in states where it’s not, many cities and communities have at least committed to go 100 percent renewable (or provide some degree of rooftop solar) on public buildings.

Community Choice Aggregation (CCA), is a system adopted into law in the states of Massachusetts, New York, Ohio, California, New Jersey, Rhode Island, and Illinois that enables cities and counties to aggregate the buying power of individual customers within a defined jurisdiction so as to secure alternative energy supply contracts on a community-wide basis. Households that don’t wish to participate can opt out. As of 2014, CCAs serve nearly 5 percent of Americans in over 1300 communities. [\[7\]](#) Many CCAs purchase and sell a higher percentage of renewable energy than their conventional utility competitors; some also offer a “green power” option at a slightly higher rate, enabling customers to purchase 100 percent renewable energy. In California, local governments have been using CCAs as a tool to achieve higher greenhouse gas reductions and renewable electricity procurement targets than state requirements mandate or than competing independently owned utilities. But this has not always been true in other states, where cost reduction is the main goal. When renewable energy is cheaper, they procure more of it; but when it’s not, CCAs in other states often revert to conventional fuel procurement. CCAs also help achieve equity by

promoting local control over energy sources.

As previously noted, in the United States, states, counties, and municipalities have considerable control over road, infrastructure, and zoning policies. It is therefore well within the power of local leaders to stop building roads (which facilitate the expansion of the most energy-intensive of our transport options) and to instead build more public transit, bicycle lanes, sidewalks, and footpaths. Zoning policies and building regulations within communities can either encourage or discourage cohousing developments and other manifestations of the sharing economy, as well as natural buildings and zero-energy buildings. Typically, municipal leaders need citizen encouragement in such efforts. Often regulations change as the result of pioneering efforts by individuals and small groups willing to organize their neighbors, meet (and argue) extensively with local officials, and patiently sit through many city council meetings to keep the political pressure on.

With “Go Local” programs thriving in hundreds of cities across the country, localism is growing into a community effort across America. Perhaps the most important thrust of relocalization efforts (and the easiest to organize) is the push for relocalized food systems. The United States Department of Agriculture currently lists 8144 farmers markets in its National Farmers Market Directory, up from 5000 in 2008.^[8] Indeed, local food is one of the fastest-growing segments of American agriculture. Further steps communities can take to promote local economic resilience include analyses to determine the proportion of food, energy, goods, and services that come from local sources.

Efforts to relocalize economic activity usually start with citizen groups. In Santa Rosa, California, a citizen-organized Go Local campaign has resulted in a downtown storefront that is home to Share Exchange—perhaps best described as a localist mini-mall, hosting a “Made Local” marketplace, a “share space” co-working center, and a cooperative business incubator. Signs on Santa Rosa windows and lampposts advise residents to “Shop Local,” “Bank Local,” “Eat Local,” and “Compost Local.” Menus at an upscale restaurant at the center of town proclaim, “We feature organic food from local farmers.”

Ultimately, localization means changing economic development goals. This can be an involved, detailed, and contentious process. The Sustainable Economies Law Center in Oakland, California, is one resource; it offers legal guidance in building community resilience and grassroots economic empowerment, highlighting policy recommendations for sharable cities.^[9]

Climate and Environmental Groups, and Their Funders

When considering the role of climate and environmental groups, perhaps it is useful to start by listing some important things already accomplished by climate and energy nongovernmental organizations:

- They have changed the conversation about fossil fuels and climate change through a divestment campaign, which persuades investors to sell stocks or bonds issued by oil, coal, and gas companies. This largely symbolic campaign casts fossil fuel companies in roughly the same light as South Africa’s apartheid regime, which was targeted by similar divestment campaigns in the 1980s.
- They have proposed policies to further the goal of climate justice—that is, to make sure that the impacts of climate change and the costs of climate adaptation do not fall disproportionately on poorer nations, and to help poor nations leapfrog fossil fuel-based development pathways and build

renewables-based economies capable of providing a sustainable, globally equitable per capita level of consumption.

- They have documented fossil fuel health and environmental impacts and exposed the public relations lies of fossil fuel industries in denying climate change, and in denying the culpability of their own products.
- They have campaigned for energy efficiency and proposed and studied specific ways of reducing energy consumption in many sectors of society.
- They have begun to prepare society for impacts of climate change by studying the factors that make communities more resilient in the face of disruption.

These are important contributions, and much more along these lines is still needed. However, there are some other tasks that have so far received less emphasis from environmental organizations:

- Give citizens a realistic sense of the size and scope of the energy transition, and help prepare society for an effort and a shift as huge as the industrial revolution.
- Identify key uses of fossil fuels that will be hardest to substitute (aviation fuel, for example), and argue for workarounds (such as rail) or for the managed shutdown of those uses.
- Explore how the transition could provide satisfying livelihoods and support thriving localized, steady-state, circular economies.
- In addition to resisting the dominance of fossil fuels, engage with communities to create persuasive models of how people can live and thrive with much reduced reliance on fossil fuels.

The philanthropic sector inevitably exerts a very large influence over the priorities of nonprofit organizations that it funds. Funders should increasingly support the following:

- Efforts to educate and inspire citizens about the energy transition
- Projects that involve development of new economic models that enable people to live with less energy, but in ways that bring greater life satisfaction
- Replicable models of community development that include taking charge of local energy production and reducing fossil fuel demand across many sectors

Funders could also help the nonprofit community view the energy transition as a systemic transformation, one that only *begins* with shutting down coal power plants.

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