

Imagine

By Gordian Raacke

Imagine a world which meets its energy needs without changing the climate. Imagine buildings so energy efficient that they run entirely on solar energy. Imagine factories powered by wind turbines, planes using hydrogen made from wave energy and tidal turbines, and electric cars charging their batteries in solar parking lots at work.

Ridiculous? Not really. Doable? Absolutely.

In fact, it's already being done. The Danish island of Samsø, entirely dependent on oil and coal in 1997, decided to question the status quo. The islanders began to make their homes more energy efficient, switched to biofuel heating and installed solar panels and wind turbines. By 2005, this island of 4,300 people was using 100% renewable sources to generate more energy than it needs. Now, communities and whole regions in many countries are planning for a 100% clean energy future.

Scientists, researchers and think tanks now say that making the transition to 100% renewable energy is not only necessary but possible within a few decades. Their studies warn that to avoid catastrophic climate change we need to quickly transform the way we generate and use energy. But they also point out that this 'great transformation' of our economy and way of life has enormous benefits, including reduced energy costs, creation of jobs, improvements in air and water quality, and fewer global conflicts over scarce resources.

The world over, a growing number of government officials, business leaders, and researchers are now questioning a "business-as-usual" strategy. Many are beginning to formulate sustainable and realistic alternatives for our energy future (see sidebar for some examples).

The wind, water and sunlight (WWS) plan by Delucchi and Jacobson, featured in a Scientific American cover story, actually calculates how many renewable energy systems the world will need to meet all energy needs: 3.8 million 5MW wind turbines, 89,000 300MW solar power plants, 1.7 billion 3kW rooftop solar electric arrays, about 5,000 100MW geothermal plants, 270 new 1,300MW hydro-electric plants, 720,000 0.75MW wave devices, and 490,000 1MW tidal turbines. Surprisingly, they find that cost of energy in this 100% renewable energy economy will be similar to the cost of energy today. Like many other studies, they conclude that the barriers to this global transformation "are primarily social and political, not technological or even economic".

While the switch to renewable fuels in the transportation sector will take several decades, repowering our electric supply with clean energy sources could happen relatively quickly.

So what would it take for Long Island to generate all of its electricity from renewable energy sources? First, we would need to boost existing energy efficiency initiatives to make all existing



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and new homes and commercial buildings better insulated and air tight. Lighting, appliances as well as heating and cooling equipment would be upgraded to high efficiency standards. Once wasteful electricity use is reduced by one third from this major upgrade of the island's building stock, much of the remaining electricity consumption could be met with solar arrays and wind turbines, both on-island and offshore, as well as other renewable energy sources brought in by transmission cables from off-island. For example, solar arrays could contribute 20%, while offshore and land-based wind power could provide another 20% or more of our electricity needs. By bringing in the remainder (approximately 27%) of additional power from hydro and other renewable off-island sources as needed, Long Island's annual electricity consumption could be met with 100% clean and renewable sources.

The economic benefits would be significant: much of the \$1.7 billion LIPA spends annually on imported fuel and power would stay on Long Island. Investing instead in a ten year initiative to make Long Island's housing stock and commercial buildings energy efficient, while installing massive amounts of solar arrays and other renewables all over the island will result in much needed construction jobs and stimulate the regional economy for the next decade and beyond, during the conversion to a 'green' economy. Long Island, as a whole, will be much less exposed to volatile price swings of fossil fuels. Anyone who improves the energy efficiency of their buildings or installs renewable energy technologies will benefit financially by lowering their energy bills.

While Long Island could be a leader in building a truly sustainable economy, we would not be alone. There are now numerous regions worldwide which envision meeting their electricity needs entirely from renewable energy sources. For example,

THE ENERGY REPORT, a groundbreaking 2011 report by the World Wildlife Fund presents a scenario of a world run entirely on renewable energy by mid-century, finding that “such a transition is not only possible but also cost-effective, providing energy that is affordable for all and producing it in ways that can be sustained by the global economy and the planet”. WWF estimates that by 2050, the world would save nearly €4 (\$5.7) trillion per year through energy efficiency and reduced fuel cost.

The **ZERO CARBON AUSTRALIA 2020** plan by the Melbourne Energy Institute at the University of Melbourne, shows that it is technically feasible and affordable to replace all fossil fuel electricity with 100% renewable energy within ten years. The 2010 plan is part of a larger effort of Beyond of Zero Emissions, to eliminate greenhouse gas emissions in all sectors including transportation, buildings, land use, agriculture, and industrial processes.

WORLD IN TRANSITION: A SOCIAL CONTRACT FOR A GREAT TRANSFORMATION, released shortly after the nuclear meltdown in Japan in 2011 by WBGU, an independent scientific advisory body established by the German government, makes an urgent case for a ‘post fossil-nuclear metabolism’. The report calls on state governments and the United Nations to immediately begin the transition to sustainable energy practices and aims for a fully decarbonized energy system in Europe by 2050 at the latest, with the elimination of nuclear energy and massive expansion of the renewable energy sources.

TWO PAPERS published in the U.S. in 2011 by Mark Jacobson of Stanford University and Mark Delucchi of UC Davis find that worldwide energy needs, including electricity, transportation, heating and cooling, can be met by using wind, water, and sunlight (WWS). By 2030, all new energy needs could be met exclusively with WWS sources, and by 2050 all energy needs would be met this way.

San Francisco’s mayor has called for the city to supply 100% of its electricity needs from renewables by 2020 and a task force is developing an implementation plan. The German state of Schleswig-Holstein plans to produce 100% of its electricity with renewable energy sources by 2020, and is already meeting 50%. The new Scottish government aims for 100% renewable electricity by 2020 with much of it coming from offshore wind farms.

It will take determination to turn these clean energy visions into reality. Challenging the “business-as-usual” strategy will encounter opposition from fossil fuel interests. “All truth passes through three stages,” philosopher Arthur Schopenhauer said more than 150 years ago. “First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident.”

What is evident is that current energy patterns are unsustainable. We have the technologies and the know-how to build a sustainable energy supply. So what are we waiting for? ■

Energy Storage

Anyone who’s ever started their car on a cold winter morning knows the value of having energy available when it’s most needed.

Until recently, large-scale storage of electricity was primarily done by pumping water up a hill, then running a hydro turbine to generate electricity when needed during peak demand. Now, advanced battery technologies make it possible to store large amounts of electricity and make them available almost instantly when needed.

These new sophisticated energy storage systems can improve the performance and reliability of conventional power supply systems while allowing the most efficient energy resources to be fully utilized. They also help integrate emission-free energy sources such as wind and solar power into the utility’s power supply by storing electricity when the wind blows or the sun shines and releasing it when needed.

These storage systems do not produce any direct emissions and do not require water resources to operate.

Working with leading suppliers of utility-scale advanced battery systems, AES Energy Storage offers this technology to help utilities and renewable energy developers manage the variability of generation and demand on the grid.

AES, which is already operating or building these systems in New York, West Virginia, and Chile, has proposed a 400 MW project to the Long Island Power Authority. If constructed, this would be the largest energy storage project in the world. ■

