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Social and Environmental Justice and the Water-Energy Nexus: A Quest in Progress for Rural People

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Abstract. Access to affordable and reliable clean water and energy is necessary for economic development, health, and well-being of all people worldwide. Unavailable, unaffordable, or unreliable water and energy resources represent social and environmental injustices that disproportionately burden poor people, especially those in rural areas. Furthermore, there is an inextricable link between water and energy: clean water requires power for delivery and sanitation, and power production requires large amounts of water. This water-energy nexus connects two vital resources for humanity with more attention to economic concerns than to human or environmental issues. This paper addresses social and environmental justice issues that confront rural populations with little or no access to clean water and affordable energy. Local examples of grassroots efforts to produce and provide access to clean water and affordable energy in remote communities and rural areas offer innovations intended to ameliorate daily deprivation of necessary resources. Indeed, the water-energy nexus is so enormous, and risks further exacerbation if global efforts to build capacities to sustain environmental resources continue to lag or fail to develop. Domestically and internationally, the interconnectivity of water and energy cannot be ignored for a sustainable future for the world's population.

Keywords: social justice, environmental justice, environmental sustainability, economic development, rural, water-energy nexus

A single definition of rural does not suffice for all purposes and regions of the world as factors such as population concentration, distances, land use, quality of life, and standard of living vary among nations and influence connotations and definitions of rural. Heilig (2012) places the world population at 7.32 billion people in 2015, and reports about 3.38 billion people, or 46 percent, as living in rural areas. Asia and Africa are home to the vast majority of the world's rural population. Asia has about 2.3 billion, or 68 percent of rural populations, and Africa's rural population is about 0.69 billion, or 0.20 percent of rural populations. The world population is projected to reach 9.55 billion with rural populations shrinking to 3.13 billion, or 33 percent of the world population by 2050. As part of this population shift, Asia's rural population is projected to shrink by about 20 percent while Africa's rural population is projected to grow by as much as 68 percent by 2050 (Heilig, 2012; Weeks, 2016). Out-migration contributes to some reduction in rural populations as do famine, war, and natural disasters. Rural to urban migration is a long-standing process as people seek employment, opportunities, have less attachment to land, and seek a better standard of living. Additionally, birth and mortality rates contribute to population trends as births increase or decrease and life expectancies grow.

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Water-Energy Nexus

Water is the world's most precious resource for which there is no substitute. Water is necessary to support life, biomass, and energy. Furthermore, water is also integral to electricity production, and electricity is needed to clean, store, and deliver water. Water and energy are therefore inextricably linked as water is used to produce energy, and energy is used to provide clean water. Moreover, water and energy are basic requirements for food production and preservation and are subsequently fundamental to economic development. As world populations grow and demands increase, power generation will similarly expand as will the use of water for its production. The water-energy nexus has enormous implications for national and international rural areas where distances and low population density drive up the costs of providing clean water and modern energy, i.e., electricity (Glassman, Wucker, Isaacman, & Champilou, 2011).

The water-energy nexus raises social justice concerns as poor people in rural developing regions are heavily burdened by the lack of access and/or affordability for clean water, sanitation, or electricity. Disadvantaged rural populations are burdened by unequal distribution of environmental resources and environmental harms, and are without resources and political power to advocate for their own participation in change (Bass, Bigg, Bishop, & Tunstall, 2006).

Social Justice and Environmental Justice

Contemporary understanding of social justice in America has roots in the liberation movements of the 1950s, and in the mass movements of the 1960s such as Civil Rights and Women's Liberation that extended well into the 1970s. Social justice principals call for basic living standards for health, mental health, housing, education, and protection from marginalization (Olson, Riffe, Reid, & Threadgill-Goldson, 2011). Continuing efforts for social justice include antiwar movements; lesbian, gay, bisexual, and transgender social movements; disability rights movements; and more. Social justice principles help inform issues of environmental justice and sustainability for the well-being and equality of people, and include rights to water and energy to sustain health and well-being (Ikeme, 2003; Parris, Hegtvedt, Watson, & Johnson, 2014).

Having roots in social justice movements for human rights and equal participation, the environmental justice movement gained momentum in the 1980s (Adams, Bell, & Griffin, 2007; Bullard, n. d.). Environmental justice is broadly defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (United States Environmental Protection Agency, n.d.c). The movement for environmental justice calls for fair treatment so that industrial development, urbanization, or modernization will not environmentally burden people regardless of race, ethnicity, or location (Bullard, n.d.; United States Environmental Protection Agency, n.d.b).

Reflecting the dilemma of protecting people or planet, environmental and social justice issues extend to all sorts of human concerns including human exposure to toxic chemicals, pollution, human rights, quality of life, access to health care, meaningful participation in political and environmental issues, and more. Environmental injustices carry heavy environmental burdens for people living close to chemical dumps, hazardous waste disposal facilities, toxic waste sites, and pollution generating facilities such as coal-fired power plants and oil refineries. The literature is replete with accounts of hazardous and pollution-producing facilities being heavily and unequally distributed and unjustly burdening communities of color, rural areas, poor neighborhoods, ghettoes, and impoverished regions (Bell, 2013; Cole & Foster, 2001; Lee & Mohai, 2012; Montrie, 2011; Parris et al., 2014). Such environmental burdens place people of color, poor people, and rural areas at considerable risk.

Environmental sustainability is not only an environmental issue, but also a social justice concern. People depend on natural resources like air, water, and soil; as well as fossil fuels (coal, petroleum, and natural gas). Most global poor live in rural areas and depend on available environmental resources for basic food, cooking, water, sanitation, and fuel for heat. Environmental resources represent wealth for many marginalized people who live in rural areas in underdeveloped or developing countries throughout the world. Access to land, natural fuels including biofuels, as well as clean water and energy are essential for food production, health, and economic growth (Bass et al., 2006; Bullard, (n.d.); Editorial, 2014). Protection thereof and access thereto are consistent with the 2000 Millennium Development Goals calling for reduced poverty and hunger and for environmental sustainability by 2015 (Sanchez, n.d.). However, the world is behind this target date.

No Easy Answers: Water-Energy Nexus

As many as 2.8 billion people are confronted by water scarcity with estimates of about 3.9 billion people lacking adequate water throughout the world by 2030 (Glassman, et al., 2011). The World Health Organization and UNICEF (2014) report that 748 million people lack access to safe drinking water, and as many as 2.5 billion people do not have sanitation facilities. Also, the Millennium Development Goal (MDG) for improved drinking water for 88 percent of the world's population was met in 2010. Of the 748 million remaining without access to clean drinking water, the majority live in rural areas (p. 8). The World Health Organization and UNICEF report the likelihood of not meeting the MDG target of 75 percent of the world's population having access to sanitation by 2015. Again, rural dwellers are heavily impacted as 70 percent lack access to modern sanitation.

At least 1.3 billion people do not have access to affordable, reliable electricity. Of 2.7 billion people who lack clean cooking facilities with non-polluting fuels, about 2.5 billion live in rural Asia and sub-Saharan Africa (International Energy Agency, 2011). In addition to lacking access to clean fuels, rural and low income people are more likely to encounter energy poverty evidenced by low consumption of energy, exposure to air pollution, and time spent in gathering biomass for fuel.

Co-dependent water and energy are fundamental inputs to health and economic development and prosperity. Production of modern energy depends on the utilization of nonrenewable resources of natural gas, petroleum, and coal to produce electricity for the masses. Generating electricity requires water for cooking, cleaning, and evaporation such as in hydroelectric plants, and more. Electricity is utilized in transporting, storing, cleaning, heating, and delivering clean water. Glassman et al. (2011) cite the need for the water-energy nexus to be placed on the global policy agenda as it is at the forefront of environmental justice and environmental sustainability for people and production worldwide (Union of Concerned Scientists, n.d.).

Voices throughout the global community are brought ever closer together by the message of “energy poverty.” Energy poverty extends beyond basic fuels and involves lack of reliable and affordable access to clean water and modern energy such as electricity. By 2030, 4 billion people are projected to be without reliable energy for daily needs such as cooking, cleaning, heating, cooling, and lighting. A major indicator of energy poverty is low consumption for daily heating, cooking, and lighting either mainly due to inaccessibility or affordability (Glassman, et al., 2011).

Nonrenewable Fuels are Central to the Water-Energy Nexus

Fossil fuels such as coal, petroleum, peat, natural gas, and oil formed millions of years ago from the decomposition of prehistoric organisms. Fossil fuels are not renewable, foul the atmosphere if burned, and have not been replaced by renewable energy sources. Nuclear power is proving to be an important source of electricity; however, uranium, a heavy metal found in rocks and soil and used in nuclear power generation, is not renewable. Solar, wind, rain, geothermal heat from the earth, light, ocean waves, and some plant products are renewable sources of energy that carry little pollution or global warming emissions (Dominelli, 2012).

Extracting Coal

The world mainly relies on coal for the production of electricity; as a nonrenewable resource, coal is a dirty fuel that releases harmful carbon dioxide, mercury, and other toxic pollutants into the atmosphere and ground. Water is required for extracting coal, cleaning coal, and cooling relevant thermoelectric power systems. Burning coal to generate electricity produces ash, mercury, and various dioxide and oxide pollutants that in turn increase water acidity levels in lakes and rivers, thus destroying water supplies and causing general environmental degradation (United States Environmental Protection Agency, n.d.a). Mining, cleaning, and transporting coal in the United States occur in rural areas, and generally in close proximity to small towns and farming regions. Presently, the United States has the largest recoverable coal reserves that are greater than those of Russia, China, and India. Among nations, and outranked only by China, the United States is the second largest producer of coal in the world. China’s coal consumption is almost greater than all other nations, with consumption projected to increase (Ayoub, 2014; World Coal Association, n.d.).

Social and environmental injustices surround coal production. Coal production is marked with economic struggles, mining disasters such as floods, rock falls, explosions, and mine fires dating back to the 1700s, and progressing in severity through the early nineteenth century with the ascendance of landowners and coal barons. The National Industrial Recovery Act of 1933 provided collective bargaining rights for unions, thus providing considerable relief to miners’ protests and demands for safer working conditions, and health care. Unionization helped reduce the controlling forces of coal companies that earlier had owned the mine, hired the workers, rented housing to coal miners and their families, and operated the company store where items could be bought with company script (Lee, 1969). Environmental degradation caused by coal extraction is minimized only by human suffering and loss of life. Recent legislation provides some protection for human and environmental factors. The Federal Mine Safety and Health Act of 1977 increased safety regulations to reduce deaths and injuries (United States Department of Labor, n.d.a). In 2006, the Mine Improvement and New Emergency Response Act (United States Department of Labor, n.d.b) required emergency response plans, rescue teams, and reporting of mine accidents.

Surface mining and mountaintop removal. The state of Wyoming mines the most coal in the United States, followed by the Appalachian states, with West Virginia being the second most coal producing state (Ayoub, 2014). Wyoming coal production is mostly from surface mining of coal seams after top soil and rock are removed. Removing coal by deep mining or mountaintop removal extracts fossil fuels, disrupts topography, and damages rivers, lakes, forests, and biodiversity. Mountaintop mining in the Appalachian Mountains has produced flooding capable of mass destruction from flood waters rushing into valleys, farms, and communities (Bartoletti, 1996; Bell, 2013; Montrie, 2011).

Deep underground mining. Underground mining in the United States increased heavily during the 19th century as industrialization brought greater demands for fuel. Recognized as a mountainous region with a rich history and culture reflecting much of the life and times of coal miners, Appalachia gained recognition for coal production as well as widespread poverty in the mid-1900s (Harper, 1974). Underground coal mining is the world's most dangerous occupation. Miners are endangered by cave-ins, rock falls, methane gas explosions, large equipment and beltway accidents, electrocution, mine fires, and flooding from underground water trapped by rocks and soil. Fatal injuries and chronic diseases (e.g., pneumoconiosis or black lung disease) are also part of the underground coal extraction legacy (Bartoletti, 1996; Goodell, 2002; Lee, 1969; United States Department of Labor, n.d.a).

In the United States, activists and environmentalists continue efforts to stop underground and surface mining, and call for protection from flood waters that when unleashed by pollution and mountain-top removal threaten entire villages and watersheds. Fly ash is a byproduct of mining that is generally stored in ponds. If embankments surrounding fly ash ponds collapse, water and acid sludge flood valleys with devastating force (Montrie, 2011). Federal and state restrictions impose penalties that mandate the coal industry to lower emissions, reduce environmental pollution and degradation, and restore land, including replanting vegetation.

In addition to the water-energy crisis being costly, changing production to meet strengthened safety and emissions standards increases production costs that in turn escalate consumer costs and issues of equitable access and affordability. One outcome of scrutinizing, regulating, and tightening coal production and use is increasing attention to nonrenewable natural gas.

Hydrofracking for Natural Gas

Hydrofracking involves deep and horizontal drilling accompanied by volumes of water and sand treated with chemicals to release natural gas and oil from deep shale. Commonly called "fracking," millions of gallons of water, sand, and dangerous mixtures of chemicals are used to drill miles under the earth's surface to fracture rock and release natural gas. Fracking requires space, water, sand, equipment, and laborers, all of which adversely impact rural areas. Criticisms about air and noise pollution from drilling equipment, and water pollution from "fracking" and dumping used water into sanitation storage areas abound--not to mention wear and tear on roads and highways where trucks transport considerable water and equipment. Shale-gas drilling is hazardous for both water supply and water quality. Further, methane contained in shale gas requires monitoring for air pollution and water contamination (Jackson, Pearson, Osborn, Warner, & Vengosh, 2011).

According to an editorial in *The New York Times*, hydraulic fracturing was originally invented in the 1940s by Halliburton, one of the world's large oil companies. However, the current practice of more modern hydraulic fracturing dates back to about 1998 in Texas (Gold, 2014). Having success in extracting natural gas, processes of hydraulic fracking grew. Interestingly, the energy bill of 2005 called for reducing dependency on foreign sources of energy and included a provision removing the Environmental Protection Agency's authority to regulate drilling processes and fracturing. Known as the "Halliburton loophole," this provision now has the potential to place the nation at risk of polluting its own water supply (Editorial, 2009).

Debate continues about chemicals forced under pressure into soil and rock. Safety concerns for America's water supply abound as chemical mixtures are not clearly understood nor approved. "Fracking" lacks adequate environmental regulation for storage and disposal of waste water despite recommendations to require full disclosure of the chemicals used as well as other contaminates (Editorial, 2009, Jackson et al., 2011; Morrone, 2013,).

Indeed, extraction of natural resources raises concerns of environmental and social injustices. Hydrofracking is occurring at a faster rate than are impact studies of health and environment. Rafferty and Limonik (2013) note that drilling for shale gas is erroneously referred to as "green" (p. 454); however, the fracturing fluid contains a mixture of toxic chemicals including methanol, carcinogens, and known air pollutants. Reports of illnesses related to toxic chemicals used in extracting natural gas and oil are of increasing concern and require greater research and understanding of chemicals that are involved (Rafferty & Limonik, 2013).

There are significant costs in human, social, and environmental degradation in this industry. The above ground processes of moving huge trucks of water, piping, and various drilling equipment impact rural areas and are in public view. And once hydraulic fracturing and natural gas or oil extraction is completed, jobs are lost and sites will likely have sustained environmental damage. Social and environmental injustices extend well beyond the immediate devastation left behind from coal and natural gas extraction, whether surface mining, deep mining, or hydrofracking.

Renewable Fuels, Microgrids, and Small Scale Energy Distribution

Much smaller in scale and production than coal generation, electricity can be generated from renewable resources such as wind, sunlight, tides, waves, rain, geothermal heat and certain biomass from plant material and animal waste. While there is progress in generating electricity from renewable sources, the amount is minimal but promising in view of ongoing research. In 2011, United Nation's Secretary-General Ban Ki-moon called for an infusion of renewable energy along with greater efficiency and increased access to modern services to address the needs of 1.4 billion people without any access (Leone, 2011).

On a smaller scale, microgrids and related technology allow for affordable and reliable distribution of electricity power generation and can utilize wind, solar, battery storage, and local fuels such as biomass to produce electricity (Espiner, 2014; Kaplan, 2009). Soshinskaya, Crijns-Graus, Guerrero, and Vasquez (2014) explain that there is no a single definition of microgrids. Instead, microgrids are mainly defined by their purpose, are likely to be relatively low-voltage, and can be networked to other microgrids or just serve as a single microgrid energy producer. Serving sparse populations in remote rural areas, microgrids offer an important means of transferring electricity with more managed distribution and payment options. Understanding technology and associated training or regulations of microgrid production of electricity varies greatly among developing countries and rural area.

Larger and economically productive in economies of scale, macrogrids have capacities for high-voltage transmission to deliver electricity to microgrids and power stations, but are not as efficient in rural areas as in more concentrated population centers. Newer technologies and communication networks have enabled the development of microgrids to provide power in a distributed manner without the presence of a large central generating plant.

Access to electricity or modern cooking fuels varies across regions in India and Africa with rural areas having the least access. Remote rural areas in these countries present special challenges as traditional plumbing and wiring systems cannot provide the needed access to electricity. Not all microgrids need identical technologies or similar fuel sources. For example, fuels can include manure, cellulose, battery, or other fuels as well as nonrenewable resources to produce energy for grid distribution. Necessary technologies involve equipment load limiters or breakers, controlled delivery, and a range of metering and payment systems (Moore & Pastakia, 2007; Schnitzer et al., 2014).

Microgrids offer renewable solutions for many rural areas such as the great northwest, Alaska, and rural and remote areas in developing and third world countries. Rural regions and developing nations are placing greater reliance on microgrid systems and recognize that electricity must be reliable and affordable for local subscribers. Affordability is critical to changing the way of life for end-users. For example, in highly agrarian and impoverished rural areas that lack income opportunities and rely on barter economies, the choice to purchase electricity from a microgrid monitoring system may not be a possibility. Instead, a choice may be to exchange resources for additional land, food, or animals, rather than electricity (Galvin Electricity Initiative, n.d.; Schnitzer et al., 2014).

There are many factors to consider when distributing electricity to localized markets. Challenges of equipment, maintenance, and trained technicians are just some barriers to delivering modern energy to rural areas (Schnitzer et al., 2014). Affordable, dependable, and accessible energy builds confidence among consumers and encourages developers to seek technologies and management techniques for even greater success in energy production and distribution to rural locations far from grid distribution systems**.**

Cases and Efforts: Rural People Need Clean Water and Energy Access

Residents in many rural areas, provinces, and remote communities are seeking their own solutions to utilize natural resources to access clean water and energy. Challenges of affordability, accessibility, and reliability are common for many small grassroots ventures. Some remote rural areas depend on bartering in the absence of currency. Such lack of currency negates monitoring for the use of payment systems such as collection through cellphone networks. Equipment failures result in delays for repairs and sometimes require access to new equipment. Nevertheless, local efforts and successes may lead to additional opportunities and chart new paths for self-sufficiency for power generation.

Researchers at the University of Oxford are Partnering with the Department for International Development (DFID), UK, and UNICEF, to develop and utilize mobile data to improve access to water for rural dwellers. Mobile Water for Development (n.d.) reports three projects for clean and accessible water in rural Africa where water supplies are scarce. First, utilizing mobile technologies, hand pumps are equipped with monitoring devices to collect information about water production, usage, and functionality. In the absence of electric or fueled generators, hand pumps offer important access to water in deep wells to reduce water scarcity and improve water purity. Furthermore, accessing water by hand pumps replaces carrying water, sometimes for miles in bucket or urns balanced on heads of women and children, some of whom spend hours each day to find and transport water. A second project funded by DFID Kenya’s Water Resources Management Authority, the Burguret Water Resource Users Association, Community Water Project, and Rural Focus Ltd., measures river water abstraction, a measure of the amount of ground water taken from its source for consumption purposes. The intent is to increase access to clean water. The third project involves mobile phone payments for water and sanitation for those who live in remote parts of Kenya, Tanzania, Uganda, and Zambia. This innovative use of phones is particularly important to people living in rural areas, and has the secondary benefit of reducing theft and robbery associated with standard payment methods.

Another interesting example is a durable photovoltaics (PV) module that can be attached to home roofs of households in rural Kenya (ToughStuff International). Recognizing that mobile phones are popular throughout rural Kenya, founders of ToughStuff International report that Africans in rural areas and villages may have to walk miles to charge a phone. Having solar generated energy not only charges phones, but also provides energy for light, cooking, and radio reception; thus reducing kerosene use for cooking and lighting (Jones, 2011; Schnitzer et al., 2014.)

Rural water and sustainable utility management are priorities of the United States Environmental Protection Agency (EPA). Rural utility needs involve considerable distances and often raise environmental concerns as forest and water resources may be threatened. The EPA funds a wide range of utility programs for rural areas with emphasis on Native American water and sanitation needs for rural and Native Alaskan villages. The EPA (n.d.a) provides a guidebook for rural utility development and management with extensive educational and management guidelines for rural utility providers. Rural Alaska has the goal of utilizing renewable resources to produce 50% of its energy by 2025. Having been heavily dependent on diesel fuel to produce electricity, projects are utilizing wind, geothermal, ocean waves, solar or biomass. Most amazing is the harnessing of geothermal power (heat from hot water and rock deep in the earth) to produce modern energy to heat homes and greenhouses among other ordinary uses of energy (Holdmann, 2014).

An independent and successful example of a rural water system in the United States is in South Dakota. The Clay Rural Water System in southeast South Dakota provides water to five counties with a population of around 5,200—less than 10 people per square mile. Initially funded by the Farmers Home Administration, the system successfully uses storage reservoirs and 900 miles of pipeline to serve a minimum of 2,280 locations (Clay Rural Water System, Inc., n.d.).

Energy generation is increasing throughout the world and reflects resources most accessible for such production. Much of rural Kenya is not linked to the country's electrical grids. Solar generated electricity can be purchased through M-Pesa, a platform for mobile payments. Generated solar power is important to John Kibet, for example, a rural farmer who no longer uses kerosene to power the generator he uses in farming his fifteen acres. Using kerosene for fuel is a smelly and dangerous process, so he now uses it only for cooking (Espiner, 2014).

Another example of creative energy production is the Solar Sister Network with a membership of 300 women who work to provide safe, affordable, clean, and renewable energy to friends, families, and others in their local communities. Led by a former investment banker, Katherine Lucey, Solar Sister aims to increase their market by selling affordable solar lighting through community networks in small villages and rural areas. Lucey identifies the lack of energy access as more than just philanthropy; energy access requires funding, expertise, and citizenry involvement. Solar Sister is an important step toward increasing energy availability and offers empowerment and entrepreneurships to African women (Kermeliotis, 2013).

The movement Fund a Child Education (FACE) focuses on the clean water crisis in Liberia by producing wells in the spirit of empowering women and children who have long borne the burden of daily treks to locate and retrieve water in large vessels balanced on their heads (Coleman, 2014). Modern energy and clean water support economic and social development, but not within the reach of all people. There is likely no issue of greater importance than access to clean water, energy production, and distribution systems for specific purposes, populations, and regions.

Concluding Thoughts

Ending extreme poverty and hunger, and ensuring environmental sustainability are among the Millennium Development Goals for 2015 (Sanchez, n.d) that call for environmental justice and access to clean water and energy for people globally—urban, rural, rich, poor, and regardless of ethnicity, gender, race, or religion. As a world leader in economic development and energy production, the United States must help address challenges that the water-energy nexus presents. No single nation can solve the water-energy nexus for the world. No doubt, discussions of access to clean water and energy involve coal, a pollutant used in producing electricity. Coal is exported and used to generate electricity throughout much of the developed world. Wind, solar, biomass, natural gas, petroleum, and nuclear alternatives to coal exist; however, not all are renewable and cannot meet the current energy demands, much less demands of future generations.

Social justice is not just the responsibility of lawmakers and governments, but requires participation at all levels of societies throughout the world. Social justice calls for all people to have equal access to a minimal standard of living that includes the necessary resources that support health, mental health, well-being, and protection from marginalization. The water-energy nexus is complex. There are no easy answers to adequate water-energy access in either rapidly growing urban or remote rural areas. Furthermore, real success in increasing access to clean water and energy requires involvement of the populace served. End consumers must efficiently and conservatively use resources if benefits of environmental justice (i.e., reduced poverty, better health, food security, and sanitation) are to be realized (Schnitzer et al., 2014). Environmental justice leaders, social policy activists, engineers, academicians, elected officials, and social entrepreneurs, must work together if social and environmental justice are to be achieved at home and in developing countries.

The social, environmental, economic, and resource crises impacting people throughout the world cannot be resolved by a single person or group. Instead, collaboration among many stakeholders is required. Having a long history of advocating for causes and understanding the construct of people in environment, social work has long been engaged in social justice and environmental justice issues. Recent literature is calling for “green” social work, not just recognition of person in environment, but recognition of people in the world (Dominelli, 2012). Moving beyond direct practice with individuals in their immediate environment, green social work calls for large-scale redress of social and environmental justice issues by establishing sustainable community involvement toward a greener paradigm for human, social, and physical resources of the planet. Shifting paradigms and reallocation of power and resources are not insignificant demands, but are prerequisite to reducing poverty and providing humanitarian aid to human suffering with attention to environmental sustainability (Dominelli, 2012). Caring societies must address sustaining renewable and nonrenewable resources if grandchildren and future generations are to have necessary resources in a sustainable environment.

References

Adams, M., Bell, L. A., & Griffin, P. (2007). *Teaching for diversity and social justice* (2nd ed.). New York, NY: Taylor & Francis Group.

Ayoub, J. (2014, May 14). China produces and consumes almost as much coal as the rest of the world combined. *Today in Energy.* U.S. Energy Information Administration. Retrieved from http://www.eia.gov/todayinenergy/detail.cfm?id=16271

Bartoletti, S. C. (1996). *Growing up in coal country.* New York, NY: Houghton Mifflin Company.

Bass, S. Bigg, T., Bishop, J., & Tunstall, D. (2006). Sustaining the environment to fight poverty and achieve the Millennium Development Goals. *Review of European Community & International Law, 15*(1), 39-55. doi: 10.1111/j.1467-9388.2006.00502.x

Bell, S. E. (2013). *Our roots run deep as ironweed: Appalachian women and the fight for environmental justice*. Champaign, IL: University of Illinois Press.

Bullard, R. D. (n.d.). Environmental justice for all. *Nature transformed: The environment in American history*. *TeacherServe®.* National Humanities Center. Retrieved from http://nationalhumanitiescenter.org/tserve/nattrans/ntuseland/essays/envjust.htm

Clay Rural Water System, Inc. (n.d.). Retrieved from http://www.clayruralwater.com/

Cole, L. W., & Foster, S. R. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. New York, NY: New York University Press.

Coleman, C. (2014, April 8). Making clean water a reality: FACE Africa's Saran Kaba Jones talks Africa's water crisis & empowering women with GlobalGrind. *Global Grind*. Retrieved from http://globalmediabuzz.com/making-a-difference/2014/apr/clean-water.html

Dominelli, L. (2012). *Green social work: From environmental crises to environmental justice.* Malden, MA: Polity Press.

Editorial. (2009, November 2). *The Halliburton Loophole*. The New York Times. Retrieved from http://www.nytimes.com/2009/11/03/opinion/03tue3.html?_r=0

Editorial. (2014). Water and sanitation: Addressing inequalities. *The Lancet*, *383*(9926), 1359. doi: 10.1016/S0140-6736(14)60665-6

Espiner, T. (2014, May 27). Mobile offers brighter future for Africa’s rural homes. *BBC News*. Retrieved from: http://www.bbc.com/news/business-27516418

Galvin Electricity Initiative (n.d.). *Understanding microgrids*. Retrieved from http://www.galvinpower.org/sites/default/files/documents/Understanding%20Microgrids%20FINAL.pdf

Glassman, D., Wucker, M., Isaacman, T., & Champilou, C. (2011, March). The water-energy nexus: Adding water to the energy agenda. *World Policy Institute*, Retrieved from http://www.worldpolicy.org/sites/default/files/policy_papers/THE%20WATER-ENERGY%20NEXUS_0.pdf

Gold, R. (2014). *The boom: How fracking ignited the American energy revolution and changed the world*. New York, NY: Simon & Schuster.

Goodell, J. (2002). *Our story: 77 hours that tested our friendship and our faith*. New York, NY: Hyperion.

Harper, K. V. (1974). Appalachia: A way of life. In F. S. Riddle, (Ed.), *Appalachia: Its people, heritage and problems* (pp. 85-91). Dubuque, IA: Kendal V. Hunt Publishing.

Heilig, G. K. (2012, June 7). *World urbanization prospects: The 2011 revision, methodology*. Presentation at the Center for Strategic and International Studies. Retrieved from http://esa.un.org/wpp/ppt/CSIS/WUP_2011_CSIS_4s.pdf

Holdmann, G. (2014, May 13-14). Approaches to integration of renewable energy in rural microgrids of 100 kW to 1 MW power range. *African Utility Week*, Cape Town, South Africa. Retrieved from http://www.esi-africa.com/wp-content/uploads/2014/05/Gwen-Holdmann.pdf

Ikeme, J. (2003). Equity, environmental justice and sustainability: Incomplete approaches in climate change politics. *Global Environmental Change*, *13*(3), 195-206. doi: 10.1016/S0959-3780(03)00047-5

International Energy Agency (2011). *World energy outlook, 2011*. Retrieved from http://www.iea.org/publications/freepublications/publication/weo2011_web.pdf

Jackson, R. B., Pearson, B. R., Osborn, S. G., Warner, N. R., & Vengosh, A. (2011). *Research and policy recommendations for hydraulic fracturing and shale-gas extraction.* Durham, NC: Center on Global Change, Duke University. Retrieved from https://nicholas.duke.edu/cgc/HydraulicFracturingWhitepaper2011.pdf

Jones, C. (2011, June 30). *ToughStuff International is driving sales for an affordable, flexible solar product.* Ashden. Retrieved from *http://www.ashden.org/blog/toughstuff-international-driving-sales-affordable-flexible-solar-product.*

Kaplan, S. M. (2009, April 14). Electrical power transmission: Background and policy issues (Report No. R40511). *Congressional Research Service*. Retrieved from: http://fpc.state.gov/documents/organization/122949.pdf

Kermeliotis, T. (2013, January 2). 'Solar Sisters' spreading light in Africa. *CNN World*. Retrieved from http://www.cnn.com/2012/12/17/world/africa/solar-sister-africa-light/index.html

Lee, H. B. (1969). *Bloodletting in Appalachia*: *The story of West Virginia's four major mine wars and other thrilling incidents of its coal fields*. Morgantown, WV: West Virginia University.

Lee, S., & Mohai, P. (2012). Environmental justice implications of Brownfield Redevelopment in the United States. *Society & Natural Resources, 25*(6), 602-609. doi: 10.1080/08941920.2011.566600

Leone, S. (2011, August 25). U.N. Secretary-General: Renewables can end energy poverty. *Renewable Energy World.COM*. Retrieved from http://www.renewableenergyworld.com/rea/news/article/2011/08/u-n-secretary-general-renewables-can-end-energy-poverty

Mobile Water for Development (n.d.). *Projects: Smart handpumps, smart rivers, and mobile payments*. Retrieved from http://oxwater.co.uk/#/projects/4559322087

Montrie, C. (2011). "We mean to stop them, one way or another:" Coal, power, and the fight against strip mining in Appalachia. In M. Morrone & G. L. Buckley (Eds.), *Mountains of injustice: Social and environmental justice in Appalachia* (pp. 81-98). Athens, OH: Ohio University Press.

Moore, P., & Pastakia, F. (2007). *Environmental justice and rural communities: Studies from India and Nepal*. International Union for Conservation of Nature and Natural Resources (IUCN). Retrieved from http://cmsdata.iucn.org/downloads/environmental_justice_and_rural_communities___studies_from_india_and_nepal.pdf

Morrone, M. (2013, August 12). Environmental justice, hydraulic fracturing and Appalachia. *Triple Pundit.* Retrieved from http://www.triplepundit.com/special/environmental-justice-hydraulic-fracturing-appalachia/

Olson, C. J., Riffe, H. A., Reid, C., & Threadgill-Goldson, N. (2011). Foot soldiers for social justice: Realities, relationships, and resilience. *Journal of Contemporary Rural Social Work*, *3*, 29-39.

Parris, C. L., Hegtvedt, K. A., Watson, L. A., & Johnson, C. (2014). Justice for all? Factors affecting perceptions of environmental and ecological injustice. *Social Justice Research*, *27*(1), 67-98. doi: 10.1007/s11211-013-0200-4

Rafferty, M. A., & Limonik, E. (2013). Is shale gas drilling an energy solution or public health crisis? *Public Health Nursing, 30*(5), 454-462. doi: 10.1111/phn.12036

Sanchez, T. (n.d.). Energy poverty: The hidden energy crisis. *Practical Action*. Retrieved from

Schnitzer, D., Lounsbury, D. S., Carvallo, J. P., Deshmukh, R., Apt, J., & Kammen, D. M. (2014, February). Microgrids for rural electrification: A critical review of best practices based on seven case studies. *United Nations Foundation.* Retrieved from http://www.ourenergypolicy.org/microgrids-for-rural-electrification-a-critical-review-of-best-practices-based-on-seven-case-studies/

Soshinskaya, M., Crijns-Graus, W. H. J., Guerrero, J. M., & Vasquez, J. C. (2014). Microgrids: Experiences, barriers and success factors. *Renewable and Sustainable Energy Reviews,* 40, 659- 672. doi:10.1016/j.rser.2014.07.198

Union of Concerned Scientists (n.d.). *How it works: Water for coal*. Retrieved from http://www.ucsusa.org/clean_energy/our-energy-choices/energy-and-water-use/water-energy-electricity-coal.html#.VNO5WGc5Dcs

United States Department of Labor (n.d.a). *A guide to miners' rights and responsibilities under the Federal Mine Safety and Health Act of 1977*. Retrieved from http://www.msha.gov/S&HINFO/minersrights/minersrights.asp

United States Department of Labor (n.d.b). *Miners' rights and responsibilities*. Retrieved from http://www.msha.gov/S&HINFO/minersrights/OnlineTraining/introduction_page_1.html

United States Environmental Protection Agency (n.d.a). *Clean energy*. Retrieved from http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html

United States Environmental Protection Agency (n.d.b). *Environmental justice program and civil rights.* Retrieved from http://www.epa.gov/region1/ej/

United States Environmental Protection Agency (n.d.c). *What is environmental justice?* Retrieved from http://www.epa.gov/environmentaljustice/

Weeks, J. R. (2016). *Population: An introduction to concepts and issues* (12th ed). Boston, MA: Cengage Learning.

World Coal Association (n.d.). *Where is coal found?* Retrieved from http://www.worldcoal.org/coal/where-is-coal-found/

World Health Organization/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (2014). *Progress on drinking water and sanitation, 2014 update.* Retrieved from http://www.wssinfo.org/fileadmin/user_upload/resources/JMP-report2014Table_Final.pdf