

## Employment in a Low-Carbon World

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As climate action grows urgent, some observers warn that economies will suffer as a result. But economic prosperity and employment depend in fundamental ways on a stable climate and healthy ecosystems. Without timely action, many jobs could be lost due to resource depletion, biodiversity loss, the impacts of increasing natural disasters, and other disruptions. Meanwhile, employment that actually contributes to protecting the environment and reducing humanity's carbon footprint offers people a tangible stake in a green economy.

The pursuit of so-called green jobs will be a key economic driver as the world steps into the uncharted territory of building a low-carbon global economy. "Climate-proofing" the economy will involve large-scale investments in new technologies, equipment, buildings, and infrastructure, which will provide a major stimulus for much-needed new employment and an opportunity for retaining and transforming existing jobs.<sup>1</sup>

The number of green jobs is already on the rise. Most visible are those in the renewable energy sector, which has seen rapid expansion in recent years. Current employment in renewables and supplier industries stands at a conservatively estimated 2.3 million worldwide. The wind power industry

employs some 300,000 people; the solar photovoltaics (PV) sector, an estimated 170,000; and the solar thermal industry, more than 600,000 (this relatively high figure is due to low labor productivity in China, the leading producer of solar thermal systems). More than 1 million jobs are found in the bio-fuels industry—growing and processing a variety of feedstocks into ethanol and biodiesel.<sup>2</sup>

Some industrial regions that have become Rust Belts, such as parts of the U.S. Midwest or Germany's Ruhr Valley, are gaining new vitality from wind and solar development. Rural communities receive additional income when farmers place wind turbines on their land. Installing, operating, and servicing renewable energy systems provides additional jobs; local by definition, these are resistant to outsourcing. In Bangladesh, the spread of solar home systems—which might reach 1 million by 2015—could eventually create some 100,000 jobs.<sup>3</sup>

Wind and solar are poised for continued rapid expansion. Under favorable investment projections, wind power employment worldwide could reach 2.1 million in 2030, and the solar PV industry might employ as many as 6.3 million people by then. Although renewables are more labor-intensive than the fossil fuels they replace, the energy sector does not account for a very large portion of employment. Many more green jobs will eventually be created through the pursuit of more-efficient machinery and appliances. Energy performance services are already a

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growing phenomenon.<sup>4</sup>

Construction jobs can be greened by ensuring that new buildings meet high performance standards. This is particularly important in Asia, which is undergoing a construction boom. And retrofitting commercial and residential buildings to make them more energy-efficient has huge job potential for construction workers, architects, energy auditors, engineers, and others. For instance, the weatherization of some 200,000 apartments in Germany created 25,000 new jobs and saved 116,000 existing jobs in 2002–04 at a time when the construction industry faced recession. Providing decent and efficient housing in the developing world's urban agglomerations and slums presents an unparalleled job creation opportunity—if the necessary resources are mobilized.<sup>5</sup>

The transportation industry is a cornerstone of modern economies, but it also has the fastest-rising carbon emissions of any sector. Incorporating the very best in fuel efficiency technology would dramatically lessen the environmental footprint of motor vehicles. An assessment of the most-efficient cars currently available suggests that relatively green auto manufacturing jobs may today number no more than about 250,000 out of roughly 8 million direct jobs in the auto sector worldwide. But a concerted push toward much greater efficiency and carbon-free propulsion systems is needed. Likewise, retrofitting highly polluting two-stroke engines that are ubiquitous, especially in Asia, to cut their fuel consumption and emissions would create many jobs.<sup>6</sup>

Overall, the reliance on cars and trucks needs to be reduced. Railways offer an alternative, yet many jobs have been lost over the last few decades as rail has been sidelined. In Europe, railway manufacturing and operating employment is down to about 1 mil-

lion. Even in China and India, rail jobs fell from 5.1 million to 3.3 million from 1992 to 2002. A recommitment to rail, as well as to urban public transit, could create many millions of jobs. In growing numbers of cities, good jobs are being generated by the emergence of bus rapid transit systems. There are also substantial green employment opportunities in retrofitting old diesel buses to reduce air pollutants and in replacing old equipment with cleaner compressed natural gas (CNG) or hybrid-electric buses. In New Delhi, the introduction of 6,100 CNG buses by 2009 is expected to create 18,000 new jobs. More-affordable and nonpolluting transportation networks also give poor people in developing-country cities better access to job opportunities.<sup>7</sup>

Basic industries like steel, aluminum, cement, and paper may never be truly “green,” as they are highly energy-intensive and polluting. But increasing scrap use, greater energy efficiency, and reliance on alternative energy sources may at least render them a pale shade of green. Secondary scrap-based steel production requires up to 75 percent less energy than primary production. Worldwide, 42 percent of steel output was based on scrap in 2006, possibly employing more than 200,000 people. Likewise, secondary aluminum production uses only 5–10 percent as much energy as primary production. About one quarter of global aluminum production is scrap-based. No global employment numbers exist for this, but in the United States, Japan, and Europe, it involves at least 30,000 jobs. The cement and the paper and pulp industries have similar greening potential, but like the aluminum industry they are relatively small employers.<sup>8</sup>

The number of recycling and remanufacturing jobs worldwide is another unknown. In the United States, these are estimated at

more than 1 million. With higher rates of recycling, Western Europe and Japan can be assumed to have greater employment in this sector. In developing countries, paper recycling is often done by an informal network of scrap collectors, sometimes organized into cooperatives in order to improve pay and working conditions. Jobs and livelihoods in informal communal recycling efforts are difficult to document; in Cairo, the Zabbaleen have received considerable international attention. Believed to number some 70,000, they recycle an estimated 85 percent of the materials they collect. Brazil is thought to have some 500,000 recycling jobs. China, with estimates as high as 10 million jobs, trumps all other countries in this area.<sup>9</sup>

For many developing countries, a key concern is the future of agriculture and forestry, which often still account for the bulk of employment and livelihoods. Small farms are more labor- and knowledge-intensive than agroindustrial farms, and they use less energy and chemical inputs. But relatively sustainable forms of smallholder agriculture are being squeezed hard by energy- and pesticide-intensive plantation and specialized crops, trade liberalization, and the power of global supply and retail chains. Organic farming is still limited, although expanding. More labor-intensive than industrialized agriculture, this can be a source of additional green employment in the future. A study in the United Kingdom and Ireland showed that organic farms employed one third more full-time equivalent workers than conventional farms do.<sup>10</sup>

Afforestation and reforestation efforts, as well as generally better stewardship of critical ecosystems, could support livelihoods among the more than 1 billion people who depend on forests, often through non-timber forest products. Planting trees creates large numbers of jobs, although these are often

seasonal and low paid. Agroforestry—which combines tree planting with traditional farming—offers significant environmental benefits in degraded areas, including carbon sequestration. It has been shown to provide food and fuel security and to create employment and supplementary income for small farmers. Some 1.2 billion people already depend on agroforestry to some extent.<sup>11</sup>



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*Installing solar panels on a roof in Atlanta, Georgia*

There is additional job potential in dealing with the accumulated environmental ills of the past and improving the ability to cope with the climate change that is already inevitable. The building of much-needed adaptation infrastructure, such as flood barriers, to protect communities from extreme weather events has barely started but presumably would employ large numbers of people, even if only temporarily. Activities such as terracing land or rehabilitating wetlands and coastal forests are labor-intensive. Efforts to protect croplands from environ-

mental degradation and to adapt farming to climate change by raising water efficiency, preventing erosion, planting trees, using conservation tillage, and rehabilitating degraded crop and pastureland can also support rural livelihoods.

So the potential for green jobs is immense. But much of it will not materialize without massive and sustained investments in the public and private sectors. Research and development programs need to shift decisively toward clean technology, energy and materials efficiency, and sustainable workplace practices, as well as toward environmental restoration and climate adaptation.

Governments need to establish a firm and predictable policy framework for greening all aspects of the economy, with the help of targets and mandates, business incentives, and reformed tax and subsidy policies. It will also be critical to develop innovative forms of technology transfer to spread green methods around the world at the scale and speed required to avoid full-fledged climate change. Cooperative technology development and technology-sharing programs could help expedite the process of replicating best practices.

To provide as many workers as possible with the qualifications they will increasingly need, an expansion of green education, training, and skill-building programs in a broad range of occupations is crucial. Some jobs involve sophisticated scientific and technical skills. But green job development also needs to offer opportunities for the broad mass of workers, including those who

have too often found themselves in underprivileged situations.

The transition to a low-carbon future will involve major shifts in employment patterns and skill profiles. Resource extraction and energy-intensive industries are likely to feel the greatest impact, and regions and communities highly dependent on them may face serious consequences. They will need proactive assistance in diversifying their economic base, creating alternative jobs and livelihoods, and acquiring new skills. Today, such a “just transition” remains a theoretical notion.

Green jobs need to be decent jobs—offering good wages and income security, safe working conditions, dignity at work, and adequate workers’ rights. Sadly, this is not always the case today. Recycling work is sometimes precarious, involving serious occupational health hazards and often generating less than living wages and incomes, as is the case for 700,000 workers in electronics recycling in China. Growing crops for biofuels at sugarcane and palm oil plantations in countries like Brazil, Colombia, Malaysia, and Indonesia often involves excessive workloads, poor pay, exposure to pesticides, and oppression of workers. Also, the expansion of biofuels plantations has driven people off their land in some cases, thus undermining rural livelihoods.<sup>12</sup>

These cautionary aspects highlight the need for sustainable employment to be good not only for the environment but also for the people holding the jobs. Still, an economy that reconciles human aspirations with the planet’s limits is eminently possible.

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