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Chapter 9

Creating Jobs, Preserving the Environment

Michael Renner

From November 1811 to January 1813, organized bands of English artisans in the wool and textile trades attacked the shearing frames, spinning jennies, gig mills, and other pieces of textile-manufacturing machinery that were beginning to replace them in the early stages of the Industrial Revolution. Acting in the name of "General Ned Ludd"—by all accounts an imaginary, yet immensely inspiring, figure—the "Luddites" conducted nighttime raids, ransacked factories, and even committed arson and burglary in their desperate struggle against the onset of an industrialism that they saw as a mortal threat to their livelihoods and the world they knew: craft, custom, and community.[1]

Kirkpatrick Sale, who has chronicled the Luddite struggle, observes that "by 1813 there were an estimated 2,400 textile looms operating by steam, but that burgeoned to 14,150 by 1820 and exploded to more than 100,000 just a decade later." Age-old crafts were obliterated, skills rendered obsolete, communities torn asunder. Some 100,000 handloom weavers in the cotton industry were impoverished. As the Industrial Revolution gathered force, hundreds of thousands of self-employed people all over Britain were driven out of work. Suddenly in need of money to secure food and other basic needs, they had no choice but to depend on wage labor. Factory towns emerged that became infamous for their reckless pollution of air and water and their inhumane treatment of workers who received no more than poverty wages. Despite deplorable conditions in factories, laws passed in 1799 and 1800 made it illegal for workers to organize.[2]

In support of the budding manufacturers, the British government unleashed the most severe episode of repression in the country's memory. Because recorded history is usually about the winners, the term Luddite entered the modern vocabulary with thoroughly negative connotations. Although Luddites are now often derided as "opposed to technological change," the machine breakers of early nineteenth-century England were not

hostile to technology per se. Rather, they protested against "machinery hurtful to Commonality," as a contemporary letter put it: an onrush of technology beyond their control, introduced without regard to the social dislocation and environmental destruction it caused.[3]

The particular technologies that triggered the Luddite movement may seem quaint today, but the issues remain salient. The economic system that was first brought into existence by the Industrial Revolution embodies a turbulence—a constant changing and churning—that, even as it propels society forward, inserts a degree of uncertainty into people's jobs and lives. In today's Europe, as elsewhere in the industrial world, more than 10 percent of all jobs vanish each year, replaced by different jobs in new occupations and sometimes in new companies.[4]

This turbulence is amplified, and more socially disruptive, in times of fundamental structural change. New technologies and industries arise and old ones wither away; some regions prosper and others become rustbelts; new jobs and skills emerge and others fall victim to the march of technology. In a transformation perhaps as momentous as the one 200 years ago, the rise of an "information economy" and the trend toward economic globalization are today spawning considerable anxiety about job security, skills obsolescence, and wage trends.

But even as computers, the Internet, and associated technologies remake the economy, another challenge beckons: the growing urgency to move toward a sustainable economy. With the spreading industrial system, environmental concerns grew from localized (though severe) pollution in early-industrial Britain to planetary-scale degradation and alteration of natural systems. The implications for a more sustainable development path are clear: we need to reduce the reliance on fossil fuels dramatically, curtail mining and logging of virgin areas, restructure the transportation and utility sectors, and alter industrial processes to minimize waste generation. The fear is that such measures will cause grave economic disruptions and massive job loss, and such worries are eagerly cultivated by industries resistant to change.

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Does sustainability need to be synonymous with economic insecurity? Primarily for reasons other than the pursuit of sustainability, logging, mining, and heavy industries like iron and steel are already far less important today than they once were for economic growth, and even less so for employment. For a long time, it was an article of faith among economists that energy and materials consumption move in lockstep with the gross national product, meaning that reduced resource use equaled lower growth and less employment. But this direct link has already been severed, and even greater resource efficiency will make it possible to produce more goods and services while reducing the burden on the natural world. The rapid rise of information and communications technologies could help forge a more sustainable economy. (See Chapter 8.)[5]

Energy and materials efficiency, renewable energy, recycling, waste avoidance, and "clean production" methods offer substantial employment opportunities—typically more jobs than in traditional industries. In place of the present resource-intensive, high-throughput economy, a sustainable

economy will manufacture products so that they are energy- and materials-efficient, are durable, upgradable, and repairable, and can be remanufactured when their useful life comes to an end. All these characteristics promise new kinds of jobs. A sustainable economy will also emphasize the intelligent use of products rather than mere ownership; services built around the idea of extending the life of a product and maximizing its utility will offer additional job opportunities.

A new economy that provides sufficient employment without exacting massive environmental damage is possible. However, as with any fundamental economic transformation, there are transition costs. The lessons of the Luddite resistance will need to be heeded: people caught in the maelstrom of change will resist if they don't see a future for themselves. Affected workers, communities, and regions—particularly those dependent on resource extraction—will need help to master new skills, technologies, and industries. Creative policies are required to boost job creation, enhance workers' education and update their skills, and smooth the transition process. A new economy will not be viable unless it is both environmentally and socially sustainable.

The World of Work

In modern economies, wage employment is the primary source of income for most people. The world's labor force—those employed or available for work—has grown from 1.2 billion people in 1950 to an estimated 2.9 billion in 1998. And because of strong population growth, it will continue to swell: during the next half-century, the world will need to create nearly 30 million additional jobs each year. If past is prologue, then there is reason for concern: Employment has expanded, but less so than the working-age population. Unemployment and uncertainty about future prospects allow those opposed to strong environmental policies to play on workers' fears about their jobs.[6]

Worldwide, at least 150 million people were unemployed at the end of 1998. Long-term structural unemployment—that is, joblessness that will not be easily reduced merely by cyclical upswings in the economy—accounts for a significant portion of the total. In western industrial countries, more than a quarter of the unemployed in 1997 had been jobless for a year or longer. In addition, as many as 900 million people are "underemployed"—involuntarily working substantially less than full-time, or working full-time but earning less than a living wage.[7]

Then there are the "discouraged" workers, who have given up hope of finding a job; since they no longer actively seek work, they are usually not even counted as unemployed. In the European Union (EU), for instance, some 18 million persons are officially unemployed, but at least another 9 million are "discouraged." And yet, even as millions are out of work, many workers end up putting in large amounts of overtime—the equivalent of at least 2 million full-time jobs in the EU.[8]

What economist Joseph Schumpeter dubbed the "creative destruction" of capitalist economies implies an ever-present changing and churning that, while creating greater wealth, at least as traditionally measured, is also bound to infuse labor markets with great uncertainty and all the attendant social and psychological impacts on individuals, families, and communities.[9]

At the turn of the millennium, the nature of work is changing dramatically,

perhaps on a scale comparable only to the Industrial Revolution. Increasing international trade and investment and a new wave of automation are reshaping virtually every kind of human economic activity and speeding up the pace of change. (See also Chapter 10.) Conventional economics praises the process in which mature industries shed jobs and new industries emerge to provide employment. But it is unclear whether computers and microelectronics will render jobs more interesting or more stressful, whether they will entail jobs that are mostly routine tasks instead of requiring problem-solving skills that stimulate human creativity, and whether they will lead to a growing polarization of the work force between well-paid and poorly paid employees. Just like the earlier revolution, this transformation brings with it a deskilling process, as existing abilities, expertise, and proficiencies lose in value and importance, and new skills and requirements rise in response.[10]

Technological development and increased capital mobility—the flow of money, technology, and machinery across borders—allow growing numbers of companies to embrace measures such as temporary or part-time hiring, parceling out components of the work process (subcontracting and "outsourcing") and tapping into a large pool of cheap labor in developing countries to either supplement or replace higher-paid workers in industrial countries. Products are now routinely made from components produced in far-flung places around the planet. Although these measures allow companies to be highly flexible and adapt rapidly to fast-changing market conditions, they also make job security more tenuous and weaken the bargaining power of labor unions.[11]

Disparities between skilled workers and those lacking skills or possessing outdated ones grow more noticeable. Manufacturing employment in western industrial countries stayed roughly even for skilled workers between 1970 and 1994, but declined 20 percent for unskilled workers. Likewise, the gap between those with full-time jobs and those working involuntarily in temporary or part-time jobs is becoming more prominent. Under the right circumstances, part-time work can be part of the solution to the employment and social challenges of our time. For the moment, however, it means mostly jobs with low pay and few benefits, limited career prospects, and no assurance that the position will still be available next week or next month. In Britain, part-time employment accounted for 15 percent of all jobs in 1971 but 25 percent in 1997. In Germany, 15 percent of employees were in "insecure" jobs (defined as part-time, temporary, or insufficient work) in 1970; by 1995, the figure had risen to 30 percent.[12]

The nature of work is changing dramatically, perhaps on a scale comparable only to the Industrial Revolution.

If current trends continue, the work force will become more polarized. A relatively small group of employees may emerge as "winners"—highly skilled, with secure, well-paid jobs, and more likely than not working substantial overtime in high-stress conditions—whereas many workers will probably confront episodes of unemployment or have to accept irregular, less secure work arrangements. The real losers may face more or less permanent exclusion from gainful employment because their skills, age, or other attributes are judged as inadequate or unneeded in a fast-paced, merciless labor market. In devel-

oping countries, too, growing disparities are likely. Employees in small high-tech enclaves such as one in Bangalore, India, are likely to benefit from world market integration. Free trade zones like Mexico's *maquiladoras* attract foreign investment and jobs, though wages and working conditions are often little better than in English factories during the early stages of the Industrial Revolution.[13]

Since the 1970s, unemployment in advanced industrial countries has been on the upswing. In Western Europe, it climbed from a little over 2 percent in 1970 to about 12 percent in the late 1990s; in Japan, from about 1 percent to above 4 percent. By contrast, after it rose from 5 percent in 1970 to above 10 percent in the early 1980s, the unemployment rate in the United States is now back to slightly below the 1970 level. (See Table 9–1.)[14]

But higher job creation has come at a cost: Almost 28 percent of all U.S. workers now have jobs that pay wages at or below the official poverty level. From a peak in 1978, real hourly earnings for all production and nonsupervisory workers outside agriculture declined 9 percent by 1997. On average, U.S. wages are lower, and unemployment benefits and the social safety network far less generous, than in most other industrial nations. In 1997, manufacturing production workers on average received $18.24 an hour in the United States, $19.37 in Japan, $20.24 in the European Union, and $28.28 in Germany.[15]

Table 9–1. Unemployment Rates by Region and Selected Countries, 1987 and 1997

Region or Country[1]	1987	1997
	(percent)	
Europe	10.4	10.5
Japan	2.8	3.4
United States	6.2	4.9
Latin America and Caribbean	5.7[2]	7.4
China	2.0	3.0[3]
India	3.4	2.3[4]
Other Asian countries	4.3[2]	4.2[3]
Central and Eastern Europe	7.2[4]	9.6[3]

[1]No comprehensive data for Africa are available. [2]1990. [3]1996. [4]1993.

SOURCE: International Labour Organization, *World Employment Report 1998–99* (Geneva, 1998).

Employment concerns are also high on the agenda in other parts of the world, as countries attempt to navigate the treacherous terrains of economic transition and developmental catching-up. Since the end of the cold war, most states in Eastern Europe and the former Soviet Union have seen a rapid rise in unemployment, from near zero to close to 10 percent. Joblessness has been accompanied by lower real wages and dramatic increases in income inequality. In Russia, where the economy has severely contracted, real wages plummeted by 58 percent between 1989 and 1996, and people often receive their wages months behind schedule.[16]

The East Asian economic crisis that broke out in 1997 has added at least 10 million people to the world's unemployment rolls and thrown substantial portions of the population there into renewed poverty, as unemployment benefits and other protective measures are sparse. Several other Asian countries—Cambodia, China, Laos, Mongolia, and Viet Nam—face serious labor market problems resulting from the excess labor in state and collective enterprises. In China, layoffs in 1998 alone affected 3.5 million workers, bringing the official unemployment rate to

5–6 percent. Perhaps as many as 30 million more workers are going to lose their jobs.[17]

In Latin America, the International Labour Organization (ILO) projected unemployment in the formal sector to rise from about 6 percent in the early 1990s to 9.5 percent in 1999, despite an upturn in the region's macroeconomic performance. Real wages have stagnated and minimum wages have, on average, fallen 27 percent since 1980.[18]

Since job creation in the formal sector is limited in many developing countries, much employment takes place in the informal sector. According to the ILO, this accounted for more than 60 percent of sub-Saharan Africa's urban work force in 1990 and 58 percent of Latin America's. The informal sector is an amalgam of economic activities, including family enterprises, that are not captured by traditional categories. It generates demand for semiskilled and unskilled labor, is more likely to adopt appropriate technologies and local resources, plays an important role in recycling and reusing waste materials, and provides a major source of income for women. But working conditions are frequently poor, social security is mostly nonexistent, and wages are often very low, typically below the official minimum wage.[19]

One of the most unsettling aspects of the jobs crisis is large-scale youth unemployment, which virtually everywhere is substantially higher than for the labor force as a whole. The ILO estimates that there are about 60 million people worldwide between the ages of 15 and 24 who are in search of work but cannot find it. In developing countries, high rates of population growth translate into massive pressure on job markets. In China, 26 percent of the population is 15 or younger; in the rest of Asia, the figure is 35 percent; in Latin America, 33 percent; and in Africa, 43 percent.[20]

Although developing countries clearly face a growing jobs challenge, labor market data are relatively scarce; scarcer still are studies addressing the employment-environment linkage in the developing world. This chapter focuses on industrial countries. But developing countries must inevitably grapple with similar issues. If anything, they face a challenge of even greater magnitude. They need to find work for growing numbers of young people entering the job market, agriculture is still the most common occupation, and large-scale rural-urban migration is placing increasing burdens on urban job markets. Hence there is an urgent need for sustainable agricultural and rural industry jobs in order to lessen the pressure. The challenge for developing countries is to not follow the siren song of unsustainable development—pollute first, clean up later—but to exploit opportunities to leapfrog to sustainable technologies and to develop labor-intensive industries.

Boosting Resource Productivity

Ever since the beginnings of the Industrial Revolution, businesses have sought to economize on their use of labor, whereas land and natural resources were seen as boundless and cheap. While companies have emphasized raising labor productivity—using fewer workers for each car, refrigerator, or computer, they have largely neglected the issues of energy and materials productivity—using less oil, electricity, aluminum, and copper for each unit of output.

This may once have made perfect sense, when skilled labor was indeed scarce and when substituting machines for humans promised rapid economic progress. But

today, given the environmental crisis and the growing abundance of human labor, particularly in developing countries, it is time to reevaluate these priorities. Not only is nature scarce today, there is no substitute for it once it is depleted: no matter what technologies human ingenuity dreams up, pure air and water, intact forests and fisheries, and a stable global climate are irreplaceable.

As labor productivity grows, output and consumption must grow at least as fast in order to maintain steady employment levels, and faster if the number of jobs is to expand. But as long as economic growth is predicated on burning large quantities of fossil fuels, using copious amounts of materials, and generating huge waste flows, this is a formula for growing environmental degradation. A sustainable economy must break the work-consumption-environmental degradation connection.

Capital, energy, and materials are steadily replacing labor. Although this section relies primarily on U.S. data for illustration purposes, the same holds true for other industrial countries and for newly industrializing nations as well. Total output by the U.S. manufacturing sector rose by about 440 percent between 1950 and 1996. Labor inputs (measured by the total number of hours worked) increased by about 40 percent between 1950 and 1969, then remained stagnant for a decade before beginning to decline slightly. By contrast, inputs of capital—that is, buildings and equipment—jumped by 525 percent during these 47 years, energy inputs rose by 369 percent, and materials inputs by 335 percent.[21]

As a result, the productivities of these individual inputs—the output of manufactured items for each unit of input—diverged dramatically. Labor productivity more than tripled. In the auto industry, for instance, this means that where a worker was once able to produce one car in a given stretch of time, one individual can now produce three cars in the same period. By contrast, capital productivity has declined almost throughout the entire postwar period, so that it takes a growing investment in buildings and equipment to produce a dollar's worth of manufactured goods. Until rising oil prices in the 1970s forced the development of more-efficient motors, lighting, and production processes, energy productivity also declined: growing amounts of oil, gas, coal, and electricity were needed to produce a dollar's worth of output. By the mid-1990s energy productivity was only marginally higher than in 1950. Materials productivity rose until the early 1970s, but then lost some ground. (See Figure 9–1.)[22]

Energy and materials productivities could be boosted substantially, since more resource-saving technologies are already available, even better ones are on the drawing boards, and opportunities for redesigning whole systems as opposed to individual

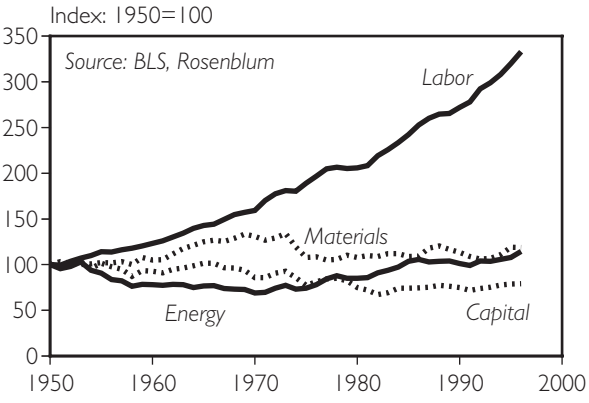

Figure 9–1. Selected Factor Productivities in U.S. Manufacturing, 1950–96

products remain largely unexplored. For instance, eco-business pioneer Paul Hawken and Amory and Hunter Lovins of the Rocky Mountain Institute argue that just using existing technologies (including advanced polymer composites, better aerodynamic design, and fuel cells) can reduce new-car fuel consumption by as much as 85 percent, and slash materials use in car manufacturing up to 90 percent (by weight). What this means is that manufacturing industries now use far more energy and materials, and cause greater environmental damage, than need be.[23]

Just a handful of industries are responsible today for the bulk of environmentally damaging activities while at the same time providing only limited (though often well-paid) employment. Four U.S. manufacturing industries—primary metals, paper, oil refining, and chemicals—accounted for 21 percent of manufacturing value-added in the mid-1990s. They absorbed 78 percent of primary energy use in all U.S. manufacturing and were responsible for 64 percent of the amount of toxics released from manufacturing operations, but represented only 12 percent of all jobs and about 14 percent of total hours worked and payroll. (See Table 9–2.) Outside the manufacturing sector, mining and utilities share these attributes: few jobs but substantial environmental impact. Thus, change in the environmentally most damaging sectors of the economy will affect only limited numbers of workers.[24]

Growing labor productivity explains why manufacturing employment in industrial countries has either stayed flat or even declined, although output almost doubled. In fact, relative to output, manufacturing employment has declined almost sevenfold since 1960 in Japan, 4.5-fold in France, and threefold in Germany and Britain.[25]

Employment is increasingly shifting into the "service" sector. (See Table 9–3.) Overall, services employment has roughly doubled in western industrial countries, and almost quadrupled in the United States since 1950. (See Figure 9–2.) For every manufacturing job, there are now almost five service jobs in the United States; three to four in Japan, France, and the United Kingdom; and more than two in Germany.[26]

Both in employment and environment terms, however, the shift toward services is an ambiguous development. The term "services" encompasses vastly disparate

Table 9–2. Value-Added, Employment, Energy Use, and Toxics Releases, Selected U.S. Manufacturing Industries, Mid-1990s

Industry	Value-Added	Number of Jobs	Hours Worked	Payroll	Energy Use	Toxics Released
	(percent within all manufacturing industries)					
Paper	4	3	4	4	12	11
Chemicals	11	4	4	6	25	36
Oil Refining	2	1	1	1	29	3
Primary Metals	4	4	5	4	11	15
Total	21	12	14	14	78	64

SOURCE: Worldwatch calculation, based on sources cited in endnote 24.

Table 9–3. Total Labor Force, Industrial and Developing Countries, by Economic Sector, 1960 and 1990

Sector	Agriculture		Industry		Services	
	1960	1990	1960	1990	1960	1990
	(percent)					
Industrial Countries	26	10	35	33	38	57
Developing Countries	76	61	9	16	15	23
World	61	49	17	20	22	31

Note: Categories may not add up to 100 percent due to rounding.
SOURCE: U.N. Development Programme, *Human Development Report 1996* (New York: Oxford University Press, 1996).

activities, including wholesaling and retailing, hotels and restaurants, health care, banking and finance, utilities, communications, and transportation. These sectors include some highly skilled and extremely well-paying jobs, but also many unskilled, low-paying ones. In the United States, a considerable share of job growth is taking place in the retail sector; that part of the economy, however, is increasingly characterized by low wages and insecure employment. In mid-1999, the average hourly wage in retail was a mere $9.02, compared with $12.61 in all services and $13.94 in manufacturing.[27]

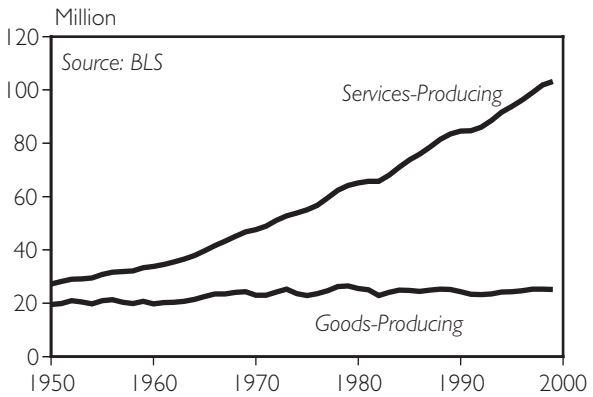

Figure 9–2. U.S. Goods and Services-Related Jobs, 1950–99

Service jobs are also by no means immune to the turbulence of change that has taken hold in mining and manufacturing. A study by the University of Würzburg concluded that computerization and information technologies in Germany may eventually do away with 61 percent of jobs in banking, 51 percent in wholesale and retail, and 74 percent in transportation and logistics.[28]

Most service establishments are directly responsible for very little pollution and environmental degradation. But many are inextricably linked to oil drilling, strip mining, forest clearcutting, paper pulping, and aluminum smelting—either by coordinating, facilitating, and financing resource extraction and processing, or by providing transport and distribution (that is, wholesale and retail) services. In essence, they are a part of the high-throughput economy. The challenge will be to generate service jobs that facilitate a shift away from our current resource-intensive forms of production and consumption—for instance, selling heating and cooling

services instead of fossil fuels, or transportation services instead of motor vehicles.[29]

Environment Policy: Job Killer or Creator?

Business leaders have long argued that environmental regulations would render them uncompetitive, forced to close plants, and compelled to delay or cancel new projects. The upshot: lost jobs. The "job killer" argument has lost some of its potency, however, for three reasons. First, many dire predictions have failed to come to pass: job loss due to environmental regulations has been extremely limited. Second, it has become clear that environmental regulations can have "technology-forcing" effects that actually give companies a competitive edge. And third, environmental regulations have spawned a sizable and rapidly growing industry (mostly focused on pollution control) that employs perhaps 11 million people worldwide.[30]

Still, as limited pollution control slowly gives way to farther-reaching pollution prevention measures and cutting-edge "clean production," and as the threat of climate change increasingly points to the need for a substantial restructuring of the energy economy, the belief in an economy-versus-environment tradeoff finds new adherents and is eagerly stoked by businesses opposed to change. But what are the impacts of environmental policy? Before looking at any specific cases, it is useful to undertake a brief conceptual assessment.

Like any other economic activity, investment in renewable energy sources, energy efficiency, railroads and public transit, less-polluting industrial production equipment, and other environment-friendly activities generates a certain number of jobs directly, plus indirect jobs in supplier industries. The crucial question is, Do these investments support more or fewer jobs for each dollar laid out than expenditures in more polluting and waste-generating industries? Countless studies suggest strongly that less damaging ways of producing, transporting, consuming, and disposing of goods tend to be more labor-intensive than the more damaging ways.[31]

Beyond specific comparisons of direct employment potential lies the larger issue of how well and efficiently an economy carries out its activities. For example, if energy services such as heating and cooling buildings, generating electricity, or powering motor vehicles can be provided more cheaply through boosted efficiency or other measures, then the money saved by businesses and households—the avoided costs—can be "re-spent" elsewhere in the economy. To the extent that this re-spending benefits segments of the economy that are more labor-intensive than the energy sector, it generates additional employment. (And because most countries import the bulk of their energy consumption, this re-spending would in effect substitute imported energy inputs with more local, decentralized labor—although oil-exporting countries would suffer accordingly.) Similar re-spending effects may also occur in other parts of the economy, as we restructure transportation, waste management, and other sectors.

When prices do not tell the truth, however, it is difficult in a market economy to realize opportunities for avoided costs and for redirecting investments and expenditures to sectors that will provide greater environmental and employment benefits. Phasing out subsidies that favor fossil fuel industries and other polluters and introducing environmental taxes will help to move toward full-cost accounting and to unveil

re-spending opportunities.[32]

Energy again serves as a useful example. Presumably, the move toward greater efficiency will be brought about in part by higher energy taxes. Some of these tax revenues may go to financing the equipment and infrastructure for a more sustainable economy—creating jobs in energy efficiency technologies and public transit systems, for instance. Governments may decide to return the remainder to taxpayers, and that money would then be re-spent across the entire economy, replicating existing patterns of demand for goods and services—and creating more jobs than would have been supported in the fossil fuel industry. Alternatively, however, these funds could be used to reduce labor costs. Studies suggest that lowering employers' contributions to national health or social security funds can be a powerful stimulant for job creation, as discussed later in the chapter.

Although the losers are likely to be far outnumbered by the winners, some workers will be hurt in the economic restructuring toward sustainability—primarily those in mining, fossil fuels, and smokestack industries. At least some and perhaps many of the displaced individuals will not have the requisite skills for the new jobs without retraining, or the new jobs may primarily arise in other locations. Regions and countries that depend heavily on extractive and polluting industries will confront a substantial challenge to diversify their economies.

The process of industry restructuring is inherently painful. Because a job provides not only economic security but often also identity and meaning, job loss—even if temporary—can be a traumatic experience. For affected individuals and families, it is little consolation that environment-related job loss is likely to be insignificantly small in comparison with job loss due to "normal" change in a market economy. Public policy must facilitate the transition to a sustainable economy by assisting individuals and communities; this may involve retraining and skill-enhancing programs and special regional development programs.

But most important, policy changes designed to make the economy more sustainable need to have a clear time horizon so that companies, communities, and individual employees know what they are up against. At the same time, however, the longer that necessary changes are postponed, the greater the urgency later on to move speedily—and the more damaging the social and economic impacts. Resistance to policies to avert climate change and to rein in other forms of environmental degradation will turn out to be a far greater job killer than embracing such policies in strategic fashion.

Restructuring Energy, Creating Jobs

Reducing fossil fuel use is one of the most central goals in moving toward a sustainable economy. The combustion of these fuels on a massive scale causes serious air pollution problems and is responsible for global climate change. Businesses opposed to serious efforts to avert this have sought to attract labor union support by arguing that an alternative energy policy would be a job killer. The AFL-CIO Executive Council, for example, issued a statement in February 1999 reaffirming its opposition to the Kyoto Protocol, arguing that it "could have a devastating impact on the U.S. economy and American workers." But even in the absence of an alternative energy policy, the number of jobs in many of these industries is already declining, often even as output continues to rise. Avoiding or postponing

an environmentally responsible policy will do nothing to save these jobs; instead, it may even hasten their demise.[33]

Coal mining is a case in point, although similar stories could be told about oil refining, utilities, and energy-intensive industries like primary metals and steel. The coal industry is increasingly characterized by bigger and fewer companies, larger equipment, and less and less need for labor. Worldwide, it is estimated that only about 10 million jobs remain, accounting for just one third of 1 percent of the global work force. In the United States, coal production increased 35 percent between 1980 and 1998, but coal mining employment declined 63 percent, from 242,000 to 90,000 workers. (See Figure 9–3.)[34]

In Europe, jobs in this field have dropped even more, since production is falling substantially. In Germany, productivity gains and rising coal imports may cut employment from 265,000 in 1991 to less than 80,000 by 2020. British coal production has fallen to less than half its 1980 level, and employment fell from 224,000 to just 10,000 miners. China—the world's largest coal producer—has cut some 870,000 jobs in the past five years and will lay off another 400,000 workers in a bid to cut subsidies and to reduce output by about one fifth to bring it more in line with demand.[35]

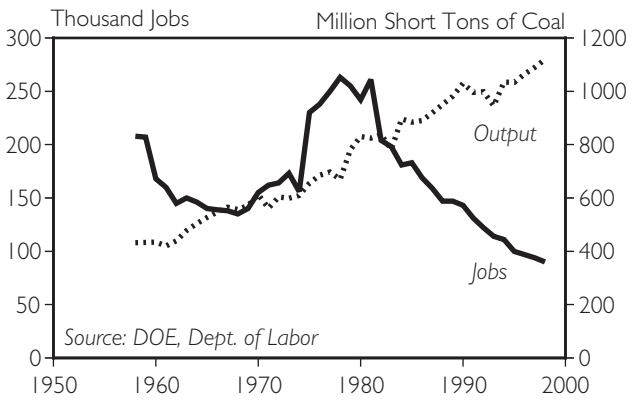

Figure 9–3. U.S. Coal Mining, Output and Jobs, 1958–98

While coal and other polluting industries are offering declining job opportunities, renewable energy and energy efficiency are beginning to make their mark. The European Wind Energy Association projects that up to 40 gigawatts of wind power capacity could be installed in Europe by 2010, creating between 190,000 and 320,000 jobs. Although no global job figure is available, some rough estimates can be made. The Danish wind turbine industry provided about 16,000 jobs (including 4,000 in installation) in 1995. Because Danish wind turbine manufacturers supply about half of the generating capacity in the world, the European Commission estimated worldwide employment in the wind power industry at 30,000–35,000 direct jobs in the mid-1990s.[36]

European wind energy companies accounted for about 90 percent of worldwide sales in 1997, and presumably will continue to garner the majority of jobs in the near future. But India, China, and other developing countries have considerable wind energy potential and could generate substantial employment by building a strong indigenous base. India already has 14 domestic turbine manufacturers.[37]

The European Commission notes that, as a rough rule of thumb, 1 megawatt of wind power generating capacity installed creates jobs for 15–19 people under present European market conditions and perhaps

double that in countries with higher labor intensity. Since this includes manufacturing, sales, installation, operations, and maintenance, it encompasses both permanent and temporary jobs. Applying this formula, there may have been 92,000–117,000 direct and indirect jobs worldwide in the mid-1990s; if installed capacity roughly doubles by 2001, as the European Commission projects, this could rise to 170,000– 216,000 jobs.[38]

A variety of studies confirm that wind power compares favorably in its job-creating capacity with coal- and nuclear-generated electricity. Wind power generation is mostly decentralized and small-scale, and the manufacturing of rotor blades and other components requires skilled labor input to ensure quality. Still, as the size of wind turbines and economies of scale increase, helping to make wind power a cheaper source of energy, the number of jobs per dollar invested will decrease somewhat in coming years.[39]

Like wind power, solar energy use, particularly in the form of photovoltaics (PV), is growing rapidly. U.S. solar industries directly employ nearly 20,000 people now and support more than 150,000 indirect jobs in diverse areas such as glass and steel manufacturing, electrical and plumbing contracting, architecture and system design, and battery and electrical equipment. The Solar Energy Industries Association (SEIA) claims that 3,800 jobs are created for every $100 million in PV cell sales, translating into 12,160 PV jobs in the United States in 1995. PV jobs in Europe are still very limited in number, but the European Photovoltaic Industry Association projects that the production, installation, and maintenance of PVs could directly employ up to 294,000 people there by 2010.[40]

Meanwhile, the European Solar Industry Federation, a group of about 300 solar thermal companies, employed more than 10,000 people in 1997 in designing, manufacturing, marketing, installing, and maintaining systems. Just under current market growth trends, the federation projects the creation of 70,000 additional jobs in the next 10 years, and a far larger number, perhaps up to 250,000, if strong governmental support for solar energy materializes.[41]

As a group, renewables have the potential to become a significant source of jobs. The U.S. industry association, SEIA, asserts that more than 350,000 net jobs will be added by 2010—a number equal to the employment provided by the largest U.S. car manufacturer. In a 1997 report, the European Commission lays out the objective of doubling the current share of renewable energy sources from 6 to 12 percent by 2010. Taking job losses in fossil fuel energy sectors into account, a half-million net additional jobs could be created in the renewable energy sector and in supplier industries, and another 350,000 jobs through exports of renewables.[42]

Like renewables, energy efficiency has considerable job potential awaiting mobilization. The American Council for an Energy-Efficient Economy (ACEEE) has assessed the impact of a "high-efficiency scenario," assuming cost-effective improvements throughout the U.S. economy. These run the gamut from better-insulated windows to more-efficient lighting to highly fuel-efficient cars. Average annual investments of $46 billion during 1992–2010 yield a 20-percent reduction in energy consumption below a business-as-usual scenario and a 24-percent reduction in carbon emissions. The study estimates that almost 1.1 million net jobs could be created by 2010. Just 10 percent of these are direct

Table 9–4. Job Impact Findings, Selected Studies on Climate Policy

Country	Policy Change	Years	Carbon Reduction (million tons)	Employoment Gain (net number of jobs)
Austria	Cogeneration, energy efficiency, renewables, alternative transportation	1997–2005	70	+ 12,200
Austria	Biomass, higher taxes on fossil fuels	1997–2005	20	+ 30,000
Denmark	Greater natural gas use, district heating, cogeneration, energy efficiency, renewables; total energy consumption stable	1996–2015	82	+ 16,000
Germany	Boosting efficiency, phasing out nuclear power, less oil and coal use, renewables to account for 10 percent of primary energy use, alternative transportation policies	1990–2020	518	+ 208,000
Netherlands	Efficiency gains in transport, industry, electric equipment, buildings; greater use of wind power	1995–2005	440	+ 71,000
United Kingdom	Accelerated uptake of cogeneration, efficiency, and renewables technologies	1990–2010	206	+ 537,000
European Union	Installation of high-performance double-pane windows in 60 percent of dwellings	10-year period	940	+ 126,000
United States	Improved efficiency in transportation, industry, power generation, buildings	1990–2010	188	+ 870,000

SOURCE: Worldwatch Institute, based on sources cited in endnote 44.

jobs in efficiency and in supplier industries; the rest are jobs created as consumers and businesses re-spend the money they save through avoided fuel costs on other goods and services that are more labor-intensive than the fossil fuel industry.[43]

Since the ACEEE study was published in 1992, other assessments have been undertaken in different industrial countries, spurred by the Kyoto Protocol on climate change and the growing urgency to deal with this issue. (See Table 9–4.) Although they rely on different methodologies, assumptions, and econometric models, making them difficult to compare directly with each other, these studies support the overall conclusion that pursuing energy alternatives will generate more jobs than the fossil fuel industries can.[44]

While this discussion has been focused on industrial countries, there are implications for developing countries as well. Given the substantial potential for wind and solar in developing countries, these energy

sources could become important job creators. But there, too, a key employment benefit of moving away from energy-intensive, fossil-fuel-focused patterns of development lies in spending less of a society's financial resources on oil, coal, and natural gas (much of which must be imported) and more on labor-intensive sectors of the economy—the so-called re-spending effect. Seeking out investment and consumption choices that promise greater job creation than the traditional energy industries is of particular interest in countries that have surging numbers of job seekers and scarce economic resources.

Durability and Remanufacturing

Energy and materials productivity can be boosted by moving the economy away from the throwaway treadmill that churns out mass-produced items designed to fall apart easily or be rendered passé by fashion cycles. Durability, repairability, and "upgradability" are key to achieving sustainability.

In today's industrial economies, many products, even some that are nominally durable, have become "commodified": large quantities can be manufactured with such ease and at such relatively little monetary cost that there is considerable incentive to regard them as throwaways rather than to produce them for true durability. If durability is not a top consideration, then human dexterity, skill, and workmanship are also likely to be given low priority by management, and labor input will be regarded more as a cost factor than a way to ensure quality.[45]

Many of today's consumer products are made in such a way as to discourage repair and replacement of parts, and sometimes even to render it impossible. And even when repair is possible, the cost is often too high relative to a new item. If repair and maintenance are not "worth the trouble," then jobs in such occupations are condemned to all but vanish. Although consumers have an obvious interest in cheap products, the price must be sufficiently high to justify ongoing maintenance, repair, or upgrading, and hence to make jobs in these occupations viable. In any event, a durable product with a higher up-front cost of purchase may well turn out, over time, to be economically more advantageous to consumers than individually cheaper, planned-obsolescence products that must be replaced frequently. If a $100 wristwatch lasts a lifetime, it represents a lower expenditure than a series of $10 or $20 watches that fall apart relatively quickly.

Products can no doubt be made to last longer, and their useful life can be stretched by making it easy to maintain and repair them. Interface, a carpet manufacturer, has developed a new material called solenium. This lasts four times as long as traditional carpets but uses 40 percent less material, reducing materials intensity by 86 percent. In addition, the material can be completely remanufactured—all the material in used floor covering can go into producing a new carpet. The company has boosted its employment by 73 percent between 1993 and 1998.[46]

For products subject to high wear and tear, such as carpets, remanufacturing is crucial; they should be easy to take apart so as much of the components can be reused as possible. For "non-consumable" goods like cars, refrigerators, washing machines, or computers, on the other hand, it is important that products be designed for easy refurbishing and upgrading, so that

durability does not translate into technological obsolescence. This calls in particular for a "modular" approach that permits an easy replacement of parts and components. Computers serve as an example here: standardized slots commonly accept components such as modems, sound cards, or memory chips virtually irrespective of which company made them.

An economy that embraces durability will require a transportation system different in its structure and mix of modes. Instead of today's "making-using-disposing" system, with its one-way flow of raw materials, products, and waste, it would instead be a "making-unmaking-remaking" system—able to collect and take back products that need to be repaired or upgraded and then redistributed to consumers, as well as those disassembled for remanufacturing or for salvaging of parts and materials. Such a system would probably be focused less on long-distance supplies and deliveries and more on interchanges within local and regional economies.[47]

What are the job implications? When goods do not wear out rapidly, they need not be replaced as frequently. An obvious implication is that fewer goods will be produced. Would this mean that fewer employees are needed—compounding the unemployment challenge? Not necessarily. Producing longer-lasting, higher-quality products, using more robust materials, and processing and assembling them into final products with greater care than might suffice for "disposable" products implies a more craft-oriented, smaller-batch production process than the current mass-manufacturing practices; it takes more labor, and particularly more skilled labor. Plus, there will be greater opportunity and incentive to maintain, repair, upgrade, and remanufacture products, and thus associated job potential throughout the life of a product. In the United States, remanufacturing is already a $53-billion-a-year business, employing some 480,000 people directly. Since products and production processes will need to undergo extensive redesign for durability and easy upgrading and disassembly, there is additional job creation stimulus in design, engineering, architecture, and other fields.[48]

In the United States, remanufacturing is already employing some 480,000 people directly.

Today's retail jobs depend on large-scale purchases of "stuff"—in principle, anything that sells, no matter what the quality and durability. Discount retailers in particular have led the trend toward a part-time, low-paid sales force; in such a quantity-focused environment, fewer consumer purchases translate into fewer retail jobs. In a sustainable economy, there is a need to move toward "quality retail," in which the salesperson knows how to sell intelligent use rather than mere ownership: advising consumers on the quality and upkeep of products; counseling them on how to extend usefulness with the least amount of energy and materials use; explaining the advantages of leasing versus ownership. Because such a system would not be geared to increasing throughput—focusing merely on getting products out of the showroom or off the store shelf—but instead to ensuring consumer utility and satisfaction, it entails higher-skill jobs.[49]

Truly durable products are likely to be more expensive than throwaways. For some items, the upfront cost could be steep, and this calls for the development of innovative financing plans. Where consumer credit is

now geared to maintaining the hyper-throughput economy, allowing people to carry high personal debts and to rebound from insolvency in order to keep consuming, finance in a durable product economy will need to devise ways to make possible—and to reward—the purchase of long-life products. This may involve longer repayment periods, for instance.

A fuller evaluation of the employment implications of a shift toward durability would require detailed assessments of the specific changes, and how they translate into job losses and opportunities for new employment. Table 9–5 provides a rough conceptual exploration. Generally, however, it seems clear that a durability strategy would accelerate the shift in employment from resource extraction and primary industries to the provision of services.

Shifting Taxes

Ecological tax reform is key to addressing both the challenge of adequate job creation and environmental protection. Depending on their design and scope, eco-taxes—such as landfill fees, taxes on nonrenewable energy, and emissions charges—promise several benefits. They can help reinforce the "polluter pays" principle, provide incentives for

Table 9–5. Likely Employment Effects of Durable, Repairable, and Upgradable Products

Product Life-Cycle Phase	Observation	Employment Effect
Design and Engineering	• Intense redesign of products (and production processes) required	Positive
Energy and Materials Inputs	• Fewer products; therefore fewer inputs needed, though more robust materials required	Negative
Manufacturing/Assembly	• Fewer products • Production more attentive to durability, and so on	Negative?
Distribution/Transport	• Fewer products • More (local) circulation from users to repair shops, remanufacturing, and so on, and back	Mixed
Maintenance	• Revitalizing neglected functions; labor-intensive	Positive
Re-Manufacturing	• Currently limited	Positive
Upgrading	• Currently limited; labor-intensive	Positive
Consulting	• Advice on product-life extension and substituting services for goods	Positive
Disposal at End of Life-Cycle	• Fewer products to be disposed of • Greater recycling, plus disassembly of parts and components for reuse; more labor-intensive than landfilling and incineration	Positive

SOURCE: Worldwatch Institute.

boosting energy and materials efficiency, help trigger technological innovation, and raise revenues to fund environmentally benign alternatives.

In the context of the environment-employment nexus, however, another aspect is key: using eco-tax revenues to reduce the payroll taxes that fund social security programs. In effect, some of the tax burden now falling on labor would thus be shifted, and levied instead on resource use and pollution. This shift is based on the recognition that current tax systems are severely out of balance; they make energy and natural resources far too cheap (inviting inefficiency and waste), but render labor too expensive (discouraging new hiring). The predictable result is an overuse of natural resources and underuse of human labor.[50]

In western industrial countries, payroll taxes and mandatory social security contributions accounted on average for 25 percent of all tax revenues in 1995, up from 18 percent in 1965. Energy taxes and nonenergy environmental taxes, in contrast, account for only about 7.5 percent, and taxes on capital have decreased in most countries. Given this situation, it is little wonder that companies have put far greater emphasis on boosting labor productivity than on enhancing capital, energy, and materials productivity—with the result that unemployment and environmental degradation are both higher than they would otherwise be. The potential impact of a tax shift is likely to be greatest in countries where labor taxation is particularly high, as it is in most of Europe. The United States, by contrast, has less leeway to decrease the tax burden on labor, but it has greater opportunities to effect a tax shift by raising its extremely low taxes on resource use.[51]

During the 1990s, a growing number of studies, principally in Europe, modeled the economic and employment impacts of ecological tax reform. Although the underlying assumptions about the nature and size of eco-taxes, as well as the precise ways in which the tax revenue would be used, vary widely, the key conclusion was that a tax shift is clearly good news for job creation. For instance, an array of U.K. energy and environment taxes to shift 6 percent of the tax burden from labor to environmentally damaging operations could generate some 717,000 additional jobs during 1997–2005. An influential German study undertaken in 1994 modeled the impact of a tax on all nonrenewable sources of energy and on electricity that would be imposed and increased by 7 percent annually over 15 years. Energy consumption and carbon emissions would decline by 21 percent, and some 600,000 new jobs be created.[52]

Discussed theoretically since the late 1970s, eco-tax shifting started to become a reality in the 1990s, as Denmark, Finland, Germany, the Netherlands, Norway, Sweden, and the United Kingdom linked a variety of such taxes to reductions in income taxes or social security contributions. The tax shifts have amounted to anywhere from 0.2 percent to 2.5 percent of these countries' total tax revenues.[53]

In the countries that have initiated a tax shift, eco-taxes are still quite modest, and energy-intensive industries are partially exempted from the eco-tax (either by paying a reduced rate or by receiving reimbursements). In the German case, all manufacturing firms are assessed at only 20 percent of the full tax rate, and coal and jet fuels are not taxed at all. This is because governments are reluctant to be seen as weakening energy-intensive industries' ability to compete internationally. But unless this preferential treatment is phased out over time, and national policies harmonized

so that competitive fears are eased, the incentive to cut energy use and carbon emissions will be diminished considerably. Less progress toward energy efficiency also means that money continues to be bound up in the energy sector that could, if invested elsewhere, create more jobs.[54]

Rethinking Work

Ecological tax reform can help shift economic priorities from increasing labor productivity to boosting energy and materials productivity, and hence is an important component of any policy aimed at ensuring that economic progress is not synonymous with job destruction and heavy environmental damage.

But there is a danger that gains in energy and materials efficiency and in other environmentally beneficial measures may simply be offset and perhaps even overwhelmed by the rising tide of consumption. To illustrate, fuel savings through more efficient car engines and other improvements in automotive technology since the early 1970s have largely been erased by the trend toward larger vehicles and the continuing growth in the amount of driving.

In this context, a key question arises: should we channel future gains in productivity principally toward wage increases and hence growing consumption, or toward reduced work time? To date, the fruits of technological progress (in the form of boosted productivity) have primarily been translated into material rewards—an unprecedented quantity and variety of consumer goods affordable for greater numbers of people than ever before in human history. Only to a limited extent has greater productivity been translated into reduced working hours and more time spent pursuing hobbies, caring for family members or friends, or doing volunteer work. Indeed, for all the mighty leaps in productivity, full-time employment still seems like an essential condition: For some, the ability to acquire a steady stream of material possessions seems to promise status, and perhaps even a fleeting happiness. But clearly others have to work full-time to make ends meet and pay the bills.[55]

The question then is not only, How can work and leisure be shaped without wrecking the planet in the process? But how can existing work be shared more equitably so that society is not condemned to polarization between the overworked and the underemployed, the haves and have-nots, the highly stressed and the alienated? The challenge is to develop a new understanding of work in modern societies, one that would help to break the work-consumption-environmental degradation dynamic.

Determining the "appropriate" length of the workday and week is an issue as old as the industrial system, and the answers have fluctuated with shifting economic structures and with the changing balance of power among employers, workers, and the state. At the last turn of the century, it was not unusual for a worker's total life-time work to tally some 100,000 hours, or well over 60 hours per week. By the 1950s, the figure had dropped by roughly one third; additional reductions have taken place since in most industrial countries, though the pace has slowed markedly during the last two decades. (See Table 9–6.)[56]

Persistent unemployment in Europe has reinvigorated the debate there over work time reductions. A variety of measures can be taken. These range from taking steps to chisel away at the hours spent in factories and offices, to providing for earlier retirement, lengthening vacations, and permit-

ting sabbaticals or unpaid leave. In France, a mandatory 35-hour week is now being phased in. Germany has so far relied on collective bargaining agreements, such as one concluded at a Volkswagen auto plant in Wolfsburg. In 1993, the company and the labor union agreed to reduce weekly working hours to an average of 28.8, to introduce much greater work time flexibility, and to guarantee job security during the transition to shorter working hours. Denmark offers employees the option of vacating their job for up to one year to pursue adult education or to care for a child; during leave, the government pays them the equivalent of 100 percent or 60 percent (for child care) of the compensation an unemployed person would receive.[57]

The growth of part-time jobs in industrial nations can, in principle, be part of the answer, too. In Denmark, Sweden, and the United Kingdom, roughly one quarter of all employment is part-time; in Germany, one fifth. In the Netherlands, it has climbed to more than 38 percent. Growing numbers of people want to work part-time. Almost one third of German full-time employees have expressed a desire to work fewer hours. And in a 1996 U.S. poll, 45 percent of respondents said they would trade a day's pay for a day off.[58]

Table 9–6. Average Workweek for Manufacturing Employees, Selected Industrial Countries, 1950–98

Country	1950	1980	1998
		(hours)	
Germany[1]	45	33	30
Sweden	38	28	32
France	39	34	32
Italy	38	34	35
United Kingdom	41	35	36
Japan	46[2]	41	37
United States	38	36	38

[1]Western Germany only. [2]1955.
SOURCE: See endnote 56.

The problem today is that part-time work, and other flexible work arrangements, often involve low pay, few benefits, limited job security, and virtually no career opportunities. As part-time work becomes a major component of the labor market, governments may decide to adopt rules and regulations to make it a socially more acceptable work option.

In a 1996 U.S. poll, 45 percent of respondents said they would trade a day's pay for a day off.

Another approach is embodied in the idea of a guaranteed basic income. Fred Block, professor of sociology at the University of California, has put forward the idea that "all citizens, whether employed or not, would receive a monthly grant large enough to sustain a minimal standard of living, including housing, food, and other basic necessities. Such grants could substitute for the elaborate systems of welfare, unemployment insurance, and social security that exist in developed capitalist societies."[59]

Clearly, this is a controversial concept whose full implications need to be given considerable thought. But the idea entails benefits for employees as well as employers. A basic income scheme would allow individuals to pursue as much paid work as they desire to supplement their basic income. It would not force anyone to work less time than they wanted, but it would permit people to volunteer, rear children, care for family members, and pursue other, traditionally unpaid, forms of work with greater ease than today. But Block also argues that

greater opportunities would emerge for individuals to pursue additional education and training—rendering workplaces more dynamic because new ideas and skills would percolate and spread more readily. In a modern, "knowledge-based" economy that more and more emphasizes the importance of continuing education and a frequent upgrading of skills, this would be of benefit to most businesses.[60]

Creating opportunities for affected workers to learn new skills will be key.

It is true that such a system would in some ways be a disincentive to work. However, employers would primarily find it difficult to fill the more poorly paid, unsatisfying jobs. That would be all for the better, argues Block, because "employers would have a strong incentive either to automate those jobs out of existence or to make them more attractive—by raising pay levels, improving working conditions, raising the problem-solving component of the work."[61]

Creating the right conditions for a sustainable economy to emerge presents one set of challenges for governments. But policymakers will also need to be attentive to the transition costs, and work to avoid the kind of severe social disruptions that confronted the Luddites and their contemporaries some 200 years ago. From a human well-being perspective, it is not enough to say that, in the end, economic transitions often leave societies better off. "Environmental measures that do not recognize a worker's right to a fair chance in the new economy," writes Alan Durning, executive director of Northwest Environment Watch in Seattle, "are equally menacing to our future" as jobs that depend on despoiling nature.[62]

As in the days of the Luddites, it is Britain that offers an illustration of how not to proceed. In the mid-1980s, the British government restructured the coal industry, closing large numbers of mines and slashing coal subsidies—though motivated more by the intent to break the power of labor unions than the desire to avert climate change. While this policy did reduce carbon emissions, it also caused high unemployment and unleashed an array of associated social ills in coal mining regions, not least because the bitterly disputed policy was forced through in a short stretch of time.[63]

If individuals and communities have reasonable hope that the transition to a sustainable economy does not translate into social pain for them, they will be far less likely to oppose change. Creating opportunities for affected workers to learn new skills and providing assistance in their shift to new careers will be key. This may entail financial support to help pay tuition for vocational and other training programs, transition income support, and career counseling and placement services. The more that the economy moves from resource extraction and mass production to services and a "knowledge" economy, in which skill requirements change more frequently, the more do training and retraining become issues for the economy as a whole.

Important as they are, educational and skill-building programs by themselves are an inadequate response to the transition challenge. Measures to spur job creation and build a sustainable economic base are equally important. Because the transition challenge is especially pronounced in areas where logging, mining, and other heavily polluting industries play a disproportionate economic role, governments will need to design programs to assist regions with

unsustainable and declining industries. This means helping to diversify and broaden the economic base and to build infrastructures that can support such a shift.

Governments can also adopt measures that reward job creation by companies, and particularly well-paying jobs. Favorable tax treatment for job creation would be part of a broader re-calibration of fiscal tools to shift the emphasis from labor productivity to resource productivity—from promoting resource extraction to supporting new employment.

But most important, policies must be pursued proactively instead of as an afterthought. The earlier that transition strategies are formulated, the greater the likelihood of success. As indicated earlier, employment is already declining in industries like coal mining, oil refining, utilities, logging, and primary metals processing, even as output continues to grow. The time to act is now. Strengthening labor unions and building labor-environment coalitions would seem to be essential for policies to preserve jobs and the environment.

In the end, the jobs-and-environment nexus touches on basic questions of how society goes about generating wealth without destroying the environment, whether it translates economic prowess into more material rewards or more "leisure" time, and whether it can reduce the extremes of wealth and poverty, and of overemployment as well as underemployment. The implications of decoupling job creation from environmental destruction are in some ways no less revolutionary than the changes that confronted the Luddites nearly 200 years ago.

Notes

Chapter 9. Creating Jobs, Preserving the Environment

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3. Ibid.

4. Pace of job destruction and creation in Europe from European Commission (EC), *Living and Working in the Information Society: People First* (Brussels: Employment, Industrial Relations and Social Affairs, 1996).

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9. Joseph A. Schumpeter, *Capitalism, Socialism and Democracy* (New York: Harper & Brothers, 1943), as cited in Robert Kuttner, *Everything for Sale: The Virtues and Limits of Markets* (Chicago: University of Chicago Press, 1996).

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13. Bonß, op. cit. note 12; Martine Bulard, "What Price the 35-Hour Week?" *Le Monde Diplomatique*, September 1999, on-line English language version at <www.monde-diplomatique.fr/en/1999/09>; Jeremy Rifkin, *The End of Work* (New York: G.P. Putnam's Sons, 1995); Diana Bronson and Stéphanie Rousseau, "Working Paper on Globalization and Workers' Human Rights in the APEC Region," International Centre for Human Rights and Democratic Development, Expert Meeting on Globalization and Workers' Rights in the APEC Region, Kyoto, Japan, 12 November 1995.

14. International Monetary Fund (IMF), *World Economic Outlook* (Washington, DC: May 1999).

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22. Figure 9–1 based on BLS, op. cit. note 21, and on Rosenblum, op. cit. note 21.

23. Hawken, Lovins, and Lovins, op. cit. note 5.

24. Table 9–2 calculated from U.S. Department of Commerce, Census Bureau, *1996 Annual Survey of Manufactures. Statistics for Industry Groups and Industries* (Washington, DC: U.S. Government Printing Office (GPO),

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