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A labourer works at an electronic waste disposal in Yingtan. China.

2. Green Policies and Business Practices

Opportunity and Innovation

With growing awareness of the global environmental crisis, growing confirmation that climate change is a real and imminent challenge, rising oil prices, as well as concerns over energy supply security in many countries, more and more opportunities are emerging for expanding green business. The World Business Council for Sustainable Development (WBCSD) offers the following pragmatic reasons why business should consider investing in sustainable ecosystems:[26]

- Create new revenue streams by introducing innovative products and services.
- Reduce dependence on increasingly scarce raw materials or fragile services through the introduction of substitutes or the use of alternative abundant or renewable resources.
- Mitigate rising costs caused by scarcity of raw materials.
- Create new markets for certified, fair trade, organically grown or environmentally friendly products.
- Develop new businesses such as water-quality trading, wetland banking, mitigation credit trading, threatened species banking, or pollution prevention, capture, treatment, and reuse.
- Strengthen businesses' license to operate.

Corporate executives increasingly understand that they need to scrutinize their way of doing business. Beyond the factors listed above, forward-looking business leaders understand that public legitimacy, consumer trust, and the ability to comply with present and likely future regulations are critical.

While some companies have barely progressed past green sloganeering—or worse, "greenwashing"—a growing number have announced ambitious goals to reduce their carbon footprint or make their operations "carbon-neutral." Traditionally, many businesses have been loath to see new environmental requirements imposed, and indeed many continue to prefer voluntary measures over mandates. The auto industry continues to take this line. But there are also more encouraging examples. For instance, in 2007 European light-bulb makers, including Philips and Osram, decided to lobby governments to promote low-energy light bulbs over traditional incandescent bulbs.[27] The same year, Siemens, one of Germany's corporate giants, decided to devote half its research budget of $7.8 billion (€5.7 billion) to climate-protection programs.[28] Xerox and Canon have been pioneers in so-called "remanufacturing"—reconditioning and refurbishing equipment and other goods. In the industrial carpet business, Interface has for many years

championed more durable carpets based on materials that can be recycled and reused rather than thrown away.

The Growth in Green Markets

At present, the global market volume for environmental technologies—products and services—runs to about $1,370 billion (€1,000 billion), according to German-based Roland Berger Strategy Consultants, with a projected $2,740 billion (€2,200 billion) by 2020. The firm offers the following estimates for individual market segments:[29]

- Energy efficiency technologies (appliances, industrial processes, electrical motors, insulation, etc.): $617 billion (€450 billion) at present; $1,233 billion (€900 billion) by 2020
- Waste management/recycling: $41 billion (€30 billion); $63 billion (€46 billion) by 2020
- Water supply/sanitation/water efficiency: $253 billion (€185 billion); $658 billion (€480 billion) by 2020
- Sustainable transport (more-efficient engines, hybrids, fuel cells, alternative fuels, etc.): $247 billion (€180 billion); $493 billion (€360 billion) by 2020.

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Recycling oil drums. Yogyakarta, Indonesia.

Constructing a green, post-carbon world will undoubtedly entail a massive undertaking in areas like the electricity network and off-grid applications; mass transit and less-polluting cars, the building sector; and organic and sustainable agriculture. Currently, much of the world's infrastructure, industrial machinery, buildings, and transportation system is still highly inefficient and overly reliant on fossil fuels. Hence, there are unparalleled investment and employment opportunities in reorienting the world economy's products and services, and jobs, toward a greener future.

For instance, each year, an estimated $200–250 billion is invested in energy-related infrastructure to replace existing capital stock and meet ever-rising demand (and another $1.5 trillion is spent on energy consumption).[30] The choices made today—whether to invest predominantly in conventional energy or in alternatives—will be a major determinant of how the world fares in its efforts to address environmental degradation and climate change.[31] Each new coal-fired plant,

each poorly insulated new home or office building, each car factory that churns out gas-guzzlers commits the world to an unsustainable path and represents a missed opportunity.

Green employment is clearly on the rise. Roland Berger projects that employment in the environmental technology industry will surpass the number of jobs in the machine tool or automobile industries in Germany by 2020. The firm predicts that environmental technology will make up 16 percent of German industrial production by 2030, a fourfold increase over 2005. Green business is becoming an engine of German economic development.[32] In the United Kingdom, a 2004 government assessment estimated that around 400,000 people were working in environmental technology industries, up from 170,000 two years earlier. A study for the Regional Development Agencies, meanwhile, put the total at 690,000 jobs.[33]

Financial Flows in the Energy Sector

The United Nations Framework Convention on Climate Change (UNFCCC) notes that, "the additional estimated amount of investment and financial flows needed in 2030 to address climate change is large compared with the funding currently available under the Convention and its Kyoto Protocol, but small in relation to estimated global gross domestic product (GDP) (0.3–0.5 per cent) and global investment (1.1–1.7 per cent) in 2030."[34] At about 86 percent, the private sector controls the bulk of all international financial flows. Greening these flows—ensuring that a steadily growing portion supports, rather than undermines, sustainable development and green job creation—is critical.

In recent years, venture capital (VC) investment in the clean-tech sector has boomed—jumping 78 percent in North America in 2006, so that clean tech now accounts for 11 percent of all VC investments, trailing only the software and biotech sectors. In China, clean tech VC investments soared 147 percent just between 2005 and 2006, representing 19 percent of all VC investment in that country.[35] A 2004 report found that, as a general rule of thumb, every $100 million in venture capital investments can generate 2,700 direct jobs in North America.[36] By a rough calculation, clean-tech start-ups there might receive between $14 billion and $19 billion in venture financing between 2007 and 2010, and these investments could lead to the creation of between 400,000 and 500,000 jobs.[37] These trends are encouraging, but the importance of venture capital is not as pronounced in many other countries, where more conventional channels of financing predominate.

Assessing all global financial flows, it is clear that current investment priorities continue to point in the wrong direction. According to International Energy Agency estimates, in 2005, $138.5 billion was invested in fossil fuel supplies and petroleum refining, $107 billion went in support of fossil fuel power generation, and another $44 billion underwrote large hydropower projects and nuclear energy. In comparison, renewable sources of energy received $35.5 billion. (Also, $225.7 billion was invested in electricity transmission and distribution networks.) Energy-efficiency investments, at about $1.5 billion, were tiny. A worrisome aspect is that more than 90 percent of renewables and efficiency investments went to developed countries, although a handful of developing countries, China, India, and Brazil among them, are attracting rapidly rising funding flows.[38] Clearly, these

priorities need to undergo a major shift if sustainable development and green job creation are to be central features of coming decades around the world.

Market Forces and Regulation

Market forces and voluntary means alone will not be enough to translate green potential into reality as rapidly as is needed in light of climate change and other environmental urgencies. Regarding European developments, a March 2007 Reuters news article notes that, "While in some cases there is still a yawning gap between rhetoric and reality, European businesses are rapidly going green—albeit driven more by profits and regulations than a desire to do good."[39] Recent reports by prominent business consultants, governments, and the United Nations alike underline this point:

- McKinsey & Company does not mince words in stating that, "Without a forceful and coordinated set of actions, it is unlikely that even the most economically beneficial options would materialize at the magnitudes and costs estimated here."[40] Though made in a U.S. policy context, this observation is equally valid elsewhere. And in a report assessing global energy productivity developments, the McKinsey Global Institute cautions about market distortions, disincentives, and failures.[41]

- The Stern Report on the Economics of Climate Change finds that, "clean energy technologies face particularly strong barriers—which, combined with the urgency of the challenge, supports the case for governments to set a strong technology policy framework that drives action by the private sector." It goes on to say that, "without [government] support the market may never select those technologies that are further from the market but may nevertheless eventually prove cheapest."[42]

- The United Nations Development Programme's (UNDP) *Human Development Report 2007/2008* concludes: "Putting a price on carbon either through taxation or cap-and-trade schemes is a necessary condition for avoiding dangerous climate change. But carbon pricing alone will not be sufficient to drive investments and change behavior at the scale or speed required. There are other barriers to a breakthrough in climate change mitigation—barriers that can only be removed through government action. Public policies on regulation, energy subsidies, and information have a central role to play."[43]

Government policy is essential in a number of regards. It is important for overall goal- and standard-setting; especially ensuring movement toward long-term development goals beyond the time horizons typical of business; providing infrastructure that private enterprises cannot or will not create; and creating and maintaining a level playing field for all actors.

The Policy Toolbox: Financial and Fiscal Shifts

Governments can take a number of steps to drive the development of green technologies, products, and services, and thus drive forward a strong framework within which green employment can be promoted far better than is possible today. This section will first discuss a variety of financial and fiscal shifts (pursuing pro-environment procurement and public investment strategies, recalibrating tax

and subsidy policies, providing more appropriate levels of international development assistance) before moving on to several regulatory measures (establishing appropriate standards, mandates, regulations, and market incentives).

Public investment and procurement programs can be important tools for governments to push the economy in a greener direction. From the national to the local level, government authorities spend trillions of dollars on public purchases every year. By buying environmentally preferable products, they can exert a powerful influence on how products are designed, how efficiently they function, how long they last, and whether they are handled responsibly at the end of their useful lives. Well-designed purchasing rules can drive technological innovation and help establish green markets.[44]

There are many examples of small- and large-scale efforts. In China's drive to accelerate the development of its renewable energy sector, for instance, Chen Deming, vice chairman of the National Development and Reform Commission (NDRC), announced in September 2007 that the country was planning to invest 2 trillion yuan ($265 billion) in renewables.[45] An effective effort on a much smaller scale is the four-year, $7.6 million Indian Solar Loan Program that was launched by the United Nations Environment Programme (UNEP) and two Indian banks in 2003 to help accelerate the market for domestic solar systems in the country's south.[46]

Subsidy Shifts

A key ingredient in shifting the economy to a more sustainable footing is phasing out subsidies for industries that pollute or use natural and financial resources inefficiently. Numerous subsidies allow the prices of fuels, timber, metals, and minerals (and products incorporating these commodities) to be far lower than they otherwise would be, encouraging greater consumption. Limits in data availability prevent a complete accounting of subsidies for environmentally harmful activities, and underlying methodologies and definitions may differ from study to study. But a 2002 report by the Organisation for Economic Co-operation and Development (OECD) estimated global subsidies at about $1 trillion a year, with OECD member states accounting for three-quarters of the total.[47]

A 2001 study by Norman Myers and Jennifer Kent put perverse subsidies in six sectors—agriculture, energy, road transportation, water, fisheries, and forestry—at a minimum of $850 billion annually. In addition, Myers and Kent found that there are about $1.1 trillion worth of quantifiable environmental "externalities." Although these are not subsidies in a formal sense, they do represent uncompensated costs that have to be borne by society at large and that, like subsidies, have distorting and detrimental impacts. For instance, the environmental and health costs associated with automobile use are not charged to motorists, which makes individual vehicle travel cheap in comparison with rail and other modes of transportation.[48]

Worldwide subsidies for fossil fuels and nuclear power ran to about $250–300 billion annually in the mid-1990s. Many former Communist and developing countries have reduced their energy subsidies significantly in the intervening years. However, subsidies for conventional forms of energy continue to be magnitudes higher than those available for renewable energy.[49] Phasing

out destructive subsidies and shifting a portion of those funds to renewable energy, efficiency technologies, clean production methods, and public transit would give the transition toward sustainability and green employment a powerful boost.

Various types of renewables subsidies have had considerable success in a number of countries. Providing favorable financing through low-interest loans for individuals and businesses can help create a market that otherwise might take a very long time to emerge and to climb to a scale where significant cost reductions become feasible. Germany's Solar Roofs programs (started as a 1,000 Roofs program in 1991 and expanded to 100,000 Roofs in 1998) is one such well-designed initiative. In China, the government supports biogas, solar energy, small hydro, and wind projects with low interest loans (at rates typically half those of a standard loan). In Nepal, the government subsidizes 75 percent of the cost of small biogas plants and solar-powered drinking water pumps used by families. Bangladesh's Grameen Bank has operated a loan program for household photovoltaic systems since 1996. Micro-lending for renewables could play a huge role in many developing countries and help create jobs.[50]

A distinction needs to be made between fossil fuel subsidies for producers and for consumers. On the consumer side, subsidies are often essential for the poor to gain access to energy and energy services. The poor often spend a much higher share of their income on heating fuels, electricity for cooling, and other forms of energy than those in the middle class, let alone the wealthiest in society. Without subsidies, they may not be able to afford commercial energy sources critical for their wellbeing and survival, or they may rely on highly polluting energy such as wood burning. A phase-out of fossil fuel-related subsidies needs to be accompanied by measures that make alternative energy affordable. This is yet another instance where environmental and social objectives need to be integrated.

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An employee of German Cell Ltd in Freiberg is stacking a machine producing solar cells in the sterile room. The company is owned by SolarWorld Corporation, Bonn, a share company listed in the TecDax. In one of the most advanced facilities worldwide, solar cells are produced using the most recent equipment with a high degree of automation under sterile and dust-free conditions. All processes are continuously improved by the firm's own research and development department. The products of SolarWorld Corp. are considered lead-free and therefore already exceed the legal limits to be expected. In addition to Germany, SolarWorld also manufactures in Sweden and in the United States.

Rethinking R&D Priorities

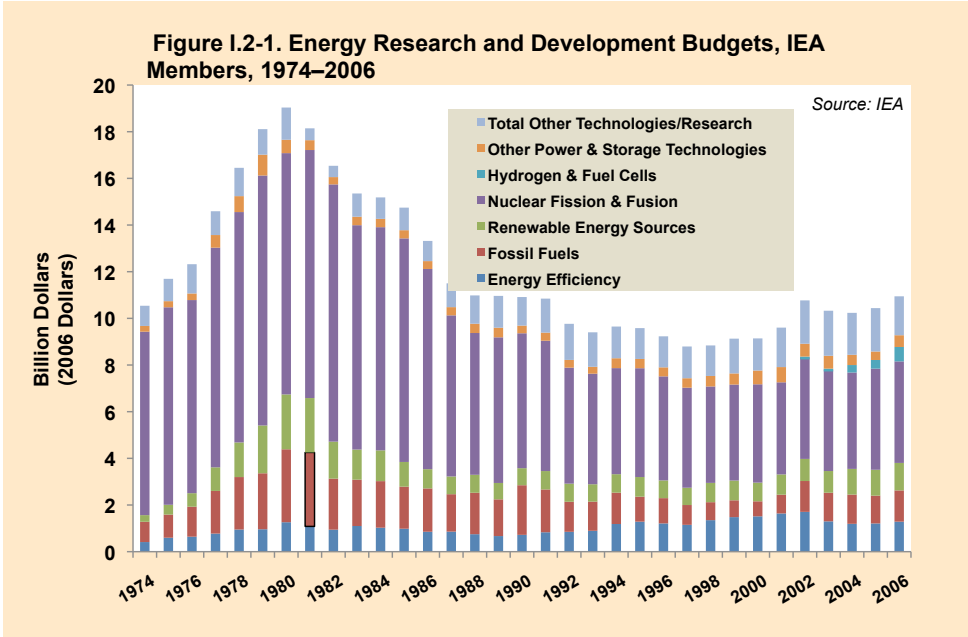
In addition to subsidies, conventional sources of energy including oil, gas, coal, and nuclear power have also long received generous R&D support from governments. Data for member states of the International Energy Agency—essentially wealthy Western industrialized countries—still indicate priorities that are highly inappropriate in the age of climate change. Although support for fossil fuels is now down from the levels of the 1980s, it is still quite generous for what, after all, is a highly mature industry. Nuclear technologies also continue to receive massive assistance.

On average, energy efficiency and renewable energy received a combined $2 billion per year in R&D support between 1974 and 2006, compared with $1.5 billion for fossil fuels and $6.7 billion for nuclear fission and fusion. Even though energy efficiency budgets increased in recent years, they peaked in 2002 and are now back to levels already reached in 1980. Support for renewables peaked in 1980 and is now at just slightly more than half that year's level.[51] (See Figure I.2-1.)

The Stern Review recommended doubling the aggregate amount of public funds devoted to energy R&D from the current level to about $20 billion per year. (According to the Renewable Energy Policy Network for the 21st Century—REN 21—public and private R&D funds devoted to renewables ran to about $16 billion in 2007.[52])

In the United States, both public and private energy R&D has declined. Corporate energy R&D spending fell by 50 percent between 1991 and 2003.[53] The federal government's energy R&D budget of $3.2 billion in 2006 was far less than the $8.5 billion spent in 1979. Renewables R&D is now one-sixth the 1980 level; energy-efficiency R&D stands at a little more than one-half of 1980 spending.[54]

Figure I.2-1. Energy Research and Development Budgets, IEA Members, 1974–2006



Dan Kammen of the University of California notes that the U.S. National Renewable Energy Laboratory budget and assistance to low-income families for home weatherization are both slated for cuts, and, "as a nation we invest less in energy research, development, and deployment than do a few large biotechnology firms in their own, private R&D budgets." This is a matter of priorities, rather than lack of resources: the decline in energy spending has occurred even as total U.S. R&D (and especially military R&D) has grown by 6 percent annually, and even though past R&D investments in solar technologies have led to strong improvements and cost reductions.[55]

In sharp contrast with the United States, Japan increased its R&D support for efficiency and renewables 2.5-fold between 1980 and 2006.[56]

International Development Assistance

The spending bias toward fossil fuels is also apparent in the budget priorities of international development institutions, export credit agencies, and bilateral development assistance programs. At $26.5 billion, World Bank funding for fossil fuel projects in the decade to 2004 exceeded that for renewable energy and efficiency (about $1.5 billion) by a factor of 18, and dwarfed the $650 million allocated by the Global Environment Facility to renewable energy projects in developing countries between 1992 and 2002.[57] By 2006, the World Bank had increased its support for energy efficiency projects ($447 million) and renewable energy ($412 million).[58]

Export credit agencies have provided massive funding for fossil fuel plants. By contrast, renewable energy projects account for a tiny share. For example, when the U.S. Export-Import Bank provided $28 billion in loans and guarantees for energy-related projects from 1990 to 2001, 93 percent went to fossil fuel projects and only 3 percent to renewable energy projects.[59]

Meanwhile, overseas development assistance (ODA) by members of the OECD has been heavily focused on hydropower, and the amounts provided have fluctuated heavily.[60] (See Table I.2-1.) Given the problematic nature of large-scale hydropower projects, these priorities need scrutiny. And the overall amounts will need to be scaled up dramatically. The Global Leadership for Climate Action—a task force of world leaders from over 20 countries—released a statement in October 2007 that estimated that about $50 billion per year will be needed for activities in developing countries in support of a comprehensive climate change agreement. Phased in from a starting level of $10 billion per year, such funding could come from increases in ODA (thus, a significant increase over current levels) and financing derived from the emerging carbon market (i.e., auctioning of emissions allowances).[61]

Table I.2-1. Overseas Development Assistance for Renewable Energy, 1999–2003

	1999	2000	2001	2002	2003
	(million dollars)				
Hydro	244	368	584	694	239
Geothermal	33	0.3	0	1.7	0.2
Solar	8	13	197	32	50
Wind	33	3	31	53	151
Ocean	0	0.003	0	0	0
Biomass	0.9	8.4	3.8	10.4	1.5
Total Non-Hydro	75	25	232	97	203

Note: Average for period for non-hydro renewables is $130 million/year, and for hydro $420 million/year.
Source: See Endnote 60 for this section.

Carbon Trading and Finance

Official development assistance accounts for a very small share of global financial flows, and analysts have pointed to alternative funding mechanisms. Carbon trading in general, and the Clean Development Mechanism (CDM) and Joint Implementation (JI) instruments included in the Kyoto Protocol in particular, have been cited as potential large-scale sources to support the development of renewable energy and energy efficiency, and thus green jobs. Companies and governments can acquire carbon credits by supporting specific emissions reduction projects, using either of these two mechanisms (with the CDM, targeting developing nations, so far playing a much larger role than the JI, targeted at former Communist countries). The European Union's Emission Trading Scheme (EU-ETS)—which currently accounts for the bulk of all carbon trading—specifically provides for such transactions.

In 2006, the value of CDM and JI projects amounted to about $4.4 billion (out of about $30 billion worth of carbon transactions).[62] According to estimates from the United Nations Framework Convention on Climate Change, international carbon finance flows to developing countries could eventually climb as high as $100 billion a year in coming decades, as carbon trading expands.[63] It is tempting to regard CDM-related flows as a way to overcome international financing strictures. But there are some major problems that need to be addressed:

- First is the highly slanted distribution of CDM projects. Analyzing the projects that are likely to take place between 2002 and 2012, China alone looks set to garner more than half—almost 53 percent—of all associated funds. Three other countries—India, Brazil, and South Korea—account for another 27 percent. Most of Latin America is largely losing out. And Sub-Saharan Africa weighs in with an abysmal 2 percent.[64]

- Second, the costs of certifying a project under CDM have so far been exorbitant, amounting on average to 14–22 percent of the projected revenue from selling project carbon credits. This is a barrier that poorer countries and smaller projects cannot overcome and limits what is ultimately available for actual green project and employment generation.[65]

- Third, the CDM approach has been narrowly project-focused and piecemeal. The process appears driven more by the needs and interests of private companies looking for cheap carbon credits than by a strategic assessment of the investment needs as developing countries move toward sustainable economies. Green employment will need to be strengthened as an objective of CDM projects.

Beyond CDM, if carbon trading is indeed to become a major funding source for climate mitigation and adaptation, then it is important that emissions rights be made available for sale. In the first phase of the EU-ETS, 95 percent of the permits were distributed for free to large emitters—effectively foregoing substantial revenue that could have been used to promote environmentally benign technologies, either within the European Union or abroad.[66] In addition, due to successful corporate lobbying, too many carbon permits had been allocated overall—more than actual emissions—causing carbon prices to fall to nearly zero before recovering somewhat. The cap set for 2008–2012 is just 2 percent below actual emissions for 2005, and at most 10 percent of permits can be distributed via auction.[67] Under these circumstances, cap-and-trade cannot become a tool for realizing lofty goals of carbon reductions. And revenue generation will remain extremely limited.

Ecological Tax Reform

Current tax systems discourage job creation even as they encourage resource consumption. Carbon taxes, levies on the use of nonrenewable energy and virgin materials, landfill fees, and other waste and pollution charges provide an incentive for manufacturers to move away from heavy fossil fuel use, to boost energy and materials productivity, and to curtail the generation of wastes and emissions. Rather than merely imposing a new tax, though, it makes sense to advance a shift in taxes. Current systems make natural resource use far too cheap and render labor too expensive. Using eco-tax revenues to lighten the tax burden now falling on labor (by deploying tax revenues to finance national health or social security funds that are now typically funded through payroll taxes) would help lower indirect labor costs and could thus boost job creation without hurting workers' interests.[68]

Discussed theoretically since the late 1970s, ecological tax shifting started to become a reality in the 1990s in a growing number of European countries. Denmark, Germany, Italy, the Netherlands, Norway, Sweden, and the United Kingdom introduced reforms linking a variety of green taxes to reductions in social security contributions. Before adjustment for inflation, environmental tax revenues in the EU more than quintupled between 1980 and 2004, to $364 billion (€266 billion).[69] (See Table I.2-2.) The bulk of these revenues are derived from taxes on gasoline and diesel, and on motor vehicles.[70]

Table I.2-2. Environmental Tax Revenue, European Union, Selected Years

Environmental Taxes	1980	1990	2000	2004
	(billion dollars)			
Revenues	74.8	178.6	332.6	365.0
	(percent)			
Revenues as Share of All Taxes and Social Contributions	5.8	6.2	6.7	6.7
Revenues as Share of Gross Domestic Product	2.2	2.5	2.8	2.7

Note: Data are for EU-15 members.
Source: See Endnote 69 for this section.

Unfortunately, eco-taxes are frequently weakened by a variety of loopholes—granting exemptions to certain industries or energy sources, applying reduced tax rates to energy-intensive firms, or making companies eligible for partial reimbursements. Often, this is done in the name of preserving the competitiveness of domestic industries on the world market. A recent study on Climate Change and Employment in the context of the European Union laments that, "the use of taxes to internalize the social costs of transport has so far run up against major forces of inertia within the Member States," and concludes that, "the use of energy taxes for European environmental ends still remains very little advanced."[71]

This is not to say that nothing has been accomplished. In Germany, for instance, an eco-tax levied on different forms of energy consumption was first introduced in 1999. By 2002, it had already helped avoid emissions of more than 7 million tons of carbon dioxide. Reductions in social security contributions made possible by these funds helped create 60,000 additional jobs by 2002 and possibly as many as 250,000 by 2005.[72]

The Policy Toolbox: Mandates

Extended Producer Responsibility

Green production—and employment—starts with the design of products that minimize resource inputs, avoid the generation of waste and emissions, and can easily be disassembled, recycled, remanufactured, or reused. To encourage companies to move in this direction and assess the full lifecycle impacts of their products, a growing number of governments are adopting "extended producer responsibility" (EPR) laws that require companies to take back products at the end of their useful life. These typically ban the landfilling and incineration of most products, establish minimum reuse and recycling requirements, specify whether producers are to be individually or collectively responsible for returned products, and stipulate whether producers may charge a fee when they take back products.

Part of the challenge is to develop materials that can easily be reused or otherwise will not linger in a landfill for centuries. For instance, German chemical giant BASF invented a new material made from an infinitely recyclable nylon-6 fiber; it can be taken back to its constituent resins and made into new products. The Swiss textile firm Rohner and the textile design company DesignTex jointly developed an upholstery fabric that, once it has been removed from a chair at the end of its useful life, will naturally decompose.[73]

The EPR philosophy had its beginnings in Germany's Packaging Ordinance of 1991, widely credited with motivating many other governments in Europe, Asia, and Latin America to embrace this concept (the United States, by contrast, is lagging behind). The EPR approach has spread far beyond packaging to encompass a growing range of products and industries, including consumer electronics and electric appliances, office machinery, cars, tires, furniture, paper goods, batteries, and construction materials.[74] (See Table I.2-3.)

Table I.2-3. Extended Producer Responsibility Laws, Selected Industries

Product Area/ Industry	Countries with EPR Laws
Packaging	More than 30 countries, including Brazil, China, the Czech Republic, Germany, Hungary, Japan, the Netherlands, Peru, Poland, South Korea, Sweden, Taiwan, and Uruguay (beverage containers only)
Electric & Electronic Equipment	Currently, more than a dozen countries, including Belgium, Brazil, China, Denmark, Germany (voluntary only), Italy, Japan, Netherlands, Norway, Portugal, South Korea, Sweden, Switzerland, and Taiwan.
Vehicles	Brazil, Denmark, France, Germany, Japan, Netherlands, Sweden, and Taiwan
Tires	Brazil, Finland, South Korea, Sweden, Taiwan, and Uruguay (considering voluntary measures)
Batteries	At least 15 countries, including Austria, Brazil, Germany, Japan, the Netherlands, Norway, Taiwan, and Uruguay (considering voluntary measures)

Note: Except for tires, EU Directives have been promulgated in all of the sectors covered in the table. In addition to national rules already adopted by a number of EU members independent of EU action, these Directives are binding on all member states.
Source: See Endnote 74 for this section.

Driven by concern over rapidly accumulating electrical and electronics waste from computers, cell phones, and similar equipment, the EU adopted an Electronic and Electrical Equipment Directive in February 2003. A companion directive on Restrictions on Hazardous Substances (RoHS) requires that manufacturers of electronic and electrical equipment no longer use lead, mercury, cadmium, hexavalent chromium, and the brominated flame retardants PBDE and PBB in products sold after July 1, 2006. There is growing concern worldwide about these hazardous materials; Japan is the leader in eliminating such substances from electrical and electronic products.[75]

Eco-Labeling

Eco-labeling programs "pull" the market by providing consumers with the requisite information to make responsible purchasing decisions, and hence encourage manufacturers to design and market more eco-friendly products. Labeling schemes have been developed for a wide range of

products, including appliances, electricity, wood products, and agricultural goods such as coffee and bananas. Some focus on a single product or product class, whereas others evaluate a broad range of items.

The first, and most comprehensive, labeling program—Germany's Blue Angel—has been in existence for a quarter century. The number of products covered grew from about 100 in 1981 to 3,600 currently.[76] Another eco-label, developed in 1992 by the Swedish Confederation of Professional Employees (TCO), now extends to more than 7,000 products worldwide. More than 100 manufacturers have agreed to display the label on their products. TCO addresses aspects like energy efficiency, use of toxic chemicals, radiation exposure, health and safety, and ergonomics.[77]

Other prominent programs include the U.S. Energy Star label (initiated in 1992), and the Energy Saving Labeling Program and Top Runner Program in Japan.[78] The Energy Star appliance label is also being used in other countries like Japan, Australia, South Korea, and members of the European Union (for office equipment only). Unlike earlier criteria, which were less demanding, the new Energy Star requirements distinguish the top 25 percent of appliances in each product group.[79] Developing countries also have adopted or are developing eco-labels, including India, Indonesia, Thailand, and the Philippines. Thailand's Green Label involves some 148 brands in 39 product categories.[80] In India, the government has established criteria for 16 product groups under its 1991 Ecomark label.[81]

By 2005, 37 countries had adopted energy-efficiency labeling systems for appliances and electronic equipment. China has started labeling air conditioners and refrigerators with a goal of saving 18 billion kilowatt-hours of electricity by 2010 and 87 billion kilowatt-hours by 2020, and is planning to extend efficiency labels to television sets, irons, and electric fans.[82]

Labeling programs have mushroomed in recent years, to the point where competing labels can confuse consumers. Some programs, particularly industry-sponsored ones, may make vague or unsubstantiated claims concerning recycled content of a product, organic growing methods, biodegradability, and other issues. Others may be based on relatively low performance standards. Concerned about these problems, an OECD report argued: "To avoid a general discredit of labeling schemes, some kind of regulatory instruments may be needed to signal to consumers that certain schemes are more appropriate for certain issues than others." Qualified certification bodies may be needed to evaluate whether a product conforms to existing standards or verify the accuracy of environmental claims made by manufacturers.[83]

Another dimension that has received inadequate attention is the linkage between environmental labels and labor conditions. Many export-oriented economies, especially in Asia, rely on cheap and exploited labor, and a single-minded focus on greening the businesses involved is not enough. As this report argued earlier, there is a need to ensure that future jobs are not only green, but also decent with regard to wages, labor conditions, and workers' rights. In the future, labeling programs need to pay greater attention to integrating environmental and labor conditions.[84]

Energy Targets and Mandates

Regulatory tools play a crucial role in the drive to develop greener technologies, products, and services—and thus green employment. This includes land-use policies (for which jurisdiction tends to be on the local and regional, rather than national, level), building codes, various kinds of energy efficiency standards, and targets for renewable energy production.

A growing number of governments have mandated efficiency standards for household appliances. By 2000, for instance, 43 countries had such programs in place—seven times as many as in 1980. Most of these were in Europe and Asia.[85] The Australian Government, meanwhile, announced in February 2007 that all inefficient light bulbs will be phased out by 2009–2010 in favor of more efficient compact fluorescent lamps (CFLs). It expects that the move will reduce the country's greenhouse gas emissions by 4 million tons by 2012.[86]

The European Commission (EC) has issued directives on the energy performance of buildings and on the final uses of energy and energy services. The first, adopted in December 2005, asks member states to define national action plans that will yield annual energy savings of 1 percent during 2008–2017. The second came into effect in January 2006 and requires member states to establish minimum standards of energy performance for new buildings and large renovated buildings. The EC also issued a directive on the promotion of cogeneration in 2004.[87]

With regard to industrial energy efficiency, the Chinese government requires that the efficiency of pumps and fans be improved from a typical 75–80 percent in 2000 to 80–87 percent, and coal-fired industrial boilers from 65 percent to 70–80 percent (both by 2010). It has also mandated a reduction, between 2000 and 2020, of the energy needed per ton of steel produced from 906 kilograms of coal equivalent (kgce) to 700; for aluminum from 9.9 tons of coal equivalent to 9.2 tons; and for cement from 181 kgce to 129 kgce. These measures are ambitious, but also very difficult to implement.[88]

A number of countries have adopted either minimum vehicle fuel efficiency requirements or upper allowable limits for greenhouse gas emissions.[89] (See Table I.2-4.) Japan has mandatory passenger vehicle fuel economy standards, which were tightened further in 2006 with the goal of improving average vehicle fuel efficiency by 20 percent between 2004 and 2015.[90] Europe, focusing on greenhouse gas emissions, is poised to move from voluntary to mandatory measures.[91] In contrast with Europe and Japan, corporate average fuel economy (CAFE) standards have languished unimproved in the United States for the past quarter century. But in January 2007, California adopted a Low-Carbon Fuel Standard that requires a 10 percent decrease in the carbon intensity of California's transportation fuels by 2020.[92] China recently established standards that almost match levels prevalent in Japan and Europe, and are higher than those in the United States.[93] (See Box I.2-1.)

*Table I.2-4. Vehicle Fuel Efficiency and Greenhouse Gas Emissions Standards, Selected Countries**

Country/ Region	Target Unit	Decision Standard	Implementation
Fuel Efficiency			
Japan	Kilometers/liter	Weight-based	Mandatory
China	Liters/100 kilometers	Weight-based	Mandatory
United States	Miles per gallon	Single standard for cars; size-based for trucks	Mandatory
Australia	Liters/100 kilometers	Single standard	Voluntary
South Korea	Kilometers/liter	Engine size-based	Mandatory
Taiwan	Kilometers/liter	Engine size-based	Mandatory
Greenhouse Gas Emissions			
European Union	Grams/kilometer	Single standard	Voluntary**
Canada	5.3 ton reduction	Vehicle class-based	Voluntary
California	Grams/mile	Vehicle class-based	Mandatory

**Standards are applicable for new vehicles only, except for Canada (new and in-use).*
***EU is moving toward mandatory standards.*
Source: See Endnote 89 for this section.

Some 50 countries—including almost a dozen in the developing world—have established targets for renewable energy as part of their greenhouse gas reduction policies, either in the form of specific quantities of installed capacity or as a percentage of total consumption. The European Union has been in the forefront of goal-setting. In 1997, it adopted a goal of doubling the share of renewable energy to 12 percent by 2010. In 2001, the EU's Renewable Electricity Directive set a goal of increasing the share of renewables in electricity generation from 14 percent in 1997 to 21 percent by 2010.[94] And in March 2007, the European Council agreed on a binding target of a 20 percent share of renewable energies in overall energy consumption by 2020 (the actual share was less than 7 percent in 2005).[95]

Germany's Renewable Energy Sources Act set a target of at least 12.5 percent by 2010 for renewables' share in electricity production. But because this goal was already exceeded in 2007, the environment ministry is considering new mandatory targets of at least 27 percent in 2020 and 45 percent in 2030.[96]

Box I.2-1. China's Fuel Economy Standards: Policies and Current Status

China's oil consumption has been increasing, driven mainly by a fast expanding automobile fleet. Transportation accounted for 50 percent of oil consumption in 2005 and is expected to reach 87 percent by 2030. Oil import dependence and vehicle pollution are among the concerns behind China's recent efforts in improving vehicle fuel economy.

China is modeling its policy on the European approach, which assesses fuel consumption in conjunction with emission measurements. Initially adopting the European I emission standards (used in Europe in 1992), China began to enforce standards that correspond to the European III level in July 2007.

The Chinese government issued its first compulsory standards for controlling vehicle consumption, the Limits of Fuel Consumption for Passenger Cars, on September 2, 2004, and the policy became effective on July 1, 2005. For each of 16 vehicle weight classes, it establishes fuel consumption limits (ranging from 7.2 liters per 100 kilometers (km) for the lightest passenger cars to 15.5 liters per 100 km for the heaviest). In January 2008, a second phase tightens the allowable limits (with a range of 6.2–13.9 liters per 100 km). (China has also enacted its first compulsory limits on fuel consumption of light commercial vehicles, to take effect on February 1, 2008.)

Half of the car models currently on the market fail to meet the phase 1 standards. Most of them are based on outdated foreign technologies from the 1980s and are scheduled to be phased out soon. Fuel consumption limits for the second phase are 10 percent stricter than those of the first phase. The second phase will also see an update of the fuel consumption measurement methods based on the European III and IV emission standards.

Automakers have roughly three years to improve their technology to meet the first phase limits, and almost six years to meet the second phase limits. Cars that fail in this endeavor will be suspended from production or sales. The standards currently apply only to passenger cars manufactured in China, not to imported cars. Auxiliary policies are being formulated to assist enforcement. They include tax incentives for fuel efficient and environmentally friendly vehicles, tariff reductions for the imports of parts, punitive tax policies on oil guzzlers, and an environmental tax.

—Yingling Liu, Worldwatch Institute
Source: See Endnote 93 for this section.

Outside the European Union, a growing number of countries have established renewable energy targets. In non-EU Europe, they are Croatia, Norway, Switzerland, and Turkey; in North America, Canada, Mexico, and the United States; in South and Central America, Argentina, Brazil, and the Dominican Republic; in Asia/Oceania, Australia, China, India, Japan, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, South Korea, and Thailand; in the Middle East, Egypt, Iran, Israel, Jordan, Morocco, Syria, and Tunisia; and in Sub-Saharan Africa, Mali, Nigeria, Senegal, South Africa, and Uganda.[97] The Chinese government set ambitious targets—the goal is to generate at least 15 percent of electricity from renewable energy sources by 2020.[98] (See Table I.2-5.)

Table I.2-5. Renewable Energy Production Targets in China

Energy Source	Unit	2006 actual	2010 target	2020 target
Wind Power	gigawatts	2.6	5	30
Biomass	gigawatts	2.0	5.5	30
Solar PV (grid)	gigawatts	0.08	0.3	1.8
Solar Hot Water	million square meters	100	150	300
Ethanol	million tons	1	2	10

Source: See Endnote 98 for this section.

Promotion of Energy Alternatives

The success of Germany and Japan in transforming themselves into leaders in renewable technologies in less than a decade is testament to the fact that proper policies play a more fundamental role than an ample resource base: long-term commitments, consistent policies, the use of gradually declining subsidies, and an emphasis on government R&D and market penetration.

Germany has adopted a range of successful policies that eliminated barriers to renewable energy development. Low-interest loans (some offered through the country's 100,000 Solar Roofs program) helped overcome the obstacle of high initial capital costs. Income tax credits drew investments of billions of Euros into renewable energy. But the policy with the greatest impact was an electricity feed-in law (***Strom-Einspeisungsgesetz***). Inspired by similar policies in Denmark, it was promulgated in 1990 and followed by successive measures, including the 2000 Renewable Energy Sources Act. The feed-in law requires utility companies to purchase electricity generated from renewable energy sources and established a minimum price. The law created certainty for investors and led to economies of scale as well as dramatic cost reductions.[99]

Japan's "New Sunshine" program, established in 1992, set renewable energy targets and led to a net-metering law that requires utilities to purchase excess PV power. In 1994, Japan launched a Solar Roofs program to promote PV through low-interest loans, a comprehensive education and awareness program, and rebates for grid-connected residential systems in return for data about systems operations and output.[100]

Around the world, governments have adopted a range of measures, including feed-in/pricing laws; quota systems such as renewable portfolio standards; tradable renewable energy certificates; capital subsidies, grants, or rebates; investment excise or other tax credits; sales tax, energy tax, or value-added tax (VAT) reductions; net metering; public investment, loans, or other financing; and public competitive bidding.[101] (See Table I.2-6.) About 40 countries, states, and provinces had enacted feed-in laws and renewable portfolio standards by 2006.[102]

Table I.2-6. Policies in Support of Renewable Energy Development

Policy Category	Policy Initiatives
Market Access	**Pricing Laws.** Guarantee producers of renewable energy fixed, minimum prices and obligate electric utilities to provide grid access. Fixed payments, also known as tariffs, are paid over several years, and typically decline over time to reflect cost reductions. Costs are covered by energy taxes or an additional per-kilowatt-hour charge on electricity consumers. Germany, Spain, and Denmark have all adopted highly successful pricing laws that made them renewables leaders.
	Quota Systems. Governments set renewables targets and let the market determine prices. The most common form is the so-called Renewables Portfolio Standard (RPS). Texas' RPS led to rapid wind growth, but failed to encourage solar PV development. Under Tendering Systems, companies submit bids to a public authority for contracts to fulfill quota mandates. In the U.K., this approach facilitated financing, but led to uneven progress (flurries of activity followed by long lulls). The lack of deadlines delayed implementation of many projects.
	Net Metering. Can be used in conjunction with quota systems. It allows households and other energy consumers that install small renewable systems to sell excess electricity into the grid at wholesale market prices. Adopted in Canada, Japan, Thailand, several U.S. states, and some other countries.
Financial Incentives	**Investment subsidies, tax credits, rebates, loans, etc.** These and other mechanisms have been used to subsidize investment in technology development or to support power production from renewables in Europe, India, Japan, and the United States. California and India underwent wind energy booms with such policies. But their experience suggests that a lack of technology standards and overly generous tax breaks can lead to fraud and substandard equipment. In the United States, Congressional extension of a federal incentive program for wind energy, the Production Tax Credit (PTC), to the end of 2007 brought a much-needed window of stability. (Failure to enact timely extensions in earlier years—in 1999, 2001, and 2003—had caused a boom-and-bust cycle. The PTC's expiration in 2003, for example, led to the loss of more than 2,000 manufacturing and construction jobs and more than $2 billion in investments were put on hold.) Rebates appear preferable to tax breaks: Japan subsidized investment through rebates and saw dramatic successes in PV development. Some 24 U.S. states offer PV rebates as well. Low-interest, long-term loans and loan guarantees are essential to overcome high upfront capital costs, as experience in China, the Dominican Republic, India, Indonesia, and South Africa suggests.
Standards	**Standards.** Essential to ensure high-quality technologies, reduce associated risks, and attract investors. Denmark's 1979 wind turbine standards are credited with making the country the world's leading turbine manufacturer. Germany's 1991 turbine standards and certification requirements prevented quality control problems such as those experienced in California and India. Building codes can also be designed to require the incorporation of renewable into building designs. Spain, for instance, instituted a new building code in 2006 requiring all new large nonresidential buildings to generate a portion of their electricity with solar PV.
Vocational Training	**Training and certifying workers.** Essential to ensure that competent people are available to manufacture, install, and maintain renewable energy systems. Austria, India, and Germany are among the countries that have established successful training programs.

Sources: See Endnote 101 for this section.

Of various regulatory options, pricing laws have so far proved to be the most successful. Reviewing the experience in the European Union to date, the German environment ministry concludes that "feed-in regulations...are very effective in promoting wind energy. Quota systems with tradable certificates that have been implemented in some countries have thus far failed to produce comparable results. The costs are also higher than in countries with feed-in regulations."[103]

Several recent trends are indicative of the fact that the renewables industry is not yet self-sustaining. These include the U.S. experience with the on-again, off-again Production Tax Credit, German reports in late 2007 of weak renewables sales in the face of uncertainty about changes in government incentives, and indications of China's failure to date to develop a strong domestic market for solar cells.[104] Two U.S. industry groups, the American Wind Energy Association and the Solar Energy Industries Association, warned in early 2008 that non-renewal of renewable energy tax credits by the U.S. Congress would endanger some 116,000 jobs.[105] A stable policy framework, with regard to government incentives and rules, will continue to be critical for the speedy development of alternatives.

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Young woman trainee.