

1 Introduction

The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together. Subjection of Nature's forces to man, machinery, application of chemistry to industry and agriculture, steam-navigation, railways, electric telegraphs, clearing of whole continents for cultivation, canalisation of rivers, whole populations conjured out of the ground—what earlier century had even a presentiment that such productive forces slumbered in the lap of social labor?

—*Karl Marx and Friedrich Engels, The Communist Manifesto (1848)*

The Puritan wanted to work in a calling; we are forced to do so. For when asceticism was carried out of monastic cells into everyday life, and began to dominate worldly morality, it did its part in building the tremendous cosmos of the modern economic order. This order is now bound to the technical and economic conditions of machine production which to-day determine the lives of all the individuals who are born into this mechanism . . . with irresistible force. Perhaps it will so determine them *until the last ton of fossilized coal is burnt.*

—*Max Weber, Protestant Ethic and the Spirit of Capitalism (1904)*

Now that mankind is in the process of completing the colonization of the planet, learning to manage it intelligently is an urgent imperative.

—*Barbara Ward and Rene Dubos, Only One Earth (1972)*

The traditional development strategies of industrialised countries all present two distinct features whether in Europe, the United States or Japan, despite their differing national and development conditions. One is that high-speed growth is sustained by high consumption of resources (especially non-renewable resources); the other is that the high-speed growth is stimulated by high consumption of the means of subsistence. We call this a traditional development model. In view of China's

conditions, it is impossible for China to realise modernisation by following the traditional model.

—Hu Angang, “*Green development: The inevitable choice for China*” (2006)

Most books with *greening* in the title would be expected to start with the observation that we have only one earth and it is subject to increasing stresses from our ever-expanding industrial system. There would follow an analysis of energy and resource issues, with the aim of showing that “business as usual” cannot be allowed to continue. Capitalism, with its unbridled appetite for expansive consumption and the production that feeds it, would be viewed as the core problem. There might ensue a discussion that critiques the notion of economic growth as something that cannot continue forever in a finite world, leading to a preferred outcome of a steady-state economy as the best approximation to a balance between ecological and economic processes. Whether it is capitalist or not would be left unsaid.

None of this is wrong; it is all too true. And none of this is new; we have heard it all before. Something different is needed if we are to make headway with the greening of capitalism. It requires changes that will *really* matter and will *really* have an effect, and that are based on capitalism as it *really* operates.

My approach is to start at the opposite end, as it were, with the current “third phase” of industrialization that is bringing China and India into the orbit of the industrialized world. As China lifts hundreds of millions of people out of poverty, and India follows a similar course, and Brazil and many other developing countries aspire to do so as well, they open up a new pathway for development and the prospect of a new kind of industrial capitalism. There is under way a process of “shifting wealth,” whereby the center of gravity of the world economy is shifting east (and to some extent south), thereby raising the prospects for hundreds of millions more to be lifted out of poverty.¹ But no sooner do these extra millions and eventually billions seek to achieve their share of industrial wealth (as did the West through the first and second industrial revolutions) than they

encounter a most inconvenient truth. Can the development model that served the already-industrialized countries—with access to the cornucopia of fossil fuels and unlimited resource flows—scale to accommodate the new demands?

The process of industrialization has lifted close to one billion people in Western Europe, North America, and Japan out of the “Malthusian trap” that pinned income to population and set them on a trajectory of rising per capita wealth. This created a “great divergence” between the West and the “rest,” accounting for the extreme disparities in wealth, income, and power that have characterized the modern world. In the twentieth century, while serious efforts were made to industrialize in many parts of the world, it was only in East Asia that catch-up, or convergence, was achieved. Now in the twenty-first century these efforts have spread to China and India, and a “great convergence” is under way, reversing the trajectories of the past two hundred years.² So the key question is, Can the industrial model that served the West so well now be adapted to meet the new demands? Can it meet the needs of up to six billion people who are looking to achieve middle-income status by 2050 (as envisaged by economists such as Michael Spence)?³ Can it do so—without subjecting the planet to irreparable harm?

The scale of the changes involved in this next “Great Transformation” is immense. The original Industrial Revolution lifted the population of Great Britain to double the per capita income over a period of around 150 years; the subsequent industrialization of the United States took around 50 years. Now China has doubled its per capita income in 12 years, and India in 16 years. Moreover, China and India are starting from a population of more than one billion, compared to around ten million for the United States and the United Kingdom early in the nineteenth century. So the pace of industrialization in this third round has picked up tenfold, and the number of people involved has expanded a hundredfold—meaning that the current transition involving the new industrial giants China and India is a thousand times more intense than the original Industrial Revolution. Can the same model of dependence on apparently unlimited fossil fuels and resource abundance underpin this latest industrial transition at such a level of intensity?

To pose the question in this way is really to answer it. As soon as the material, resource, and energy requirements needed to expand the

present industrial system along conventional lines are spelled out, the impossibility of pursuing such an approach becomes clear. Industrial capitalism is rapidly “filling” the planet. Something therefore needs to be done in a way that is consistent with the engine of wealth generation that drives the capitalist economy. To borrow the phrase made famous by Karl Polanyi, who described the process of industrialization as the “Great Transformation,” we may characterize the changes that would allow industrialization to spread worldwide, in a manner that respects ecological realities, as the “Next Great Transformation.”⁴ Its current drivers, as well as the obstacles that stand in its way, are the subject of this book.

In this work I examine efforts under way in East Asia and Europe that seek to carve out a new development pathway. Insofar as its material foundations are based on a less resource-intensive approach to growth, we might call that pathway “green.” Eminent Chinese scholars like Hu Angang see such a development as the “inevitable choice” for China and, by extension, for the rest of the developing world. Thus, rather than beginning with the problems of carbon emissions; devastation of forests, fisheries, and agriculture resources; and degradation of soils and other problems, my approach is to look to “greening” of development strategies and to ask what may be the consequences for the myriad problems of environmental mismanagement that are widely discussed. The difficulty encountered in framing the issue in the conventional way, which starts with the problems, is that it appears to place the burden of solving problems created by the developed world on the shoulders of developing countries; this makes “green growth” strategies thereby suspect in the eyes of some. After all, why should developing countries have to bear the burden of higher costs for renewable energies while the developed world goes on burning cheaper coal? *Why* indeed? That there is considerable debate and some opposition to green strategies in the developing world is hardly surprising.⁶

A different starting point is possible, and indeed necessary. Instead of listing the well-known problems created by capitalism, one can begin by celebrating its achievements. Capitalism is an extraordinary social, political, and economic innovation that has been world transforming. The modern global system, powered by industrialization, is quite unlike anything that came before. New gigantic productive forces have been conjured into existence, in the phrase immortalized by Marx and Engels.

Mortality rates have been drastically reduced, leading to a population explosion that has in turn enhanced productivity and innovation potential. Income levels have exceeded population growth, breaking humanity free of the Malthusian trap that constrained everything before.

On the whole, the arrival of industrial capitalism has been associated with profoundly positive results. Food has become cheaper and more abundant; extraction of resources has grown, and their prices relative to wages have plummeted. Early experiences of pollution and environmental degradation have been reversed. Scientific and medical breakthroughs of the first order—*anesthesia, antibiotics, vaccines*—have relieved humanity from age-old burdens (although those breakthroughs are not yet universally shared).

Recognition of the many achievements of industrial capitalism has sparked its emulation and rapid diffusion worldwide—in Latin America, India, East Asia, and now in China. All these countries have been industrializing on a conventional resource-intensive and fossil-fueled model first—as did the West. As industrial capitalism powered by fossil fuels and extensive resource throughput spreads worldwide, so its impact on ecological processes becomes more obvious, more intrusive, less avoidable.

The costs of continuing with “business as usual” (to use the terminology of the International Energy Agency and the Intergovernmental Panel on Climate Change) are becoming apparent—and it is in the developing countries that these costs are encountered with greatest force, as ecological limits are breached with abandon. The polluted air of Beijing and the clogged waterways of Mumbai are ever-present reminders of the toll being taken by such a pathway of industrialization, where massive resort to coal and fossil fuels leads to the fouling of the air and waterways, and equally massive throughput of resources leads to chemical pollution on a scale unprecedented.

It is therefore perhaps not surprising that the strongest response is also to be found in these developing countries. China in particular is emerging as a leader in building renewable energy industries and advancing the frontier of resource efficiency technology. After all, the conventional view has been that it would be the most advanced countries that would be supplying the technologies needed to clean up the planet. The fact that in many ways it is the latecomers like China that are taking the lead, while the advanced countries remain locked in by their carbon

investments, is at odds with this conventional view. It throws up one of the most challenging issues to be resolved by the social sciences.

How can we account then for this unanticipated development? I advance a response in this book that integrates three major lines of argument, each associated with a pioneering thinker of the twentieth century. First, the argument I advance is neo-Schumpeterian, in that it evolves through repeated episodes of creative destruction, which turns on the capacity of firms to drive change, subject to the institutional incentives and barriers created by the prevailing techno-economic paradigm. The latest such shift may be identified with the surge of investment in renewable energies and low-carbon technologies. It amounts to a complete change in techno-economic paradigm and creates unprecedented opportunities for the firms (and countries) that grasp the challenge. Second, the argument is neo-Gerschenkronian, in that it focuses on the latecomers to industrialization and how they draw advantages from adopting a green development model. China is the clear latecomer that is arguably adapting fastest to the demands of a greening of capitalism. Finally, the argument is neo-Olsonian, in that it takes account of the tangle of institutional blockages and vested interests that block and delay the transition in the most advanced countries—what is memorably described as “carbon lock-in.”⁷ This implies that the initiative in shifting to a new kind of industrial system will most likely pass to the countries that have contributed least to the present problems.

From these three perspectives an argument is distilled whereby it is the latecomers like China that have the most pressing need for green growth strategies, given the terrible environmental catastrophes they are experiencing, and that have the greatest incentive to implement an alternative development model. What is equally important is the fact that the state centered on Beijing has the capacity to do something about those problems. The country’s current Twelfth Five-Year Plan provides as close a template as one is likely to find for greening an industrial economy. In a similar move, South Korea, another East Asian practitioner of state-guided industrial transformation, has initiated its own green growth industrial strategy. By contrast, the lead countries, and particularly the United States, which came of age in the oil era, have the densest thicket of rules and institutions favoring fossil fuel interests. These rules and interests are proving to be exceedingly difficult to undo. In Europe,

however, the German *Energiewende* (energy transformation) may have wider ripple effects as it demonstrates a middle way.

The Focus of Change: Renewable Energies, Resource Efficiency, and Finance

The variety of problems we are confronted with—the peaking of oil and gas supplies; environmental spoliation; depletion of soil and water; long-term systemic disturbances exhibited in such miscellaneous phenomena as loss of biodiversity, collapse of coral reefs, mass extinctions—all call for specific kinds of solutions. But underpinning these solutions there is a common cause—and that is the “business as usual” (BAU) kind of capitalism that has brought us (effectively so far) to this point. The argument of this book, then, is that it is changes to the rules of *this particular kind of capitalism* that are called for—not changes to the rules of capitalism as such, insofar as it works well on foundations of property rights, markets, and innovation. Indeed, the “free-market environmentalism” school of thought would have it that if these foundations could be extended and built on more completely, then all the problems would disappear. As Jeffreys puts it, “Free market environmentalism can save the planet.” Faith in market fundamentalism, however, has not been well rewarded, as the blowback from deregulated financial markets amply testifies.⁸

The problem is to get from a BAU trajectory to something quite different involving renewables, resource efficiency, and eco-finance—a zone in which markets may be expected to work well. The transition is, however, most unlikely to be brought about by market forces alone (such as through consumer demand, perhaps buttressed by carbon taxes) because the carbon lock-in is simply too strong. In this case there is a necessity for the state to take action to drive the system onto a new trajectory with new rules and standards that make the system more “sentient,” more attuned to the scale and scope of interaction between economic and ecological processes. Specifically, there will need to be new rules for the transition to a new kind of green growth capitalism—and these new rules will have to engage directly with the details of energy, resource throughput, and finance, replacing the existing trajectories with new state-mandated renewable pathways.

In short, the capitalist tools of property rights, markets, and creative destruction can be expected to work effectively—as claimed by the proponents of free-market environmentalism—but only after the system has been given a reboot and is embarked on a new course that results from smart state intervention. Such intervention can be expected to take the form of publicly stated and enforced “default options” in the form of renewable energies and resource efficiency and recirculation principles, effected through differential tax rates, penalties and subsidies, differential interest rates, and other instruments. (Since I will be referring to “renewable energy and resource efficiency” principles repeatedly, let us agree to refer to them as RE principles.) The refounding has to be genuine, and has to be seen to be genuine. It has to be public in order to generate systemwide change and adherence by capitalist entrepreneurs. It has to be enforceable if it is to have the desired effect—and that means backed by strong state capacity. Weak governments giving weak commitments or backsliding too easily will not produce the desired effect.

Now the free-market environmentalist critics respond that all this is unnecessary; if there is a profit to be made in the new RE² sectors, then capitalist interests will dictate that entrepreneurial initiatives flow in these directions. The flaw in this assumption is that it ignores time and scale. There is an urgency to dealing with the problems created by the conventional model that demands a timely response. A leisurely reliance on, say, common law procedures for sorting out conflicting property rights claims as between fossil fuel burners and those affected by the emissions cannot hope to achieve resolution before the problems become unmanageable. Such court procedures advocated by free-market environmentalist authors can tackle incremental problems but not comprehensive system transformations.⁹ The intensity of the carbon lock-in presented by the BAU system is such that only a government-mandated shift to a new regime could succeed in creating the conditions for genuine competition in energy and resource industries. To rely solely on private-sector entrepreneurial initiative in a context where Olsonian vested interests are so powerful is to condemn the system to inertia for decades.¹⁰

Other critics might respond that in advancing the case for RE² to be the default option, we are “picking winners” on a grand scale. Why not leave it to the market to sort out what kind of post-fossil fuel energy system and resource operations might prevail? The response is that it will

indeed be the market that determines which specific options—including particular renewable energies and resource recirculation pathways—will be chosen and adopted. But a flood of new investments in these various options will come into being only after the alternative option of investing in destructive fossil fuels and resource exploitation has been phased out by governments' introducing of new rules that favor green trajectories. It is the character of these rules—and not the individual technologies of energy generation and resource circulation—that will make the difference in countries' effectively dealing with these issues.

Once a new direction is signaled and followed through, with policy resetting that mandates a new renewable trajectory, then entrepreneurial initiative can be expected to take over and investments in the new options to start flowing on a large scale. In this sense there is little difference between myself and advocates of “pure capitalist” solutions like Deidre McCloskey or the free-market environmentalists.¹¹ If there is a difference, it is that I recognize the need for smart state action *to set the system on a new trajectory*—an inescapable precondition—and that such a new trajectory will not be brought into being without state involvement. Insofar as the advocates of free-market principles deny the need for state action, they deny the power and potential of capitalist tools to really do the job in driving the system onto renewable pathways. Indeed, they condemn the tools of a greener capitalism to be working forever against the inertia and vested interests of business as usual, becoming blunted and thereby never succeeding in bringing about a more sustainable economy.

This is where the case of China makes a powerful entrance. In the terms of a detective novel, China has both motive and means. It has the motive in wishing to clean up its own environment and to avoid the endless geopolitical conflicts that a continuation of the fossil-fueled pathway promises. And it has the means in the form of a strong (in this case, authoritarian) state that is prepared to make tough decisions and implement them. I make this statement as an observation, and not as an endorsement of authoritarian rule.

China's Green and Black Model

Some will no doubt find it an “inconvenient truth” that it may well be China—widely condemned for its industrial pollution—that is

leading the way toward a renewable alternative. The key point to highlight is that while China has been expanding its fossil-fueled energy system at an unprecedented rate, at the same time it has been expanding its alternative renewable energy systems and resource-efficient circular economy, also at an unprecedented rate. From 2005 it was doubling its wind power capacity each year and is now continuing to double it every two to three years, creating by far the world's largest wind power sector (turbines and components) and largest land area of wind farms. It has been scaling up its solar photovoltaic (PV) systems in a similar way, so that its solar PV production industry is by far the largest in the world. In the period of the Eleventh Five-Year Plan (2006–2010), its investments in a strong and smart electric power grid that can collect and distribute power from a variety of fluctuating renewable sources were doubled, so that they outranked investments in power generation; this process is accelerating under the Twelfth Five-Year Plan. By 2013 China had by far the largest renewable energy industry in the world, outranking the entire German and French power systems. There is still a reluctance to acknowledge this point, and some leading climate scientists discount Chinese efforts, promoting nuclear as the only alternative to fossil fuels.¹²

As China succeeds in building this new RE trajectory, it can be expected that India will follow, with perhaps a ten-year lag.³ If India pursues a trajectory with a clear focus on renewables and resource efficiency, and it shows many signs of doing so, then it, too, will be focused firmly on a development pathway that can scale. Likewise in the case of Brazil, there is already a high reliance on renewable energies, including bioenergy, and emergent green investment strategies being developed by the Brazilian Development Bank. In the West, too, Germany is now firmly committed to such a course, whether through competitive emulation of China or through its own ambitions, and Japan is now reviewing its commitments to nuclear power after the Fukushima shock. But it is China that is the main story.

If its stated ambitions offer a reasonable guide to the future, then the Chinese leadership is determined to set the country on a greener course. At an Association of Southeast Asian Nations conference staged in Beijing in 2006, the vice minister of environmental protection, Li Gan-jie went on the record to state that “green development is an inevitable choice” for China and for developing countries generally. The vice minister

noted that in the short term, promoting green development acted as a stimulus for the economy; in the medium term, it improved resource efficiency (reducing the scale of resource usage and imports), reduced emissions, and reversed environmental degradation; and in the long term, it promoted a different kind of sustainable industrial system. Since these words were spoken, China has surprised many with its commitment to green development, establishing renewable energy industries at a pace unheard of in the West, putting in place the building blocks of a circular economy by turning wastes into raw materials and by directing finance to support such investments via differential interest charges levied by state-owned banks.

The obvious contrast to be made is with the China model that everyone recognizes—the “black” development model, based on coal. Since 2001, when it joined the World Trade Organization, China has built the world’s largest manufacturing system powered by the world’s largest energy system—and fueled, for the most part, by coal and other fossil fuels. In this respect, China has merely been replicating the steps of earlier industrializers, from Great Britain to Europe and the United States, and in the twentieth century, to Japan, Korea, and Taiwan. All these countries utilized fossil fuels to build their formidable industrial systems. China is doing the same, but on a much grander scale than anyone else—adding 50 billion watts of coal-fired electric power each year (or a 1 gigawatt [GW] thermal power station a week), as well as scouring the world for coal, oil, and gas supplies. Indeed, China is now burning nearly as much coal as the rest of the world combined—nudging 3.5 billion tonnes per year.¹⁴ Its rapid ramping up of coal consumption and fossil fuel electric power generation follows a well-known course (Figure 1.1).

The Chinese leadership appears to recognize that this strategy will not scale, because it will call for coal production and oil imports that will force China to go out into the world in search of resources and impinge too openly and aggressively on other countries’ claims. China has a clear interest in avoiding resource-based confrontations (at least away from its immediate neighborhood) because it has a strong commitment to achieving standards of living comparable with those of the West through peaceful development, without the waste of war. If resource confrontations are to be avoided, Beijing realizes that renewable energy industries will need to be built as fast as is physically and technologically possible.