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The Post-Industrial Imperative: Energy, Cities and the Featureless Plain

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Increasingly in recent decades, post-industrial change and our understanding of it have shaped public expectations of the possibilities for progress. At the same time, public policies, and specifically energy and urban policies, have been modified to accommodate the perceived requirements of a post-industrial future. In what follows we seek to evaluate the urban and energy implications of post-industrialism. After briefly reviewing the early pattern of post-industrial change, we consider the challenges to post-industrialism posed by the urban and energy crises of the 1960s and 1970s. In our view, this period was a crossroads in the post-industrial transition. We emerged from the crossroads with a more realistic assessment of the costs of economic progress, but we did not question the value of post-industrialism, nor did we seek to redirect our future. Rather, post-industrialism has been elevated to the status of a national imperative. This imperative currently serves as the basis for rationalizing the costs of change while it simultaneously establishes national economic and technological progress as the ultimate standard for evaluating public and private decisions. Having defined the nature of this imperative, we examine its implications for our energy and urban futures. We argue that by treating post-industrialism as an imperative, we both distort its costs and forego the opportunity of evaluating it against other possibilities for social change.

On the Path to Post-Industrialism

Throughout the industrial era, American cities played a decisive role in economic development. The key to this role was the complementarily between industrial technology and urban form. This

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complementarily was so extensive and so supportive of economic growth that the phenomena of industrialization and urbanization became virtually inseparable. The relationship between industrial technology and urban form was stimulated and sustained by the types of energy resources which became dominant in the nineteenth century. Indeed, the importance of cities as centers of industrial progress has been directly attributed to their characteristics as energy systems; their spatial concentration was well suited to exploitation of fossil fuel resources for industrial production. As Odum and Odum point out, "Western cities became centers of growth-promoting activities that accelerated the use of resources for growth. The systems became specialized in the uses of new energy sources." (1976: 153-154) The industrial city thus came to symbolize economic and technological progress. "Urban technology had provided urban man new visions of magnificent and powerful mechanical forms and of pulsating, surging force and energy." (Glaab and Brown, 1976: 158)

In the twentieth century there has been a fundamental realignment of the relationships between economics, technology, energy and spatial form. This realignment has been viewed by many as signaling the transformation of America from an industrial to a post-industrial nation. The post-industrial transformation entails a radical departure from the complementary relationship between energy and cities which earlier sustained economic and technological progress. Reorganization from a manufacturing to a post-industrial service society involves a rearrangement of the urban landscape manifested in an increasing mobility and spatial deconcentration of population and economic activity. These changes are reinforced by modifications in the energy basis of society. In particular, electricity, an energy form without significant locational constraint, is seen to be emerging as the dominant source of energy for the future. Ultimately, market adaptations to new technologies, paced by a revolution in communications and fueled by continent-wide electric power pools, are expected to offer virtually limitless mobility. The post-industrial transition means that urbanization is proceeding to a new stage characterized by the dispersal of traditional city amenities and functions and by the obsolescence and eventual displacement of industrial cities.

The transformation of the urban landscape toward a more spatially deconcentrated pattern was already apparent in the first half of the twentieth century (Mills, 1970; Muth, 1984). Innovation in transportation technology and energy services both contributed to the dispersion of urban populations and economic activity. While the process of spatial diffusion did not begin with the petroleum age, the

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emerging prominence of the automobile and the highway system assured that deconcentration would become the dominant spatial trend. The urban consequences of the automotive age were already perceptible in 1924 when the American Academy of Political and Social Science published this assessment:

> The gas-driven machine has brought an era as distinct and creative as that brought by steam ... In addition to its economic contribution ... the automobile brings the few remaining attractions of the city...within such easy reach of the farm family that all incentive to migrate cityward will soon be gone ... The actual limits of a city are far beyond the political city line. (Quoted in Still, 1974: 390)

As the automobile and the highway system granted new mobility, industrial and commercial institutions were able to move farther away from urban centers to areas where land and building costs were cheaper and where there were fewer obstacles to expansion. Similarly, residential location decisions were modified by the new opportunity to leave the city and still enjoy urban amenities and access. Lewis Mumford accurately assessed the consequences of this emerging mobility:

> [E]very street becomes a thoroughfare, and ... every thoroughfare is potentially a commercial street. The tendency toward movement in such a city vastly outweighs the tendency toward settlement. As a result of progressive shifts in population due to the changes to which commercial competition subjects the use of land, the main institutions of the city, instead of cohering naturally... are dispersed in every direction. (1945: 10)

By mid-century, the pattern of deconcentration was being reinforced by federal home mortgage policies which served as further inducement to suburban and exurban growth and by an interstate highway system which contributed to inter-metropolitan shifts in population and economic activity and promoted the rise of Sunbelt cities with their low-density land use patterns. Inter-regional shifts were also stimulated by the growth of commercial aviation and by massive public investments to develop the infrastructure for economic growth in the South and the West.

The rapid growth in electricity services also encouraged spatial deconcentration. Improvements in electric power generation and transmission technologies in the first half of the twentieth century provided opportunities for serving larger and more dispersed market areas. The first steam powered plant constructed in 1901 had a 2000

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kw generating capacity, followed by a 5000 kw plant in 1903 and a 200,000 kw plant in 1930; dramatic enlargement continued unabated and by the 1950s projections assumed that nuclear power plants could be built with virtually no limit to scale. As Ford points out, although large nuclear power plants "relied on complex, untried technology," the assumption of boundless scale economies continued to prevail and led to projections of constant expansion to meet the growing demand for electricity (Ford, 1982: 68). Advances in transmission technology led to the expansion of an electricity grid system which made it possible for dispersed areas to be serviced by the large central power stations that were becoming typical for production. As Morris notes, "the process that had begun in the 1920s ... the gradual evolution of relatively small, isolated electrical systems... blossomed into nearly continent-wide pools." (1982a: 42) The electricity industry itself experienced the effects of the dispersion it promoted; while electric generating plants were initially sited close to urban areas, the newer, larger plants were located away from urban centers. As technological changes altered the physical scale of electricity production and transmission, new economic and political arrangements removed municipal control of the electric industry and vested authority in state regulation (Messing, et al., 1979). These arrangements fostered the economic growth and centralization of private utilities. Between 1900 and 1965 the number of privately owned utilities decreased from over 2,500 to less than 300. Yet, this smaller group continued to account for over 80 percent of electricity sales (Bergman, 1982: 65-68). The political economy of electricity thus transcended city scale and ultimately nullified city influence.

The increasing reliance on electricity was seen by post-industrial theorists as the natural energy implication of technological and economic progress. Herman Kahn, for example, echoed the forecasts of earlier post-industrial theorists and proposed that in the coming age "most of the energy (will be) produced on a large scale and will be in the form of electricity power." (1976: 78) Electricity would come to symbolize post-industrial prosperity which would result from "using science and technology to exploit resources for the creation of material wealth." (1976: 78) The growth of electricity consumption and the declining cost of electric services through the 1960s were thus taken as a clear affirmation of progress. Indeed, as nuclear power generation expanded, electricity would become "too cheap to meter." (Strauss, 1954)

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The prosperity to be derived from society's increased reliance on electricity was already seen as coming to fruition in the construction of all-electric homes connected to an expanding electric power grid and in the rapid commercialization of new household appliance technologies that provided greater freedom from mundane tasks. Indeed, we seemed on the brink of realizing the benefits of the liberating neotechnic age anticipated by Patrick Geddes at the beginning of the twentieth century.

> [T]he fairy godmother is coming, nay is even here year by year she stands waving her fairy electric wand as the herald of the new era in the domestic labour and consequent life of woman, ready and waiting to free her from all the old elements of dirt and drudgery, and this henceforth for good and all. Her future in the adequate neotechnic home, characterized by electricity and its labour-saving, by hygiene, and by art, is thus as true princess, that is lady commanding assured wealth, effective service, adequate leisure, and thus with no limit to her refinement and her influence. (1971: 129)

As to the urban future, post-industrial theorists and urbanists were in general agreement that the well-documented patterns of spatial deconcentration would continue. Indeed with the rise of a service society and the growth of electricity as the dominant energy form, the opportunities for deconcentration seemed boundless. Telecommunication systems would offer a substitute for the traditional advantages of urban locations. At the same time innovations in communications would reduce "the energy, materials, and capital required to support social and economic interaction." (Harkness and Standal, 1982: 219) With tertiary forms of communication as the least-cost alternative, social organization would no longer be constrained by the limitations of place. The result would be the continued loss of function and importance by primate cities and the rise of new urban forms adapted to the more dynamic character of post-industrial society. The direction of this post-industrial urban future was described by David Lewis in 1969.

> Cities in our age of unprecedented dynamism are no longer autonomous and self-sufficient. This implicitly inward-looking, insular form of the single-center city is in conflict with the dynamism of modern mobility and communications systems. The United States as a whole has become a complex network of communications and services and every major city, and thus every citizen, is a component of this intricate network - connected by

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> telephones and television, power grids and consumer production, airways and highways...
>
> The closed urban form, the finite and mononuclear city of tradition, gives way to a new species of urban form in which the basic factor is mobility; an open-form, multinuclear, multidirectional city - a city which is infinitely additive and infinitely variable in its capacity for growth and change. (1969: 302, 303)

The Post-Industrial Crossroads

Despite the enthusiasm of prophets of progress, the path to post-industrialism has hardly been trouble-free. During the 1960s and 1970s two sets of conditions challenged the smooth transition to a post-industrial future. One set arose out of the implications of transition for central cities and their residents. The other set reflected resource limitations which challenged the energy basis of post-industrialism. In combination these conditions exhibited the high costs of transition and as such posed a threat to the achievement of a post-industrial society. Consequently, in the third quarter of the twentieth century, post-industrialism arrived at a perceptible and problematic crossroads.

By the 1960s, the urban reality of the emerging post-industrial order was recognized as containing a number of harsh implications. As new patterns of urbanization broke down the central city's spatial boundaries and displaced many of its traditional functions, they also eroded the city's internal coherence as a social and political unit and undermined its economic prospects. Not only were the core areas of central cities in decline, but many cities were left without the capacity to reverse their fortunes or even to cope with decline in a socially acceptable fashion. The evidence of decline was difficult to ignore. The old urban core was "physically obsolete, financially unworkable, crime-ridden, garbage strewn, polluted, torn by racial conflicts, wallowing in welfare, unemployment, despair and official corruption." (Raskin, 1974: 481) Those with new-found mobility moved out; those who remained increasingly included "old industry, old people, the poor, the discriminated against and their keepers." (Long, 1972: 160) A sense of alienation came to be portrayed by analysts as the pervasive feature of modern city life, and the experience of such alienation was accentuated by the physical, economic and social segregation of races and classes. In this environment, the urban riots of the 1960s may not have been entirely unexpected, but it was only with their occurrence that an "urban crisis" was officially declared. The forces which fomented that crisis, however, had been in operation for

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

decades; only the grudging social admission of urban decay was new. That admission posed a challenge to post-industrialism's presumed beneficence since at least some of the conditions contributing to the urban crisis were also conditions associated with a mobile post-industrial service society.

In seeking to deal with the urban crisis, most urbanists and many in the policy community focused attention on reforming the social conditions of the urban underclass and refurbishing the dilapidated physical infrastructure of cities, particularly older industrial cities. While divided in their specific recommendations, they assumed the need for a comprehensive national urban policy that would mobilize public and private resources to address the multiple symptoms of city decline. The central policy focus was on poverty, inequality, racism and the other manifest conditions of the urban unease. Little attention was given, however, to influencing the patterns of spatial deconcentration or the attendant political and economic diffusion which accompanied post-industrial development and which contributed to central city decay and impoverishment. Indeed, there was no contradiction perceived between efforts, on the one hand, to redress the decline of cities and the poverty of the urban underclass and, on the other hand, to promote the technological, spatial and mobility requirements of economic progress. Thus, for example, Daniel Moynihan proposed that:

> Urban policy must have as its first goal the transformation of the urban lower class into a stable community based on dependable and adequate income flows, social equality and social mobility. Efforts to improve the conditions of life in the present caste-created slums must never take precedence over efforts to enable the slum population to disperse through the metropolitan areas. (1970: 31-32)

As John Mollenkopf has argued, the urban policy proposals during this period not only were compatible with the post-industrial revolution, they were intended to facilitate it (1983: 12-46; see also Judd, 1979). Thus, despite the urban crisis, there remained a prevailing optimism about the coming post-industrial era.

Amongst post-industrial theorists this optimism was hardly restrained in any degree by the extant conditions of decay and social unrest in America's central cities. While recognizing the decline of large urban centers, post-industrial theorists were usually convinced that new and viable urban systems would be created through the technological innovation and spatial rearrangement that were

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

accompanying post-industrialism. The key to progress was to acknowledge that traditional cities were dying forms and then to invest in new urban systems which facilitated economic progress. In typical fashion Buckminster Fuller was more direct in his assessment than other prophets of progress.

> The concept of cities as they now exist developed entirely before the existence or the thought of electricity or automobiles... Cities, as we know them, are obsolete... Trying to rebuild cities to make them accommodate the new needs of world man is like trying to reconstruct and improve a wrecked ship as the shipwreck rests upon the reef, pounded by the surf.
> (1969: 140)

He proposed to replace the shipwrecks with one-million passenger vertical-tetrahedronal floating cities developed in accord with the principles of a "comprehensive anticipatory design science" which would deliver us from "1966 to Utopia." (1969: 143) Others offered proposals for new urban systems which were less ambitious but they were no less optimistic about the availability of technological solutions to the less desirable urban side effects of progress. Impressed by the achievements of the space program, some advocates of the moon-ghetto metaphor sought to "launch the aerospace companies on problems of garbage collection, education and crime-control" (Nelson, 1977: 17). Others drew their inspiration from the proclaimed successes of the defense industry and offered proposals for city resurrection which one observer labeled "the ballistic missile solution to the urban crisis." (Sapolsky, 1969) Underlying all these proposals was a faith in the power of technical rationality and innovation to solve our social problems and an impatience with what were perceived to be unnecessary political distractions and distortions. Regaining momentum for post-industrial progress seemed to require an "end to ideology" (Bell, 1965, 1967). Again, Fuller was more outspoken than most: "Take away all the politicians and all political ideologies and leave all the inventions in operation and more will eat and prosper than now while racing on to take care of 100% of humanity." (1969: 141) In sum, while the urban crisis made manifest the social costs of transition, there remained confidence that such costs could either be removed, ameliorated, or transcended without diminishing the prospects for a post-industrial future. The challenge posed by the urban crisis was deemed to be a manageable one; its resolution need not retard economic progress.

As the urban crisis was being publically declared "over," another challenge emerged which seemed, at least initially, to pose a more direct threat to a post-industrial future. The energy crisis of the

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

1970s, precipitated by the six-month embargo on Arab oil and the ten-fold increase in crude oil prices in the ensuing six years, raised serious doubts about the availability of energy resources that were seen as essential for economic development. The historical correlation between economic growth and energy consumption led many analysts to project an economic future absolutely constrained by the limited availability of fuel.

Early projections of impending economic collapse were later moderated as the energy-economy relationship was recognized to be other than lock-step. Econometric projections were typically based on the expectation that sustained growth is possible even with significantly reduced growth rates in energy demand. Hudson and Jorgenson, for example, projected a 3.85 percent increase in GNP per annum through the year 2000 while the growth rate in energy demand was expected to fall from 3.9 percent to 2.9 percent. Yet, even this decrease in the growth rate of energy demand would entail a more than doubling of energy consumption by the end of the century from 77 quads to 164 quads (Hudson and Jorgenson, 1976: 44-49). Thus, few in the public or private sectors were willing or able to ignore the energy limits to economic growth (compare Myers, 1975; Ford Foundation, 1974; and FEA, 1976). The energy crisis also held potentially serious implications for the emerging pattern of diffuse urbanization. The dispersal trends and mobility distinctive of the post-industrial urban system were seen by several analysts to be at odds with the conditions of higher energy prices and possible energy shortfalls (Burton, 1979; Dantzig and Saaty, 1973; Van Til, 1979). Despite this threat to general economic progress posed by continued deconcentration under conditions of energy shortfall, cities and spatial forms never figured prominently in either the prevailing understanding of the energy problem or the policy proposals offered as solutions.

The energy crisis challenged two central features of post-industrialism. It made vulnerable the technological base of a society where continued economic progress was dependent upon rapid growth in transportation and innovation in communications. At the same time, it threatened the fossil fuel base needed at least for the short term to sustain electricity growth. The most immediate impact of the energy crisis was to endanger the transportation sector. Because no viable substitute for petroleum in the transportation sector exists, a near-term technological fix of the problem was precluded. Improvements in the design of automobiles and other modes of transport which could materially reduce the energy needs of this sector were readily available. The accommodation of higher petroleum prices

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

necessary to induce widespread adoption of these improvements, however, meant that post-industrial progress would be substantially more costly than before. Moreover, the expected rapid substitution of communications for transportation was jeopardized by the higher costs and growing uncertainties associated with increasing electricity production in the face of constraints on fossil fuel resources.

The major policy initiatives adopted since the 1973-74 embargo have all stressed the national and international character of the energy-economy problem and have sought solutions at a corresponding scale. While differing in other respects, the common thrust of Project Independence, Carter's "moral equivalent of war," the Synfuels Program, the acceleration of nuclear programs, and the regulation - and then deregulation - of prices was to restart the national economic engine and to insure secure energy supplies by stimulating rapid technological innovation and diffusion. Despite these policy initiatives (and in part because of them), the energy crisis diminished confidence in continuous economic growth to an extent that the urban crisis was unable to do. We were confronted not merely with problematic side effects of transition, but with a direct challenge to the prospects for economic progress. While each of the national energy initiatives in the 1970s was undertaken with the expectation that it would guide us back to the path to economic renewal, there was little expectation that this would be easy or painless. Nevertheless, as in the case of national responses to the urban crisis, the responses to the energy crisis did not challenge the value of a post-industrial future.

The combined effect of the urban and the energy crises was to force recognition of the high costs of economic progress and to signal the need for efforts to remove these costs, or at least to reduce them to socially acceptable levels. In some sense, the post-industrial crossroads represented an occasion for adopting a more realistic understanding of the costs and the conditions of economic growth. It also offered an opportunity for reevaluating and redirecting society's course on the path to post-industrialism. The occasion for realism was exploited, but the opportunity to redirect our future was not. Indeed, the national policy orientation as we entered the 1980s stressed the need to acknowledge post-industrial progress not simply as a preferred possibility but as a national imperative.

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

The Post-Industrial Imperative

While the urban and energy policies of the 1960s and 1970s sought to control the process of post-industrial development, the policies of the 1980s have sought to remove those controls and, instead, accommodate the natural forces of change. This shift reflects a now-dominant belief that if it is a crisis we face, it is not an energy or an urban crisis but a crisis of national economic and technological renewal. That crisis is understood to result from a national failure to recognize and adapt to the underlying processes of societal change. Earlier efforts to guide the post-industrial transition are seen as having exacerbated our situation by restraining the changes required to ensure future prosperity. Indeed, previous social interventions are now considered to have been, at best, well-intentioned failures and, more often, dangerous intrusions that delayed and sometimes obstructed economic and technological progress. A long-term, post-industrial transition is now assumed to be irresistible and the responsibility of society is to refrain from any actions that inhibit that transition. In this sense, post-industrialism has become a national imperative and the framework of change defined by that imperative has become the standard for judging the legitimacy of both public and private actions.

The logic of the post-industrial imperative is predicated upon a series of assumptions about the processes of social change that have been elevated to the status of public articles of faith. Neither these assumptions nor the imperative logic they support is new. What is new, however, is the emergence of this imperative logic as the dominant framework for policy in America. This dominance has been encouraged by a change in political climate represented in the election of a conservative administration dedicated to economic and technical renewal. In our view, however, this political change was as much a reflection as a cause of the dominance of the post-industrial imperative. The striking characteristic of the current national policy climate is the extent to which virtually all political interests have accommodated their proposals for social change to the perceived requirements of a post-industrial transition. As a result, the post-industrial imperative is largely unchallenged and the policy debate is focused instead on how we can best facilitate post-industrial change. Indeed, the measure of post-industrialism's emergence as a national public philosophy is the extent to which it now determines what policy issues are regarded as salient and what range of policy alternatives are thought to be realistic.

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

The articles of faith underlying the post-industrial imperative define the possibilities for national progress. First, it is assumed that progress can be adequately assessed only at the scale of the nation as a whole. The progress of society cannot be gauged by the well-being of specific places or groups. National development needs must now take precedence over other social values, and efficiency in meeting these needs must be the ultimate criterion for evaluating social actions. It is also assumed that technological innovation is the pacing element of national economic progress. As in the past, many of the current problems of society are seen to reflect the existing limits of technology, and the resolution of these problems is thought possible only through the further development of technology. Because of the complex, interrelated changes involved in the process of technological and economic renewal, policy interventions intended to influence that process are expected to create more difficulties than they resolve; in other words, the unintended results of policy interventions are likely to overwhelm the intended results. Unless such interventions are avoided, the cumulative process of national development is likely to be obstructed or diverted and the whole process of social change correspondingly set back. A third article of faith follows from this interpretation of the development process. Because the economic marketplace is presumed to be the most responsive medium for rapid societal adaptation, a market-led transition is favored as the most conducive to technological innovation and the most effective in diffusing innovation throughout society. In this sense, the marketplace is best suited to the criterion of efficiency in meeting national needs. Restrictions on the marketplace, like efforts to control technological development, delay the process of social change and increase its long-term costs. It follows from these assumptions that society's preoccupation with the short-term costs of transition only serves to prolong and worsen conditions of social distress and to postpone the lasting improvements that can materialize only through post-industrial progress. Thus, a fourth article of faith is that the economic, social and spatial dislocations that arise in the process of change must be evaluated in light of the long-term benefits of the national development process. Viewed from this perspective, many of our current social problems are in fact necessary stages on the path to progress. In particular, urban and energy conditions which earlier were understood as the signals of crisis are now understood as the acceptable costs of transition to an ultimately beneficial post-industrial order. Deteriorating cities, spiraling energy prices and the social impacts of these circumstances are actually signs that the process of economic and technological recovery is well underway.

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

In our view, the post-industrial imperative serves to limit our vision of the possibilities for social change. It focuses attention only on changes that can arise out of the evolution of existing institutions and technology, and it defines social responsibility as passive adaptation to a process of change purportedly beyond society's ability to control. In effect, the post-industrial imperative implies that the conditions of social change are beyond social choice. On the one hand, post-industrialism is to be exempted from evaluation against alternative futures, while on the other hand, it is to be accepted as the standard for evaluating current social action. In this way, the post-industrial imperative serves as the basis for rationalizing the costs of social change while avoiding any assessment of the adequacy of a post-industrial future. These implications of the post-industrial imperative are nowhere more apparent than in the accounting of our energy and urban conditions.

Rationalizing the Costs of an Electric Society

Post-industrialism has always entailed a commitment to the development of electricity as the dominant energy source for the future. Only in the last decade, however, have the costs of this commitment become apparent. Yet, it is in the nature of the imperative logic that currently undergirds post- industrialism that such costs are rationalized as the necessary price of progress. To understand the implications of this for our energy future, we must first examine the costs of achieving an electric society and then consider the basis for rationalizing these costs as acceptable.

The feasibility of an electric future depends on the use of coal and nuclear power to provide stable and economical supplies of primary fuel for electric generation. In the case of coal, the adequacy of supplies is not in question. Indeed, the abundance of domestic supplies has meant that coal is frequently thought of as a readily available alternative to petroleum-based electricity production. According to a 1980 federal study, coal can replace more than 2 million barrels of oil per day in electricity power generation, liberating this sector from its dependence on a potentially unstable oil supply. The price of exploiting this resource, however, is substantial. Converting existing oil-fired generators has been estimated in this same study at $12 billion and could only be completed sometime after 1990, assuming a smooth transition free of any major obstacles (cited in Horwitch, 1979: 95). Given the additional social, environmental and infrastructure costs

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

associated with this transition, the real price is likely to be much higher.

At a minimum, the development of coal will require unprecedented coordination between the coal industry and other economic sectors. Railroads, for instance, must add substantially to their rolling stock to handle the increase in supply while utilities must convert their existing plants and construct new generating capacity. In both cases, lead times of 10 to 12 years are required to make significant adjustments in infrastructure. The transition is further complicated by a locational mismatch between the cheapest and least polluting coal in the west and the most reliable transport systems in the east.

In addition to the infrastructure costs associated with a coal-powered electricity system, environmental costs are also substantial. High levels of acid rain pose serious environmental dangers as plant emissions release sulphur into the atmosphere, where it mixes with evaporating moisture that ultimately feeds forests, lakes and rivers, and which may threaten agricultural crops. Similarly, destruction of the ozone layer induced by the burning of fossil fuel poses an exceptional problem in the case of coal since its CO_2 emissions are the highest among conventional fuels. It is possible that these environmental threats could ultimately be addressed through the application of complex new technologies that prevent or minimize their impact. Even so, such prospective technofixes will be expensive. The only other alternative is social acceptance of immense environmental costs. Coal development also engenders serious social costs which conventional evaluations of energy alternatives do not usually address. Coal miners work under the most hazardous conditions known to American workers, and this has created the need for the largest occupational health program in the country. Substantial health and safety improvements in mining conditions will be expensive; without them, the social costs of exploiting coal supplies may be prohibitive.

If we choose coal to fuel post-industrial progress, it will not be because its abundance offers a quick and relatively costless technofix (Horwitch, 1979). Rather, it will be chosen because the economic, environmental and social costs are deemed an acceptable price for transition to an electric society. In this context, some observers still maintain that coal remains a viable and important option for our energy future. As Dukert notes, "(relative decentralization of energy consumers need not affect the concentration of basic energy supply. Coal, the nation's most abundant domestic fuel source, could still be mined in large quantities" (1980: 76). Similarly, Harry Perry

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

concludes that "[while U.S. coal productive capacity could be overtaxed for short periods and in limited geographic areas, there appear to be no overriding constraints to satisfying any foreseeable coal demand"; meeting demand may require substantial investments in new technology and infrastructure as well as favorable policy incentives, but current obstacles are not insurmountable (1983: 49). Moreover, those who represent the mining and transportation systems, the essential infrastructure for coal development, have maintained their confidence in the rapid development of coal resources to fuel electric production: "there do not appear to be any serious constraints that would prevent coal mines east of the Mississippi from greatly and quickly increasing their output in order to meet substantially increased domestic and export demands ... The time is past when we, as Americans, can afford the luxury of using natural gas or expensive imported oil under utility or industrial boilers. Coal can and should do those jobs..." (Gobrecht, 1983: 10-14) Despite such assessments, however, coal has increasingly come to be considered largely as a transition fuel on the way to an electric future that will ultimately exploit the power of nuclear energy.

Most frequently, post-industrialism has embodied a belief that nuclear power will gradually assume the key responsibility for our energy future and eventually make possible the generation of electricity "too cheap to meter." Thus, for example, in 1965 Theodore Gordon proposed: "If we didn't have atomic energy in our back pocket, we should be extremely worried about the prospects of seeing our fossil-fuel supply run out in a century or so." (95-96) While the unrestrained enthusiasm of earlier post-industrialists has somewhat abated, nuclear-generated electric power is still regarded as the epitome of the high technology road to a post-industrial energy future. Nonetheless, the costs of achieving such a future have continued to mount, especially in the last decade.

National economic trends, particularly rising long-term interest rates, combined with soaring building and operating costs and conflicts over insurance responsibility, have greatly increased the economic burden and insecurity of the nuclear industry. A recent study conducted by the Office of Technology Assessment (OTA) estimated that the total cost of constructing a nuclear power plant in the early 1970s was between $150 and $300 per kWh. As of 1983, this figure had risen to between $1,000 and $3,000 per kWh, an increase of 550 to 900 percent (OTA, 1984: 58). Despite decades of direct and indirect government subsidies (including federal military and civilian research and development), the economics of nuclear power remains precarious. The OTA

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

concludes, notwithstanding the myriad costs attendant to the use of coal for electricity generation, that "the average capital cost is now so high that the typical nuclear plant probably would produce more expensive electricity over its lifetime than the typical coal plant." (1984: 65) To change this condition will require levels of public subsidization of nuclear development which exceed those provided in earlier decades. Even so, recent experience suggests that the economic risks to the nuclear industry will remain substantial.

Consider, for example, the case of the nuclear development projects undertaken by the Washington Public Power Supply System (WPPSS). The total bill for the WPPSS nuclear projects has been estimated at $31.2 billion, $8 billion of which was spent on two plants that will "be left to sit in the rain." (Gleckman, 1984: 35) WPPSS was initiated because of a common concern among 88 participating utilities about the possibility of severe future power shortages in the Northwest region. Fearful of losing their economic position in the electricity market, the utilities embarked on an aggressive campaign to retain their capacity to continue to provide inexpensive power supplies. The outcome has turned out to be very different from what was projected with WPPSS forced to default on bonds of $2.25 billion - the largest municipal default in U.S. history. Although WPPSS is the only major nuclear project in default at this time, many of the economic woes it experienced are not unique. As a recent Energy Information Administration report indicates, the industry has *regularly* experienced cost overruns of the scale of WPPSS; indeed, 72 percent of American nuclear plants have cost at least 1.5 to 4 times their original estimate (EIA, 1983: 7).

In a dramatic way, WPPSS symbolizes the unstable economic condition of the nuclear industry and the immense risks of nuclear investment. These conditions and risks have not been overlooked by advocates of a nuclear electric future. Rather, the interpretation given to these circumstances proceeds from the assumption that the failure to continue with nuclear development will eventually engender even greater costs. From the vantage point of post-industrial progress, the price of transition to a nuclear electric society may be higher than previously anticipated, but we must ultimately pay this price since the alternative to proceeding with that transition is much worse. In this context, not only the economic but also the social and environmental costs of continued nuclear development must be viewed as acceptable. The costs of disposing of radioactive waste, the implications for proliferation of nuclear weapons, the continued requirement for government protection of the nuclear industry, and the possibilities for

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

catastrophic accidents are not necessarily to be ignored. They are, however, to be understood as the inevitable, if not typical, burdens of progress. In essence, the post-industrial imperative means that we have no choice but to continue the development of nuclear power. Failure to do so amounts to an admission of an absolute limit on progress. This interpretation is forcefully expressed by Harold Agnew in his assessment of the future of nuclear power.

> The difficulties the civilian nuclear industry have encountered in the past few years are enough to shake the faith of even many of the talented and dedicated people within the industry. Is a bright nuclear future for the U.S. and for the world a dream of the past that will never be fulfilled? Was Dwight D. Eisenhower wrong when he foresaw and proclaimed an energy abundance that would benefit all mankind by setting in motion his Atoms for Peace Program in 1954?
>
> The answer is no. Despite the difficulties and problems that have beset the industry in recent years, the vision of Eisenhower was and still is correct for these simple reasons: abundant, inexpensive energy supplies are the foundation upon which major advances of the past two hundred years - and the accompanying rising standard of living - have been based; where fossil fuels carried us into - and perhaps through - the industrial age, nuclear energy, both fission and fusion, represent the fuels on which future progress will be based; and nuclear is the only non-fossil energy source that will be available to us in sufficient amounts to support our current civilization and to fuel progress for the foreseeable future. While technological advances have often been resisted, it is comforting to note that throughout history people have never turned their backs on progress for any significant periods of time. (1983: 1)

Beyond the issues associated with the choice of primary fuels, an electric society raises important implications in terms of the institutional requirements for electricity production and use. A society heavily dependent on electricity must accept a number of distinctive costs associated with the operation of the electric utility industry. In its current state, that industry is dominated by state and federally regulated monopolies which are insulated from economic failure. Regulated price increases, complex rate structures, and other financing and service techniques are available as needed to accommodate management and investment decisions. The usual consequence of this monopoly structure has been to charge to the public, rather than private investors, for the costs of management decisions, economic reverses caused by national and international forces and other conditions which contribute to the precarious financial situation of utilities. These costs

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

have been high in the past, but they will almost assuredly become even higher in a post-industrial electric future.

Because of the highly capital-intensive character of electricity production, the utility industry already controls one-third of total domestic U.S. private capital. Moreover, capital costs have continued to rise over the last decade from $10 billion in 1970 for new plant construction to $28 billion in 1982 (OTA, 1984: 31). Since an increased reliance on electricity will require even greater capital investments, utilities must become an even more decisive force in the operation of the capital funds market in the future. Moreover, because new plant construction requires a ten to twelve year planning horizon and the conditions affecting the ultimate productivity of new plants are shifting and uncertain, the capital investment decisions of utilities are increasingly characterized by risk.

Precisely because of the central role of utilities in bringing about the transition to an electric society, post-industrial advocates have argued that society must create the conditions necessary to assure that the required capital is available for utility investment. The price tag for such a guarantee is admitted, even by its advocates, to be staggering. Thus, according to Navarro, it will require at least $350 billion dollars within a ten-year period "just to keep the lights on and the economy growing." (1983: 87) The Energy Department forecasts that this figure will rise to $1.8 trillion by the end of the century (Stanfield, 1984: 69). In the context of the post-industrial imperative, we dare not avoid or postpone these investments unless we are willing to forego economic and social progress. Citing recent econometric evidence, Navarro points out that "GNP cannot grow at a rate much higher than the rate of increase in electricity supply... utility capacity is the locomotive of the American economy." (1982: 93) Given this premise, the recent federal efforts to provide both financial support and regulatory relief to the utility industry must be understood as necessary conditions of progress.

Recent consumption trends have served to further complicate the electricity situation. Although the industry has incorporated a series of promotional schedules that subsidize large consumers of electricity, it has been unsuccessful in forestalling a sustained slowdown in electricity demand. From 1973 to 1982, electricity demand increased at an annual rate of 2.6 percent. In contrast, in the years between 1960 and 1972, consumption grew at a rate of 7 to 7.5 percent. Thus, recent trends display a significant decline in the use of electricity despite forecasts of a greater dependence on electricity in the post-industrial

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

future. If such trends were to continue for the next twenty years, the Office of Technology Assessment predicts that they would "provide no more than a weak stimulus to the further building of central station power plants." (OTA, 1984: 31-32) These unanticipated reductions in demand have had the effect of encouraging utilities to seek higher revenues from customer classes to pay for increasingly idle capacity. It has also led to encouragement of the use of electricity for purposes for which it is not well suited. For example, in order to reduce idle capacity during off-peak periods, utilities have encouraged consumption for home heating during the winter months. This solution engenders both technical and economic inefficiencies, however, since electricity is not competitive with other energy forms for low-grade heat (below 200 degrees Fahrenheit).

Between 1970 and 1980, electric utility revenues grew nearly fourfold (from $19 billion to $78 billion), while sales failed to even double (from 4,750 trillion Btu to 7,146 trillion Btu). A large portion of the differential increase in revenues versus power supplied went to finance growth in the industry reserve margin which climbed from 1520 percent to 30-35 percent. In sum, the electric industry is charging more for less on the justification that long-term requirements for continued growth to meet anticipated increases in demand justify any short-term costs resulting from excess capacity. Moreover, such justification carries with it the implication that estimates of capacity requirements must be based on anticipation of future needs that largely ignore current consumption trends. In effect, it is a vision of an electric future rather than an assessment of existing energy requirements that becomes the criterion for judging current performance. As the chairman and chief officer of Pacific Gas and Electric (the largest utility in the U.S.) states, "if you run short of power the economic loss is so great, that it makes the extra carrying cost of overbuilding pale by comparison ... (s)o if in doubt you overbuild even though it is very painful." (Stanfield, 1984: 69)

It is clear that an electric society involves more than a selection of fuel types. The importance of electricity to post-industrial progress must be understood in the context of the energy requirements generated by more general processes of technological and economic change. It is through an "abundant, inexpensive and reliable supply of electricity," that "basic industries such as food processing, chemicals plastics, paper textiles, aluminum and steel as well as newer industries like computers and semiconductors" can flourish (Navarro, 1982: 87). Thus, the post-industrial imperative transcends the advocacy of an electricity-based society as such. Instead, the conditions of

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

post-industrial progress serve as the criteria against which all energy alternatives are to be evaluated. It is through the application of these criteria that electricity emerges as the clear and apparent preference for the future. Thus, Jorgenson finds that productivity in 23 of 35 U.S. industrial categories depends on technological changes using electricity. "Historical evidence suggests that much of the innovation in the twentieth century is electricity using. Innovation increases the share of output for a given set of input prices...[T]echnical change results in an increase in the share of electricity input in the value of output, holding the relative prices of all inputs constant." (1984: 28-29) In the context of such analysis, Navarro concludes:

> [E]lectricity-intensive innovations... are essential to real growth in productivity and income. Successful modernization of the American steel industry, for example, depends on the electric arc furnace which greatly reduces ore-handling costs, economizes on coal resources and provides a more precise method of metal fabrication. The renaissance of the auto industry rests in large part on time and labor-saving devices like robots, which feed greedily on electricity. The bulk of energy saving and productivity enhancing technologies - computers, telecommunications systems and word processing equipment - are electricity intensive. (1982: 92-93)

The development of an electric society is thus to be understood as an inescapable technical requirement for continued economic prosperity. So viewed, the costs of transition to an electric society will always be judged as negligible in comparison to the costs of foregoing the technological innovation essential for progress. Moreover, if we do not exploit the opportunity for progress, others will and we will be left to pay an even higher price for future economic growth. As Harold Agnew points out, "[i]f you think our steel industry is in trouble today, just wait until the Japanese bring out a 50-megawatt, high-temperature gas-cooled reactor for their steel industry." (1983: 7)

Some advocates of post-industrialism have argued that the costs that would have to be absorbed by a high technology path to an electric society can be circumvented without endangering the post-industrial transition. They argue that the marketplace rather than technology per se is, or ought to be, the ultimate arbiter of post-industrial progress. Proponents of this view have focused less attention on the high technology requirements of progress than on the conditions of market competition necessary to stimulate innovation. The aim is to reduce and ultimately remove the government as a force in the energy market and to replace this influence with a free-market

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

orientation which would maximize competition in the energy marketplace and would result in performing energy services at minimum cost (Sant, 1981). The distinctive feature of the market system is that it is not tied to any particular technology , fuel, consumption level or pattern, service mix or even any particular arrangement of production and use. In the marketplace, the costs attendant to different options will be incorporated in the calculus of choice and those options which are more costly will ultimately fail. In brief, the costs that will accompany a post-industrial energy transition will be naturally minimized if we simply let the market do its work.

While advocates may be right that a market-driven transition to a post-industrial energy future will be more efficient than one driven by technological requirements, this does not mean that the costs will be negligible. Indeed, it appears as if the costs will not even be very different. That is, while the marketplace is not committed to an electric future per se, it is nonetheless delivering a spatial distribution of economic activity which is predicated upon an electricity-based energy system.

A central feature of the post-industrial transition in the U.S. has been the migration of populations from the Frostbelt to the Sunbelt coupled with disproportionate growth in the service economy of the latter (Long, 1980). Our analysis of selected Sunbelt and Frostbelt states indicates that this migration has been accompanied by an extraordinary increase in Sunbelt energy demand. Most important, this increase has led to growth in per capita and per service employee energy consumption that is greater than what could be expected as a result of shifts in population and economic activity. Sunbelt per capita demand grew between 1965 and 1980 at roughly 3.5 times the rate of Frostbelt per capita demand and stood at 393 mBtu compared to the Frostbelt's 290 mBtu. Moreover, Sunbelt per capita consumption was greater initially. Comparisons of energy demand per service employee, a measure of energy intensity in the service economy, reveal even more disturbing regional trends. Whereas in 1965, Frostbelt states averaged 10 percent more energy use per employee for services, by 1980 the situation had reversed; Sunbelt states had increased their per service employee demand about 10 percent above states in the Frostbelt (Byrne and Rich, 1983: 139-145)

In themselves, these trends might not be regarded as an adequate measure of the energy tendencies of post-industrialism. Indeed, as we pointed out, national energy trends suggest that despite the growth in Sunbelt energy demand the consumption levels of post-industrial

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

society as a whole are stable or declining. But the recent stability is neither characteristic of what is occurring at the leading edge of post-industrialism within the Sunbelt nor, more importantly, is it indicative of what is being delivered by the market as a post-industrial energy future. What is being delivered by the market is a future very much in line with what has been anticipated by the advocates of an electric society. This is apparent in the rising importance of electricity in the fuel mix; between 1965 and 1980, energy used to produce electricity grew from 21 percent of total U.S. energy consumption to 32 percent (EIA, 1982: 14). Such growth has been spurred to a significant degree by the rise of the Sunbelt as a center of population and economic activity. This area more than any other in the country is built upon an electricity-based energy system. Thus, despite all of the costs of an electric society, electricity is being chosen by the marketplace as the energy form of preference for post-industrial renewal. Moreover, the trends toward growing Sunbelt populations and economic activity and toward greater reliance on electricity means that the post-industrial energy future will engender significant energy inefficiency. As of 1980, nearly half of the energy flowing into the Sunbelt residential and commercial sectors served no end use but instead was lost in conversions to electricity. The catalyst of American economic revival, the Sunbelt commercial sector, diverts nearly one-third more of its energy demand to no productive use than the commercial sector of the Frostbelt (Byrne and Rich, 1982: 145). While energy losses have been growing as a percent of national energy consumption for some time, the Sunbelt migration has accelerated the problem. Between 1965 and 1980, when the migration was at its strongest, energy losses grew from 15 percent to 23 percent of total U.S. energy consumption.

From the perspective of the post-industrial imperative, our increasing reliance on an energy system with 50 percent losses is not part of our energy problem, but part of our best economic solution to the challenges of progress. Indeed it is expected that if we intervene in the process of market change so as to redress these energy outcomes, the ultimate costs will be even greater. We must accept market outcomes as encompassing the least-cost energy future even if that future engenders 50 percent losses in end-use efficiency.

Rationalizing the Social Costs of Urban Change

The now familiar trend of spatial deconcentration and its attendant economic and social dislocations is conventionally accepted as the

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

most compelling feature of urban change in America. Encompassed in this change has been the continuing economic and population decline of older industrial cities, the growing concentration of relatively immobile low-income groups within the urban core, the resulting rise in the social service burden, the accumulating costs of maintaining older urban infrastructure, and the erosion in local revenue bases. These factors have combined to produce a pervasive condition of urban social and fiscal stress. In response, efforts at urban revitalization have focused on reversing the deterioration of local economies. In aggregate, such efforts have sustained a national competition for economic growth and affluent residents in which individual cities have sought to achieve more specialized and stable economic roles within the new spatial arrangements of the emerging service society.

There is little doubt that the process of urban change and the economic competition among cities have engendered dramatic social costs for substantial parts of urban America. What is in doubt, however, is whether society could or should intervene to remove these social costs. In the 1980s, this issue is increasingly framed in the context of the post-industrial imperative.

The interpretation of urban change that is now in good currency reflects ideas that were articulated over a decade ago. The most comprehensive statement of these ideas was Edward Banfield's controversial critique of the urban and social policies adopted to deal with the urban crisis (1970, 1974). Banfield argued that most urbanists and policy makers had misinterpreted the nature and implications of the urban changes underway. The decline of central cities was understood as a social problem largely because we applied middle-class expectations regarding the "amenities, comfort and convenience" to be delivered in an urban society. Thus, in Banfield's view, the decay of older urban infrastructures may raise problems of efficiency, but it cannot be identified as a crisis unless we choose to adopt a bias to "beautify cities." As to the social distress experienced by the urban underclass, Banfield argued that we have similarly mistaken its source and therefore implemented a series of policy responses that proved to be overwhelming failures. What was needed was the recognition that the decline of cities is really the hallmark of progress made possible by unparalleled economic growth; that much of what we conventionally define as urban problems are dimensions of a necessary and ultimately beneficial social transition. These "problems" will be resolved naturally if we adjust our expectations and resist the temptation to intervene. If older cities no longer hold great advantages as places for people to live and work, then we should accept this as a fact of economic

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

progress. Our policies should promote the "good health of society" rather than attempt to sustain or enhance the advantages of particular places or groups.

Banfield's ideas were the subject of protracted debate throughout the 1970s. In the 1980s, however, ideas very much like Banfield's have emerged as the dominant framework for urban policy. Perhaps the most straightforward statement of post-industrial thinking applied to the issues of urban change is contained in the report *Urban America in the Eighties* (1980) prepared by the President's Commission on a National Agenda for the Eighties at the close of the Carter Administration. Recommending a shift from an urban policy to a social policy, the Report implores urbanists and policy makers to rethink the recent history of American cities as the unfolding not of a crisis but of a transition for the better. "In large measure, [urban changes] - including the transformation of local economies, the lower-density settlement patterns, and the growth in location beyond metropolitan areas - are often beneficial to the nation as a whole, even though they may have undesirable short-term effects on specific communities." (1980: 64) In this context, the Report calls for public acceptance and encouragement of the shifts of population and economic activities from the industrial cities of the Northeast and Midwest to the emerging post-industrial regions in the Sunbelt. These shifts are to be understood as the spatial expression of a technologically driven transformation to a new economic and social structure. In terms strikingly like those used by Banfield ten years earlier, the Report depicts the upheaval of cities as a manifestation of dynamic technical and economic processes at work for the long-term "good health" of society. Such processes need to be recognized as the essential foundation of continued material progress which in turn generates new demands and lifestyles and which entails dramatic changes in attitudes and preferences that cannot be controlled. In the midst of this change many cities have experienced and will continue to experience economic and social dislocations but, the Report contends, this is unavoidable and does not justify actions that impede the long-term well-being of the nation.

The Report describes our earlier policy responses to the problems of declining urban areas as having been "short-sighted and misleading" (1980: 20); they have attempted to prevent the natural decline of some urban places rather than to facilitate evolution and change. "In the past two decades, federal policies have sought to preserve the functions inherited and the scale achieved by cities, rather than to assist them in adjusting to an emerging post-industrial era." (1980: 90)

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

What has not been recognized is that the general welfare of the nation depends on the vitality and adaptability of the national economy and not on the condition of specific places. Thus, the Report proposes that there "are no national urban problems, only an endless variety of local ones" and these reflect the inability of specific localities to adjust to the requirements for national economic revitalization. "The general implication is that, in the long run, the fates and fortunes of specific places be allowed to fluctuate." (1980: 65)

The Report argues that we need to recognize social and economic change as the manifestation of an inherently ordered and dynamic system operating across time and space. The workings of this system are evident in such processes as in the globalization of markets, the changing fortunes of specific places and the transformation of work life away from a focus on physical and mechanical labor and toward a focus on services and adaptability. Understanding the complexity of systemic change means that we must also respect the limits it poses on our capacity to intervene. As Banfield pointed out, we must learn what we cannot do. Thus, for example, the Report proposes that social policy may be needed to assist those who bear a heavy burden of the costs of transition but "the principal role of the federal government should be to assist communities in adjusting to redistributional trends rather than to attempt to reverse them." (1980: 4) The authors of the Report "urge the government to adopt social policies that have as their collective aim ensuring that those who can work are able to and those who cannot work are able to lead a life of dignity while their welfare is provided through alternative means." (1980: 65) In making this recommendation, the authors accept as unavoidable society's obligation to provide for a residual group of individuals who have no productive relation with the economic system and who have not and will not figure in the transition to a post-industrial future. In effect, society needs to recognize and accept the limits of the economic system. The welfare populations of older cities do not reflect the failure of our socio-economic system; rather the non-adaptability of such groups creates the social costs they experience as post-industrial change proceeds.

The Report advocates a policy for urban America that by design is not urban either in focus or scope. Cities as discrete spatial entities do not figure centrally in such a policy or in the transformation of society it seeks to promote. Some cities will incidentally experience the benefits of society-wide transition; others incidentally will not. But throughout the process, "national economic vitality should take precedence over the competition for advantage among communities

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

and regions." (1980: 4) So far as cities are concerned, the Report concludes:

> The nation can no longer assume that cities will perform the full range of their traditional functions for the larger society. They are no longer the most desirable setting for living, working, or producing. They should be allowed to transform into more specialized service and consumption centers within larger urban economic systems. **(1980:** 4)

The imperative logic reflected in the Urban America Report has been challenged in regard to two of its central claims: first, that the process of "creative destruction" experienced by cities is guided by a principle of social efficiency; and second, that the course of economic renewal was and continues to be defined by the inexorable forces of markets and technology. Bluestone and Harrison (1982) have extensively documented that social efficiency has deteriorated with post-World War II economic and spatial deconcentration. Labor productivity has fallen throughout this period and especially during the last two decades of highly uneven regional and sectoral development. Accompanying the decline in national productivity have been massive social costs for the deindustrialized urban areas: long-term earnings losses and declines in occupational status of displaced workers; the spread of serious physical and mental health problems in declining communities; adverse "ripple" employment and other economic effects which compound the economic losses of decline; and the destabilization of local public sectors as substantial tax losses brought on by "national economic adjustment" coincide with rapid growth in social service needs (1982: 55-78). Any technical gains, reduced production costs or short-term profits garnered by deconcentration are more than offset, according to their calculations, by the continuous fall in productivity and the social costs incurred by decaying urban areas. Beyond this, Bluestone and Harrison point to the additional social costs experienced by the supposed beneficiaries of the "boomtown/bust-town" cycle of post-industrial development. Patterns of economic and social displacement are shown to pervade "boom" areas, as well, as the way is literally cleared for the new economic players (1982: 82-107). Further, there are redundant economic costs inherent in the cycle as both private and public infrastructure investments already made in "bust" areas are duplicated in "boom" areas (e.g., Adams, 1982: 17-19).

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

From the standpoint of social efficiency *and* social justice, the costs of post-industrial passage would appear to overwhelm the benefits of development. To Bluestone and Harrison, the costs of uneven development in the post-war period are the direct result of the premium placed on capital mobility in the post-industrial economy. The "velocity" of capital has outstripped the capacities of both boom and bust urban areas to respond. Capital and its effects have, to put it directly, become socially unmanageable (1982: 105-107).

As post-industrialism has been questioned in terms of its contribution to social efficiency, it has also been challenged with regard to its claim that urban change has been the product of objective forces. Mollenkopf (1983) argues that the pattern of deconcentration, particularly in the post-war years, has been significantly the result of national policy interventions to foster post-industrial growth. Similarly, Barnekov et al. (1981) contend that the boom conditions of cities in the West, Southwest and Southeast regions of the U.S. can be traced to heavy national subsidy of the physical and resource infrastructures of these regions: in particular, the flow of federal funds for water development and for rail, highway, and air transport systems to link these areas to one another and to the rest of the country. This subsidy can hardly be attributed to market or technological responses to the intrinsic advantages of the regions. Further, the recent infusion of Department of Defense dollars to shore up and in some cases to virtually remake the economic bases of many Sunbelt cities cannot be explained as resulting from the natural expression of forces beyond government control. From this perspective, a post-industrial transition has been purchased at a high price which was not set by the marketplace alone, but by public policy as well. Thus, for example, the construction of a 40,000 mile interstate highway system was a political choice, and not an economic or technical necessity. This choice was and remains an essential stimulus to deconcentrated development; and, equally, this choice encompasses a decision to allow systematic urban decay.

> [F]ar more federal dollars were poured into the construction of concrete pathways to the suburbs than were spent in reconstructing central cities. During the **1960s,** spending was more than ten to one in favor of highways. (Judd, 1979: 288)

It is a measure of the dominance of the post-industrial imperative in American culture that the challenges to post-industrial claims have had almost no influence on national policy, despite their implication that unnecessary, and, in any event, intolerable social costs are

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

being experienced in the name of progress. From the perspective of the post-industrial imperative, the arguments concerning social efficiency and policy intervention may be valid, but they are nevertheless dismissed as irrelevant. Whether any particular plant closing or relocation improves the productivity of a corporation or region is, like the fate of individual cities, incidental. Indeed, the decline in efficiency cited by Bluestone and Harrison may itself be an inescapable condition of modern economic life. Thus, Baumol earlier forecasted the social costs of urban decay and yet explained why they must be accommodated: "inherent in the technological structure of each of these activities," namely, "municipal government, education, the performing arts, restaurants and leisure time activities," are "forces working almost unavoidably for progressive and cumulative increases in the real costs incurred in supplying them." (1967: 415) Older cities have declined in this view because they are hopelessly costly; they can only fulfill their functions, in our time, on the inclining portion of their service cost curve. Baumol concluded that the cumulative decay - "which once set in motion induce[s] matters to go from bad to worse" - is exactly what is to be expected as economic and technological forces continue their drive toward Pareto optimal development (1967: 424-425).

In a more recent article, Baumol has offered an explanation for the social costs of post-industrial progress as a whole (1981). Here, the issue is not simply to account for the burdens of failing cities, but the appearance of high cost *on net* for an urban society. Echoing the theme of his earlier argument, Baumol stresses that technological change and its diffusion through markets is shaping a new social equilibrium. Post-industrial technologies, he points out, have eliminated most of the agglomerative advantages of urban places and for this reason cities will decline in size and economic power. However, the adjustment toward a new urban order entails inevitable "lags in the equilibrium process" until "the present value of the excess in marginal net output at the new location over that in the old location is equal to the marginal cost incurred by...plant construction at the new site." (1981: 7) In other words, the adjustment process is *necessarily* costly on net until it reaches maturity. To the complaint that no visible improvements in social efficiency are evident from deconcentration and deindustrialization, then, Baumol responds with the ultimate imperative logic - we cannot possibly know whether social efficiency has increased until the "lags in the equilibrium process" have run their course. Inefficiency and high social costs are not, in themselves, evidence that social efficiency is not being served.

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

The retort to those who would claim that national policy has had a heavy hand in the post-industrial transition is equally breath-taking. Post-industrial advocates do not deny that significant public sector infrastructure investments greatly helped to make the Sunbelt more attractive than the Frostbelt. Some of these investments might have been justified, however, to counterbalance earlier periods of subsidy of the Frostbelt; or they may have served a national need, such as a modernized communication and transport network, which, appropriately, was regarded as a more important consequence than their local impacts. But even if much of the public investment was not justified, this circumstance is of no consequence from the standpoint of the post-industrial imperative, precisely because these are *sunk costs.* From where we are, irrespective of how we got here, the post-industrial future is our most efficient course and further government intervention would only increase future costs. Moreover, while the speed of deconcentration and interregional migration may have been influenced by past public policies, the basic direction of change was already set and apparent without these interventions. That direction is now irreversible.

A sense of the futility of policy interventions to alter the course of post-industrial change can be found in the conclusions of Arrow and Baumol about the consequences of well-intended social programs for distressed communities. For Arrow -

> [W]e must ask how the economic system as a whole will react to such measures. In actual fact, improving the status of the poor and the blocks in particular cities and especially in particular areas is likely to induce further in-migration and preservation of the ghetto as natural economic responses. (No date: 22)

And according to Baumol -

> A rebuilt South Bronx can only lure the jobless into remaining longer where they have no economic prospects. One can be fairly confident that the reconstructed homes will be transformed into slums soon enough, and that the torch will be back at the task of destroying them soon enough. (1981: 12-13)

Once we accept our current condition and all that it entails for the future, the need for urban policy as a constructive instrument for change all but vanishes. What was previously viewed as a national urban crisis must now be recognized as the acceptable and localized costs of inevitable transition. In this context, the pace of transition

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

can occasionally be influenced by wise public policy but the direction of change is beyond choice. Our collective responsibility is, therefore, prudent adjustment.

Energy Futures and Urban Futures

The energy and urban futures projected by the post-industrial imperative are not isolated dimensions of social change. Certainly, historical experience suggests that energy and urban changes are highly interactive. Because of this we need to consider how such interactions may influence post-industrial prospects. Some analysts have suggested that the interactive character of energy and urban change raises the possibility of a future very much different from that forecast under the post-industrial imperative (Van Til, 1979, 1982; Morris, 1982a, 1982b; Dantzig and Saaty, 1973).

Thus, for example, Jon Van Til has argued that of the factors shaping spatial patterns, "energy is a primary factor and always has been"; "it is energy that most fundamentally enables and constrains our use of urban, suburban, and rural space." (1982: 1) If the energy abundance assumed as part of the post-industrial imperative fails to materialize, the urban future, Van Til argues, will look vastly different from the pattern of spatial dispersion we have witnessed throughout this century. This energy resource constraint is seen not simply as a transient stage in the process of technological progress, but as a reflection of an approaching limit on the resources available to sustain a system of large-scale centralized production and inefficient end-use. At the same time, such a constraint creates incentives for the movement back to more compact urban forms and for the exploitation of the city's untapped potential for greater energy efficiency. Without the inexpensive and abundant supplies of energy forecast as part of a high-technology, service society, our urban future may be determined "almost entirely by energy availability; values and preferences may become submerged to necessity as our resource options disappear." (Van Til, 1979: 321) Under these circumstances, predictions of the obsolescence of cities would be premature.

It has been argued that higher energy prices and dwindling supplies might serve not only to alter the fortunes of cities as economic and population centers, but may also to encourage their resurgence as cultural and political forces in modern society. In this regard. David Morris has proposed that our urban future need not be characterized by the progressive diffusion of urban amenities and functions but instead could become an age of self-reliant city-states which exploit

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

the efficiencies of community technology and enhance their historic role as producers of wealth. "Cities have the resource base to move toward local self-reliance... We are at a turning point in history. The opportunity exists to marry local political authority to the advantages of modern technology to make more independent self-reliant communities." (1982b: 60, 69) From this perspective, the post-industrial future might involve a conscious choice of community scale and soft path alternatives as our real least-cost options for a viable energy *and* urban future.

Among advocates of the post-industrial imperative, the forecasts of an urban renaissance induced by constraints on energy resources simply lack credibility. The urban conditions impelled by changing energy conditions are seen as consistent with the continuing pattern of spatial deconcentration. Higher energy costs and less reliable sources of supply are in fact portrayed by some post-industrial theorists as a further inducements for low-density development. Thus, for example, W. Jackson Davis accepts that constraints on energy resources will be an important facet of our future but that "(a)s energy dwindles human beings must redistribute in accord with the natural carrying capacity of the earth." (1979: 254) The city, he concludes, is a "dying institution"; the industrial order it represents is too expensive to maintain. Limitations on energy resources only serve to confirm this diagnosis. The decline of industrial cities remains a necessary condition for the transition to new and more efficient low-density urban forms that will restore the equilibrium between spatial distribution and resource availability. Even under conditions of energy scarcity, the new technologies and market adaptations that accompany post-industrial dispersal will of[f]er the best prospect for a stable energy future.

An underlying assumption of the post-industrial imperative is that the energy-city bond, which loomed as so important in the past, no longer plays a central role in determining either our energy or urban future. In this sense, those who anticipate an urban resurgence resulting from energy scarcity have simply failed to accept that the basic dynamics of social change no longer depend upon the complementarily between energy resources and spatial form. Thus, Kenneth Small concludes that "substantial revitalization of central cities will not occur as a result of energy scarcity and price changes." (1980: 115) While energy conditions may over a long period of time exert

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

some influence on spatial patterns, Small argues that there is no evidence that the underlying dynamics of post-industrial change can be materially influenced by such conditions.

> Existing opportunities and preferences both favor use of technological means of reducing energy consumption in the automotive and residential sectors. Even without such adaptation, the differences in energy consumption between central cities and suburbs are not large enough to induce any substantial 'back-to-the-city' movement. Even under highly uncertain supply conditions, other means of adjustment would provide more flexibility with less disruption to life styles than large scale reversal of postwar decentralization trends. (1980: 115)

Under the logic of post-industrialism, the relationship between energy and spatial form is mediated by technology and markets. Changes in either energy or spatial conditions have only a second order, tangential influence on one another and cannot be expected to reverse the basic direction of our post-industrial future. Thus, Richard Muth (1984) argues that recent energy price increases are likely to serve as only a modest restraint on the tendency to decentralize and that even more substantial increases in prices would not have a dramatic impact on this tendency. In effect, we are being told that changes in energy conditions may increase the costs of transition, but no increase in energy costs can be sufficient to displace the underlying technological and market dynamics of post-industrial change or to challenge the mobility requirements for such change. Rather, we can expect that these underlying dynamics will naturally accommodate higher energy prices without requiring a fundamental modification of current urban trends.

Perhaps the most direct statement of the implications of post-industrialism for the energy-city relationship is contained in a recent report of the Brookings Institution edited by Anthony Downs and Katharine L. Bradbury (1984). The logic, and even the language, of this study closely parallels that of the *Urban America in the Eighties* report. The Downs and Bradbury study concludes that the necessary changes for economic and technological progress are already underway and that government should avoid interventions that may slow or disrupt these changes. Higher energy prices may require accommodations in urban and spatial trends (although not those citied by optimistic urbanists), but these accommodations are already happening and require no further direction than that offered by markets.

> Market mechanisms responsive to the rise in energy prices since 1973 are generating appropriate adjustments concerning most

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

> location decisions and other long-run allocations of resources. Higher energy prices will cause few households, firms, or nonprofit organizations to change their locations...No major policy changes seem to be needed, therefore, to compensate for market failures concerning the long-run allocation of resources geographically or in the nonrental housing stock. (1984: 1)

The Brookings study recognizes that the impact of market adjustments is uneven an, as a result, some groups are bearing a heavier burden than others in adjusting to higher energy prices. The study concludes that policies to aid the hardest hit of these groups may be justified. But we are reminded that such interventions "would be focused on issues of equity rather than improvements in economic efficiency." (1984: 2) Consonant with the logic of the *Urban America* report, it is concluded that a social policy may be needed to offset the inequitable impacts of changing energy conditions but that such social policy is and ought to be completely separate from energy and urban policy. Indeed, it would probably be "more equitable to aid the poorest households... regardless of how they were affected by energy price increases" (1984: 2).

The impacts of higher energy prices are also expected to differentially affect regions of the country but, the authors conclude, policy interventions to moderate such impacts would be inappropriate because they would distort market effects and slow the process of adjustment.

> In the long run, entire energy-importing regions may also suffer adverse income effects from higher energy prices that are not felt in energy- exporting regions... Such regional income effects will probably accelerate long-run migration into energy-exporting regions from energy-importing regions. It would be unwise, however, to try to offset these long-run effects through public policies to redistribute incomes among regions deliberately. (1984: 2)

In fact, the Brookings study reaches virtually the same conclusion as the earlier Presidential Commission report in asserting that the most rational path to adjustment is for the government to stand aside and let the market direct our future course. While it is recognized that "[i]n theory, significant changes in future patterns of housing and urban development beyond those that will come about through market forces could help the country save energy," the use of government regulation to achieve such changes would be inefficient; "they would require huge outlays of capital, and many other highly valued goals would have to be sacrificed." (1984: 2-3) Although "acute energy shortages and sharper price rises in the future" may create pressures

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

for the federal government to "do something in response," such pressures should be resisted (1984: 2-3). The authors warn that "the economic appropriateness of many urban policy responses is incongruent with their political acceptability." (1984: 34)

From the perspective of post-industrial progress, the energy-urban relationship is no longer a central force in social change. The adjustments needed to accommodate resource constraints will be resolved naturally by markets and technology. As Roger Sant has suggested, the prudent course is to "let the forces start turning; we're not going to be able to stop them." (1982: 117)

The Featureless Plain

The post-industrial imperative proceeds from the premise that the underlying forces of societal change are beyond social choice. For economic and technological progress to continue, social accommodation rather than the exercise of social choice is required. This accommodation involves the acceptance of energy and urban changes that reflect the resource and spatial configurations necessary to meet the mobility requirements of a high-technology, service society. Indeed, what is distinctive about these energy and urban changes is that, in combination, they signify the declining importance of central places for economic and technological progress. Stripped of any intrinsic economic importance and no longer required for their earlier advantages as energy systems, the value of cities becomes ephemeral. In a world dictated by the post-industrial imperative, there is no good reason why any city should exist, except by happenstance of rising or declining economic activity, within a national marketplace that is best conceived as operating on a featureless plain.

If one accepts this reasoning, it is easy to rationalize any costs of social change as the necessary price of progress. In this sense, the post-industrial imperative is, to use Donald Schon's phrase, self-sealing (1971). What is being delivered as a post-industrial future may exhibit chronic instability and massive social burdens. From the vantage point of the post-industrial imperative, however, no degree of instability and no level of social burden is sufficient to call into question the path to progress. So long as we accept markets and technology as the appropriate and necessary substitutes for social choice, we must conclude that whatever conditions they deliver are for the best. It makes

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

the matter of social progress seem so simple: all we need is the will to face post-industrial reality - markets and technology will deliver the rest.

But it is not so simple. The dichotomy posed between post-industrial progress and the exercise of social responsibility is false and dangerous. It serves mainly to narrow our vision of the possibilities for the future. Social change is limited by the inertia of the political and economic arrangements which currently sustain markets and technology. Alternative possibilities incompatible with the existing order are dismissed as abstractions while, at the same time, the transition to a post-industrial future, however costly and unstable it may be, is accepted as inevitable. So long as the post-industrial imperative defines the possibilities for progress, we have no reason to expect any other outcome.

In our view, the principal challenges to post-industrial progress, or any other possibilities for progress, lie in the realm of social choice. At least some early advocates of post-industrialism, such as Patrick Geddes and Lewis Mumford, understood that the major impediments to social change were not the constraints on economic and technological development. Rather, they were the absence of civic and social aims that might give direction to economic and technological development and the corresponding failure to create institutional arrangements capable of controlling the resources that already were at our disposal. For Geddes and Mumford, the results of these limitations were already apparent in the industrial age.

> Here in the new industrial centers was a chance to build on a firm foundation and make a fresh start... Almost everywhere that opportunity was fumbled... At the very moment that cities were multiplying in numbers and increasing in size all through Western Civilization, the nature and the purpose of the city had been completely forgotten. (Mumford, 1961: 449, 419)

In a political and cultural sense, cities had little more than transient value - "a fortuitous concourse of atoms ... held together temporarily by motives of self-seeking and private profit" (Mumford, 1961: 454).

Geddes and Mumford looked to the post-industrial age as offering the possibility to redress the narrow commitment to markets and technology. As Geddes had argued, the essential first step was to break loose from the prevailing mind set which regarded history as a process beyond social choice and influence:

From *Energy and Cities*. 1985. J. Byrne and D. Rich, eds.
New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

> It cannot be too often repeated, too frequently presented in different ways that the self-satisfied 'practical man' who looks down upon all our hopes of the redemption and ennoblement of his industrial and commercial world towards civic and social aims as 'mere sentiment' is himself the victim of sentiments gone wrong. (1971: 92)

It is disconcerting that the very processes which were envisaged as freeing us from economic and technological determinism are now understood as the basis for rationalizing the inevitability of a future that engenders massive social costs. The ideal of directing social change toward civic and social aims is, if anything, more likely now to be dismissed as 'mere sentiment.'

The urban implications of the post-industrial imperative are ironic. The successful adaptation of cities to the changing demands of economic progress has ultimately led to declarations of their obsolescence and perceptions of their status as national liabilities. In our urban civilization, the final testimonial to the primacy of economic and technological values is that our civic centers can come and go without endangering material abundance and without being seen as a threat to cultural stability and integrity. The spatial and energy changes attendant to post-industrialism reflect the deteriorating "commodity value" of place in a world of markets and technology that hovers above a featureless plain. As Norton Long has pointed out, the currently dominant view serves to trivialize cities.

> In this view aging cities should be treated in much the same way as worn out mines and obsolete factories. They should be phased out as rapidly, and painlessly as possible in the interests of the efficient functions of the national economy and resources should not be squandered in a counter-productive effort to keep losers afloat. (1983: 21)

It was once hoped that post-industrialism would deliver a humane civilization based on the aesthetics and intelligence of civic culture. Post-industrialism is now understood in terms of an imperative logic which makes the demise of cities a rational need of economic and technological progress. The question that needs to be addressed, as Long and others have pointed out, is whether cities are not something more than "organizations on a continuum with mines and factories whose fates should be decided by the unhampered play of market forces as they alter the terms of trade and comparative locational advantage." (1983: 22) As Jane Jacobs has warned - "Societies and civilizations in which the cities stagnate don't develop and flourish further. They deteriorate." (1984: 232) If this is true, the post-

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New Brunswick, NJ and London: Transaction Publishers. Pp. 101-141.

industrial imperative should lead us to despair over the prospects for civilization. A fundamental challenge to our time is to overcome this despair by re-establishing possibilities for intentional social change.

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