

The Green Transition, Neoliberalism, and the Technosciences

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A political sociological approach to the problem of neoliberalism and the technosciences builds on but is distinct from two other, influential frameworks in the social sciences: cultural analysis, which studies practices and discourses such as entrepreneurialism across social fields and over time (e.g., Foucault 2010), and class analysis, which studies the shifts in government policy since the 1970s as a strategy advanced by large capital (e.g., Harvey 2005). Rather than focusing primarily on cultural practices or class conflict, political sociology situates the problem of neoliberalism and technoscience within quasi-autonomous but interrelated social fields. Our previous work on the topic identified three primary fields: the university, which has undergone a transformation to academic capitalism and an asymmetric convergence with the private sector; civil society, which has politicized the research agendas of the sciences, posed alternatives to the design directions of technologies, and in general modernized the relationship between researchers and their publics; and the state, for which regulatory policy has undergone a process of scientization, privatization, and internationalization (Moore et al. 2011). This essay develops the line of research in the third field, the state; within that topic the focus is on the problem of trade and industrial policy rather than regulatory policy, and within trade and industrial policy the attention is on the regulation of green technology.

The argument about the relationship between neoliberalism and the technosciences is developed in three parts. First, the political field is described as a contested social space in which agents draw on underlying political ideologies that shape and are shaped by their action (Bourdieu 2005, Fligstein and McAdam 2011). Thus, neoliberalism is one of other contending ideologies rather than a totalizing policy regime. Second, an analysis of the green-energy policy field in the United States is used to show how the ideologies are embedded in specific policy directions and decisions. Third, the problem of how to relate one type of green technology, solar energy, to the underlying ideologies of the political field is discussed as a way of formulating the problem of the relationship between neoliberalism and the technosciences. The analysis will be limited to the United States and the case of green technology, but the case study will be used to develop the general argument that there is a historically contingent relationship among a research program in the scientific field, a type of technology that appears in an industrial field, and a political ideology in the political field. Steering a path between technological determinism and unlimited interpretive flexibility, I suggest the value of a perspective that attends to broad issues of differences in sociotechnical systems design and their homologies with positions in the political field.

The analysis presented here is based on previous work on localist movements and green-energy policies in the United States. The research projects were based on summer training seminars for graduate students and interviews by the author, with a total of about 80 interviews and case studies of green-energy policy in the American states and 20 cities. Interviews were supplemented by studies of government documents and attendance at approximately two-dozen conferences.

Neoliberalism in the Political Field

Although one might define neoliberalism narrowly as a subfield of economics associated with monetarist and supply-side approaches to economic policy, the approach taken here is to view neoliberalism more broadly as a political ideology, that is, as a network of cultural models of and for action that provides a point of reference to guide and legitimate action in the political field. Tax-cutting, anti-regulatory, and anti-inflationary policies have a place in this conceptualization of neoliberalism, but it is also understood to involve a broader political philosophy associated with the principles of decision-making by markets, limited government, fiscal discipline, privatization, devolution, and the importance of self-responsibility. As an ideology, neoliberalism is situated in a contested political field that includes competing ideologies, but the ideologies often are not manifest in their pure form. Instead, the ideology of a particular political agent or embedded in a specific policy often is a compromise formation that bears the imprint of more than one ideology. Thus, for the purposes of social scientific analysis, ideologies are ideal types that facilitate an analysis of the relations among positions in the political field.

One of the great problems with much current scholarship on neoliberalism is that it does not pose limitations on the concept. At its worst, the scholarship can result in a totalizing analysis in which almost all historical changes that have occurred since the 1970s are part of a neoliberalization process. In contrast, a field sociological approach begins with the assumption that neoliberalism is one among other positions in the political field. However, just as one can analyze the position of agents in a political field as having a relatively dominant or subordinate position, so one can analyze transitions in the political field in which one ideology becomes hegemonic. This section will provide a map of the ideologies in the United States and their relative position in the political field.

To begin, neoliberalism is only one type of liberalism, that is, an ideology based on the premise that there should be limits on the role of the state in the economy, which is assumed to be composed largely of private firms related to each other via markets. Historically, the concept of liberalism is associated with the limitations on the rights of monarchs and nobles that emerged in the constitutional developments in early modern Europe. Within the long tradition of liberal thought and political practice, important tensions emerged during the late nineteenth and early twentieth centuries, when liberal political orders responded to the challenge of socialism. Thus, the primary alternative to liberalism in the modern political field is not royal absolutism but socialism, or the government control over the economy through state ownership of enterprises. Although other alternatives exist, such as the anarchist organization of society into communes, only socialism has played a major role in world history during the twentieth century. Although considered to be defeated and discredited after the conversion of communist countries to capitalist and quasi-capitalist economies, it is also the case that public ownership of some industries continues to play a significant role in many of the leading national economies. In the United States, public ownership is highly restricted (e.g., nuclear energy, roads, passenger intercity rail, and the postal service), whereas in other countries public ownership often includes the health-care system and mineral extraction industries.

Within the mainstream of twentieth-century liberalism, the primary tension was between neoliberalism and what can be called a social liberal (or, in Europe, social democratic) variant of liberalism. In the United States social liberalism is associated with the policies of the New Deal, Great Society, and President Nixon. The presidency of Jimmy Carter included many reforms that, in retrospect, suggested a shift in political currents in favor of neoliberalism, and the presidency of Ronald Reagan marked the first full expression of neoliberalism in national politics. When the Democratic Party returned to power in the 1990s, there were strong currents of neoliberalism in many policies, such as the transformation of the welfare system.

The central tension between social liberalism and neoliberalism involves the relative role of the state in the economy. The ideal-typical social liberal believes in using the state to provide some economic redistribution, some public ownership, regulatory intervention for market failure, protections for labor and the poor, and deficit spending in periods of an economic downturn. Although social liberalism is closely associated with Keynesianism in economic policy, it is a broader ideology that goes beyond the idea that government intervention is needed to smooth out the economic cycle and move the economy to a desirable

general equilibrium. In contrast, the ideal-typical neoliberal believes in a much more restricted role for the government and generally advocates reversing social liberal policies in favor of decision-making through market mechanisms. Economic policy is focused on reducing government spending, often by cutting redistributive programs and taxes and by reducing regulatory burdens on the private sector. The supply-side approach to economic policy is intended to unleash the governmental fetters on the private sector and enable growth, and likewise the neoliberal focus on price stability enables a healthy, long-term climate for investment decisions. In some cases there is also support for government intervention in the economy in order to create new markets and competition, often in place of highly regulated policy regimes (such as for airlines and electricity in the United States).

Within the United States, social liberalism and neoliberalism represent two poles of the mainstream of political debate. One tends to find political leaders that come close to the ideal type of social liberalism on the left wing of the Democratic Party, such as politicians associated with labor and progressive coalitions, and one tends to find leaders who approximate the ideal type of neoliberalism on the right wing of the Republican Party, such as Tea Party activists. Often leaders in the political center from both parties develop compromise policies that can be analyzed as having social liberal and neoliberal components. Over time the political center has shifted to the right, and leaders of the Democratic Party have increasingly adopted positions that are consistent with neoliberalism.

On the margins of the political field, in subordinate positions in most policy fields, one can find radical ideologies such as socialism and localism. Although social liberals accept some public ownership, socialists advocate for a much higher level of public ownership, for example in health care, transportation, and energy. Currently, there is only one openly socialist senator in Congress, and there has not been a significant socialist presidential candidate since the Citizens Party of Barry Commoner in 1980. Localism is a more ascendant political ideology associated with mobilizations by the small-business sector to achieve access to capital and protections from predation by large capital such as chain stores. Localist politics can be traced back to the coalitions between farmers and small businesses that characterized the populist and progressive movements of the late nineteenth and early twentieth centuries. Those coalitions were often linked to the trade-union movement, and they were swept out of the mainstream of American politics by the New Deal coalition, which developed a social compact between the industrial unions and large capital. Localism in the twenty-first century can take the form of locally owned,

independent retailers who are mobilized in support of the “buy local” movement and anti-big-box mobilizations, but it can also take a more progressive, “local living economy” vision of small businesses that address issues of social fairness and sustainability (Hess 2009). Support for the local living-economy vision is found among independent, green retail stores (such as fair trade coffee shops); food cooperatives; small farms that are linked to local consumers through independent restaurants and farmers’ markets; independent media; credit unions and community banks; reuse centers; advocates of human-powered and public transportation; and systems of distributed and locally controlled renewable energy.

Developmentalism

The typology of ideologies in the political field is adequate up to a point; however, I have found that in the analysis of green-energy policies in the United States it has been necessary to characterize another position: developmentalism. Unlike localism and socialism, the field position is often in the political mainstream, especially at the state-government level. Developmentalism in the United States is liberal in that it retains a vision of the economy based on firms, and it is mainstream in the sense that it assumes an economy characterized by corporate capital rather than small businesses or public enterprises. However, in contrast with the two other mainstream ideologies in the political field, social liberalism and neoliberalism, developmentalism involves a much more defensive approach to free trade and further trade liberalization. Furthermore, redistributive politics are approached neither through welfare-state programs nor supply-side entrepreneurialism but instead through job-creating industrial policy. Although not isolationist, the politics of developmentalism include emergent protectionism and a call for government intervention in the private sector to enable competitiveness. Those two sides indicate a Janus quality to developmentalism: it seeks both protections from a liberalized global economy and enhanced competitiveness to enable more effective participation in it.

The rise of developmentalism in American politics is due to the effects of the long-term pattern of trade liberalization on the American economy (Hess forthcoming). Since World War II, there has been an underlying agreement between social liberals and neoliberals that trade liberalization is beneficial to the American economy and to the rest of the world, and the post-war economic order set in motion a mechanism for ongoing trade negotiations with the goal of attaining higher levels of trade liberalization. No matter how interventionist Keynesians, New Deal Democrats, and other social liberals were with respect to domestic policies, they believed

in free trade, and they assumed that protectionist policies had worsened the trajectory of the Great Depression and enhanced the possibility of war. However, during the period of the hegemony of social liberals in national politics (1932 to 1980 in the United States), there was tolerance for protectionist policies among less developed countries. According to economist Ha-Joon Chang (2011), during the 1950s and 1960s trade agreements focused on developed countries, and less developed countries were allowed to support infant industries by enacting developmentalist policies such as import substitution, tariff barriers, currency devaluation, government support and ownership, and capital controls. After the economic stagnation and the mobilization of Third World countries during the 1970s, wealthy countries extended the scope of trade liberalization to include formerly protected, poorer countries. Where those countries could not be convinced of the benefits of trade liberalization, they were often forced to accept such conditions as part of structural adjustment packages negotiated for debt repayment.

Within both wealthy and newly industrializing countries, trade liberalization facilitated the underlying economic conditions that transformed the political field in a direction that generally favored advocates of neoliberal policies. As large capital became globalized, the threat of run-away shops and competition from foreign enterprises increased its bargaining power with respect to the state and labor. Large capital was then able to make successful demands on government to reduce the regulations and tax policies associated with the social liberal compact of the Great Depression, and likewise it was able to wrest from labor reductions wage and other demands from capital. In turn, the loss of revenues from lower taxes, privatization, and lower wages placed financial pressure on the state. The old social compacts of social liberalism could be temporarily preserved through deficit spending, but in the long term the resolution of the revenue gaps occurred by reducing expenditures associated with the redistributive functions of the welfare state and by selling off public assets. The whittling away of the social liberal state occurred both incrementally over decades and suddenly during fiscal crises, and it occurred with different compromise formations with the old social compact in different countries (Harvey 2005). Supporters of social liberal ideology never disappeared, and specific laws and policy reforms after the rise of neoliberal ideology to a relatively dominant position in the political field often emerged as compromise formations that showed evidence of both social liberal and neoliberal ideologies. Nevertheless, in many countries there was an historic change in which

political actors associated with neoliberal ideology often achieved a dominant position in national governments and in specific policy fields.

My argument with respect to developmentalism is that just as trade liberalization weakened the political position of social liberals, it is now undermining the position of neoliberals and opening the political opportunity structure to the ascendancy of developmentalist liberalism. Neoliberals' advocacy of opening up the global economy to trade with less developed countries has led to the rapid growth of some of the countries, above all China, which in turn has led to the relative decline of the United States as the hegemonic economy in the world system. China has increased its position in the global economy through its use of developmentalist policies, including currency devaluation, import restrictions, and subsidies for export-oriented businesses. Recognition of the aggressive use of developmentalist policies by the country's primary global rival has strengthened the growing chorus of voices that call for a more developmentalist approach to American economic policy. The idea that the United States could compensate for the loss of low-tech manufacturing jobs to newly industrializing countries by climbing up the ladder of technological complexity to high-tech jobs (and to protect the high-tech sector through trade-related intellectual property agreements) has proven to be elusive, because China has rapidly moved into high-tech manufacturing as well.

Although the liberalization of trade has enabled economic elites in the United States to benefit from participation in the high-technology export market and from investments in foreign countries, the changes in the American economy have left behind the working class and increasingly also the lower professional strata. As economists Michael Spence and Sandile Hlatshwayo (2011) argue, wages have increased in the tradeable or export-oriented sector, but job growth has been limited. In contrast, in the nontradeable or domestically oriented sector, there has been job growth but wage compression. More generally, for hourly workers, there has been wage stagnation for decades, and overall inequality in the country has increased (Labor Research Organization 2004). The declining position of working people has in turn generated a growing trend of skepticism toward free trade, which is seen as taking away good jobs. Public opinion polls in the United States show increasing lack of faith in free trade and increasing concern that it has taken away jobs. The percentage of Americans who believe that free trade had hurt the country from thirty percent in 1999 to fifty-three percent in 2010, and sixty-nine percent believed that free-trade costs Americans jobs. Opposition to free trade was also high

among both Tea Party and union supporters, a pattern that suggested a place where right-left polarities were being cross-cut by a different ideological current (Harwood 2010).

Scholars committed to the historical thesis of ongoing and deepening neoliberalization would likely argue that the resurgence of developmentalism is a further deepening of neoliberalization, and in contrast those who are committed to the historical thesis that neoliberalism is in a state of crisis would lean toward an interpretation of developmentalism as a fundamentally different form of liberalism. From a field sociological perspective, developmentalist politics and policies are an analytically distinct type, due primarily to fundamental differences with respect to the underlying doxa of support for free trade in both social liberalism and neoliberalism. In practice developmentalist approaches may be aligned with further neoliberalization, the oppositional politics of social liberalism, or even marginal positions in the political field (such as localism, which has a strong current of advocacy for local import-substitution). Thus, from an analytical perspective it is best to treat developmentalism as a separate ideological current in the political field rather than merely a development within neoliberalism.

Political Ideology and the Green-Energy Transition

As the global economy in the twenty-first century adjusts to the relative decline of the liberal triad of the twentieth century (Europe, North America, and Japan) and the emergent defensiveness in the United States toward trade, it also faces a second, interlocking historical transition: adjusting the material infrastructure of the global economy to the global ecology. There is general recognition that the combination of human population growth and high consumption levels has exceeded the planet's carrying capacity. More than global warming, there are interlocking ecological crises that include deforestation, desertification, peak oil, freshwater depletion, and marine life extinction.

Naomi Klein (2011) has argued that climate science and policy (and, by extension, all sustainability sciences) are at some level anathema to the politics of neoliberalism, because environmental and energy problems are so extensive and pervasive that they require government planning and intergovernmental coordination to solve. To some degree the valences toward government intervention and steering in the economy help explain the growing anti-green reaction in the United States, which has been mounted under an anti-government, pro-market ideology associated with Republican Tea Party activists. Although in part a

grassroots movement, wealthy benefactors from the oil and coal industries, which have the most to lose from a rapid green transition, have supported Tea Party organizations and political candidates and provided legislators with policy guidelines. In the United States, the coalition of conservative organizations and fossil-fuel industries has created a division within large capital between the anti-green industries and other industries that have embraced the idea of a long-term green transition as part of corporate strategy. For example, General Electric, venture capital from Silicon Valley, and some of the large information-technology and consumer-products firms have become supporters of stronger green-transition policies, partly because they have invested significantly in green technology. During the 2010 election the California venture capitalists, in alignment with labor unions and environmental organizations, played a significant role in turning back a challenge to California's green-transition policies that had been funded by out-of-state fossil-fuel interests. Even when the national political field turned anti-green in 2010 under the wave of climate-denying political leaders, green-transition policies continued to deepen at the state and local government level where the Democratic Party remained firmly in power (Hess forthcoming).

Although I agree with Klein that green-energy policies (as part of a broader transition to a more sustainable economy) are caught in the intense ideological crossfire of the political field, I do not agree that green-energy policies as a whole are inherently opposed to neoliberalism. Rather, I suggest that green-energy policies themselves are transected by the different ideologies in the political field. Thus, the categorization of the political field in the previous section can be used to interpret the politics of green-energy policies.

Social liberalism. A portion of the green-energy policy field is closely associated with the redistributive politics of social liberalism. The most prominent example is the creation of green-jobs training programs that are oriented toward persons with employment barriers, including at-risk youth. Programs can be found in city and state green-jobs corps and nonprofit organizations that promote such policies, such as Green For All. The programs provide training so that the unemployed can find positions in grounds maintenance, weatherization of buildings, rooftop solar installations, and other green service-sector industries (Hess et al. 2010). Government subsidies to renters and owners of apartment buildings enable them to retrofit buildings in ways that reduce the burden of energy costs. Although some of the policies are in the New Deal tradition of direct government employment, many of the programs represent a modified form of social liberalism that channels government funding into nonprofit training centers, contracts

for private businesses, and public-private partnerships. In some cases labor unions receive funds for training, and workers may become members of unions such as the Laborers' International Union of North America. Thus, this variant of green-energy policies speaks directly to labor-environmental-urban poverty coalitions that are the traditional constituency of social liberal politics.

Socialism. Public ownership in the energy field is the legacy of two previous eras of energy policy. During the height of the progressive era, some city governments municipalized their electricity generation and distribution system, and some publicly owned municipal electricity systems, such as Seattle City Light, are a legacy of the period. During the height of social liberalism, state governments such as New York and the federal government also created publicly-owned electricity generation systems, at first mostly for hydropower and later for nuclear energy. Although most of the electricity in the United States is produced through publicly regulated, private enterprises called investor-owned utilities, about forty-six million people are served by public power (American Public Power Association 2011).

Some of the greenest energy distribution and generation organizations in the country are publicly owned municipal organizations. For example, Seattle City Light became the country's first carbon-neutral electricity service provider based on generation from solar, wind, and hydropower in combination with purchased carbon off-sets. The organization also utilizes net revenue to invest in building retrofits and distributed renewable energy such as rooftop solar. Studies of public power indicate that they generally have better performance on greening metrics in comparison with investor-owned utilities (Hess 2009).

Localism. There is a tradition of cooperative ownership of electricity generation in the United States, generally in rural areas, and some city governments and municipal electricity service providers also offer ratepayers an opportunity to buy shares in a solar array, which enables people to have the benefits of local ownership in solar-energy generation without the problems of rooftop maintenance. However, by far the most widely diffused policy associated with local ownership was property-assessed clean-energy (PACE) financing, which enabled owners of homes and commercial buildings to pay for rooftop solar and building retrofits with an increment on their tax bill that in turn was financed by a city or state revenue bond. The program offered the advantages of affordable financing and liquidity in the event that the owner must sell the building. Although in 2010 the federal housing authorities ended PACE programs because the property tax lien was potentially in conflict with their mortgage lien

priority, the programs were continued for commercial buildings and in some cases for residential buildings but with secondary lien status. Furthermore, a similar program developed in New York allows for on-bill financing through the utility company (Van Nostrand 2011).

Although social liberalism, socialism, and localism play a role in green-energy politics and policies, there is also evidence that developmentalist and neoliberal ideologies have played a major role. Their role is discussed in the next two sections.

Developmentalism and Green-Energy Politics

A primary example of the protectionist dimension of developmentalism during the Obama administration is the “Buy America” provision in the American Recovery and Reinvestment Act of 2009. The provision was designed to favor American companies in infrastructure projects, some of which involved green-energy construction such as wind farms. The policies were designed in way that did not antagonize American trading partners that had signed the Government Procurement Agreement, a side agreement of the World Trade Organization that ends domestic content provisions for federal government purchases. Because China and some other newly industrializing countries had not signed the agreement, the Buy America provision cleverly served as a protectionist measure directed toward those countries, but one that was allowed under international law. Another example of the defensive posture to trade that is characteristic of developmentalism is the complaint that the United States has filed with the World Trade Organization to pursue China’s allegedly illegal support of green-technology companies in the export sector (Chan and Bradsher 2010). The United States and China have also invoked trade sanctions on many specific product categories, including green-energy products. Finally, American support for some green-technology companies, such as battery and wind-turbine manufacturers, has allowed the country to regain some manufacturing that had been lost to Asia. The support is legal under World Trade Organization rules provided that the companies are producing for domestic markets. General support, such as research funding through federal agencies and the national laboratories, is also allowed.

In 2011 the American solar-energy industry became the main arena in which the politics of developmentalism were debated in Congress. The bankruptcy of Solyndra served as an occasion for neoliberals to decry the Obama administration’s green developmentalism as a failed industrial policy. For example, Republicans attacked industrial policy as a role for government best left to markets, and they questioned the propriety of using taxpayer funds to

play the role of venture capitalist (Wald and Savage 2011). The president defended the failed investment as part of the necessary risks that a government must take, and he argued that it was important for the United States to maintain a solar industry. The solar industry also argued that China was attempting to take over the world's solar industry through subsidies that are not legal under WTO rules. As Gordon Brinser, president of SolarWorld Industries America, Inc., stated, "The illegal subsidies that China has put into the solar industry are no different than giving an athlete a bucket full of steroids" (Drajem and Martin 2011). The solar industry also asked the American government to put duties of more than \$1 billion on Chinese solar imports. The leading Chinese solar manufacturer, Suntech, responded by claiming that the American solar manufacturers were acting in a "protectionist" manner that could trigger a "solar trade war" that would harm the country's goal of "achieving a clean-energy future" (Drajen and Martin 2011).

This type of exchange between the United States and China has become commonplace. The Chinese argue that their successes are due to consistent support over time in contrast with the inconsistencies in American policy across political administrations. They also note that the American government is hypocritical because it also has "buy American" provisions. In response, Americans argue that Chinese policies are far more onerous and in violation of trade agreements. For example, Leo Hindery, chairman of the U.S. Economy/Smart Globalization Initiative of the New American Foundation, explained how China's Indigenous Innovation Production Accreditation (IIPA) Program affected American companies. He noted that the program is "far more restrictive than any other buy-domestic program in the world," because it requires companies that want to sell their products in China to "transfer and license, to Chinese companies, their latest technology for 'co-innovation' and 're-innovation'" (Hindery 2010). Hindery added that foreign companies in China have also been unwilling to complain, because they are afraid of retaliation from the Chinese government.

Although the solar industry has become central in the debate over developmentalist policies, evidence of developmentalism can be found in other energy policy fields as well, such as liquid fuels. Federal government policies that support the transition away from petroleum, such as support for electric vehicles, are based on a strategy of import-substituting industrialization that is usually framed under the banner of energy security. Likewise, the federal renewable fuels standard, which is combined with an ethanol tariff, supports the development of the domestic ethanol industry, even over more efficient foreign alternatives, such as the

Brazilian ethanol industry. Support for American biofuels is justified by the infant-industry argument that eventually the American industry will transition to a more efficient, cellulosic form of ethanol and algae-based biodiesel. In 2010 the Brazilian government removed its twenty-percent tariff on ethanol as part of an effort to get the American government to open up its protected ethanol industry to free trade. In turn, the American biofuels lobby rallied to keep its protections in place. Industry spokesperson General Wesley Clark noted, "Ethanol is America's fuel: It's made here in the U.S., it creates U.S. jobs, and it contributes to America's national and economic security" (Mulkern 2010).

In battles over the American solar and biofuels industries, there is an interesting role-reversal on the issue of free trade. The world's historical home of free-trade rhetoric and policy, the United States, has found itself defending its industries against the calls for more openness from emerging industrial giants China and Brazil. In turn, those countries have aggressively pursued industrial and trade policies to support their domestic industries. As threats to American industries mount, the country is pushed into a situation of having to defend those industries through trade protection and industrial policy support. The situation is a long-term change, and one can find evidence of developmentalism even during the 1980s, when the American government responded to protect its automotive industry from Japanese competition. However, the level and extent of global industrial competition has continued to rise, and with it so has the motivation for developmentalist policies.

Defensive trade policies and import-substitution policies for petroleum tend to receive bipartisan support in the federal government, because they do not provoke sectional rivalries and they enable a bipartisan consensus to be built in opposition to perceived foreign threats. In contrast, industrial policies such as support for solar energy tend to be more controversial, partly because they flounder on sectional rivalries and partly because they involve a heavy government hand in the steering of the economy, which neoliberals oppose on philosophical grounds (Eisinger 1986). As a result, the industrial policy side of developmentalism in the United States tends to be more common at the state-government level.

State governments aggressively pursue green developmentalism both through import-substitution policies and green industrial policy. State governments have engaged in an import-substitution policy for energy by replacing coal and natural gas that are "imported" from other states with local renewable energy and, in the case of oil from other countries, with local biofuels and electricity. To support the transition, state governments have developed

renewable-electricity portfolio standards, demand support from system benefits charges, and carbon trading in the Northeast and California. Likewise, energy-efficiency measures, such as the numerous building-efficiency laws and ordinances passed at the state and local government level, replace imported energy with local labor and sometimes locally manufactured building materials. Although some of the policies were first approved based on environmental motivations, increasingly they have been reframed and justified on economic-development and job-creation grounds. In addition to the more implicit policies of import substitution, some state governments have also enacted measures that support in-state manufacturing and production. For example, some states now have a goal that biofuel consumption in their state will include a percentage produced from in-state biofuel sources. Florida has also pioneered biofuel production from citrus peels, a source that is relatively unique to that state. We also identified state governments that have created incentives for wind and solar production projects that motivate the use of wind and solar components that are manufactured in-state (Hess et al. 2010).

The other side of developmentalism, industrial policy, is especially visible among state and local governments. Rather than attract a large manufacturer that might later decide to pull up stakes and move to another region in the world, economic development strategies focus on growing local businesses by creating dense networks of government support, university-based research, technology transfer, business services, venture capital, and jobs training programs. The goal of the cluster is to make the region itself a reason for businesses to stay in place. Even if they eventually locate some of their manufacturing operations elsewhere in the world, they are likely to retain high-end functions such as management, research, and marketing in the region. The clusters are based on local industrial histories and factor endowments, and increasingly they are the outcome of government planning that targets specific regional industries as candidates for regional industrial policy. Green-tech industries have begun to concentrate in some regions of the country through regional industrial clusters for wind (Colorado, Iowa, Michigan, South Carolina), fuel cells (Connecticut, New York, Ohio), solar (California, Ohio), battery and energy storage (Michigan, New York), and rail (New York; Hess et al. 2010).

Although the clusters are poised to participate in the global economy, they also benefit from local demand policies, such as solar and wind carve-outs in the renewable electricity standards. Cluster development also requires a suite of supply-side policies, such as the

cultivation of local networks, finding finance for start-ups and business growth, providing green jobs training (at a higher skill level than the programs discussed above), and connecting local research universities with the business community. These highly interventionist policies are anathema to neoliberals, who reject the “horse betting” of industrial policy, but they are also distinct from the redistributive policies associated with social liberalism. Nevertheless, because the policies promise jobs, and often good jobs in high-tech manufacturing, they receive support from segments of unionized labor and corporate capital.

Neoliberalism and Green-Energy Politics

Within this broad field of policy reform, neoliberal politics have played both a generative role in promoting green-energy policies and an oppositional role to their development. With respect to the generative role, three types of electricity policies associated with neoliberalism have opened up opportunities for renewable energy. First, government reforms have led to the slow restructuring of the electricity industry, beginning with the Public Utility Regulatory Policy Act in 1978. The liberalization of the industry during the 1990s created new markets that enabled competition among electricity generation companies and retail service providers. The changes created some political opportunities for green-energy production, because some state governments responded to the new regulatory environment by requiring utilities to purchase green electricity from independent generators or produce it themselves.

A second approach that is consistent with neoliberal ideology has been the removal of barriers to distributed energy production. Regulatory changes such as net metering enabled the interconnection between energy producers and the grid, and regulations that reduced the burdens of permitting (called “fair permitting” laws) have facilitated the greening of electricity. Generally, the laws also protected producers by mandating that utilities purchase power at the avoided cost rate, a more market-oriented approach than the feed-in tariff, which is more common in Europe. Our review of party-line votes in state legislatures also indicates that this approach to green-energy policy tends to receive bipartisan support (Hess forthcoming).

A third approach has been to implement environmental policies by creating new markets. Thus, the general pattern for carbon regulation in the United States has been based on a cap-and-trade system rather than a carbon tax. Likewise, some of the states that have a

renewable-energy portfolio standard have experimented with markets for renewable energy credits.

Although neoliberal ideology has played a generative role in green-energy transition policies, it has also inspired opposition to them. The hostility is largely found among anti-green political candidates who have been supported by the coalition of conservative and fossil-fuel donors. Although conservative foundations had long funded climate-change skepticism, the mobilization after the election of President Obama and the attempt by Democrats to pass a national cap-and-trade law was of a different order, because it involved attempts to roll-back existing green-energy policies.

With respect to social liberal, localist, and social liberal policies, the attacks by neoliberals have been relatively muted. The green-jobs training programs for persons with employment barriers represent relatively small expenditures, and they also represent third-way social liberalism, in which traditional welfare and antipoverty programs have been combined with the more neoliberal philosophy of helping the unemployed to find work. Based on our review of green-energy legislative votes in state governments, the localist programs such as PACE and on-bill financing have also received bipartisan support in state legislatures, perhaps because they do not involve increased taxes or fees, and because they are ultimately based on a voluntary choice that creates opportunities for business development. In contrast, recent attempts to municipalize local energy, such as the long battle in San Francisco that emerged in response to the crisis in 2000 and 2001 caused by electricity restructuring, have met with strong opposition from utilities, which have attacked such efforts as socialistic (Hess 2009).

The more concentrated attacks that are anchored in a neoliberal ideology have been reserved for developmentalist policies. Attacking demand policies such as cap-and-trade programs, renewable electricity standards, and system benefits charges, Tea Party activists and other Republican leaders argued that they were taxes that placed unnecessary burdens on businesses and households. In 2011, the state of New Jersey withdrew from the regional greenhouse gas initiative, the state of New Hampshire remained in the agreement only after a razor-thin vote, and the effort among Midwestern states to develop similar initiatives stalled. As noted above, in 2011 anti-green Republicans took advantage of the collapse of the solar-energy manufacturer Solyndra to attack green industrial policy in general. Thus, whereas scholars of neoliberalism have viewed “roll-back” strategies as a phase of neoliberalization associated with the 1980s (e.g., Peck and Tickell 2002), one can use the case of the anti-green backlash to build

on their work by noting that roll-back neoliberalism has received a second life. The attacks on developmentalist policies both on the demand side (unnecessary taxes) and the supply side (wasteful and misconceived industrial policy) suggest the need to view developmentalism as distinct from neoliberalism, at least in the case of the United States during this historical period.

One can also see the debate in general ideological terms among some of the political commentators. For example, Nobel laureate and *New York Times* columnist Paul Krugman has defended a developmentalist approach to American industry, including protectionism:

There's the claim that protectionism is always a bad thing, in any circumstances. If that's what you believe, however, you learned Econ 101 from the wrong people — because when unemployment is high and the government can't restore full employment, the usual rules don't apply.

Let me quote from a classic paper by the late Paul Samuelson, who more or less created modern economics: “With employment less than full ... all the debunked mercantilistic arguments” — that is, claims that nations who subsidize their exports effectively steal jobs from other countries — “turn out to be valid” (Krugman 2009).

In contrast, Robert Samuelson, a contributing editor for the *Washington Post* and *Newsweek* (and not related to Paul Samuelson), worries about the decline in faith in free trade in the United States:

Of course, opposition is not new. Even if free trade benefits most countries, some firms and workers lose from added competition. But for most of the postwar era, a pro-trade consensus neutralized this opposition. That consensus is now fraying (Samuleson 2007).

Science, Technology, and Neoliberalism

With the map of ideological positions in the political field available as a point of reference, it is now possible to turn to the problem of how neoliberalism is related to science and technology. Distinctions within economics research—for example, among Keynesian, supply-side, and heterodox schools associated with studies of local ownership, public ownership, and import substitution—can be easily linked to positions in the political field. Likewise, it is relatively easy to show general connections between the overall valuation of research fields and political ideology. As Bourdieu (1998) argued, the right and left hand of the state are the congealed outcome of many historical battles, including the battles of social movements to achieve limitations on the power of global capital over both small businesses and

social life in general. To extend Bourdieu's argument, the scientific field also has a right and left hand. In the case of university-based research there are schools and departments in relatively close alignment with the needs and interests of the corporate clients and benefactors (business, medicine, engineering, applied sciences), and there are schools and departments more aligned with the left hand of social liberalism (social work, sociology, geography, anthropology, public health, some humanities, and schools and departments associated with community development). As the state withdraws from its left-handed functions, the university also shrinks its left hand, resulting in some cases in the dismemberment of traditional left-handed departments. In a process that mirrors the asset stripping of governments, universities in the United States have in some cases closed departments and programs in the humanities and social sciences, even as they have invested in schools associated with high technology. The case of the State University at Albany is a good example: the university and state government have invested heavily in a new school of nanosciences, but the university also closed several departments in the humanities.

Can one extend the historical restructuring of the priorities of university research fields to make a general argument that the technosciences that have emerged since the 1980s and that have been the benefactors of academic capitalism—nanotechnology, information technology, biotechnology, and green technology—are in some ways inflected by neoliberalism? A field sociological approach to the question would suggest caution against blanket statements (e.g., biotechnology research is inflected as a whole by neoliberal politics), and the case of green technology can be used to demonstrate a method for studying the relationship that is more disaggregated. In this section I will take the example of solar energy and examine it as a sociotechnical system, that is, as a system that includes technical design choices and organizational, user, and regulatory choices (Hughes 1983, 1987).

Beginning first with the choice between a large-scale, grid-based solar farm and a small-scale, building-based rooftop system, how do the design differences align with ideological positions? The social liberal approach to green-energy development would have a valence in favor of the rooftop configuration, which would favor the green-jobs programs linked to retrofitting programs, where the politics of social liberalism have most closely connected with green-energy policies. Likewise, localism would also tend to favor the rooftop scale, because it is consistent with local ownership. Municipal utilities might favor the centralized solar farm, because it would be easier and less costly to develop and manage than a distributed system of

similar scale. Supporters of developmentalism are potentially neutral on the topic. Large contracts are easier to align with manufacturing needs, but distributed energy is aligned with state government goals to substitute renewable energy for out-of-state, fossil-fuel sources. Finally, a neoliberal approach may favor distributed renewable energy, because it is more consistent with a voluntary, market-oriented approach, whereas solar farms tend to be constructed only in the context of government intervention in electricity “markets” in the form of renewable electricity standards, system benefits charges, and carbon-based regulatory caps.

In short, on the issue of the scale of solar technology, there are valences in the design decision that would enable an analyst to develop what Winner (1986) called a politics of design. This strategy of analysis goes beyond the more general statement that would argue that solar-energy technology as a whole as having a single political valence. Thus, one avoids the blanket statement that “green-tech” is in some general way inflected by neoliberalism. Instead, one looks at positions within the field of a specific green technology and relates it to positions in the policy field.

One can complicate the analysis further by studying design distinctions at one scale. For example, at the scale of grid-based solar farms, there are also design choices between the concentrating solar (steam-powered) approach and photovoltaic farms. The former is a very large and heavy technology that may be more amenable to domestic manufacturing (like the larger components of wind turbines), whereas the modular structure of photovoltaics may favor Chinese manufacturing. Thus, from a developmentalist perspective, concentrating solar would be potentially preferable if it were to remain cost competitive. However, the modular design of photovoltaics enables a similar technology to be used at the scale of solar farms and rooftop solar, whereas concentrating solar favors the larger scale. Thus, there is arguably a valence in the photovoltaic form of a solar-farm design that would be consistent with small-scale, rooftop solar energy development, which then links the photovoltaic farm with the politics of rooftop solar energy discussed above.

At the scale of individual buildings such as rooftop solar photovoltaics, the sociotechnical system can be configured in several ways, of which the following set of ten technical and social distinctions provides a basic map: off-grid systems versus systems that permit grid interconnection, on-site storage versus systems that use the grid as the “storage” site, systems owned by the building owner or owned by a company that manages the system as part of power-purchase agreement, systems partially funded by a government assistance

program or funded by the building owner, and a rate structured by feed-in tariff versus a more market-oriented rule such as avoided cost. It is possible, then, to analyze this set of sociotechnical distinctions with respect to the political field.

Social liberalism. Political leaders who are primarily concerned with redistributive issues and social fairness would be relatively neutral with respect to grid interconnection, storage, and ownership, but they would have a valence toward a government assistance program and a feed-in tariff, both of which would correct for market failures. The first failure is the need to provide a fair source of assistance across income levels, and the second is the need to correct the capacity of the electricity service provider to charge monopoly prices for electricity supplied to the grid.

Socialism. Municipal electricity organizations would tend to favor grid interconnection, on-grid storage, and government assistance programs to provide a fair source of assistance. However, they would likely favor ownership by the public agency rather than the building owner. On the issue of a payment structure, the public organizations would likely prefer a more market-oriented price structure to the inflexibility of a feed-in tariff.

Localism. The central feature of localism, ownership by the building owner, is facilitated by a feed-in tariff and government assistance programs. Local ownership is potentially compatible with grid interconnection and off-site storage, but there is a valence in off-grid systems with on-site storage toward local ownership.

Developmentalism. Because solar photovoltaics in the United States are increasingly imported, the primary form of developmentalism is the creation of jobs in the installation and service industries for solar energy. Thus, leaders who are most concerned with developmentalist issues would support features of a sociotechnical system that favor demand creation. Government assistance programs (but to create demand, not to neutralize income disparities) and a feed-in tariff would strengthen demand. A developmentalist might also support grid interconnection and on-grid storage, because the policies would facilitate demand growth.

Neoliberalism. Because a neoliberal would favor the removal of barriers to the development of markets, a neoliberal would likely support grid interconnection, off-site storage, power-purchase agreements, and a feed-in tariff, but an ideal typical neoliberal would likely oppose government assistance programs. In general a neoliberal would favor systems that enable choices and maximum flexibility in system design so that various types of markets and product strategies could coexist in a competitive relationship.

In summary, the ways in which a specific feature of a sociotechnical system might be viewed as neoliberal require a broad analysis of the distinctions at play in the technological field and their relationship with positions in the political field. There are both possibilities of convergence and divergence in the politics of technology, and those possibilities provide opportunities for political conflicts and coalitions to emerge. For example, an ideal typical neoliberal, social liberal, and developmentalist might favor the need to open up the grid to interconnection from distributed energy sources, but a neoliberal might part ways with both on the issue of tax credits and other incentive programs. In turn the social liberal and developmentalist may both support tax credits, but disagree on their structure (redistributive goals versus demand-creation goals). A neoliberal might oppose the large-scale solar farm because it is associated with a renewable electricity standards and carbon regulation, but net meters may be more closely in line with an approach to renewable energy that enables new market development and frees up barriers to them. In turn, a social liberal could agree that distributed renewable energy is preferable (but due to redistributive goals), whereas a developmentalist might be neutral on the issue or split depending on what kind of demand policy is foremost (supporting local solar manufacturing versus installation).

The politics of sociotechnical system design have implications for the politics of research fields as well. A research funder could choose to favor one or more of a wide range of research programs: concentrating solar versus photovoltaics, off-grid storage systems versus smart grids and grid interconnection, and even research on types of regulatory incentives and ownership programs. From the perspective of a researcher in one of the fields, the relationship between a research program and a political ideology would likely be invisible, because the researcher is preoccupied with the technical questions of the research field. However, when one steps back to an analysis of the relations among distinctions in the technical and scientific fields and the distinctions in the political field, it is possible to see the connections that may otherwise be “misrecognized,” to use Bourdieu’s phrase (1981).

To generalize the argument, other than in the social sciences the connection between a political ideology and a technology and associated research field is contingent on specific historical and cultural contexts. This does not mean that the relationship is subject to infinite interpretive flexibility, a view that is suggested by the constructivist and performativity traditions in science and technology studies. Although those approaches provided a helpful corrective to determinist forms of structuralism, the alternative adopted here steers a course

between infinite interpretive flexibility and technological determinism. Some choices in the design of sociotechnical systems (and the choices in agendas for associated research fields) have a valence toward a position in the political field. To develop an analysis of the relationship between neoliberalism and the technosciences, one must first begin with the problem of relationships, not only the relationships between neoliberalism and other political ideologies in the political field, but also the relationships among design features in the field of technologies and the priorities for research agendas in the associated research fields. Thus, field sociology offers a methodology for studying the problem of neoliberalism and the technosciences that opens up new research questions and new insights into the politics of technology.

Conclusions

The conceptual and methodological framework outlined here suggests a way of thinking about the history of neoliberalism and its relationship to science and technology that begins with the problem of inter-related, semi-autonomous fields where practices and coalitions are articulated and remade. By starting with a view of neoliberalism as a position in a contested political field, it becomes possible to map the homologies between distinctions in scientific and technological fields with those in the political field. In the case of economics and the policy-oriented social sciences, the homologies are transparent in the schools and research programs. However, in the case of the natural sciences and engineering fields associated with industrial technologies, the politics of technology can only be understood through a double exploration of technological and political distinctions.

In summary, the field sociology of neoliberalism and the technosciences suggests caution with respect to analyses that assume a comprehensive relationship between one type of technoscience and neoliberalism. Although many new research fields and associated technologies have emerged since the ascendancy of neoliberal political leaders after the 1980s, the correlation does not necessarily imply a straightforward relationship. A relational and comparative approach makes it possible to see both the political valences toward an ideological position and the potential for neutrality on some design configurations.

The field sociology of neoliberalism also provides new ways to think about its possible future. The fact that there was an historical change during the 1970s and 1980s from the dominance of social liberalism to neoliberalism in many political fields across the world raises the question of what type of ideology might emerge to replace neoliberalism. Historical change

tends to create new contradictions and countermovements (Polanyi 2010), but much of the scholarship on a post-neoliberal order is clouded by nostalgia, such as belief that increasing within-nation inequality will lead to a swing of the pendulum back toward the happy days of social liberalism, or by utopianism, such as belief that a crisis in capitalism and global ecology will lead to a great transition to socialism or localism. I suggest that the historical condition of the relative decline of an economic superpower may be leading to resurgence of a modified form of its past of developmentalism. Developmentalist liberalism can be distinguished from neoliberalism and social liberalism on several grounds, of which the increasingly defensive position on trade and the corresponding invigoration of industrial policy are the most central. Developmentalism remains mainstream because it does not challenge the premise of restricted government intervention into an economy based on large, publicly traded corporations.

In contrast with the three mainstream positions, agents in subordinate positions in the political field advance more radical visions of the global economy, such as an economy based on locally owned, independent enterprises or one based on much higher levels of public ownership. Although it is possible that ideologies currently in a subordinate position in the political field may become dominant over the long run, the likely outcome, albeit not necessarily desirable from either a sustainability or social justice perspective, may be a growing tendency toward developmentalism.

The shift within the American political field in the twenty-first century is consistent with its nineteenth-century past and its isolationist proclivities. During the nineteenth century the United States was a secondary economic power with respect to European countries, and it pursued its successful policy of industrialization based on strong tariffs and import substitution. Only after the United States had achieved clear hegemony in the global economy did it shift to a liberalized position on trade, which at that time benefited the country by opening up foreign markets to trade on terms favorable to the United States (Chang 2008). However, as foreign competition increased, sentiment in favor of a more defensive approach to trade increased, first with respect to Japan during the 1980s and then today with respect to China. Thus, the stage is set for the political field in the United States during the twenty-first century to look more like that of the nineteenth century than the twentieth century. Because the United States has been the world's leading supporter of neoliberal policies, a shift toward developmentalism could have global implications for the history of neoliberalism as well as for the global economy.

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