

**Regional Responses to Climate Change:
Class, Capability and Dis-integrative Adaptation**

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Abstract:

With profound climate change now unavoidable, adaptation joins mitigation as urgent tasks. While climate adaptation has typically been approached as a matter of risk management, direct climate impacts and indirect ones arising from related market and regulatory shifts will also create adaptive opportunities. At the regional level, the range of possible adaptive paths is a function of these direct and indirect impacts and of existing, geographically specific economic assets and capabilities. But differential class interests and power will affect what avenues are preferred by various groups. This paper applies perspectives from the organizational capabilities and social structures of accumulation literatures in exploring these conflicts for northwestern Pennsylvania (NW-PA), a part of the southern Great Lakes region of the U.S. Adaptation in NW-PA could revolve around enhanced intermodal transportation infrastructure, renewable energy sourcing, and machining capabilities scaled up for the large work required to build and maintain these industries. But key corporate players show little inclination toward this path's required private and public investments. With capabilities that have evolved alongside a neoliberal social structure of accumulation fostering free capital and trade flows and a disempowered working class, regional capital does not depend on the regional economy; what is globally integrative for firms is dis-integrative for NW-PA. The analysis suggests that climate adaptation is ultimately a political, not a technical, problem, one that will require joint working class and environmentalist struggle to resolve.

Introduction

With profound climate change now unavoidable, adaptation joins mitigation as urgent tasks. While climate adaptation has typically been approached as a matter of risk management (NRC 2010), direct climate impacts and indirect ones arising from related market and regulatory shifts will also create adaptive opportunities. At the regional level, the range of possible adaptive paths is a function of these direct and indirect impacts and of existing, geographically specific economic assets and capabilities. But differential class interests and power will affect what avenues are preferred by various groups. This paper applies perspectives from the organizational capabilities and social structures of accumulation literatures in exploring these opportunities and conflicts for northwestern Pennsylvania (NW-PA), a part of the southern Great Lakes region of the U.S.

Key regional resources are related to its once-thriving rail and inland shipping corridors, ample offshore wind and woody biomass energy sources, and a major precision machining industry. Given these resources, the most salient climatic impacts are likely to be indirect ones: systemic pressures toward lower-carbon transportation and energy technologies. Adaptation in NW-PA could revolve around enhanced intermodal transportation infrastructure, renewable energy sourcing, and machining capabilities scaled up for the large work required to build and maintain these industries.

Key corporate players show little inclination toward this path's required private and public investments. With capabilities that have evolved alongside a neoliberal social structure of accumulation fostering free capital and trade flows and a disempowered working class, regional capital does not depend on the regional economy; what is globally integrative for firms is dis-integrative for NW-PA. But a climate-adaptive cluster as proposed above could underpin the rejuvenation of valuable skills and family-supporting jobs for workers and communities region-wide. The analysis suggests that climate adaptation is ultimately a political, not a technical, problem. For the capabilities and assets embodied in NW-PA's firms and workforce to be bent toward regenerative, sustainable regional adaptation, local working class and environmental organizations will need to build a coalition for the necessary private and public sector struggles.

In the next section, the research project giving rise to the present paper is described: the adaptation scenario-building methodology, background on the region itself, and the likely, critical, direct and indirect climate change impacts. The following section sketches the climate adaptation scenario. In the next one, the dynamics of class and intra-organizational power are explored as obstacles to the proposed scenario's potentially rejuvenating effect on the region. A concluding section discusses the political implications.

The regional adaptation project

The present paper is part of an extended project whose goals are to construct plausible, creative climate adaptation scenarios for the NW-PA region and provide local decision makers with tools for affecting and advancing such scenarios.

(Additional detail is contained in: Goldstein et al. 2011, on the project and regional background; and Goldstein 2012, on the climate adaptation scenarios).

Methodology

The approach is to develop economic scenarios based on the projected direct effects of climate change; indirect effects likely to be transmitted by climate-related shifts in markets and policies; and existing regional resources that may be relevant in adapting. The regional adaptation literature pays considerable attention to projecting the direct impacts of climate change, and focuses on reducing vulnerability to those direct effects (IPCC 2007, NRC 2010). On the other hand, little has been done to explore the salience of indirect impacts, broader climate responses in markets and policies from beyond the region that will act as systemic parameters in shaping the constraints and possibilities of innovative regional adaptation. (An important exception is Jackson et al. 2011.)

The method in this project has been to iterate between examining likely climate impacts (direct and indirect) and the region's potentially adaptive resources. The focus has progressively sharpened on those climate impacts that are capable of stimulating significant local responses, and those local resources which might effectively respond to key impacts. Following initial literature and data reviews, semi-structured interviews with participants in preliminarily targetted industries and policy roles sought views on key developments in their areas; and how their organizations might relate to the preliminary adaptation scenarios under consideration, including interaction with other sectors. Thus hypothesized scenarios were refined, modified, and/or rejected.

In identifying potential scenarios, regional resources have been analyzed within a theoretical framework based on organizational capability, economic clusters, and the institutional embeddedness of both. "Organizational capability" (OC) is "the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result" (Helfat and Peteraf 2003, p. 999). The OC approach looks at what firms can do well relative to both their competitors and the broader market setting. Because the competitive environment changes, organizational learning and change are important; "dynamic capability" is "...the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, p. 516). Organizational change is seen as being "path dependent," with adaptive responses conditioned and often constrained by the set of operational capabilities built over time. Thus it has been important to look at regional firms' capabilities in terms of how they might provide bases on which to generate effective responses to the direct and indirect impacts of climate change.

Change and development by individual companies may depend not only on their own OCs, but also on relationships with and among other, nearby organizations. An approach to understanding such interrelationships is Porter's theory of "clusters": "...geographic concentrations of interconnected companies and institutions in a particular field" (1998, p. 77). Clusters may incorporate firms in a given industry,

specialized labor and suppliers, important customers, makers of complementary products or inputs, and institutions such as governments and universities that provide related research and education. Cluster theory suggests that strong climate adaptation scenarios would incorporate mutually reinforcing responses by organizations across particular sectors.

Finally, both organization-level capability and the operation of clusters depend on the broader institutional environment in which they are embedded. Both can be seen as emerging within a “mode of social organization” comprised of systems of labor training and control, supply chain relationships, capital access, education, and social status (Lazonick 1994). A large literature in radical political economics studies these relationships in terms of “social structures of accumulation” (SSAs; see McDonough 2008). As will be seen, the region’s set of possible climate adaptive paths, and the often contending class interests around those possibilities, are powerfully affected by this broader institutional setting.

The region

The NW-PA region for **which** these dynamics will be explored is bounded on the north by a short strip of Lake Erie coastline, all in Erie County. There are five other counties around Erie whose topographies, economies, demographics, and histories make it reasonable to group them all as a single region: Crawford, Forest, Mercer, Venango, and Warren.¹ In line with the foregoing, its history helps define its range of potential climate responses. Location made NW-PA an important central point on east-west shipping and (especially) rail lines. Near Pittsburgh’s iron and steel and half-way from New York to Chicago, both Erie and Meadville through the mid-20th Century were the sites of major rail yards and work crews. Both were also important small manufacturing cities. General Electric’s locomotive division in Erie and Talon Zipper in Meadville anchored deep metal-working supply chains and skilled workforces. Deindustrialization hit the area hard, and by the late 1980s only GE in Erie remained of the biggest firms. Nevertheless, the region retains a mix of manufacturing as well as a nationally prominent cluster of mostly small tool and die and precision machining companies (Onyeiwu 2009).

The decline of Midwest manufacturing and the rise of trucking shrank rail and shipping volumes and brought infrastructure decay. By the 1980s, Meadville lost its east-west line and most rail yard functions. Numerous short-haul carriers also closed or consolidated. Port Erie on the Great Lakes-St. Lawrence Seaway (GL-SLS) declined for decades due to broader steel industry shifts – most of GL-SLS shipping is bulk commodities, especially steel and coal (Lake Carriers’ Association 2012) – but unlike rail, GL-SLS shipping has continued to languish (U.S. Department of Transportation N.D.). Nevertheless, Port Erie retains major deep-draft dock, crane, shipbuilding, dry-dock, and warehousing facilities (World Port Source 2012).

¹ Much of the paper’s analysis can apply to a considerable degree to the broader, southern Great Lakes region running from Milwaukee (southern Wisconsin) to Rochester (western New York), but would have to be increasingly qualified the farther from NW-PA one goes.

Union membership and power fell sharply along with these industry declines from the 1960s onward. Steel, rail, construction, and other unions have shrunk through shut-downs, slow or negative industry growth, and loss of the strength required to organize new groups. While labor retains some political influence in Erie, that has been lost in the smaller cities scattered across the region. Service sector growth, particularly in retail and health care, has not been sufficient to replace the lost jobs and earnings in transport and manufacturing, resulting in rising poverty and shrinking population (except in Crawford and Erie counties, where retail and health services are concentrated). Nevertheless, relative to the region's economy and the indirect effects likely to be felt from climate change, transportation and manufacturing remain important industries. Transportation provides about 5% of the six-county region's total employment and about half that in terms of income, while manufacturing is responsible for about **14%** of income and employment.

Since the mid-2000s, the major growth industry statewide has been deep-shale natural gas extraction in the well-known Marcellus "play." Shale gas activity is affecting the NW-PA economy, and for two reasons this is likely to intensify. First, the Marcellus supply chain reaches deep into the region. Many local companies are servicing the extraction process, and the need to move hydraulic fracturing ("fracking") sand to well sites is reversing the longtime decay of short-haul rail and intermodal and Class I – short-haul linkages; it is widely anticipated that GL-SLS shipping will soon also be transporting sand as well. The second factor is the prospect of direct extraction activity for the deeper Utica shale formation, whose commercially viable zone in northeastern Ohio may extend into NW-PA. Despite its own environmental implications, shale gas extraction is stimulating economic changes that could powerfully complement regional climate adaptation.

The changing regional climate

Historical. NW-PA partakes of Pennsylvania's humid continental climate, but its proximity to Lake Erie makes it cooler, cloudier, and more moist than the state overall. Average summer temperatures in the region approach only 70 degrees, typically including few days with highs of 90 degrees or above (The Pennsylvania State Climatologist 2012). Precipitation (approximately 40 inches annually) has historically tended to be more frequent and less intense than elsewhere in the state, with the exception of heavy "lake snow" events in the winter. Along the lake shore the region enjoys moderated temperature extremes and a long growing season, and is home to orchards and Pennsylvania's chief grape vineyards. The region's eastern edge is mountainous and often cold.

The global greenhouse effect in coming decades will have both direct, climatological impacts and indirect, systemically transmitted impacts on the region's economy.

Projected direct impacts. World maps of projected changes in temperature and precipitation show that the southern Great Lakes are part of a zone that will likely get wetter and warmer overall (IPCC 2007, pp. 46-47). But small regions must adapt to climatic variations affected by local topographies, bodies of water, land use patterns, and other factors not captured by global projections. Cooney (2012)

provides a summary of the main approaches to “downscaling” climate projections into higher-resolution regional models. Downscaling research done in the context of the larger Northeastern and Great Lakes regions, at whose intersection NW-PA stands, includes the Great Lakes Regional Assessment (GLRA 2000), the Northeastern Climate Impacts Assessment, or NECIA (Frumhoff et al. 2007), and the ClimAID report (2011) on climate adaptation in New York State.

All three studies make projections at high enough resolution to bring the trend toward an increasingly warmer and wetter region into sharper focus. By mid-century, average temperatures in NW-PA are predicted to rise by 4-5 degrees Fahrenheit. Annual precipitation is expected to increase on the order of 10%, but summers will be drier. All three predict snow and Lake Erie ice cover diminishing in amount and duration. Most research through the 2000s, including the GLRA and NECIA studies, has projected that rising temperatures will reduce Great Lakes water levels due to elevated evapotranspiration. However, recent work (Lofgren et al. 2011) suggests that with better downscaling methods, projected Lakes levels do not fall and may even rise. It will be seen in the next section that this result may be important for NW-PA regional adaptation scenarios. Another potentially significant direct impact is the likelihood of increasing frequency and severity of heavy precipitation events. From 1958 to 2007, while average annual precipitation rose 15-20% in the NE-U.S. generally, rainfall amounts during the heaviest 1% of daily events increased by 67% (Karl et al. 2009, pp. 30-32). Storm water systems are being stressed already, and this will probably worsen over time (Kessler 2011).

Projected indirect impacts. Broader, systemic, climate change-induced shifts in markets, technologies, and policy frameworks will act as parameters within which regional adaptation takes place. These effects are likely to be more salient than direct climate impacts. The focus will be on two shifts: toward renewable energy (RE) relative to fossil fuels and toward rail and waterway freight transportation relative to trucking. The shared underlying driver of both is public concern and policy change around three environmental issues: climate change itself, surface air pollution (smog, particulates, and other dangerous emissions), and what might be called “extreme extraction”: costlier and riskier technologies of fossil fuel exploitation like fracking, deep water drilling, tar sands mining, and mountaintop removal. With limited sources and rising world demand, extreme extraction becomes technically and economically possible, but with high direct costs, massive externalities, and low-probability but catastrophic-outcome risks (Ackerman 2010).

These factors have combined to create long term pressures toward alternative energy and transportation technologies. This does not rely on a future U.S. carbon pricing policy. The emergence in other countries of carbon cap and trade and tax regimes is already affecting current and prospective costs for U.S. companies. Meanwhile, tougher emissions restrictions have sharply reduced the prospect for new coal-fired power plants in the U.S. And policies to encourage renewable energy adoption continue to proliferate world-wide; the EU has mandated that 20% of its energy needs come from renewable sources by 2020, with direct implications for NW-PA, as will be shown. Even in the U.S., it is highly likely that RE incentives will

remain part of the policy mix and usage will continue to grow. U.S. consumption of renewable energy (excluding hydro and liquid biofuels) more than doubled from 2000 to 2010 (BP 2011), with wind power capacity more than doubling every three years (Global Wind Energy Council 2010). Per-kWh costs for wind power have fallen steadily and are approaching competitiveness with fossil fuel-generated power.

Meanwhile, the high prospective costs of conventional fossil fuel sources have contributed to the growing importance of alternatives to trucking in U.S. freight transport. Despite retrenchment in the 1970s and deregulation in 1980, U.S. railroads remained a major part of the freight mix along with trucking due to the lower cost of rail shipping for heavy loads over long distances. By the turn of the century, the economics of expanding the overburdened U.S. freight system had tilted away from trucking. Key here has been the long term increase in the cost of fuel; the per-mile cost gap between trucking and the more fuel-efficient rail and waterway modes widens as fuel prices rise (TEMS 2008). Highway congestion and environmental regulation have also played roles in stimulating intermodal construction at major ports² and substantial public and private investments in national rail freight corridors. The broad resurgence in rail freight shipping may be considered an indirect impact of climate change because the long term likelihood of U.S. carbon pricing is one among many related considerations factoring into corporate and government infrastructure investment decisions. As for domestic waterway shipping, it has not enjoyed the renewed attention and vitality exhibited by rail; indeed, in recent decades the railroads have taken long-haul business away from trucking and waterway shipping alike (Transportation Research Board 2003).

Nevertheless, it will be argued in the next section that for NW-PA and environs, increased Great Lakes-St. Lawrence Seaway shipping may be in store and – in combination with systemic growth in renewable energy and rail – underpin construction of a viable climate adaptation strategy.

Regional adaptation scenario

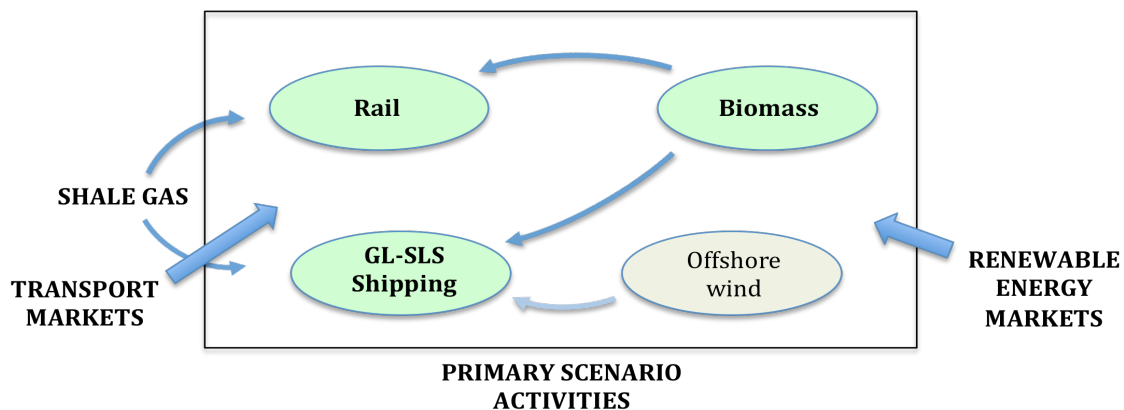
The direct and (especially) indirect climate impacts likely to be felt regionally are already stimulating early, potentially complementary responses toward economic reconfiguration around an alternative energy and transportation nexus. As will be seen, the scenario constructed here from these responses is based on significant, existing regional resources and could build those resources in ways that would create good jobs and new business for area firms. The differential class interests and power that make such outcomes problematic will be analyzed in the following section.

To summarize this scenario: Broader shifts toward renewable energy and rail and waterway shipping would stimulate growth in NW-PA biomass sourcing, offshore wind production, and intermodal rail and shipping capacity. The ability to respond to these stimuli would be a function of the region's existing skill-based, locational,

² "Intermodal" is sometimes used to refer to the interface of trucking, rail and shipping in transporting containerized freight. Here, it will carry the broader meaning of any freight transport for which two or more modes interface.

and organizational resources, as well as others now being built throughout the region in conjunction with the shale gas industry. Figure 1 shows these relationships, and in addition, how the scenario's main activities would be mutually supportive in creating demand for one another. Biomass export requires shipping and potentially rail services; inbound shipping needs intermodal connections; and offshore wind farms use shipping firms for construction and ongoing operations. (Wind is shaded differently because it faces steeper hurdles, as discussed below.) One of the region's resources that cuts across these individual activity areas is the Erie Development Corporation – a public-private organization that is spearheading biomass, Port Erie, intermodal, and regional shippers initiatives.

Figure 1³ Primary NW-PA Climate Adaptation Scenario: Key Drivers and Demand Relationships



It is important for the subsequent discussion of class dynamics to consider some of these relationships in greater detail. The biomass opportunity arises due to the EU's mandate for 20% of its energy supply to come from renewable technologies by 2020 (European Commission 2010). NW-PA's relevant resources include extensive hardwood forests (which have lacked demand for waste cuttings and pulpwood since Erie's International Paper mill closed); substantial infrastructure and a labor force with the requisite skills, equipment, and organizational know-how to provide raw material; and sustainable forestry capabilities from a variety of sources. Amsterdam port managers are now examining this supply as a potential source of wood pellets for import to Europe. To make this viable, transportation economies are needed that can be achieved by direct waterway shipping from Erie and nearby ports, out the GL-SLS, and direct to the Netherlands (GFR 2011). Also required is public-private investment in port and related facilities.

The scaling up of biomass export would complement waterway shipping and intermodal facility and capability development, potentially including short-haul rail. In the case of GL-SLS shipping, industry sources indicate that Marcellus activity is

³ Figure 1 also appears in Goldstein 2012.

spurring arrangements to ship frack sand into the region via Great Lakes freighters. For NW-PA's Port Erie and nearby ports as well, this will dovetail with European biomass export in driving improvements in already strong loading, storage, dockage, drydock, and ship-building capabilities, along with intermodal connectivity. The feasibility of such investments will be increased by the likelihood that regional warming will shorten the annual period during which Lake ice halts traffic. These regional boosts would be cutting against the overall decline of Lakes shipping, but there are potentially positive subscenarios. One would be GL-SLS capture of even a very small fraction of the East Coast's growing Asian container trade due to increased Suez and (in 2015) Panama Canal flows (Chambers 2010). In addition, the small two-way regional waterway trade with northern Europe could expand along with better infrastructure and adaptation of new, smaller, GL-SLS-compatible European vessel technologies (Vickerman 2012).

The scenario's rail component is less biomass-specific. Much of recent years' uptick in rail freight activity in and around NW-PA is driven by Marcellus frack sand. Class I lines have increased staffing and operations in western Pennsylvania and have added transload (rail-to-truck) and railcar storage capacities. Short-haul lines have done likewise in deepening the network between east-west Class I corridors running through Pittsburgh and Erie. But the shift toward rail goes deeper. Rail freight relative to trucking has been rising nationally since the late 1980s (U.S. Department of Transportation N.D.), and industry participants agree that both container and bulk rail freight into, out of, and through NW-PA is increasing. This trend may be strengthened as growing East Coast container arrivals increasingly move inland via the more fuel-efficient rail and as intermodal regional nodes handle more goods. NW-PA may benefit if Marcellus activity has led to the public and private infrastructure investments required to create one or more attractive container inter-connectors off the big national corridors.⁴

Offshore wind is a final potential scenario component. Lake Erie has a substantial, commercially viable wind resource (Great Lakes Wind Collaborative 2012) and is the shallowest and most construction-accessible among the Great Lakes. Here also there would be strong complementarities; as noted above, building and running offshore wind farms creates business for shipping companies and ports. But unlike Ohio and New York, Pennsylvania lacks a clear legal framework for the underwater development rights required for private offshore wind investment. A bill to resolve this problem, despite bipartisan local authorship, faces an uncertain future in the Pennsylvania legislature. On the other hand, even offshore wind projects in northeastern Ohio or southwestern New York could bring supply-chain business for NW-PA shipping, construction, and ship-building companies and workforces. Port Erie has much of the requisite dockage and ship-building capability, and there is considerable slack in the region's relevant construction sector. But even Lake Erie wind projects in Ohio and New York have run into additional barriers including cost,

⁴ Lacking this, the increased container flow is likely to go to Class I hubs in Ohio and Pittsburgh and be trucked into the region.

aesthetic and environmental concerns, and price competition from shale gas (Funk 2012, Precious 2012).

The complementarities among the scenario's components would go beyond the interacting demand creation suggested in Figure 1. These activities would share similar kinds labor skills, supply chains, and customer bases in the areas of facilities construction and maintenance; logistics; and intermodal operations. Assets and capabilities created in the Marcellus – for getting infrastructure, equipment and supplies into rural areas and gas out – will come into play in creating a biomass feeder network from the hinterland.⁵ And logistical companies, systems, and skills being forged around shale gas will find additional employment in biomass and intermodal transport development generally. In addition, ongoing rail infrastructure enhancement is increasing the region's construction capacity for building new port facilities. Rail and shipping upgrades will make biomass and offshore wind investment more profitable, while offshore wind deployment and maintenance will build shipping capabilities. Attention from biomass buyers will hone the capabilities of and attract new customers to regional intermodal shippers.

Such complementarities are in line with the predictions of cluster theory. But unlike Porter's framework, key businesses in this case have already built capabilities and strategies in ways that bypass rather than leverage intra-regional linkages. Before developing this point, it will be useful to look briefly at another, potential contributor to the theorized scenario.

This study's initial working hypothesis was that NW-PA's nationally important precision machining cluster (Onyeiwu 2009) would be at the center of a regional climate adaptation scenario. This would involve regional metalworking firms extending existing capabilities to enter the equipment supply chains for the other scenario activities. It would develop along two, interrelated dimensions of larger-scale metalworking than is now prevalent in the region: precision machining and structural iron and steel. On the precision machining side, regional machining firms would increase their currently just-beginning entry into the supply chain for deep-shale capital expenditures (IHS 2011). That would be leveraged by extension into supplying parts for wind turbines, whose component types (Sterzinger and Svercek 2004) apparently overlap significantly with those in deep-shale equipment. Much of the deep-shale work and most of that for wind involve considerably larger pieces than typically handled by regional metalworkers, so significant investments would be needed.

In the structural iron and steel dimension, the scenario's transportation and offshore wind elements will generate substantial infrastructural demand for structural metal products. An additional demand boost from outside the scenario proper would be the need to cope with the increasing severity and frequency of

⁵ Evidence for this commonality comes in the ongoing shift of logging haulers and truckers out of that market and into Marcellus supply (GFR 2011). Thus in the short run, there may be competition between the two. But longer term, new and deeper resources will be drawn into this complex of related activities.

major precipitation events over time. All will require structural and fabricated iron and steel products like stanchions, culverts, under- and overpasses, bridgework, gratings, and weirs. In addition to complementing the main scenario activities, precision machining and structural metalwork would feed into each other, because rail and port facilities, wind farms, and storm water systems also incorporate guages, gears, controls, fasteners, and other machined components.

There are, however, significant problems with the metalworking sub-scenario as sketched. Industry interviewees report that shale-gas producers source from equipment producers centered around Texas. Wind turbine makers in the U.S. similarly purchase components abroad (Uchitelle 2010), and at any rate, offshore wind is the most uncertain piece of the primary scenario. For their part, local metals firms have shown little interest in the investments required to enter renewable energy supply chains. It will be argued in the next section that these problems are indicative of obstacles likely to be faced by the entire scenario, as a function of the regional and extra-regional dynamics of class and power in a neoliberal political-economic setting.

Class dynamics in regional adaptation

To show that it will be technically possible to adapt to climate change by restructuring the regional economy around lower-carbon energy and transportation is far from saying that it is politically or economically likely. The inertia of routine and capability make change difficult in general. And the political-economic orientations of regional capital at all levels will tend to channel the changes that do occur in more atomistic, less regionally integrative, and more narrowly distributive directions. Both the organizational capability (OC) and social structure of accumulation (SSA) approaches can be used to explore these obstacles.

The basic issue is that capability arises and changes within an institutional context whose nexus of forces includes particular relationships of agency and power (Appelbaum and Batt 1995, Lazonick 2001). Corporate decision makers in NW-PA will respond to the shifts coming in the train of climate change by using discretionary tools from kits jointly defined by their firms' own OC paths and shared institutional setting. They will use the power they have to shape and exploit the opportunities as they see them. As will be seen, their strategies have not depended on adaptive regional development and will tend to continue that way.

What might be considered to be the germane elements of the neoliberal SSA at the regional level?⁶ The following discussion focuses on three (see Kotz 2009 on the components of this SSA): labor process and practices; globalized production configurations; and political process and relations.

The neoliberal SSA in the U.S. was marked by capital's abandonment of its partial "accord" with labor (Gordon et al. 1982). Compensation, working conditions, and

⁶ The institutional and market pressures associated with climate change are being overlaid on what many researchers consider to be a breakdown period of the neoliberal SSA. Whether and how these two processes may interact is important, but beyond the scope of this paper.

unions themselves came under attack – facilitated by a more thoroughgoing globalization of individual companies’ accumulation processes. In line with this broader institutional setting, union numbers and influence have been driven steadily down since the 1960s in NW-PA. The complete or virtual closing of rail yards throughout the region eliminated an important unionized workforce. Construction trades unions suffer chronic and significant unemployment in the face of reduced activity and increased use of non-union labor. Major unionized manufacturers like Meadville’s Talon Zipper expanded into the non-union South (later Mexico, then China) starting in the 1950s and within three decades had shuttered operations in NW-PA. GE Transportation in Erie remains organized by the United Electrical Radio & Machine Workers (UE), but over the years has shed jobs locally and added locomotive capacity at new, non-union facilities in Texas (Frederick 2011). The region’s precision machining industry, a residual of former manufacturing glory, consists of small-to-medium sized shops whose owners are mostly local and fiercely anti-union. Belief systems act as cohesives for the institutions of an SSA, and there is a powerfully shared belief among the region’s business and economic development elites that labor involvement in new ventures of any kind is the kiss of death.

The labor process within companies in or related to the scenario sectors discussed above affords few avenues by which workers might contribute to the development of new products, processes, and markets that could push companies and the regional economy toward creative climate adaptation. In the smaller, more local firms, owner-manager prerogative is absolute. In manufacturing, this may be combined with aspects of flexible production or high-performance work models, but in ways that maintain and even deepen workers’ separation from matters of planning and design. The handful of larger, unionized companies – like GE – utilize a global division of labor that situates such strategic decision making far from production sites like NW-PA. A “hierarchical segmentation” between managers and workers is not new to the neoliberal SSA in the U.S. (Lazonick 2001), but the evolution of greater geographical scope and complexity acts to deepen the regional impact.

Indeed, the core capabilities of successful small and large regional firms alike have been built alongside, and include, capacities for buying, selling, and/or producing across national borders. Such internationalization capabilities are the organizational concomitants of the neoliberal SSA’s open-border policy and production regimes. GE operates full-scale R&D facilities on four continents and produces and sources interchangeably around the globe. A NW-PA firm recently lost its component-supply contract for GE wind turbines to a lower-cost producer abroad; when GE sells turbines in Canada, it must meet domestic content requirements, but not in the U.S. (Business Wire 2012). Class I U.S. rail companies have also built capabilities around globally integrative processes. For example, CSX’s and Norfolk Southern’s NW-PA operations are tiny cogs in these firms’ intermodal major-corridor strategies, which revolve around capturing global container traffic and often, according to industry sources, explicitly entail freezing regional and short-haul lines out of this trade.

Even small regional companies deploy capabilities around globally integrative accumulation processes. Local machining and machine tooling firms have learned to identify, win, and satisfy contracts with buyers in Europe, Asia, and Latin America. These operations provide jobs, but in most cases the local manufacturing footprint is light. In combination with the management monopoly on planning and design discussed above, global integration means that this footprint could be removed and placed elsewhere at any time. The region's skilled but low-cost labor, not its full complement of potentially cross-fertilizing assets, activities and capabilities, is the local resource of strategic interest.

These strategies and interests of capital large and small are reflected in the business community's relationship to and demands upon the public sector. As for the neoliberal SSA generally, low business and income taxes are sought and slashed services tolerated at the local government level in NW-PA. The public sector's diminished standing is well symbolized in the recent action by a cash-strapped Meadville city government to move its offices out of the city building and into an abandoned National Guard armory; the (former) city building is to be leased to an area manufacturer whose owning family is an important part of the local elite. Tax cut-driven fiscal stringency has flowed relentlessly down from the federal to the state to the local levels. School districts have been hard hit across NW-PA, and regressive municipal user fees and local taxes have been instituted or increased.

What are the implications for a proactive, regionally developmental climate adaptation scenario of the kind outlined above? Moving toward a regional economy focused more on alternative energy and transportation would require many private investment decisions by businesses. But the complementarities logic of the scenario implies that for many of these individual investments to be validated, others must be made as well. The presence of a network of positive externalities means that public action will be necessary. Port and intermodal facilities that benefit many private players will need public investment. Public support for rail infrastructure, typically proprietary, will in key instances have to be leveraged to ensure open access. Intergovernmental and cross-sectoral backing must be mobilized for a new underwater development legal framework. Publicly subsidized workforce training will need to provide flexible skills that enable recipients to move freely among companies and sectors as the scenario unfolds. Information, encouragement, and support will need to be offered to firms and public entities across the board. Lacking a transparent, consistent, credible framework for long term public support, individual firms and workers will not commit to the private actions that must add up to the collective scenario as described.

There is little evidence that such a framework can be created by the elites who typically dominate decision-making in the region. The labor, international, and public sector strategies attributed above to regional capital militate instead toward individual company responses based on existing capabilities and narrow interests. These responses, in turn, often make it difficult for other regional actors to take common action around progressive climate adaptations. Some examples will illustrate the point. First, local manufacturers publicly lined up in complete

opposition to the 2009 U.S. House of Representatives energy and climate bill, and few have shown interest in expanding their capabilities to enter available renewable energy supply chains. In another instance, broad business support has been lacking for legislative and investment initiatives tied to offshore Lake Erie wind power; even environmentalists have been divided, and labor's voice (despite tremendous jobs potential) has been mostly silent, on the issue. In contrast, Meadville and Crawford County development agencies passively endorsed an individually profitable but regionally detrimental tires-to-energy incinerator, with environmental opposition blunted by construction union support mobilized by the incinerator company.

Under the *status quo*, workers are accessing only small numbers of jobs – mostly low-paid, insecure ones – from new corporate investment, and are frozen out of decision making in supposedly public economic development processes. Meanwhile, environmentalists view with suspicion any public action on behalf of private business ventures. In this sectionalized and individualized context, workers often support dubious projects (tires-to-energy) and environmentalists oppose good ones (offshore wind). In contrast, motion toward the climate-adaptive scenario proposed here could generate considerable good, location-specific (hence more secure) employment. And the scenario's new energy and transportation foci would fit well with the goals and values of environmentalists. The basis would emerge for a working class-environmentalist coalition in a movement for regional revitalization around progressive climate adaptation.

Such a movement would not only be possible, but – given the analysis presented above – also likely be necessary for the scenario under consideration to gain any traction. Nationally, exploratory steps in this direction have been taken for many years (Obach 2004). Such steps have become more numerous and urgent recently, as groups like the BlueGreen Alliance have brought together labor and environmental organizations around the development of new operating capabilities and concrete programs and policies.

The formidable class obstacles to acting on this potential in NW-PA are not unique to this region. In fact, they are depressingly familiar. That regional firms stay on the path of least resistance, and that the neoliberal SSA reduces the degrees of freedom available to workers and environmentalists for moving capital off that path, have been dissected here not because they are unusual. Rather, these class dynamics point toward the conclusion that climate adaptation is fundamentally a political, not a technical, problem. Some discussion of this point will close the paper.

Conclusion

This project started from the observations that very little thinking about climate adaptation has approached the problem with an eye toward creative, potentially transformative change – and that such change could be anchored at the regional level. It has been argued here that a NW-PA adaptation scenario built around new energy and transportation technologies is viable and could bring broadly shared economic vitality to this rustbelt Great Lakes region. The upshot of the preceding section is that, like for any such proposed transformation, there are reasons why

things are the way they are. While technically viable, the scenario as envisioned cuts against the grain of a host of institutional dynamics as they interact with class interest and organizational capability.

Forward-looking regional capital, large and small, has been shown to be globally integrated. But what is integrative for business in this sense is dis-integrative for the region: The capabilities that are utilized and extended are those that connect capital with world markets, while those that could also broaden and deepen firms' linkages with complementary, livelihood-providing regional activities are ignored or overtly rebuffed. The analytical tools of OC and SSA theory help understand why these firms are systematically programmed to see certain kinds of opportunities but be blind or indifferent to others.

There is a further dimension to this. Effective routines for scanning and processing outside information provide a kind of external integration that is critical for dynamic capability (Grant 1996). The interfaces that globalized NW-PA firms have developed with the external environment are sophisticated, but not necessarily in ways that are fully conducive to organizational learning. Hierarchical segmentation (Lazonick 2001) means that functional and strategic learning and planning are limited to managerial decision makers (to corporate-level executives in the case of large companies). Because workers at all levels are excluded, U.S. firms do not invest in the "broader and deeper skill bases" (50) that are needed to integrate manufacturing, design, R&D, and upstream and downstream supply chains in virtuous cycles of learning and innovation. The critical point here is that organizational integration in the latter sense is not only conducive to learning, but is also, to an important degree, *place-based*. Broad and deep skill bases reside in workers, and labor, unlike capital, is by its very nature embedded in specific regional communities and economies.

Globalist, hierarchical external integration fosters individual corporate profitabilities whose sum effect is regional decline and isolation from broader climate-adaptive trends. In contrast, place-based rootedness can underpin a kind of external integration that fosters innovation while and through contributing to adaptive, sustainable regional development. But this latter path will have to be forged through struggle.

Ultimately, climate adaptation is a political, not a technical, problem. Different technological possibilities for reducing and spreading risks, and for seizing and sharing opportunities, will allocate costs and benefits differently within regions. Representatives of capital not only perceive and pursue opportunities according to their capabilities and class interests, but also use their myriad forms of influence to shape regions' adaptive paths in their own image. It is up to working class and environmental movements to force the terms of debate around climate change adaptation onto terrain more favorable for sustainable regional development.

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