



Climate-adaptive technological change in a small region: A resource-based scenario approach



Don Goldstein

Economics, Allegheny College, Meadville, PA 16335, USA

ARTICLE INFO

Article history:

Received 2 June 2014

Received in revised form 19 February 2015

Accepted 7 April 2015

Available online xxxx

Keywords:

Climate adaptation

Technology pathways

Scenario planning

Clusters

Organizational resources

Stakeholder engagement

ABSTRACT

Society at large must find technological pathways capable of mitigating climate change. But small regions – where private and public sector decision makers take actions whose aggregated effects shape those broader pathways – are faced with the need to adapt to climate impacts over which they have little control. Such impacts already include not only direct climatological ones, but also related systemic shifts in technologies, markets, and policies. Firms and policymakers can widen the range of adaptation opportunities by exploring regional resources applicable to emergent clusters, through which technologically related inter-organizational dynamics may permit more effective climate responses. As in the resource-based view of the firm underlying cluster theory, key decision fields are chosen based on existing capabilities internal to the region in relation to the threats and opportunities transmitted by external climate change impacts. Adaptive strategy options at the regional level can be identified and assessed using a scenario-building methodology that incorporates the interactions among multiple variables and decision-makers' actions over time. Stakeholder input and engagement during the research process can facilitate realism and traction. This methodology is applied to northwestern Pennsylvania, on Lake Erie, projecting a scenario based on a set of complementary, lower-carbon energy and transportation technologies.

© 2015 Elsevier Inc. All rights reserved.

“Transformations in economic, social, technological, and political decisions and actions can enable climate-resilient pathways (...sustainable-development trajectories that combine adaptation and mitigation to reduce climate change and its impacts)...Strategies and actions can be pursued now that will move towards climate-resilient pathways for sustainable development, while at the same time helping to improve livelihoods, social and economic well-being, and responsible environmental management...[B]ut tools to understand and manage these interactions remain limited” (IPCC Working Group II, 2014, pp. 24–5).

1. Introduction

Society at large must transition to lower-carbon energy, transportation, and other technologies that are capable of mitigating climate change. But movement toward these technology shifts, and mitigation efforts generally, have been slow and fragmented (Kriegler et al., 2012). Because the effects of climate change are growing and nearly certain to accelerate (Bierbaum et al., 2014), private and public sector decision makers at sub-national levels are increasingly faced with the need to adapt to climate impacts over which they have little control. It is at the regional level that the impacts, exposures and vulnerabilities relevant to climate adaptation are constituted (Seitz, 2014).

In thinking about adaptation to climate change, this logic suggests the usefulness of much smaller regional definitions

E-mail address: dgoldste@allegheny.edu.

than the continental breakdowns often employed (for example, in *IPCC Working Group II, 2014; Kriegler et al., 2014*). The specific geophysical and socioeconomic characteristics of smaller regions, often missed by more macro-level analyses (*Rosen and Guenther, 2014*), can be highly salient. In turn, the aggregated effects of local actions over time will play a role in shaping the broader technological changes that emerge (*Moss et al., 2010*). Thus it is critical to develop analytical tools to assist firms and policy makers in small regions in projecting potential adaptive pathways that are locally viable and globally consistent with climate change-mitigative technological shifts.

This is all the more true in that adaptation at all levels has been uneven and has rarely progressed beyond the planning stages (*Berrang-Ford et al., 2011; Bierbaum et al., 2014*). The likely direct impacts of climate change itself are complex and uncertain, compounded by the fact that a myriad of wider public and private sector responses will increasingly transform the macroenvironment within which regional firms compete, governments operate, and economies evolve (*Moss et al., 2010*). Old technologies, products, and capabilities will lose traction, and both the need and the opportunity for new ones will emerge. Realizing such opportunities will require technological innovation – not only for individual companies, but also in related supply chains, other intra- and inter-sector relationships, and policy frameworks (*IPCC Working Group II, 2014, p. 24*). This in turn will require that decision making by private and public entities go forward in the presence of multiple variables that will co-evolve along uncertain trajectories. Individual actors must make adaptive choices whose eventual viability will depend in part on choices made by others. In the face of such complexity, often the resulting choice is to take no action at all.

Many researchers and practitioners are dealing with these problems – region-specificity, uncertainty and complexity, and stakeholder (dis-)engagement – in terms of adaptation “pathways”: “...an analytical approach for exploring and sequencing a set of possible actions based on alternative external changes over time” (*Wise et al., 2014, Section 2.2 paragraph 2*; see also *Moss et al., 2010; Kriegler et al., 2012; Haasnoot et al., 2013*). The present study reports preliminary results of ongoing research on potential climate-adaptive technology pathways in a small region: the northwestern part of Pennsylvania (NW-PA), adjacent to Lake Erie.

The aim is to contribute to our understanding of adaptation pathways in several respects:

- “Region” is defined in geographically delimited terms relevant to the kinds of place-specific characteristics and decision processes that must underpin adaptive change.
- Related, the project is framed in terms of regional economic opportunities (a “livelihood” perspective – *Wise et al., 2014*) rather than primarily risk management and vulnerability reduction (*Berrang-Ford et al., 2011*). It poses “the question ‘What are we adapting for?’ ... [which] is as significant, if not more, as the question ‘What are we adapting to?’” (*PROVIA, 2013, p. 46*).
- This implies a widened focus to include the regional implications of external technology and market changes induced by climate change – not just direct climate impacts themselves. The exercise begins from a normative position of seeking adaptation scenarios that are consistent with climate change

mitigation, recognizing that many of the broader parameters that can shape regional adaptation will be driven by mitigative policy and market pressures.

- The attendant uncertainty and complexity are approached through a set of tools from the strategic management literature: scenario-building (*Bishop et al., 2007*), regional clusters (*Porter, 1998*), and the resource-based view of the firm (*Collis and Montgomery, 1995*). These theories are well suited to the fine-grained exploration required by the small-region focus: identification of competitive resources capable of supporting adaptive development and consideration of key interactions among these resources in projecting internally and externally consistent technological pathways over time.
- Practitioner-experts’ views of evolving scenario projections are a key feature of the research design. Stakeholder views were used to draw attention to complex interactions among potential adaptive responses arising in disparate economic sectors and to generate technology predictions that are empirically plausible, stakeholder-relevant, and capable of testing and reworking over time. Thus a goal of this research is to increase stakeholder support for climate adaptation at the local level.

The next section develops a theoretical framework using the literatures on climate adaptation and the three strategic management concepts. The scenario methodology requires detailed attention to mutually relevant regional resources and external climate change-induced impacts transmitted to the region. This is provided in subsequent sections on the region’s economy and changing climate (*Section 3*); the impacts it is likely to experience as the climate changes (*Section 4*); and how technological innovation based on relevant resources might create an adaptive regional technological pathway (*Section 5*). The projected scenario describing such a pathway is described in *Section 6*, and a discussion concludes.

2. Literature review and theoretical framework

Wise et al. (2014) provide an extensive and insightful review of recent developments in climate adaptation research. While the regional adaptation literature itself pays considerable attention to the risks and vulnerabilities arising from the direct impacts of climate change (*IPCC, 2007; NRC, 2010; Bierbaum et al., 2014*), less has been done on the salience of indirect impacts. Broad climate change-induced shifts – especially in technological alternatives, but also in markets, policies, and more – will act as powerful systemic parameters shaping the adaptation constraints and possibilities that smaller regions face (*Moss et al., 2010; IPCC Working Group II, 2014*). Some studies have begun to explore this dimension. *Easterling et al. (2004, p. 5)* stress that “... anticipatory ... adaptive reorganization” facilitates systemic resilience by “altering existing relationships or establishing new relationships and components.” The *NRC (2010, p. 27)* argues that by identifying the most salient among the system of likely climate change-induced shifts, adaptation efforts can “minimize harm and take advantage of opportunities that may result from a changing environment.” *Bolton and Foxon (2014)* and *Wise et al. (2014)* go further in developing theoretical frameworks for understanding these relationships. Adaptation is seen as highly place-specific, but occurs in the context of external parameters – both

Download English Version:

<https://daneshyari.com/en/article/7256476>

Download Persian Version:

<https://daneshyari.com/article/7256476>

[Daneshyari.com](https://daneshyari.com)