Innovation and the Role of Collaborative Planning in Local Clean Energy Policy

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ABSTRACT

The adoption of clean energy policies is becoming more common among US localities, but is still far from universal. Policy innovation theory suggests that some shared internal characteristics should distinguish the localities that adopt those policies from others that do not. Based on a survey of US local government officials, and supplementary data from the US Census, we use multiple regression analysis to identify those distinguishing characteristics. We find that collaborative planning approaches play a crucial role in helping localities build the local civic capacity necessary to adopt these innovative policies. Our results reinforce prior studies which have found that citizen participation and stakeholder participation in planning processes can help to foster the development of innovative local policies for sustainability and climate change mitigation. Copyright © 2014 John Wiley & Sons, Ltd and ERP Environment

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Introduction

An increasing number of cities and towns in the USA have initiated efforts to reduce greenhouse gas (GHG) emissions in their communities via long-range climate action planning processes and the adoption of climate change mitigation policies, including innovative new ‘clean energy’ policies that specifically promote energy conservation, efficiency and renewable energy use. The goal of this study is to help determine why certain localities have been able to embrace clean energy policies, which may provide insight into how local governments can innovate in the broader realm of sustainability and environmental protection. Is the adoption of these policies simply a matter of local population characteristics, i.e. the domain of more affluent, better educated communities with a history of environmental activism? Or are other characteristics of a locality’s planning process and overall approach to the climate change issue the more important drivers of policy innovation? For example, does regional coordination help clean energy policies diffuse among neighbouring localities? Or does engaging with community stakeholders through collaborative planning strategies help to foster policy adoption, as has been found in other studies of local sustainability initiatives (Frame et al., 2004; Mandarano, 2008; Pitt, 2010a; Hawkins and Wang, 2012)?

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Our analysis of survey responses and supplementary data from 87 US cities and towns identified several factors that influence the adoption of clean energy policies. We found population size to have the strongest positive influence on policy adoption, followed by the use of collaborative planning techniques. Membership in a national climate change policy network (ICLEI Local Governments for Sustainability) and the completion of climate action planning milestones were also associated with increased adoption of clean energy policies.

Local Climate Action Planning and Clean Energy Policies

The movement among US cities and towns to reduce their emission of GHGs began in the early 1990s with the launch of the ICLEI Cities for Climate Protection campaign, followed by Portland’s adoption in 1993 of the nation’s first local global warming reduction strategy. Interest in this type of planning grew dramatically after the creation in 2005 of the US Mayors’ Climate Protection Agreement (USMCPA), which commits members to reduce GHG emissions within their boundaries to at least 7% below 1990 levels, although some have adopted much more aggressive targets. Now over 1000 localities have joined ICLEI, the USMCPA or both, and at least 120 have adopted a climate action plan (CAP) outlining goals, objectives and actions for achieving local GHG reductions (Boswell et al., 2012). These plans’ recommendations for achieving climate change mitigation (i.e. reducing GHG emissions) often involve regular local government actions such as increasing public transportation, bicycle and pedestrian infrastructure, and using land-use planning to encourage more compact, mixed-use development that reduces vehicle miles travelled. However, our analysis focuses specifically on local policies to encourage clean energy use – energy conservation, efficiency and renewable energy – which fall outside of traditional local government planning and public service provision and are therefore a better example of policy innovation.

Many of the tactics that local governments can use to promote clean energy involve creative use of land-use planning and construction permitting regulations. One obvious approach is to modify the local building code to mandate a certain level of energy efficiency in new construction, although this may not be allowed in ‘Dillon’s Rule’ states where localities cannot supersede their respective state-wide building codes. Alternatively, local governments can offer density bonuses or fast-track permit processing for development proposals that include a clean energy component. Zoning codes can also be amended to protect solar access (i.e. limit development that would lead to excessive shading on neighbouring properties) and to ensure that design standards do not create unintended barriers for building-integrated solar panels or other renewable energy systems.

Local governments can also offer a wide range of grants, tax credits or low-interest loans to support clean energy investments by local residents or businesses. Two intriguing examples are Property Assessed Clean Energy (PACE) and ‘on-bill financing’ loans, in which a local authority or partnering agency provides low-interest up-front financing for a clean energy project and the recipient pays back the loan over time via a surcharge on the property’s tax assessments or monthly utility bill, respectively.1 Cities that own their own municipal electricity utilities can offer a wider range of financial incentives including, in some cases, a feed-in-tariff or similar programme to purchase renewable electricity from customers at above-market rates.

Policy Innovation and Clean Energy

The premise that certain characteristics of a city or its immediate region can make it more or less likely to adopt a given initiative reflects one of the key themes of policy innovation-diffusion theory. This theory is generally divided into two ‘models’ that explain why governments adopt new policies and how they spread from one government to the next. The internal determinants model argues that the political, economic and social characteristics of a given

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1While originally intended for use in the residential sector, objections from the Federal Housing Finance Agency have limited the use of PACE loans to the commercial sector, and they have only been implemented by a handful of local governments. On-bill financing has become more popular than PACE in recent years but requires the participation of the local electricity utility.
Innovation in Local Clean Energy Policy

state are the primary factors leading to policy innovation. The regional diffusion model, by contrast, argues that policies most easily spread geographically among neighbouring jurisdictions (Berry and Berry, 1990). Other US local government policies that have been examined in the context of policy innovation-diffusion theory include living wage ordinances (Martin, 2001), anti-smoking policies (Shipan and Volden, 2008) and gun-control ordinances (Godwin and Schroedel, 2000).

Prior research has assessed the factors that lead US cities to initiate a local CAP programme (e.g. Brody et al., 2008; Krause, 2011), the process of developing a CAP (e.g. Boswell et al., 2012) and the content of adopted CAPs (Wheeler, 2008; Bassett and Shandas, 2010). While not always framed in the context of policy innovation theory, a handful of studies have evaluated the factors influencing local adoption of specific climate change mitigation policies. Among those, Pitt (2010a, 2010b) found that collaborative planning approaches and coordination with neighbouring jurisdictions were key factors among cities that had exceeded expectations in adopting climate change mitigation policies. Other recent studies have identified citizen and stakeholder engagement as important for the adoption of local sustainability initiatives more broadly (Portney and Berry, 2010; Hawkins and Wang, 2012).

Our research examines the roles of collaborative planning, regional coordination and other factors in the adoption of policies specific to clean energy use (energy conservation, energy efficiency and renewable energy). The emphasis on clean energy isolates policies that are innovative in the context of local community planning, as opposed to multi-modal transportation and ‘smart growth’ style land-use policies that have GHG benefits but were common local planning objectives for years before the rise of climate action planning. The hypothesis that collaborative planning and regional coordination are key determinants of this type of policy innovation is informed by the body of prior research on climate action planning and other local sustainability initiatives, as described below.

Understanding the Determinants of Local Climate Action

Much of the earlier research in this field focused on climate action planning as an example of multi-level governance (e.g. Bulkeley and Betsill, 2005; Granberg and Elander, 2007; Gupta et al., 2007). Relying primarily on case studies of early-adopter communities, these studies found that communities are more likely to engage in climate action planning if the following conditions are in place: the issue is championed by important political or community leaders, ideally with support from business, industry and other institutions (e.g. Droge, 2002; Bulkeley and Betsill, 2003; Wheeler et al., 2009); the community is well informed on energy and climate issues and has a pre-existing commitment to sustainability (Collier, 1997; Bulkeley and Betsill, 2003); and energy and climate action planning is performed in collaboration with external networks (e.g. ICLEI), universities or other institutions (Holgate, 2007; Knuth et al., 2007). Another important theme from the prior literature is that communities that engage in climate action planning are motivated at least in part by the potential to accrue local ‘co-benefits’ such as reduced traffic congestion, lower energy costs or improved air quality (e.g. Betsill, 2001; Kousky and Schneider, 2003).

A series of large-scale quantitative analyses have assessed the factors influencing cities’ choices to join a national climate action network (either ICLEI or the USMCPA) or to adopt certain climate change mitigation policies. A few have found evidence that regional diffusion has helped the spread of ICLEI membership (Vasi, 2006) or climate change mitigation policy adoption (Pitt, 2010b; Krause, 2012), but most have focused on three categories of internal determinants: sociodemographic conditions, climate change ‘risk’ and ‘stress’ variables, and various measures of local civic capacity.

Is Climate Action Limited to a Certain ‘Type’ of City?

Many of the prior studies hypothesized that certain socioeconomic and demographic conditions such as large populations, high incomes and education levels, a history of voting for the Democratic Party, and significant local environmental activity or awareness make cities more likely to engage in climate action planning. Vasi (2006), for example, found that high per-capita education levels and city membership in various environmental organizations (e.g. the Clean Cities Coalition) increased the likelihood of ICLEI membership. A series of three articles by Brody et al. (2008) and Zahran et al. (2008a, 2008b) found that several these variables had a strong positive influence

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on the likelihood of ICLEI participation, including the percentage of residents who are college graduates (Brody et al., 2008), the percentage who vote Democratic or recycle (Zahran et al., 2008b) and the presence of environmental non-profits in the community (Brody et al., 2008; Zahran et al., 2008b). Similarly, Krause (2011) found population size, educational attainment, and per cent voting Democratic to be positive determinants of USMCPA membership, while income levels had a negative effect.

Do Climate Change Risk or Stress Impact a City’s Approach to Climate Action?

The aforementioned studies by Brody et al. (2008) and Zahran et al. (2008a, 2008b) also hypothesized that cities would be more likely to join ICLEI if they were experiencing high levels of ‘climate change risk’, such as susceptibility to sea-level rise and other anticipated physical impacts of climate change. Additionally, they argued that higher levels of ‘climate change stress’, or the extent to which the area contributes to climate change via car use, manufacturing, etc., would increase the opportunity costs of climate action planning and thus reduce the likelihood of ICLEI membership.

For climate change risk, two of their studies found that coastal proximity, the impact of prior natural hazard events and measures of projected future temperature change all increased the likelihood of ICLEI membership (Brody et al., 2008; Zahran et al., 2008b). In a third study, however, an index of similar climate change risk variables was not significant (Zahran et al., 2008a). Their results for climate stress were more consistent, as ‘high stress’ characteristics such as car commuting (Brody et al., 2008) employment in carbon-intensive industry (Brody et al., 2008; Zahran et al., 2008b) and high levels of emissions per capita (Brody et al., 2008) were found to decrease the likelihood of ICLEI membership, as did an index of climate change stress variables that also included population density (Zahran et al., 2008a). However, other studies have found that local air pollution levels, which correlate with manufacturing activity and car driving and could thus be considered a measure of climate change stress, do not have an effect on membership in ICLEI (Vasi, 2006) or the USMCPA (Krause, 2011).

Is the Extent of Local Climate Action Activity Better Explained by Other Variables?

The five studies mentioned thus far on the determinants of local climate action activity all employed a dependent variable – membership in ICLEI or USMCPA – that demonstrated a city’s intent to pursue climate change mitigation but did not necessarily ensure the actual adoption of any specific mitigation policies. Furthermore, the oft-cited Brody and Zahran studies included many spatial and landscape variables that could only be measured at a county or broader level. This forced those researchers into awkward county- or regional-based dependent variables such as the presence of any one ICLEI-member community within a given county (Brody et al., 2008; Zahran et al., 2008b), or ‘the number of persons in a metropolitan area that reside in a jurisdiction (county, city, or town) committed to the ICLEI campaign divided by the total number of persons residing in a metropolitan area’ (Zahran et al., 2008a: 452).

Thus, these studies did not directly measure relationships between a city’s specific internal characteristics and the likelihood of that individual city joining ICLEI, much less the likelihood that it would take the additional steps to actually adopt climate change mitigation policies.

A more recent article by Sharp et al. (2011) goes a step further by assessing the influence of a similar range of variables on the extent to which cities have implemented the ‘five milestones’ of ICLEI membership: developing a GHG emissions inventory, adopting GHG emission reduction goals, completing a CAP, implementing specific climate change mitigation policies and evaluating the results of those policies. They found that educational attainment increases the extent of ICLEI implementation, and a prevalence of manufacturing industries decreases it, but only in cities with a strong-major form of government. Additionally, they found that that cities with a higher level of ‘fiscal stress’ are less likely to implement ICLEI’s goals, regardless of their form of government, which suggests that a city’s institutional capacity to engage in planning or policy-making in general may influence the extent to which it engages in climate action planning.

Pitt (2010b) first analysed the effects of these types of variables on the extent to which cities develop actual climate change mitigation policies. Most notably, socioeconomic variables such as income, education level and political leanings (per cent voting Democratic), and college town status were not found to be significant. Variables related to climate change risk (location in a coastal county) and ‘stress’ (poor local air quality and car dependency) were
Innovation in Local Clean Energy Policy

...statistically significant, but had low coefficients, indicating little practical impact on mitigation policy. The largest drivers of climate change mitigation policy were the presence of municipal staff members assigned to work on energy and climate change issues, the influence of neighbouring jurisdictions and, to a lesser extent, environmentally aware local government officials and an environmentally active community (Pitt, 2010b). A follow-up qualitative study (Pitt, 2010a) found that localities that had exceeded expectations for mitigation policy adoption had almost universally done so via extensive public outreach campaigns, with active stakeholder committees empowered to make policy recommendations early in the planning process. Many had also collaborated heavily with neighbouring jurisdictions and/or others at a broader regional level.

A subsequent study by Krause (2012) came to a similar conclusion regarding the determinants of cities’ actual adoption of climate change mitigation policies. In her results the influence of socioeconomic variables was fairly weak, as a large population and a high concentration of residents with PhDs increased the number of adopted policies, but other measures of educational attainment, income levels and per cent voting Democratic did not. Likewise, her one ‘stress’ variable (presence of manufacturing industry) was not significant, nor were variables related to climate change risk. In contrast, she found several measures of local institutional capacity to be significant, specifically high per-capita general revenue, the presence of policy or political entrepreneurs who championed the climate action issue, and the presence of a sustainability coordinator or similar employee on municipal staff. Location within a county that is active in climate change mitigation also had a positive impact on policy adoption, which lends credence to the notion that regional coordination can help further climate action planning.

Which Factors Best Explain Local CAP Innovation?

Taken together, the previous findings indicate that while socioeconomic and ‘climate change stress’ variables may influence a locality’s likelihood of joining a group such as ICLEI or the USMCPA, the ability to follow through on this promise and actually develop climate change mitigation policies is more probably a function of their institutional capacity to engage in the climate action planning process, their use of collaborative planning approaches and their prior experience with environmental issues. Our research builds on the prior findings and provides a more focused analysis of the internal determinants of local clean energy policy innovation. We examine the adoption of specific policies as our dependent variable, as this represents a greater commitment to GHG reduction than the simple act of joining ICLEI or a similar group. We focus exclusively on clean energy policies, as they are better examples of innovative new approaches than the broad suite of climate change mitigation activities included in other recent analyses (Pitt, 2010b; Krause, 2012).

We consider a relatively narrow set of independent variables compared with some of the previous work on the determinants of climate action planning. First, we include several demographic variables that suggest an inclination on the part of the community to support local environmental policies: high education levels, status as a ‘college town’ and public concern for environmental issues. Our second set of variables addresses the likelihood that localities have adopted clean energy policies via long-range climate action planning processes, as indicated by joining ICLEI or meeting climate action planning milestones (e.g. completing a GHG inventory or CAP). Our final set of variables indicates whether a locality is likely to be effective in its pursuit of innovative policies. Prior studies have shown that larger populations increase the likelihood of a city adopting clean energy policies (Pitt, 2010b; Krause, 2012; Cidell and Cope, 2013), and many of the leading clean energy cities in the US (e.g. Austin, Chicago, Seattle) have populations over 500,000. Building on previous research (Pitt, 2010a; Portney and Berry, 2010; Hawkins and Wang, 2012), the use of collaborative planning approaches and coordination with other nearby local governments are also anticipated to be key drivers of clean energy policy innovation.

The hypothesized relationships among these independent and dependent variables are demonstrated in Figure 1. College towns and communities with high education levels and concern for environmental issues are more inclined to take action on environmental issues, making them more likely to adopt innovative clean energy policies. These characteristics also increase the chance that a locality will join ICLEI and engage in climate action planning, which also lead to clean energy policy innovation. Localities that have a greater capacity for innovation are also more likely to adopt clean energy policies. Larger cities have this capacity simply due to the greater resources at their disposal, but localities can also develop their capacity by coordinating efforts with other nearby jurisdictions or engaging with community stakeholders through collaborative planning approaches.
Several independent variables addressed in similar studies are not included in our analysis. For example, we do not consider local income levels as they are highly correlated with education, which we do include, and because prior studies have not found income to be a statistically significant determinant of climate change mitigation or sustainability policy adoption (Pitt, 2010b; Portney and Berry, 2010; Bae and Feiock, 2012; Krause, 2012). Prior research has also examined local voting patterns, under the premise that those who vote for Democrats are likely to have pro-environmental sentiments and be supportive of climate change mitigation initiatives. Instead, we more directly measure local environmental concern via survey results.

We do not include any measures of climate change risk. The early studies of ICLEI membership had mixed results for these variables (Brody et al., 2008; Zahran et al., 2008a, 2008b), and more recent analyses have found them to be to be insignificant determinants of the development of climate change mitigation policies (Pitt, 2010b; Krause, 2012). Furthermore, there are many forms of climate change impact – sea-level rise, localized flooding, extreme weather patterns, and increased drought and forest fires to name just a few – and most if not all localities are threatened by at least one of those risks. To include one or two specific risks as variables would be highly subjective, and to attempt to comprehensively measure the extent to which localities are threatened by these risks would be futile. Finally, as noted by Krause (2011), an awareness of local climate change risks would more logically inspire a locality to pursue climate change adaptation rather than mitigation strategies.

We also do not consider local air quality or any other climate change stress variables. While it seems logical that implementing clean energy strategies would provide a ‘co-benefit’ of improving local air quality, and localities with poor local air quality would therefore be more likely to adopt such strategies, several prior studies (Pitt, 2010b; Vasi, 2006; Krause, 2012) all found local air quality conditions to be an insignificant variable. The argument for climate change stress variables is that ‘localities that stress the climate face greater enactment costs’ for climate action (Brody et al., 2008: 34), such as resistance from powerful local manufacturing industries. This notion is consistent with those authors’ conclusion of a ‘recruitment dilemma’ for the ICLEI programme, in which membership was largely limited to ‘well-educated, politically liberal, urban communities, with a strong record of environmental activities’ (Zahran et al., 2008a: 558–559). While this observation was probably true at the time, when membership in ICLEI and USMCPA was still rather low, the rosters of those organizations have since grown dramatically and now include many localities that do not necessarily fit into the well-educated, liberal, environmental mould. For example, in explaining the rationale for the ‘climate stress’ variables, Brody et al. (2008) identified Wayne County, Michigan, as an area in which localities ‘are significantly less likely to commit to CO₂ reduction targets because of the selectively higher policy costs imposed relative to low-stressor localities’ (p. 34). Since the publication of that study, however, Detroit and three other cities in Wayne County (Dearborn Heights, Taylor and Westland) have joined the USMCPA (US Conference of Mayors, 2012) and another, Dearborn, is now a member of ICLEI (ICLEI-USA, 2012).
Methodology

We conducted two multiple regression analyses to determine the marginal effects of seven key independent variables on the adoption of clean energy policies. We began with a binary logistic regression in which the dependent variable indicated whether the localities had adopted at least one clean energy policy. We then used an ordinary least squares (OLS) regression to test the effects of the independent variables on the total number of clean energy policies adopted by each locality.

Survey Distribution

Our research began with an electronic survey on which respondents identified and described the clean energy policies that their localities have initiated, obstacles they have encountered with respect to clean energy, and the nature and extent of their collaborative planning activities. We distributed the survey to a stratified sample of 400 US localities with at least 25 000 residents across 16 states (25 per state). This stratified approach was necessary to avoid over-representation of highly populated states such as California and Texas, which together have over one-quarter of the country’s localities with populations of 25 000 or more. The selected states provided broad geographical representation across the country, with five in the western US (including Texas), five in the midwest and six along the eastern seaboard (split evenly between north-east and south-east).

We then conducted a web search to identify the single employee in each locality who would be most qualified to answer questions about local clean energy policies. We looked first for employees with titles such as energy manager or sustainability coordinator, followed by the planning director or similar high-ranking planning staff, then high-ranking staff in the public works or city manager’s offices. This search produced a contact name and associated email address for each of the 400 localities. We sent the contacts three rounds of emails with links to the online survey. In the end 117 surveys were returned, for a response rate of 29.3%, with 91 completed in entirety. Table 1 shows that most of the survey respondents were either the local planning director or other planning department staff, with local sustainability managers, energy managers or other similarly titled staff members making up most of the remaining respondents.

We then gathered Census data on the level of educational attainment and number of residents currently enrolled in college from the 2010 American Community Survey 5-year estimates. Four of the otherwise complete survey responses did not include the name of their locality, and thus corresponding Census data could not be obtained, which left 87 cases in the final data set. Figure 2 identifies the states included in the sample and the number of cities from each state that responded to the survey (number on left) and were included in the final model (number on right).

Table 2 shows that the survey respondent population was comparable to the overall sample regarding population size, with a slight overrepresentation of ‘large’ cities with populations above 300 000. However, these large cities still represent only 8% of the response population, which comprises primarily ‘very small’ cities of less than 50 000 residents (44% of respondents) and ‘small’ cities of between 50 000 and 99 999 (27% of respondents).

Dependent Variable Measurement

The survey instrument provided respondents with a list of potential local clean energy policies and asked them to identify those that their respective localities had adopted (see list in Table 3). We then created a Clean Energy Index indicating the number of those policies that each locality had adopted.

<table>
<thead>
<tr>
<th>Job title category</th>
<th>Total respondents ((n = \text{117}))</th>
<th>Per cent of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Manager, similar title or related staff</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Sustainability Manager, similar title or related staff</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Planning Director or planning department staff</td>
<td>77</td>
<td>66</td>
</tr>
<tr>
<td>Public works director or public works department staff</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>City or town manager or related staff</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1. Survey respondents by job title
This index differs substantially from that developed by Krause (2012). Most of the actions that she included reflect an organizational commitment to climate action on the part of the locality (e.g. completing a GHG inventory or dedicating general revenue funds to climate protection) or would reduce the carbon footprint of municipal government operations (e.g. purchasing a ‘green fleet’ of municipal vehicles). The Clean Energy Index in this study, however, is limited to planning procedures, financial incentive programmes or other policies that would directly encourage energy conservation, efficiency or renewable energy use in the local community (i.e. among homes and businesses rather than municipal facilities). Only two of the items included in Krause’s index match the clean energy policies in our study: financial incentives for energy efficient construction or building retrofits and efficiency standards for new residential and/or commercial construction.

We calculated Pearson’s correlations for the individual policies to confirm that they are discrete actions appropriate for combination in an index. The correlations were generally small, with only four relationships correlated at a level of 0.600 or greater. The highest correlation (0.850) was between the survey options ‘other policies or initiatives’ and ‘other financial incentives’. Examination of the open-ended responses associated with these ‘other’ options revealed that many were quite similar to other measures already identified on the survey. Several more were related to transportation, recycling or other activities not being examined in this study. Therefore, responses to both of the ‘other’ options were removed from the index.
The other highly correlated relationships were among the various forms of loan assistance. The adoption of ‘other forms of low or zero-interest loans’ was correlated with both PACE loan (0.660) and on-bill financing (0.680) programmes. On-bill financing was also highly correlated (0.662) with property tax exemptions or reductions. However, each of these options was adopted by a very small number of localities, and examination of the micro-data revealed that the actual overlap among them was minimal. Given this lack of actual overlap in the adoption of those various forms of financial incentives, all were retained in the final Clean Energy Index.

Independent Variable Measurement

Most of our independent variables were derived from the survey responses. First, the survey asked if the respondent localities were members of ICLEI, the USMCPA or any other national sustainability organization. Membership in ICLEI and USMCPA was of course highly correlated, and therefore they could not be included as separate variables. An examination of cross-tab relationships between each membership status and the dependent variables indicated that ICLEI membership was more strongly correlated with clean energy strategy adoption. This makes sense as membership in ICLEI includes benefits that USMCPA alone does not, such as access to GHG mitigation analysis software and technical assistance from the organization’s professional staff. A third option, membership in either USMCPA or ICLEI, was included in the cross-tab analysis, but its results were also weaker than those of ICLEI membership by itself. Therefore, a variable for ICLEI membership was included, measured as follows: 0 – non-member; 1 – member for <2 years; 2 – member for 3–5 years; and 3 – member for more than 5 years. The ‘extent of GHG planning’ variable was calculated as the number of the following climate action planning milestones that the localities had achieved: completed a GHG emissions inventory, adopted local GHG reduction goals or prepared a CAP.

The survey also asked respondents to identify, on a scale of 1–5, how frequently their localities typically engage in public involvement and collaborative planning activities when addressing environmental issues (see list of activities in Table 4). Separate scores for public involvement and collaborative planning were initially calculated, but as those values were highly correlated (Pearson’s = 0.687), they were combined into a single community engagement variable.

The regional government consultation variable was based on a single Likert-scale question in which respondents identified the extent to which they consult with neighboring or regional jurisdictions on policy development issues. Finally, ‘environmental concern’ was measured as the average of a series of Likert-scale questions in which respondents identified the level of concern for environmental issues (scale of 1–5).
on the part of their locality’s mayor or top elected official, other elected officials, high-level municipal staff, local citizens, local community groups or organizations, and local businesses, industry or other institutions.

We also considered the possibility that cities with an identified energy manager, sustainability coordinator or similarly titled employee are more likely to have adopted clean energy policies than cities that do not have an employee dedicated to those issues. A simple comparison of the clean energy index scores among our survey respondents does seem to support this assumption. However, when added as a binary variable to the regression analyses, the presence of an energy manager or sustainability coordinator was not a statistically significant predictor of clean energy policy adoption. This variable was left out of the final models, as it reduced their descriptive power (i.e. their \( R^2 \) values) without impacting the results for the other independent variables.

We drew three demographic variables from the US Census Bureau’s 2010 American Community Survey 5-year estimates: total population (measured in thousands); education level (per cent of residents with at least a bachelor’s degree) and ‘college town status’. The use of total population rather than the log of population raises the possibility that a curvilinear relationship between population and clean energy policy adoption would compromise the binary logistic regression analysis. However, a scatterplot comparison demonstrated that the relationship was not curvilinear within our data set. Furthermore, the use of the logged variable significantly reduced the \( R^2 \) values of the binary logistic regression, without otherwise impacting the results. We therefore retained the simple population count variable for our analysis.

We identified as ‘college towns’ any locality with at least 18% of its residents over the age of 18 enrolled in college. The nine localities meeting this threshold included eight small to medium-sized towns and cities that are the homes of major public universities and one large city that contains numerous public and private universities. The 18% cut-off point captured the last of the towns known to be the home of a large state university while excluding a couple of localities in which students (presumably commuters) constitute 15–16% of the population, but which are not themselves home to any significant college or university. The range of outcomes and other relevant information about the independent variable scores in the final model are shown in Table 5.

Before the regressions we analysed Pearson’s correlations among the independent variables. The only potentially problematic relationship was a correlation of 0.600 between the environmental concern and community engagement variables. We ran each regression both with and without the environmental concern variable and found that its exclusion did not alter the overall ranking of the variables by \( \beta \) coefficient (i.e. the extent to which they impact the dependent variables). We therefore retained the community environmental concern variable for the final analyses reported below.

### Table 4. Survey Questions included in Final Community Engagement Variable

<table>
<thead>
<tr>
<th>Question</th>
<th>Score of 1 (never) to 5 (always)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How frequently does your municipality <strong>typically</strong> engage in the following activities when developing local environmental policies or initiatives?</td>
<td></td>
</tr>
<tr>
<td>Public forums, charrettes / workshops, or open houses to solicit public feedback</td>
<td></td>
</tr>
<tr>
<td>Consultation with a standing citizen/stakeholder environmental advisory committee</td>
<td></td>
</tr>
<tr>
<td>Consultation with a new citizen/stakeholder advisory committee formed for that specific issue</td>
<td></td>
</tr>
<tr>
<td>Interviews or meetings with local professionals and/or activists with relevant expertise</td>
<td></td>
</tr>
<tr>
<td>General community surveys (telephone, mail or online)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>To what extent are the following types of organizations or institutions <strong>typically</strong> involved in the development of local environmental policies or initiatives in your municipality?</td>
<td></td>
</tr>
<tr>
<td>National or international environmental non-profit organizations</td>
<td></td>
</tr>
<tr>
<td>Locally based environmental non-profit organizations</td>
<td></td>
</tr>
<tr>
<td>Other local non-profit or community groups (e.g. foundations, faith-based organizations)</td>
<td></td>
</tr>
<tr>
<td>Nearby higher education institutions (administration, staff or faculty)</td>
<td></td>
</tr>
<tr>
<td>Local businesses, other large employers (e.g. hospitals) or their representatives (e.g. Chamber of Commerce)</td>
<td></td>
</tr>
<tr>
<td>Other local governments in the region</td>
<td></td>
</tr>
<tr>
<td>State and/or federal government agencies</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>
Findings

Overall, 57 of the 87 localities in the final model had adopted at least one of the clean energy policies identified in Table 3. Table 6 shows the results of the binary logistic regression model, which measured the impact of each independent variable on the likelihood that a locality had a Clean Energy Index score greater than zero.

The community engagement score is the only significant variable in this model. Its exp(B) value of 1.559 indicates that a one-unit increase in a locality’s community engagement score increases the likelihood that it will have adopted a clean energy policy by 55.9%. The lack of other significant variables and the relatively low R² score for this model suggest that adopting just one clean energy policy is a relatively low threshold of achievement that can be achieved by a wide range of localities. As previously noted, over two-thirds of respondents had adopted at least one policy, and it would appear that the adopters include localities with varying levels of environmental concern, with and without prior GHG planning experience, both ICLEI members and non-members, etc.

The OLS regression therefore offers a better metric, as it estimates the effects of the independent variables on the extent to which localities have adopted clean energy policies (Table 7). The adjusted R² value of 0.34 indicates that these independent variables account for 34% of the variation in the dependent variable scores. In this analysis the community engagement score is again significant, and is now joined by the variable for population. The ICLEI membership and GHG planning variables miss the traditional threshold of statistical significance by a small fraction (both are significant at the 0.11 level). The standardized coefficients indicate the magnitude of each independent variable’s impact, adjusted for their respective units, on the Clean Energy Index scores. Among those four variables

### Table 5. Descriptive statistics of independent variables

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (in 1000s)</td>
<td>25.1</td>
<td>1445.6</td>
<td>36.6</td>
<td>116.8</td>
<td>185.8</td>
</tr>
<tr>
<td>Education</td>
<td>6.2</td>
<td>75.1</td>
<td>31.0</td>
<td>34.5</td>
<td>15.9</td>
</tr>
<tr>
<td>College town</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Environmental concern</td>
<td>2.3</td>
<td>5.0</td>
<td>4.0</td>
<td>3.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Extent of GHG planning</td>
<td>0.0</td>
<td>3.0</td>
<td>0.0</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>ICLEI membership</td>
<td>0.0</td>
<td>3.0</td>
<td>0.0</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Community engagement</td>
<td>2.0</td>
<td>9.6</td>
<td>6.0</td>
<td>5.9</td>
<td>1.6</td>
</tr>
<tr>
<td>Regional government consultation</td>
<td>1.0</td>
<td>5.0</td>
<td>4.0</td>
<td>3.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Table 6. Results of binary logistic regression analysis

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>B</th>
<th>SE</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (in 1000s)</td>
<td>0.006</td>
<td>0.004</td>
<td>0.146</td>
<td>1.006</td>
</tr>
<tr>
<td>Education</td>
<td>0.019</td>
<td>0.018</td>
<td>0.309</td>
<td>1.019</td>
</tr>
<tr>
<td>College town</td>
<td>0.874</td>
<td>1.195</td>
<td>0.465</td>
<td>2.396</td>
</tr>
<tr>
<td>Environmental concern</td>
<td>−0.701</td>
<td>0.541</td>
<td>0.195</td>
<td>0.496</td>
</tr>
<tr>
<td>Extent of GHG planning</td>
<td>−0.016</td>
<td>0.327</td>
<td>0.962</td>
<td>0.984</td>
</tr>
<tr>
<td>ICLEI membership</td>
<td>0.465</td>
<td>0.346</td>
<td>0.179</td>
<td>1.592</td>
</tr>
<tr>
<td>Community engagement</td>
<td>0.444</td>
<td>0.222</td>
<td>0.046</td>
<td>1.559</td>
</tr>
<tr>
<td>Regional government consultation</td>
<td>0.168</td>
<td>0.292</td>
<td>0.565</td>
<td>1.183</td>
</tr>
<tr>
<td>Constant</td>
<td>−1.310</td>
<td>1.785</td>
<td>0.463</td>
<td>0.270</td>
</tr>
</tbody>
</table>

−2 log likelihood = 90.008
Cox & Snell $R^2 = 0.224$
Nagelkerke $R^2 = 0.309$

**Significant at 0.05 level;**
*Significant at 0.1 level; n = 87.
population size has the greatest effect on the number of adopted policies, followed by the community engagement score and then ICLEI membership and the extent of GHG planning, respectively.

### Discussion and Conclusions

When taken together, the two sets of multiple regression results indicate that virtually any locality has the potential to adopt clean energy policies to at least some small degree, particularly if it has an ongoing tradition of stakeholder involvement and collaborative planning on environmental issues. However, larger localities appear more likely to adopt a broad range of clean energy policies. Aside from the population size advantage, membership in ICLEI and completion of at least one or two of the steps recommended by that organization (GHG inventory, GHG reduction goal, CAP, etc.) increases a locality’s likelihood of adopting clean energy policies. The use of stakeholder involvement and collaborative planning also seems to increase the number of policies eventually adopted. However, the variable for regional cooperation is not significant in either model, indicating that while such approaches may be productive in certain cases (as in Pitt, 2010b), they may not be key drivers of local clean energy or environmental policy innovation in general.

These findings, in combination with results from Krause (2012) and (Pitt, 2010a), paint a clear picture that a local civic capacity for engaging in climate action planning is critical for the ultimate adoption of clean energy policies. Furthermore, the presence, or lack thereof, of such capacity is not necessarily a function of a locality’s demographic characteristics, political leanings, economic base or geographical location. Clearly larger cities are at an advantage (see also Portney and Berry, 2010), probably due to their greater staff capacity and other internal resources, but perhaps also because they can draw on a wider range of citizen activists, local environmental organizations and other stakeholders to help to develop those policies.

However, the fact that many small cities and towns have adopted multiple clean energy policies demonstrates that a large population is not a prerequisite for success. It may be that extensive use of stakeholder involvement and collaborative planning is the very thing that evens the playing field. As noted by Hawkins and Wang (2012), collaborative planning approaches allow localities to crowd-source expertise from citizens and other stakeholders and utilize the capacity of the community as a whole to devise strategies and overcome implementation obstacles. Collaborative planning is also credited with fostering shared learning and reducing tensions among opposing interests (Frame et al., 2004; Mandarano, 2008). Such approaches can also create dialogue with key local stakeholders (Brody, 2003) such as environmental non-profit organizations, who could help to implement local clean energy policies, and the industry groups that would be directly affected by them.

### Table 7. Results of OLS regression analysis

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Unstandardized coefficients (B)</th>
<th>SE</th>
<th>Standardized coefficients (β)</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−1.439</td>
<td>1.270</td>
<td>−</td>
<td>−1.134</td>
<td>0.260 **</td>
</tr>
<tr>
<td>Population (in 1000s)</td>
<td>0.003</td>
<td>0.001</td>
<td>0.257</td>
<td>2.670</td>
<td>0.009 **</td>
</tr>
<tr>
<td>Education</td>
<td>0.007</td>
<td>0.012</td>
<td>0.057</td>
<td>0.596</td>
<td>0.553</td>
</tr>
<tr>
<td>College town</td>
<td>0.293</td>
<td>0.612</td>
<td>0.045</td>
<td>0.478</td>
<td>0.634</td>
</tr>
<tr>
<td>Environmental concern</td>
<td>0.074</td>
<td>0.372</td>
<td>0.023</td>
<td>0.198</td>
<td>0.843</td>
</tr>
<tr>
<td>Extent of GHG planning</td>
<td>0.304</td>
<td>0.188</td>
<td>0.170</td>
<td>1.621</td>
<td>0.109</td>
</tr>
<tr>
<td>ICLEI membership</td>
<td>0.351</td>
<td>0.214</td>
<td>0.191</td>
<td>1.641</td>
<td>0.105</td>
</tr>
<tr>
<td>Community engagement</td>
<td>0.260</td>
<td>0.143</td>
<td>0.211</td>
<td>1.826</td>
<td>0.072 *</td>
</tr>
<tr>
<td>Regional govt consultation</td>
<td>0.115</td>
<td>0.206</td>
<td>0.052</td>
<td>0.557</td>
<td>0.579</td>
</tr>
</tbody>
</table>

R² = 0.633
Adjusted R² = 0.340
Standard error of estimate = 1.63
We must recognize, however, the limitations of this purely statistical analytical approach. Many of the key variables are drawn from survey responses, which by nature are subject to several potential biases. Furthermore, the environmental concern, community engagement and regional coordination variables are all based on Likert-scale survey questions that require respondents to describe complex, nuanced conditions on a simple five-point scale. This approach helps us to get a sense of which factors influence the adoption of clean energy policies, but they can never capture the full complexity of this issue. Further research, including qualitative analysis and case studies, is needed to examine the specific processes by which localities plan for and develop clean energy policies, as well as to identify other factors beyond those examined here that influence their likelihood of becoming a clean energy policy innovator.

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References


