Prioritizing Regulatory Barriers to Combined Heat and Power Adoption Using Selected Case Studies

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ABSTRACT

This study looks at five cases and assesses the influence of regulatory requirements on the adoption of combined heat and power (CHP) technologies controlling for other adoption relevant variables. Furthermore, the present study not only looks at adopters but also at nonadopters of CHP technologies. The article identifies a prioritized approach to reducing regulatory barriers associated with CHP adoption.

INTRODUCTION

Combined heat and power (CHP) technologies generate electricity more efficiently, more reliably, and in a more environmentally friendly manner than larger centralized power plants. Despite these advantages, adoption of this technology in the marketplace has been slow.

This study looks at five case studies in an attempt to explain the slow adoption of CHP technologies. The main hypothesis of this study is that regulatory requirements are partially responsible for the nonadoption of CHP technologies in the marketplace. The main regulatory requirements for CHP systems are associated with a) controlling the air emissions, b) connecting a CHP system to the electric lines of the incumbent utility company, and c) complying with local electric, plumbing, and other code requirements.

Case studies on the influence of some of these regulations on CHP adoption have been performed before [1, 2]. The unique feature of this study, however, is that it looks at the influence of regulatory structures controlling other adoption relevant variables such as a firm's ownership

structure, profitability of CHP at the facilities, a firm's access to capital, and knowledge about CHP within firms. Furthermore, the present study not only looks at adopters but also at nonadopters of CHP technologies.

Regulators and policy makers have called for the development and deployment of regulatory instruments that may provide preferential treatment for CHP. Understanding which regulatory process may pose the biggest barrier to CHP adoption will serve to inform this discussion.

REGULATORY PROCESSES FOR CHP

Predominantly three types of regulatory requirements govern the installation of a CHP system [3]. These are the interconnection requirements from the local utility, air permitting requirements, and compliance with local building codes.

The Clean Air Act from 1970 and the Clean Air Act Amendments (CAA) from 1990 set forth the environmental permitting process for air emissions sources such as CHP facilities. Depending on the prevailing air quality in geographic region, different emissions thresholds apply. CHP facilities with emissions above these thresholds are required to utilize certain prescribed emission control technologies. The administrative agency responsible for the enforcement of the Clean Air Act in Illinois is the Illinois Environmental Protection Agency (IEPA).

Electric interconnection constitutes another regulatory requirement for CHP. Historically, investor-owned utility companies provided the majority of electricity in the United States. The electric rates that these utility companies can charge to their electricity customers are highly regulated by state utility regulatory agencies. In Illinois, the Illinois Commerce Commission is responsible for regulating the rates of investor-owned utility companies. In most cases, facilities with CHP systems connect to the local utility company's electric system for backup power during periods of maintenance and malfunctioning of the CHP system. The Illinois Commerce Commission also approves the rates for backup power charged by utility companies to CHP facilities in the state.

Another regulatory requirement for CHP systems is local code approval. In Illinois, there are approximately 1,300 municipalities made up of cities, villages, and towns. Each municipality is authorized by Illinois Municipal Code 65 ILCS5 to oversee building codes, fire-codes, and zoning codes development. Chicago building codes, for example,

have not been updated to include CHP technologies for backup emergency power supply.

Proponents of CHP technologies argue that for each of the current regulatory structures, alternative ones that are more favorable for CHP have been developed and could be implemented. For the environmental permitting process, for example, regulations that take the higher efficiency of CHP systems into consideration can reduce complexity by providing expedited permitting review or permitting exemptions. For local codes, the adoption of model codes can reduce the fragmented local code system. Finally, uniform interconnection procedures can reduce the complexity associated with this process.

CASE CHARACTERISTICS

Case studies were performed for adopter and nonadopter facilities. In total, five case studies were conducted consisting of two adopter facilities and three nonadopter facilities.

Cases were selected in a way that controls for certain variables such as ownership structure, availability of capital (a proxy for a firm's profitability), CHP profitability, and knowledge about CHP technologies. With respect to ownership structure, community colleges in Illinois are overseen by the same agency, the Illinois Community College Board (ICCB). Capital expenses for community colleges such as those required for CHP facilities are funded through the same funding mechanism using ICCB and local property tax funds. Because local property tax funds may, however, differ between communities, community colleges located in relatively prosperous northern Illinois communities were selected to provide for a similar environment of available capital. CHP profitability was controlled for by matching the floor-size of adopter facilities with the floor-size of non-adopter facilities. Valenti showed that floor size of a facility constitutes a good proxy for profitability of a CHP system for similar building uses (such as schools) [4]. Table 1 shows the studied facilities by adopter-status and floor-size. Finally, pre-screening the interviewees by telephone prior to the interview process controlled for knowledge about CHP technologies and the associated regulatory processes.

The selected community colleges are located in five different regulatory jurisdictions. As discussed above, with emphasis placed on similar

access to capital, only northern Illinois facilities were selected. As a result of this emphasis, the selected facilities do not differ by electric interconnection jurisdiction because northern Illinois is served by the same electric utility company. The environmental permitting jurisdiction is, by default, the Illinois EPA for all facilities.

Table 1: Case Characteristics

	Adopter Status	*Size (m^2)*
1	Adopter	57,598
2	Adopter	125,415
3	Nonadopter	58,063
4	Nonadopter	130,153
5	Nonadopter	111,480

CASE STUDY INTERVIEWS

Each interview was conducted in person with the energy procurement manager of the facility and lasted between 30 minutes to 2 hours. The topics explored the interviewees knowledge about CHP and their knowledge and perceived complexity about the three main regulatory requirements for this technology (environmental permitting, local codes, and electric interconnection).

With respect to knowledge about CHP, all energy procurement managers seemed well educated on this technology. Two adopter and one nonadopter college belong to APPA (Association of Higher Education Facilities Officers), which in the past has addressed CHP as part of its educational efforts. The two other nonadopter colleges are not part of a professional organization but are avid readers of association publications, particularly the ASHRAE magazine (American Society of Heating, Refrigeration and Air-Conditioning Engineers).

When asked about the environmental permitting requirements, none of the interviewed facilities thought that the IEPA environmental permitting process would pose an obstacle to CHP adoption. The adopter facilities claimed that the IEPA process was "very easy." One adopter college pointed out that his facility may be required in the future

to provide a yearly emissions report to IEPA. Two nonadopter colleges stated that they did not have many dealings in the past with IEPA, but that they would not view permitting as an issue. The energy procurement manager at the third nonadopter college operated large steam boilers and was therefore familiar with the IEPA permitting process. He also did not believe that the environmental permitting process would pose an obstacle to CHP adoption.

When asked about local code requirements, four colleges did not consider local codes an issue to CHP adoption. One did; the energy procurement manager at that college clearly stated that the location of the campus in a flood plain requires local approval of any building expansions. As such, he stated that an electrical facility such as CHP would be very difficult to adopt because of these local regulatory requirements.

The electric interconnection requirements were viewed as a significant barrier by both adopter facilities and one nonadopter facility. One adopter facility stated that the incumbent electric utility "put up every roadblock they could," including exertion of influence at the board of trustee level. The facility overcame the "roadblock" by providing an engineering analysis to the board of trustees that showed the attractive economic paybacks of the system. The second adopter facility stated that the incumbent utility told them at first that the college would "not be able to connect a CHP facility" to the utility's electric system. The energy procurement manager stated that the college, in response, used "engineers to show [the incumbent utility] how it would be possible." The manager also stated that in his view the "problem was political, not technical." The energy procurement manager at the nonadopter college located in a flood plain area did not elaborate on any interconnection issues. This may have been because the strict flood regulations dominated the respondent's perceived barriers to adoption in his decision process. The energy procurement manager at the second nonadopter college stated that he would contract out all code compliance and that this would not be his concern. The energy procurement manager at the third nonadopter college stated that his preliminary research has shown that CHP would be difficult to install partially because "[the incumbent utility company] owns the wires into the buildings and the [incumbent utility company] is not willing to sell the wires to the college."

Table 2 shows the regulatory processes cited by interviewees as an adoption obstacle. As can be seen, the electric interconnection process was cited by three interviewees as the dominating obstacle to CHP adop-

tion, including both adopter facilities. The adopter facilities stated that they employed a significant amount of third party expertise to overcome this obstacle. Local code compliance with flood restrictions, a type of code that would not immediately be expected to be related to CHP technology, was cited as a significant adoption obstacle by one college.

None of the facilities viewed the environmental permitting process as a significant obstacle; one adopter facility pointed out, however, that in the future the facility may require filing a yearly emissions report with IEPA.

Table 2: Regulatory Obstacle to CHP Adoption

	Adopter Status	*Electric Interconnection*	*Local Code Compliance*	*Environmental Permitting*
1	ADOPTER	X		
2	Adopter	X		
3	Nonadopter		X	
4	Nonadopter			
5	Nonadopter	X		

In summary, for four out of the five studied facilities, the electric interconnection or local codes constituted an obstacle to CHP adoption. The two adopter companies were able to overcome this obstacle by being able to deploy the appropriate expertise.

CONCLUSIONS

Five case studies were conducted with the main hypothesis stating that regulatory complexity retards the adoption of this technology in the marketplace. When controlling for firm profitability, CHP profitability, knowledge about CHP technologies as well as ownership structure, the case studies show regulatory complexity to be an important variable to CHP adoption. The results from the case studies indicate that electric interconnection and local code requirements constitute an adoption barrier for four out of five of the interviewed facilities. Two adopter facilities were able to overcome regulatory barriers based on their substantial

technical expertise.

Furthermore, adopters and nonadopters do not differ in their views of the environmental permitting and interconnection requirements. Both adopters and nonadopters view the interconnection requirements as a barrier, while neither adopters nor nonadopters view the environmental permitting process as a barrier. The consistency between adopter status groups may indicate that the interconnection requirements may constitute a barrier that is not based on a lack of information about regulatory processes. If, hypothetically, adopters did not find interconnection to be a barrier but nonadopters did, this may indicate that information campaigns may help alleviate the problem. However, this is not the case here and changes to the interconnection process may be warranted. Five case studies do not constitute a statistically significant sample. However, these case studies do provide an indication that interconnection may be a problem for CHP facilities at least in the studied territory, while environmental permitting and local codes compliance seem less of a problem.

Public utility commissions with their mandate to ensure their citizens efficient and reliable utility service at reasonable prices should be able to revise interconnection requirements if they pose a barrier to efficient and reliable types of generating sources such as CHP. If these commissions do not have a mandate to change interconnection requirements, legislative change should be pursued.

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Dr. Mueller is a senior economist for the Energy Resources Center at the University of Illinois at Chicago (UIC-ERC). His current research interests focus on distributed generation and combined heat and power technologies (DG/CHP). He has authored numerous documents ranging from an assessment of the "Energy, Economic, and Environmental Impact of Renewable and Energy Efficiency Deployment in Illinois" to an environmental permitting guidebook for DG/CHP technologies. He has organized and spoken at several conferences aimed at reducing regulatory barriers associated with DG/CHP technologies as well as conferences that promote the technical aspects of this technology. Prior to joining the UIC-ERC, Steffen held the position of manager, business development, with Calpine Corporation/Skygen Energy where he was involved in energy sales, natural gas procurement, and financial analyses for merchant power/co-generation projects. Dr. Mueller has a Ph.D. in public policy analysis from University of Illinois at Chicago, an MBA, and a B.S. in environmental engineering. Dr. Mueller may be contacted at *muellers@uic.edu*.