AN EVALUATION OF CONCERNS OF EXTENSION FIELD FACULTY IN WESTERN STATES REGARDING RENEWABLE ENERGY EDUCATION AS IT PERTAINS TO PROGRAMMATIC DESIGN AND IMPLEMENTATION

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

April 2012
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Demand for information and educational programming on the topic of renewable energy continues to grow within Extension. In this study, evidence showed that Extension was not addressing educational demands on the subject. Using the Concerns-Based Adoption Model as a theoretical framework, this study sought to identify concerns of Extension educators in Montana, Wyoming, and Colorado that influence programmatic efforts in renewable energy.

The objectives of the study were to: 1) measure the levels of faculty engagement in renewable energy education 2) describe the concerns (as defined by the Concerns-Based Adoption Model) of Extension educators regarding renewable energy education, 3) determine whether field faculty concerns differ by the primary job function, and 4) identify concerns of subgroups that may influence program involvement with renewable energy education. The study was conducted using a census of Extension educators (n=307) in Montana, Wyoming, and Colorado in October 2011. Using an electronic, web-based Stages of Concern Questionnaire (SoCQ) survey, the study had a response rate of 41% (n=126). Quantitative methods of analysis included SoCQ profile comparisons, High Stage Score and Second High Stage Score analysis, analysis-of-variance (ANOVA), and Tukeys post hoc t-test analysis for significant results in the ANOVA analysis.

Across all job functions and subgroups analyzed, faculty indicated a 99% Unconcerned, or Stage 0 Concern, and profiled as “non-users” of the innovation “renewable energy programming”. Results reflected a general lack of knowledge and awareness about renewable energy programming, followed by strong personal concerns about adopting this change. While three subgroups indicated potential negative dispositions to renewable energy programming, the majority of faculty were positively disposed but indicated a “nonuse” state. Therefore, Extension educators had little or no knowledge of or involvement with the innovation, and were doing little to become more involved. Based on these results, recommended change management strategies for the Extension organization were generated. These strategies focus on the need for clear definition of “renewable energy programming” and the determination of acceptable levels of field faculty engagement.
CHAPTER 1 – INTRODUCTION AND STATEMENT OF PROBLEM

Background and Setting

The Morrill Act of 1862 created the land-grant universities in the United States (7 U.S.C. 301). The subsequent development of the Cooperative Extension Service (CES) in the Smith-Lever Act of 1914 (7 U.S.C. 3103) established a partnership of localized outreach from the land-grant universities between federal, state, and county governments. This act resulted in the faculty of the universities being available in almost every county in the United States. McDowell (2003) asserts that the principle of engaging citizens with institutions of higher education in these acts was without precedent and “provided access to new knowledge to those who would never qualify, nor want, to be in classrooms” (p 33).

Linking the research and education functions of universities with society is a primary tenet of Extension. Perspectives differ as to the relevance of this linkage. For example, former president of Harvard University, Derek Bok, argues that without the engagement of universities in society, the society is in peril (Bok, 1994); while the Kellogg Commission suggests that unless universities engage in society, the universities are in peril (Kellogg Commission on the Future of State and Land-Grant Universities, 1999). Notwithstanding differences of opinion on why this engagement is relevant, the principle of engaging citizens with the universities through CES is a revolutionary concept and its implementation has been a cornerstone of success in the history of land-grant institutions. (McDowell, 2003)
However, authors of *Universities and the Future of America*, (Bok, 1994) and the 1999 Kellogg Commission report *Returning to Our Roots: The Engaged Institution* (1999) argue that societal needs are changing and that universities must organize themselves to engage more fully with citizens on relevant issues. The system risks peril if it fails to engage as it may not be perceived as sufficiently relevant in society (McDowell, 2003). The Kellogg President’s Commission summarizes this risk in stating,

> We are convinced that unless our institutions respond to the challenges and opportunities before them they risk being consigned to a sort of academic Jurassic Park – of great historic interest, fascinating places to visit, but increasingly irrelevant in a world that has passed them by (McDowell G., 2003, p. 32).

To mitigate the risk of becoming irrelevant, universities must continually find new means of engaging with society on relevant issues.

The onus of responsibility for engagement on relevant issues is borne by CES, as it was created to be the primary linkage between land-grant universities and society. By examining CES’s response to one societal issue, it may be possible to both establish whether CES (and by extension, the land-grant institutions) are responsive to changing societal needs and the extent to which prior practices continue to meet the needs of constituents.

Examination of the Cooperative Extension Services’ ability to engage can be conducted on the relevant societal issue of renewable energy. Evidence of renewable energy as a relevant societal issue is presented in the 2011 State of the Union Address (White House, 2011), the US Farm Bill (USDA, 2006), and the Western Extension Director’s Association (WEDA) reports from 2006 to present. Federal and state partners
in the CES model recognize renewable energy as a relevant topic. Research suggests that Extension professionals have a “growing responsibility to provide research-based data about these emerging [renewable energy] opportunities” (Fortson, 2006). Additionally, the United States Department of Agriculture’s (USDA) National Institute of Food and Agriculture (NIFA) established a national plan of work to identified areas of focus for all USDA-NIFA agencies, of which Extension is one. Of five NIFA national priorities, sustainable energy is number three (NIFA, 2010). In the February 2, 2010, *State Plans of Work Newsletter*, NIFA identifies that USDA has developed these priorities “to properly address solving these [sustainable energy] agricultural issues, not just working on them” (NIFA, 2010). The Association of Public and Land-Grant Universities (APLU) provides additional evidence of the recognized need for Extension involvement in renewable energy education. Energy is one of the APLU’s ten Major Initiatives (APLU, 2011). There are five subcategories within the APLU Energy Initiative. The subcategories include: 1) Energy Technology Successes; 2) Improving Energy Efficiency of Existing Energy Sources; 3) Renewable Energy; 4) Energy Policy and On-Campus Demonstration, Development and Outreach; and 5) Utilizing Cooperative Extension to Bring Warmth Home. CES is not referenced in the first four subcategories, where the 2011 APLU Initiative identifies specific examples of university engagement in energy. As an example, in the subcategory of Renewable Energy, the initiative identifies,

Examples of universities’ promising research in biomass and biofuels abound. [The] Georgia Institute of Technology, working with industry partners and other universities, is working on turning softwoods and algae into biofuels. Micro-organisms developed by Oklahoma State and the University of Oklahoma have been licensed and are used to convert biomass to ethanol (p. 2)
This description indicates an awareness by APLU of specific activities and efforts of universities in addressing renewable energy.

In contrast, the subcategory entitled *Utilizing Cooperative Extension to Bring Warmth Home* indicates potential for Extension involvement in energy, but lists no specific or current action (APLU, 2011). APLU indicates that Extension has worked to provide information to constituents on energy issues. “There is much more, however, that may be achieved as national priorities for energy goals are set, if CES [Cooperative Extension Service] is used to its full capacity” (p 2). The initiative goes on to state,

…while Cooperative Extension exists in every state and territory of the country and has a presence in almost every county, the level of ‘energy’ expertise varies greatly. Utilization of the Cooperative Extension Systems’ network of educators at the land-grant universities and distributed throughout the local environment could be a primary element on strategy for engaging individuals, businesses, and communities in energy efficiency and conservation education (p 3).

APLU then suggests a “draft” list of activities and suggested impacts in which Cooperative Extension could provide education and assistance (p 3). An example of a proposed activity is to educate and provide technical assistance to multiple publics on issues of energy efficiency. For the example activities suggested by APLU, there are also expected outcomes, such as increasing the awareness of consumers on energy issues related to purchasing decisions (APLU, 2011). The lack of specific examples and the suggestion of outcomes that are very basic to CES programming indicates that APLU does not perceive the current engagement of Extension in the types of activities listed.

As early as 1978, authors of articles in the *Journal of Extension* argued that energy is an important topic and that Extension should provide education that will affect
societal change on energy consumption and production (Born, 1980; Liles, 1978). Stephen Born (former chairman of the Department of Urban and Regional Planning at the University of Wisconsin-Madison) argued in 1980 that Extension should “find new educational delivery methods, strengthen relationships within Extension and other government entities, and develop problem-solving tool kits to address technical, economic, and regulatory educational needs” (p. 7). However, the WEDA February 2009 report of energy-related programs and outreach in the Extension systems of the Western states reveals that implementation of energy programming is sporadic and, where implemented, does not tend to include Extension field faculty educators in renewable energy outreach.

To say that CES is not involved in energy education would be inaccurate. A few examples of CES energy programs include the Montana State University Weatherization Training Center (Montana State University, 2011), the Consumer Education Program for Residential Energy Efficiency that is operated in cooperation between Cornell Cooperative Extension and the New York State Energy Research and Development Authority (Laquatra J. M., 2009), and the Washington State University Extension Energy Program (WSU Extension, 2011). Other examples of CES involvement in energy can be found on eXtension. eXtension is an Internet-based collaborative environment where Land Grant University content providers exchange objective, research-based knowledge on a variety of topics (eXtension, 2012). The most robust CES-produced materials on eXtension are found in Home Energy, but some resources are available in Farm and Wood Energy categories as well (eXtension, 2011). In 2009, WEDA developed a more
specific inventory of energy programming taking place in the Western States (WEDA, 2009). The inventory provides a listing of activities in the various Western States, but no summarized strategies on how CES might leverage these activities into tangible actions that result in field faculty or societal engagement.

The perception that CES is not involved in energy may stem from a failure of current programs to consistently engage field faculty and society in education and outreach efforts in renewable energy, especially in the Western States. Evidence of this perceived lack of CES engagement on energy issues can be found in the 2008 WEDA Energy Survey (WEDA, 2008). The survey included responses from 443 constituents in 13 Western Extension Region states. The survey researchers found that 72% of constituents surveyed perceived that CES provides “some or very little” assistance on energy-related issues. The researchers also found that 60% of respondents perceived the universities or colleges to be providing “some or very little” assistance on energy-related issues. The research found a clear public interest in renewable energy and energy efficiency and respondents indicated that they believed Extension can and should provide information to the public on energy issues. Respondents stated that there is a need for energy expertise within Extension and that an expanded role of Extension in energy would benefit them (the constituents) in their work, showing clear societal demand and relevance for education on energy issues (WEDA, 2008).

Given both the WEDA survey results (WEDA, 2008) and the APLU Initiatives (APLU, 2011), there is a perception that CES is not effectively engaging with society in the basic mission described by Seevers, Graham, Gamon, and Conklin (1997) as linking,
“research, science, and technology to the needs of the people where they live and work” (p. 11). Although clear centers of excellence in energy education within the CES network exist, those who measure the engagement at the county level find that CES has not leveraged field faculty consistently in outreach and education efforts on energy topics.

This research concerned itself with why Extension had not more effectively engaged field faculty on the topic of renewable energy education, and more specifically, whether Extension educator concerns contributed to the failure of Extension to meet this relevant social need through its traditional outreach. Therefore, this research identified what concerns currently exist regarding renewable energy education within Extension field faculty of the Western States, and assessed how those concerns may influence the engagement of field faculty in renewable energy Extension education and outreach efforts.

**Research Question**

In what ways do Extension educators’ existing concerns regarding renewable energy education influence the implementation of programmatic efforts?

**Purpose**

The purpose of this study was to determine what Extension field faculty concerns exist regarding renewable energy programming.
Objectives

The research objectives of this study were to:

1. Measure the present level of field faculty engagement in renewable energy education in MT, WY, and CO.

2. Describe concerns (as defined by the Concerns-Based Adoption Model) of Extension educators in MT, WY, and CO regarding renewable energy education.

3. Determine whether MT, WY, and CO field faculty concerns differ by the primary job function.

4. Identify CBAM (Concerns-Based Adoption Model) concerns of subgroups of MT, WY, and CO Extension faculty that may influence program involvement with renewable energy education, based on standardized user profiles generated from the SoCQ (Stages of Concern Questionnaire).

Definition of Terms

For purposes of this research, the following definitions were used:

- Extension educator (also referred to as field faculty) – professional employees of the state Extension service of the land-grant universities and the Extension Service-USDA (Seevers et al. 1997)

- Renewable energy – energy that comes from resources that are regenerative or for all practical purposes cannot be depleted (US DOE, 2011)
- Programming – a planned sequence of educational experiences guided by specific objectives (Severs et al., 1997).

Limitations of the Study

The following limitations were assumed:

- The study did not attempt to assess the ability of Extension professionals to implement education and outreach efforts.
- The study did not address curricula and training design on topics other than renewable energy.
- The study was limited to Extension field faculty in MT, WY, and CO, and therefore is limited in its generalizability.

Basic Assumptions of the Study

In this study, it was assumed that:

- all survey participants completed the assessment tool to the best of their abilities.
- survey participants responded honestly to survey questions.
- educator concerns were not impacted by differences in Extension structure and/or position description by state.

Significance of the Study

Fiscal challenges exist for Extension systems throughout the United States. For example, in March 2011, University of Nevada Extension was targeted for 72% reduction
in operating budget (University of Nevada Cooperative Extension, 2011). In April 2011, South Dakota State University announced termination of all field faculty positions in order to conduct a system-wide restructuring commensurate with a 10% budget reduction (South Dakota State University Extension, 2011). Ongoing discussions of the need to balance state and federal budgets result in Extension systems nationwide considering the most effective means of meeting societal demands in the face of diminishing resources. Failure to engage both field faculty and citizens on new and relevant societal issues may add fuel to arguments that Extension and the land-grant model are dated and inflexible (McDowell, 2003). Meeting societal needs from a state level, in a direct-to-consumer approach that bypasses field faculty, may be a short-term solution. However, if faculty members are not engaged in education and outreach in the medium to long term on relevant societal issues, their lack of engagement may serve to validate arguments that Extension presence at the local level is not necessary. Notes McDowell (1985),

Extension, as the outreach arm of the land grant university system, has a primarily educational mission. However, it is also expected to collect political support on behalf of the system….Cooperative Extension has a visibility problem and solving that problem is critical to eliciting public support for Extension… (p. 717) (McDowell G. R., 1985)

Extension engagement in energy education at the field faculty level is essential to fostering public support and demonstrating Extension’s role in land-grant university engagement with society.

Understanding the concerns of field faculty on relevant issues, such as renewable energy, may aid Extension systems throughout the West in correctly identifying faculty concern barriers that result in implementation of appropriate strategies for professional
development. Given the current political drive toward renewable energy and the increasing pressures on Extension to meet societal needs, there can be little doubt that Extension will be expected to engage on renewable energy issues. As an example of public demand for energy information, the 2008 WEDA survey found that 60% of respondents identified the level of public interest on renewable energy as “high” or “very high”. This study assessed why the system has failed to incorporate renewable energy education thus far, and more importantly, to determine optimized means of preparing field faculty to meet the educational demand on the topic.

This study was also relevant in identifying any subgroups within CES that may be more or less receptive to implementing energy education. CES positions typically addressed topical categories of agriculture, family and consumer sciences, youth development and community and economic development. At the time of the study, few states had defined the responsibility for energy education. Analysis of subgroups within CES may yield differences in receptiveness based on concerns. This information may help CES to more effectively target subgroups willing to engage in renewable energy programming.

Findings from this study will be used directly in the creation of renewable energy programming to be made available to the Western states Extension field faculty. The findings will identify the source of field faculty concerns. Concerns assessed in this study will include: a) awareness of the issue; b) concerns over information access; c) personal concerns; d) management concerns; e) consequence concerns; f) concerns regarding collaboration; and g) concerns regarding refocusing efforts on the issue. This
will be accomplished using a standardized instrument of the Concerns Based Adoption Model (CBAM) (Hall G., 2003) known as the Stages of Concern Questionnaire. Once understood, it is possible to determine professional development needs that can help to resolve the concerns of field faculty. Findings will provide evidence of changes in the Extension system that might be implemented to assist field faculty in effectively engaging in renewable energy outreach and education.
CHAPTER II - THEORECTICAL FRAMEWORK
AND REVIEW OF THE LITERATURE

Introduction

Chapter I established that, although renewable energy is a relevant societal need, CES has not consistently incorporated the subject in education and outreach efforts. The concept of utilizing the Concerns-Based Adoption Model was proposed as a method for assessing barriers to the change, specifically for implementing renewable energy education.

Chapter II further discussed the Concerns-Based Adoption Model (CBAM) and explained how these concepts were used to identify concerns of CES faculty. The research used a proven survey instrument, the Stages of Concern Questionnaire (SoCQ), to collect and analyze the data. Chapter II also explores fundamental change theory and how the models upon which this study was based will assist Extension in correctly identifying faculty concerns. This information will assist Extension in designing programming and training that will effectively move CES into renewable energy education venues utilizing field faculty.

Theoretical Framework

Essentially, this study sought to examine constraints to change and to identify appropriate communications and change-agent strategies that will successfully move CES
into renewable energy education. Therefore, a theoretical framework based upon change theory in education was appropriate for the study.

**History of Change Theory**

Scientists began to concern themselves with how and why innovations were adopted by societies as early as the 1890s. The concept of *diffusion theory* emerged. Diffusion theory is concerned with “the process by which an innovation is communicated through certain channels over time among members of a social system. Diffusion is a special type of communication concerned with the spread of messages that are new ideas” (Seevers, 1997, p. 245). While interest in how and why people change their behavior can be traced to ancient times, one of the earlier scientific models that sought to explain the concept of the diffusion theory was developed by Garbriel Tarde, a French sociologist, in 1903 (Hall G. E., 2006). Significant advancement of diffusion theory occurred from 1928 to 1941 at Iowa State University. There, diffusion studies conducted by Ryan and Gross, examined the rate of adoption of hybrid corn seeds by agricultural producers (Stephenson, 2003). Lippit, Watson, and Westley furthered this research by considered individual adoption within an organizational context adding the dynamics of “change forces” or influences that may impact rates of adoption (Lippit, 1958).

In 1962, Everett Rogers published *Diffusion of Innovations* (Rogers, 2003) which synthesized over 500 studies on diffusion theory and resulted in the model of Adopter Categorization of Innovativeness seen in Figure 1.

Roger’s concluded that adoption innovation usually follows a non-symmetrical bell-shaped distribution. The *innovators*, which make up about 2.5% of the population,
are risk-takers. They are eager to try new ideas and are the first to adopt innovations. *Early adopters* comprise 10 to 15% of the population. They are opinion leaders and tend to have great respect and position within the population. *Early majority* members tend to adopt innovations just before the average member, but do so only after intense thought and deliberation. They represent approximately one-third of the population. *Late majority* members adopt new ideas shortly after the average member. They tend to adopt innovation as a result of societal pressure or economic necessity. They also represent approximately one-third of the population. *Laggards*, the remaining 15 percent of the population, are the last to adopt innovation and tend to make decisions based on what has been done in the past (Rogers, 2003).

Figure 1: Adopter Categorizations by Innovativeness

(Rogers, 2003)

Rogers synthesized diffusion research into the adoption categories, but also helped to articulate the research work of diffusion scholars in the analysis of the innovation decision process, both in groups and individuals (Rogers, 2003). While the adoption categories helped to profile innovation adopters, it did not address the individual decision-making process. Ryan and Gross (1943) recognized that individuals considering the use of hybrid corn transitioned through a process of awareness, seeking information, experimenting or testing the corn seed, and ultimately making a decision. Other
researchers noted similar stages of decision-making. Rogers (2003) evaluated the stages and (though modified through the years) summarized five stages of the innovation-decision process as follows:

1. Knowledge – The decision-maker is exposed to an innovation and seeks to gain an understanding of the innovation.

2. Persuasion – The decision-maker develops an attitudinal position regarding the innovation. Some key variables considered at this point are relative advantage - the degree to which an innovation is perceived as superior to the idea it supercedes (p. 212), compatibility - the degree to which an innovation is perceived as being consistent with existing values, past experiences, and the needs of the potential adopter (p. 224), complexity – the degree to which an innovation is perceived as relatively difficult to understand and use (p. 242), triability – the degree to which an innovation can be successfully experimented with on a limited basis (p. 243), and observability – the degree to which the results of an innovation are visible to others (p. 244) (Rogers, 2003).

3. Decision – At this stage, the decision-maker rejects or adopts an innovation.

4. Implementation – Those who adopt put the innovation into practice.

5. Confirmation – The decision-maker then seeks reinforcement of the previous decision. The decision may be reversed at this point if inconsistent or negative messages are received regarding the innovation (p. 169).
The articulation of categories of adoption and of the individual’s decision process within the categories provided a structure for further research on innovation adoption.

In 1971, Havelock built upon Rogers’ model and created the Research, Development, and Diffusion Model, the Social Interaction Model, and the Problem Solving Model, which sought to explain further individual acceptance of innovations, especially as they related to group dynamics and organizational change (Havelock, 1973). In the 1970s, Hall and Hord divided Havelock’s Social Interaction Model into five phases, which were very similar to Rogers’ Innovation Decision Process model (Hall G., 2003). Again, this research sought to understand the dynamics of the individual decision-making process in adoption of innovation. The work of Hall and Hord, however, was also highly influenced by the work performed at the Research and Development Center for Teacher Education (RDCTE), where specific attention was given to innovation adoption of educators.

Change Theory in Education

Many perceived the 1957 Russian launch of Sputnik as a failure of the United States in innovation and technology. In response, the U.S. Congress passed the National Defense Education Act of 1958, which supported several large-scale curriculum development programs, including efforts of new math, open education, individualized instruction, and radical revisions of chemistry and physics (Hord, 1987). When these efforts failed to result in the desired change, a national curriculum development movement sought to develop “teacher-proof” curricula. In other words, the curricula were very well defined and were not intended to be adapted or modified (Hord, 1987).
These efforts, which sought to control implementation by defining strict guidelines and removing individualization by educators, also failed. In the late 1950s and 1960s, researchers at the RDCTE began investigating these failures of national education curriculum development. The Concerns-Based Adoption Model (CBAM) resulted from the work of researchers, Hall, Wallace, and Dossett (Hall G., 2003). These researchers built upon change theories by Lewin (1951), Rogers (1971), Lippitt, Watson, and Westley (1959) and Havelock (1971). They also included work from Frances Fuller, a clinical psychologist, who in the 1960s identified stages of professional development in educators as moving from concerns of “self,” to concerns of “pupils,” to concerns of “impact” as teachers matured professionally (Fuller et al, 1973). These research efforts began to consider that the readiness of the teacher to implement change may be the determining factor in adoption of new practices, rather than the practices themselves being at issue. In other words, efforts to change the curriculum failed because they did not address the human side of change.

From 1970 to present, the researchers of CBAM established an international network of change-process researchers. The long-term collaborative research resulted in the researchers being able to identify principles of change – patterns that occur when people and organizations are involved in change (Hall G. E., 2011). While every situation is unique, “enough is now known about the change process that we can state a series of principles that will hold true for all cases” (p. 5). They are:

- Change Principle 1: Change is Learning (p. 6). There is a process of learning whenever a person tries to change behavior. Organizations need not only
notify people about a change, they also have to provide them the information they need to change practices and modify behavior.

- Change Principle 2: Change is a Process, Not an Event (p. 8). Change does not occur with a one-time event or training. Change is a process that people move through as they learn, come to understand, and then become competent in new behaviors.

- Change Principle 3: The Local Organization is the Primary Unit for Change (p. 9). Although the individual decision-makers ultimately effect change, the dynamics and leadership of the local organization set the tone for implementation. However, it is essential that the local organization move in concert with and be supported by other components of the system. In the case of CES, this local organization is the state Extension office.

- Change Principle 4: Organizations Adopt Change – Individuals Implement Change (p. 9). While much work and research has focused on concepts like organizational culture, policies, and systems, “successful change starts and ends at the individual level” (p. 9). Change is not fully implemented until each individual member has changed.

- Change Principle 5: Interventions Are Key to the Success of the Change Process (p. 11). Because learning is essential in the change process, it is important for those implementing change to consider myriad ways to train people and aid in the learning process.
- Change Principle 6: Appropriate Interventions Reduce Resistance to Change (p. 12). Interventions that address the needs of people involved in change increase the comfort level and understanding and assist people in working through the learning process.

- Change Principle 7: Leadership is Essential to Long-Term Change Success (p. 13) Bottom-up efforts can initiate change and can create short term results, but the research has shown that if leaders, “do not engage in ongoing active support, it is more than likely that the change effort will die” (p. 14). Leadership must legitimize and support the effort for long-term change to take effect.

- Change Principle 8: Facilitating Change is a Team Effort (p. 14). Each member of the organization contributes to the change process.

- Change Principle 9: Mandates Can Work (p. 15) Mandates are often criticized as being top-down and ineffective. The research has found that, “mandate strategy fails when the only time the change process is supported is at the initial announcement of the mandate” (p.15). Mandates that are supported with appropriate learning interventions and leadership can be successfully implemented.

- Change Principle 10: The Context Influences the Process of Learning and Change (p. 15). There are two primary factors that influence context – the physical attributes of the institution and “people” factors (attitudes, beliefs, and values of individuals). The amount of sharing and the cultural
The expectation of continuous improvement and learning contributes to the relative success of change implementation.

The principles of the Concerns-Based Adoption Models integrate diffusion theory and individual decision-making process research, while also considering that people’s emotions and concerns were fundamental to implementing change. The principles further reminded those seeking to implement change that the content and technical elements of change or innovation were less relevant to adoption than the human elements associated with implementation. In other words, in our example of renewable energy programming, CES could not resolve the entire issue of field faculty engagement simply by defining the technical content and providing a workshop for faculty. Full adoption of change requires understanding the human decision-making process of field faculty who are asked to adopt renewable energy education programming, as well as understanding the organizational context of CES.

To aid organizations in understanding the human elements of change, CBAM researchers developed standardized methods of concern assessment. At the time of the study, CBAM assessment was comprised of three parts: Stages of Concern, Levels of Use, and Innovation Configuration (Hall G., 2003). Stages of Concern Questionnaire (SoCQ) deals with adopter concerns and issues related to his or her experience with, or perception of, the innovation. This part analyzed the adaptor’s feelings, observations, issues, and successes with regard to the innovation. Stages of Concern is typically the first assessment conducted regarding an innovation. Levels of Concern relates to the amount of utilization of an innovation through an organization and is usually evaluated
after an innovation has been recommended for adoption for a period of time. *Innovation Configuration* documents changes and modifications of the innovation as it evolves through an organization (Hord, 1987). This research began with use of the Stages of Concern Questionnaire, which is explained in this chapter.

**Review of the Literature**

This research reviewed literature related to the context of CES, based on the principles of change. This analysis consisted of a review of the personal elements associated with change toward renewable energy. Second, a review of literature regarding the organizational context was conducted. This information provided insight into the environment in which change toward renewable energy education will be conducted.

**Personal Concerns and Extension Change**

No research was found related to Extension field faculty concerns related to energy or renewable energy education. Therefore, to understand the dynamics contributing field faculty adopting renewable energy education, examination of the innovation of sustainable agricultural education was conducted. Sustainable agriculture was selected as a parallel concept for three primary reasons. At the time that sustainable agriculture was introduced to Extension: a) it was highly politicized; b) it was supported and promoted by advocates of “green” practices; and, c) there was an expectation and push for Extension to engage in field-faculty-level education and outreach on the topic
(Arunga, 1995). These three elements were common between sustainable agriculture and renewable energy.

**Adoption of Sustainable Agriculture:** In the case of sustainable agriculture education, curricula were designed and educators were trained in the use of the curricula. Research was conducted following these trainings to assess Extension’s adoption and implementation of sustainable agriculture education. The sustainable agriculture research found that adoption of the innovation (sustainable agriculture education) was highly influenced by the perceptions Extension educators held prior to the introduction of the training material (Arunga, 1995; Coffinner, 1997; Francis & Clive Edwards, 1995; Grudens-Schuck, 2001). In training Extension educators on sustainable agriculture (SA), for example, Coffinner and Kolodinsky (1997) concluded that, “different attitudes and knowledge had a large effect on the usefulness and impact of the training,” and recommended that curriculum and training materials should be modified to address differences in perception and knowledge (p 5).

In the case of SA, training and curriculum designers were “aware of the controversy and polarized opinions associated with SA” (p. 7) and found that differences of opinion regarding social justice issues and political views on the topic greatly influenced adoption of teaching materials and receptiveness to training (Coffinner, 1997). A study of Ohio Extension agents found that the majority were skeptical of SA and that Extension agents felt that they should not be expected to teach SA to producers because doing so actually undermined their credibility (Arunga, 1995).
Coffinner (1997) recommended specific modifications to training and curriculum design. It was further suggested that Extension should consider, in “situations of controversial subject matter,” whether all educators should be trained, or whether resources should be devoted to “those who express an interest and intent to apply the knowledge” (p. 18). Similar findings were reported by Arunga (1995), who found that educator understandings of sustainable agriculture both contributed to the comfort of the educator in teaching the subjects, but also noted that agent perceptions and opinions about the subject prior to training directly influenced the effectiveness and adoption of training materials (Arunga, 1995). Other analyses of Extension adoption of sustainable agricultural teaching indicated that Extension was slow to adopt sustainable agricultural concepts, but ultimately incorporated many of the concepts as justification of the work they were already doing (Francis & Clive Edwards, 1995; Grudens-Schuck, 2001). For example, once educators were able to define “sustainable” from an economic standpoint, they were better able to view any work that made producers more economically viable as work in sustainable agriculture. Eventually, this logic melded into triple-bottom line economic concepts of fiscal economy, social economy and natural economy.

Understanding preconceived notions of renewable energy and better assessing educator concerns about renewable energy may well influence programming and training design. In the case of sustainable agriculture, educator attitudes about the content led to fragmented adoption of teaching sustainable agriculture concepts. Renewable energy issues also had controversy and differing political views. In the Stages of Concern Questionnaire, high levels of concern in Stage 4 (concern related to the content or
implications for learners) or Stage 6 (refocusing) would indicate that educators are concerned with the content or methodology with which renewable energy programming might be accomplished. In that instance, it could be argued that sustainable agriculture is an appropriate parallel to renewable energy education. However, the research of faculty concerns was necessary for it to be concluded whether concerns were consistent with SA or unique to renewable energy education.

Personal Concerns Related to Designing Curriculum and Training: Once concerns of educators are better understood, curriculum design and training strategies can be developed accordingly. The literature review indicated several examples of educational programming adaptations that were implemented effectively following the identification of an underlying issue. Murphrey and Dooley (2000) offer an example of the importance of understanding perceptions of educators using the innovation of distance education technology. They state, “How people perceive and react to these technologies is far more important than the technical obstacles in influencing implementation and use” (p. 465). Once the perception issue was identified as a key factor, strategies for implementing training were adapted. A Mississippi State University study of Extension perceptions of risk management found that faculty “considered themselves to be deficient in terms of preparation in several areas of risk management” (p. 20) (Stage 2 SoCQ Concern) and specific training needs of educators were addressed. In contrast, a study by Texas A&M regarding the future of family and consumer science agents found that the issues were organizational (a Stage 3 SoCQ Concern). The outcome of that study was best summarized by the statement that
the findings “…challenged the Extension organization to develop a mindset of potential rather than survival, leadership rather than management, and doing the right programs rather than doing the programs right” (Shinn, 1999, p. 399).

The idea of identifying the problem in order to apply an appropriate solution was modeled by Calabrese’s (1982) problem identification matrix (PIM). To solve the problem, it is necessary to understand the cause-and-effect relationship that naturally exists and it is important that the process not assume simple solutions, unless the root cause of this disconnect is fully understood (Calabrese, 1982). The inclination in Extension may have been to assume that educators were too busy to accommodate new programming (SoCQ Stage 3 Concern) or that educators were intimidated by energy issues because they lacked specific training in energy (SoCQ Stage 2 Concern), or to assume that the concerns were the same that were found in Sustainable Agriculture programming (Stage 4 and Stage 6 Concerns). Thus, our “solutions” may be to remove tasks from faculty calendars, to inundate faculty with new fact sheets and information, or to structure education assuming a high level of controversy on the topic. However, unless CES has identified those concerns correctly, the solutions may not address the problems and may squander already scarce resources. Correctly identifying the concerns will enable Extension to effectively address the perceptions limiting adoption, develop appropriate training or implement organizational modifications that truly address the barrier.
Analysis of Organizational Context

While this research focused on understanding the concerns of individuals related to renewable energy education, the principles of change reflect that it was also important to assess and understand the organization in which change will occur. Once individual concerns are identified and understood, this analysis aided in identification of appropriate interventions.

Perceptions Related to Extension Theories: In this research, it was important not only to consider the concerns of the individual within CES as they make decisions about change, but also to consider whether the organization (CES) itself was able to modify, learn, and adapt to change as dictated by relevant societal needs. Murphrey and Dooley’s (2002) study of innovation diffusion with regard to implementation of new technologies within CES stated,

Land grant institutions have been in existence since 1862. Thus, a multitude of policies, procedures, and strategies have been established. As institutions enter and continue to move through the new paradigm[s] …, policies, procedures, and strategies must be reviewed and revised to ensure critical issues are addressed (p. 474)

When the issue of renewable energy programming was considered, the strategies and policies of CES in connecting with society may be a limiting factor in adapting to change.

One strategy that may need to be overcome was Extension’s use of innovation diffusion in outreach and education. As previously discussed, the introduction of hybrid corn in Iowa in 1928 by the Iowa State University Experiment Station was significant in diffusion theory research, where the work of Ryan and Gross (1943) contributed to the framework for what Rogers would later define as the Diffusion Theory of Innovation
(Stephenson, 2003). However, this work also set precedence for the structure of the land-grant University Extension system.

Using the concept of innovation diffusion, Extension systems have been established worldwide under the premise of distilling best practices of university-based research to agricultural producers. Especially in agriculture, CES has worked with the universities to identify beneficial innovations and then to introduce innovators and early adopters to those practices. In theory, those producers then become advocates of the new practice, either by example (such as higher yields or livestock weights being viewed by others) or by actively promoting the innovation to area producers. For more than thirty years, the underlying fundamentals of university Extension work have revolved around use of the innovation diffusion theory (Stephenson, 2003). It historically has been a critical element in helping the United States to become the most agriculturally productive nation in the world. In defense of the theory, Cash states that there was a,

…causal connection between [Extension] and effective production and use of scientific and technical information…[Extension] provides an institutionalized space in which long-term relationships can develop and evolve, two-way communication is fostered, tools for management are developed and utilized and the boundary of the issue itself is negotiated. As such, the organization is dynamic and changing, responding to the changing interests of actors… (Cash, 2001, p. 450).

The model has been effective not only in introducing new innovations to CES constituents, but also in fostering the “two-way communications” whereby the changing needs of constituents can be identified to university researchers and the results of practical applications of innovations can be reported and analyzed. In theory, the land-grant institution can then provide a dynamic response to localized needs.
Where renewable energy education was concerned, the issue was whether Extension can be dynamic and respond to demands from society. Stephenson (2003) argued that this reluctance of Extension to respond may be based on the use of innovation diffusion theory for outreach and that perhaps, the theory should be reconsidered and revised in terms of current issues faced by Extension constituents. For example, he suggested the theory had a pro-innovation bias. There was an implication that innovations should be diffused and adopted universally and rejecting the innovation was considered a negative behavior (Stephenson, 2003). In the case of renewable energy, there may be question as to whether Extension’s role was to educate versus promote installation of the technologies. The concept of innovation diffusion may be influencing Extension educators in that the economic returns on many renewable energy systems can be long (10 to 40 years) and the costs of implementation can be high, perhaps making the idea of promoting the innovation of renewable energy problematic for educators. This may be especially true if educators perceive that the promotion of the innovation is more politically aligned than it is economically sound.

Research also revealed that there may be some question as to whether the traditional approaches of Extension, specifically the use of innovation diffusion in agriculture, has created political barriers that limit the organization’s ability to change. McDowell supported this concept (2003). McDowell built a compelling argument that the innovation diffusion theory was partially responsible for Extension systems becoming “hostages” of their traditional constituent base. He suggested that, “As the character of the land-grant institutions changed in response to changes in society, the agenda of the
Extension services in the respective states did not follow suit” (p. 45). He went on to argue that because the political support of Extension had come from the agricultural sectors that have benefited from innovation diffusion theory, attempts to move Extension services into less traditional models have been difficult and that “the carcasses” of administrators who have attempted to shift traditional Extension dynamics can be found around the country (p. 45). McDowell suggested that Extension had lost much of its ability to adapt and change because it was captive to its own bureaucracy and history.

Research in change theory indicated that bureaucracy and history could be overcome, especially if the organization was effective in organizational learning (Rowe, 2010). Therefore, a review of Extension as a learning organization was important in assessing the institutional context.

Extension as a Learning Organization: This researcher was interested in how organizational dynamics in Extension influence productivity and performance and on the factors that contribute to continued improvement and positive change. Research and work on organizational culture in the corporate sector has been taking place for decades - Argyris (1982), Deal and Kennedy (1982), Likert (1967), McGregor (1960) and Schein (1985) to name a few. In the early 1990s, similar research began regarding educational institutions. The work of Senge (1990), though not the first work in this field, initiated dynamic discussions regarding educational institution improvement. Continuous improvement was predicated on organizational learning (Senge, 2000). Senge identified five disciplines, or ways of thinking, that characterize effective organizational learning. They were: 1) systems thinking – where there is a consideration for the whole system
and interrelationships within the system, 2) building a shared vision, where members of the organization are focused on what the organization wants to create, 3) personal mastery – which is the practice of continually clarifying personal vision and understanding personal participation within the system, 4) mental modes – where members are able to separate what has truly been observed and experienced versus generalizations and assumptions and 5) team learning – individuals come together to learn and discuss and to achieve collaborative decision making that benefits all (Hall, G.E., 2011, p. 22-23). Implementation of change is most successful in learning organizations, whereas in institutions where these characteristics are not present organizational barriers may prohibit the change process.

As an example of an organization barrier, Lezotte and McKee (2002) suggested that many organizations have a “single loop model” of educator engagement. In these models, bureaucratic layers reinforced the status quo by restricting the free flow of information and learning throughout the entire system by limiting opportunities to question norms or paradigms. Such barriers limited an organization’s ability to respond to change. Single loop models were often “top-down” where communications were handed down through the ranks of an organization. In contrast, “double loop” or learning organizations emphasized a core value of continuous improvement. Continuous improvement required constant feedback from systems that were designed to monitor the current situation and adjust future actions (Lezotte, 2002).

Another example of an organizational barrier was one that limits personal mastery. Senge (2000) suggested that professionals were most motivated and successful
when they not only were able to produce results, but were also able to “master” the principles underlying the accomplishment. The learning associated with implementing change was associated with this concept. Personal mastery was a critical element in job satisfaction and in implementation of innovative initiatives (Senge, 2000). Given low levels of experience in energy education in the CES network, personal mastery concerns may have existed for field faculty.

In assessing CES’s ability to change, Rowe (2010) offered research regarding the ability of Extension to engage in organizational learning. Using work in educational organization research (Kofman & Senge, 1993; Popper & Lipshitz, 1998; Watkins & Marsick, 1993), Rowe examined whether Extension was a learning organization. As Senge identified, the extent to which an organization "learns" was related to both structural factors (mechanisms and procedures that allow organizations to systematically collect, disseminate, and use information) and cultural factors (including shared professional values, leadership, and vision) (Rowe, 2010). These factors contributed to faculty perceptions and behaviors. Rowe found that, in Extension, many dynamics of learning organizations were not present or were present at low levels, indicating that both structural hierarchies and cultural practices would need to change in order to enable the organization to adapt and respond to new needs. Rowe (2010) stated, “Building and sculpting a learning organization will take deliberate action and monitoring of results” (p. 5) However, in favor of renewable energy education, she also noted that,

Environmental influences often stimulate organizational change. In order to maintain a competitive edge, Extension as an organization must realize and respond to sudden shifts in services for our customers. Change is a constant that must be considered for
survival in this rapidly changing environment. Extension must become a learning organization and be flexible (p. 5).

Evaluating change in the context of both individual faculty concerns and the dynamics of organizational change required review of Extension’s role in renewable energy.

**Extension’s Role in Renewable Energy:** As discussed in Chapter I, the current political environment promotes the concept of renewable energy. From Born in 1980 to the 2010 USDA/AREERA/NIFA State Plans of Work (NIFA, 2010), the concept of Extension in renewable energy education has been supported, yet implementation remained a struggle.

The struggle of Extension to incorporate energy education was not new. Liles (1978) discussed the need for Extension to become responsive to client needs in oil and gas leasing in 1970, emphasizing that individuals within the system, and not the system itself, responded to client needs (p. 9). Laquatra et. al (2009) reflected on the National Extension Service Act of 1977, where a funded 10-state pilot project was implemented to form a new energy outreach program utilizing Extension. McDowell (1985) identified that the program encountered political problems with existing energy education programs within Extension and ultimately failed (McDowell G., 2003). Born (1980) acknowledged that Extension was grappling with similar issues in the late 1970’s in his article, “*Extension and the Energy Crisis: Players or Spectators*” (Born, 1980).

Extension outreach and education in energy has been highly variable and wrought with challenges.
One challenge faced by CES was that few field faculty members had a specific background or training in energy-related fields. APLU acknowledged this challenge by stating that levels of energy expertise within CES vary greatly (APLU, 2011). Thus, faculty members with experience in agriculture, family and consumer sciences, horticulture, youth development or community development must re-tool in order to address energy-programming needs. Emphasizing this challenge Forston (2006) explained, “There is no simple track for learning the renewable energy ropes. Nor is there a one-size-fits all option that will work for every willing [agricultural] producer…There are countless variables to consider when learning about the viability of renewables” (p. 2). Where, for example, information from a one-day workshop on a new wheat variety or food preservation technique might be easily integrated into existing knowledge base and programming efforts, there was little existing renewable energy knowledge base in the current field faculty upon which to build. Faculty required training from very basic levels in order to be competent in discussing renewable energy technologies.

Fiscal resources presented another challenge. Frigden (1995) reported that Extension had acknowledged a changing and shifting consumer base. Yet, questions regarding capacity, collaborators, potential resources, constraints, and forward process must all be examined in order to effectively implement new programming areas (Fridgen, 1995). The addition of renewable energy education to the slate of expectations of CES programming was essentially an un-funded mandate, which required balancing existing knowledge and resources with remaining relevant in society. However, Extension was
not unique in facing changes imposed from an external source. Many organizations implemented change as a result of external forces. Some examples of externally imposed changes were found in mandates required for schools, OSHA or EPA requirements for businesses, or even Department of Homeland Security requirements that airline passengers remove their shoes before boarding a plane (Hall G. E., 2011). In other words, the changes required to address renewable energy education could not be dismissed simply because of scarce resources or because external influences recommended the change. Change is constant and adaptation is essential for long-term support and funding of Extension work (McDowell G. R., 1985).

Although Extension faced many barriers in making change toward including energy education, barriers could be overcome. Oregon State University provided an example of incorporating some elements of renewable energy as part of natural resource consumption education program using an ethics-based educational model (Simon-Brown, 2004). North Carolina’s E-Conservation Program (Kirby, 2009) and Cornell’s Consumer Education Program for Residential Energy Efficiency (Laquatra J. M., 2009) provided excellent examples of Extension work in energy efficiency and conservation. Overcoming the barriers required changing status quo, however. Simon-Brown (2004) emphasized that “Cooperative Extension is strategically situated to play a key role in energy conservation and efficiency education”, (p. 2) but also noted that doing so required the use of a variety of teaching methods. The authors of Sustainable Living Education: A Call to All Extension (2003) pushed the issue further in stating that, “only if Extension educators unite across the programming areas…will we reach our impact
potential. To effectively address the need…Extension must immediately refocus and retool” (Elliot, 2008, p. 3). Refocusing and retooling would not only involve development of programming efforts in renewable energy, but would also involve addressing elements of becoming a learning organization if the status quo were to shift.

Personal Concerns Assessment in Addressing Organizational Change: The literature review provided insight into organizational issues that CES may need to address to fully integrate renewable energy programming. However, CBAM research pointed out, “Although everyone wants to talk about such broad concepts as policy, systems, and organizational factors, successful change starts and ends at the individual level” (Hall G. E., 2011, p. 9). The assessment of individual concerns aids in identifying organizational change priorities and providing clarity as to immediate intervention actions that address personal barriers.

Understanding concerns of educators is a multi-faceted process. Concerns are influenced by the organizational dynamics, hierarchy, personal concerns, professional concerns, and the extent to which the educator were engaged in or indifferent to an innovation (in this case renewable energy) (Hall G. E., 2006). The levels of concern related to a change can be assessed using the Stages of Concern Questionnaire (Hord, 1987). This tool enabled the researcher to understand concerns through a SoCQ Profile. The profile not only enabled an understanding of the primary and secondary levels of concern, but also was able to help identify elements of the organization that may be contributing to educator perceptions. Figure 2 illustrates a hypothesized concern profile using the SoCQ instrument:
SoCQ assessment recognized seven stages of concern related to adoption of innovation. These stages reflected the ways in which CBAM has integrated historical diffusion theory research into understanding individual decision-making processes.

Stages included:

- Stage 0: Awareness: Assessed the level of concern or involvement with the issue being assessed
- Stage 1: Informational: Indicated general awareness and interest in learning more regarding the innovation
- Stage 2: Personal: Indicated the level of individual concerns about the demands the issue might place on the individual and the educator’s concerns
regarding his/her adequacy to meet those demands, as well as concerns related to his/her role with implementing an innovation

- **Stage 3: Management**: Identified the level of concern regarding process and tasks of implementation, such as, but not limited to, efficiency, organizing, managing, scheduling, and time demands

- **Stage 4: Consequence**: Indicated level of concern related to impact on the clients in educator’s sphere of influence. The focus was on the relevance of the innovation for clients, evaluation of the outcome including concerns regarding the educator’s performance and competencies, and changes needed to increase client outcomes or impacts.

- **Stage 5: Collaboration**: Indicated the level of concern regarding cooperation and coordination of efforts with others regarding the issue

- **Stage 6: Refocusing**: Identified the level of concern of universal benefit from the innovation or issue, including the possibility of major changes or replacement of the suggested innovation with a more powerful innovation. Measures extent to which individual had a definitive idea about the proposed innovation (Hall G. E., 2006).

The 35-question Stages of Concern Questionnaire (SoCQ) instrument had strong reliability estimates (test/retest reliabilities range from .64 to .86) and internal consistency alpha-coefficients range from .64 to .83 (Hall G. E., 2006). The instrument had been used for decades in educational institutions, including universities, to assess educator concerns and continues to be seen as a reliable and valid measure (p. 148). The
instrument was utilized in this study to assess CES educator concerns and to address the research objectives regarding renewable energy programming.

**Historical Development of the Stages of Concern Questionnaire**

The researchers at RDCTE engaged in a three-year development process of a quick-scoring stages of concern instrument in the fall of 1973. The initial construction of the standardized instrument began with researchers developing 544 potential items that could indicate a stage of concern. These items were consolidated and edited for redundancy, resulting in a 195-item pilot instrument reflecting the stages of concern categories. This instrument was administered to elementary school teachers and college faculty in May 1974. From the 363 returned questionnaires, item correlation and factor analysis indicated 60% of the common variance among the 195-items correlated to the hypothesized scales developed in CBAM (George, 2006).

Following additional testing, the data convinced RDCTE researchers that the seven factors represented independent constructs, which could be correlated to the seven stages of concern, proposed in the CBAM. The 195-item instrument was refined (based on the five most heavily loaded items for each stage) and edited for redundancy, which resulted in a 35-item instrument. The five items representing each stage were selected to improve the likelihood of high internal reliability. This instrument was then tested through pilot analysis and correlation matrixes for validity and reliability (George, 2006).

**Reliability of Stages of Concern Questionnaire:** In September 1974, the 35-item SoCQ was administered to 830 professors and teachers to explore their concerns about
team teaching instruction models. Item analysis resulted in coefficients for each stage of internal reliability from .64 to .83. Two weeks later, 132 respondents were retested and t-test correlation analysis resulted in Pearsons r correlations of .65 to .86 with five stages scoring above .75. The results of these two tests are presented in Table 1.

Table 1: Coefficients of Internal Reliability and Test-Retest Correlations (1974)

<table>
<thead>
<tr>
<th>Stage</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>0.64</td>
<td>0.78</td>
<td>0.83</td>
<td>0.75</td>
<td>0.76</td>
<td>0.82</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Test-Retest Correlations on SoCQ

<table>
<thead>
<tr>
<th>Stage</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>0.65</td>
<td>0.86</td>
<td>0.82</td>
<td>0.81</td>
<td>0.76</td>
<td>0.84</td>
<td>0.71</td>
</tr>
</tbody>
</table>

The statistics suggested satisfactory reliability of the SoCQ instrument (George, 2006).

Because other measures of concern did not exist for comparison to the SoCQ, researchers used inter-correlation matrices, interview data and changes over time to investigate the validity of the instrument. For example, subjective validity studies were conducted in 1976 to measure the relationship between raw SoCQ stage scores and open-ended questions or interviews. The instrument was found to be reliable (George, 2006). Several longitudinal studies were conducted in the late 1970s. Further correlation analysis was conducted on peak stage concerns. The instrument again was found to be valid and reliable. (George, 2006).
Since the publication of the original SoCQ manual in 1978, the instrument has been used in an extensive array of studies (George, 2006). Some of these studies included non-teaching applications, but statistical analysis with regard to the internal reliability of the instrument has been constant. A summary of the reliability analysis for several of the studies is provided in Table 2.

Table 2: Coefficients of Internal Reliability for Various Studies (1979-1991)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Sample Size</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hall, George &amp; Rutherford (1979)</td>
<td>830</td>
<td>0.64</td>
<td>0.78</td>
<td>0.83</td>
<td>0.75</td>
<td>0.76</td>
<td>0.82</td>
<td>0.71</td>
</tr>
<tr>
<td>Van den Berg &amp; Vandenbergh (1981)</td>
<td>1585</td>
<td>0.77</td>
<td>0.79</td>
<td>0.86</td>
<td>0.80</td>
<td>0.84</td>
<td>0.80</td>
<td>.76/.73*</td>
</tr>
<tr>
<td>Kolb (1983)</td>
<td>718</td>
<td>0.75</td>
<td>0.87</td>
<td>0.72</td>
<td>0.84</td>
<td>0.79</td>
<td>0.81</td>
<td>0.82</td>
</tr>
<tr>
<td>Barucky (1984)</td>
<td>614</td>
<td>0.60</td>
<td>0.74</td>
<td>0.81</td>
<td>0.79</td>
<td>0.81</td>
<td>0.79</td>
<td>0.72</td>
</tr>
<tr>
<td>Jordan-March (1985)</td>
<td>214</td>
<td>0.50</td>
<td>0.78</td>
<td>0.77</td>
<td>0.82</td>
<td>0.77</td>
<td>0.81</td>
<td>0.65</td>
</tr>
<tr>
<td>Martin (1989)</td>
<td>388</td>
<td>0.78</td>
<td>0.78</td>
<td>0.73</td>
<td>0.65</td>
<td>.71/.78*</td>
<td>0.83</td>
<td>0.76</td>
</tr>
<tr>
<td>Hall, Newlove, Rutherford &amp; Hord (1991)</td>
<td>750</td>
<td>0.63</td>
<td>0.86</td>
<td>0.65</td>
<td>0.73</td>
<td>0.74</td>
<td>0.79</td>
<td>0.81</td>
</tr>
</tbody>
</table>

*Note: In these studies, the authors proposed two subscales in place of the original SoCQ scale.

The subjects of the studies listed in Table 2 were: Hall, George, and Rutherford (1979) - the original study of 830 teachers, Van den Berg and Vandenbergh (1981) – 25 schools in the Netherlands and 52 schools in Belgium, Kolb (1983) – assessed nurse’s concerns about the nursing career, Barucky (1984) – measured concerns about leadership development in the US Air Force, Jordan-March (1985) – measured concerns about exercise, Martin (1989) – measured concerns of people learning computer programming, Hall, Newlove, Rutherford & Hord (1991) – retesting of the instrument following modifications of the questionnaire (George, 2006). The instrument measurement guide cited at least 27 studies (of various subjects) that have been monitored for validity and
reliability by the instrument authors, the most recent in 2006 (George, 2006). The instrument has been most typically used in educational settings, in both K-12 and university settings (George, 2006).

Applications of SoCQ Research: Once the Stages of Concern were identified, strategies for increasing rates of adoption could be employed and shared visions of the future constructed. The organization could begin to address communications strategies that shift from top-down (first-order communications) to team learning and shared vision communication which utilize second-order communication strategies (continuous loop models) (Meynell, 2005). This communication strategy would be especially important in Extension given geographic distance and limited funding for travel.

Further, the work of Lezotte and McKee (2002), Senge (2000), and Meynell (2005) in conjunction with the results of a concern profile can enabled analysis of institutional barriers that impacted educator engagement, in addition to appropriately identifying other concerns. Notes Senge (2000), understanding common concerns might have facilitated alignment, where “alignment has the connotation of arranging a group of scattered elements so that they function as a whole, by orienting them to a common awareness of each other, their purpose, and their current reality” (p. 51).

The CBAM Stages of Concern Questionnaire was not able to address all elements of organizational politics nor did it identify specific content training needs of field faculty. However, the instrument identified where faculty had concerns and helped to establish a starting point for the change process given organizational and fiscal constraints.
CHAPTER III - METHODOLOGY

Methodology

The purpose of this study was to assess concerns regarding renewable energy programming held by Extension professionals. It sought to determine how the concerns of educators might influence the design of Extension renewable energy programming and associated professional trainings. This chapter explains the instrumentation used and target population of the study. The survey instrument, the Stages of Concern Questionnaire (SoCQ), is explained with regard to how the instrument was used to analyze faculty concerns related to renewable energy programming. The reliability and validity of SoCQ is discussed, as well as the procedures used to administer the survey. Data processing procedures and appropriate analysis methods are described.

Research Design

This research was conducted utilizing a descriptive survey analysis based on the Stages of Concern Questionnaire (SoCQ). It was administered electronically to Extension faculty in the Fall 2011.

The population for this research was all Extension educators employed in Montana, Wyoming, and Colorado. These states were selected because of the following similarities in renewable energy Extension programming: 1) all states had an Extension renewable energy professional in place, but were within the first three years of developing renewable energy programming for field faculty, 2) all states had similar
renewable energy opportunities given climate and topography, and 3) all states had identified a desire to engage field faculty in renewable energy education programming. The size of this population at the time of the study was 307 (Montana = 90, Colorado = 153, and Wyoming = 64), as reported by the Extension Human Resource Department in each state.

Total Extension faculty numbers represented a broad cross-section of employees and may have varied by state. For example, many counties had grant-funded positions that were included in counts of full-time equivalents. WY and CO also had regional specialist positions that were included in this number. MT did not have regional specialists and did not include any statewide appointments in the count. Ideally, the number of Extension faculty could have been more specifically defined. This was not possible, however, for several reasons. First, in Montana faculty did not always have specific assignments, as they did in WY and CO. For example, a faculty member in MT who worked predominately in agriculture may also have had a position description that included youth development or family and consumer sciences. Second, accountability for energy programming at the time of the study had not been assigned to any type or group of faculty in MT and WY. To delimit faculty would eliminate responses from faculty who could later be assigned energy responsibility. Further, to eliminate, for example, grant funded or positions with regional responsibility may also have compromised responses from those later assigned responsibility in energy programming. While the counts of faculty provided by the human resource offices in each state likely varied in terms of which types of positions were included in the FTE counts, there was no
effective means of standardizing the position counts without potentially sacrificing a valid sample of the population.

A census was used. The census sought to overcome differences in staffing patterns and field faculty assignments in the selected states. Proportional sampling by position type was not possible as common classifications for positions did not exist between state Extension systems. Given the small population size and the high response rate required, true randomization was not possible. A sample size ranging from 50 to 100 percent of the population would be appropriate. Leedy and Ormrod (2010) indicated sample sizes of 100% for populations of N =100 and below, and a sample size of 50% for populations of 400 to 600 (p. 213). In a review of Extension research from 1995-1999, response rates for Extension census surveys averaged 29.5% (Linder, 2002). Research by Archer suggested that for Extension, in-house, web-based surveys of this type, a response rate of 40% should be expected (Archer, 2008). This study had a total response rate of 46.9%, and a usable response rate of 41%, which was consistent with Archer’s findings.

Procedures

Permission and Validation of Use for Extension Faculty

Permission to use the SoCQ instrument to assess faculty concerns regarding renewable energy was granted by Dr. Gene Hall via email communication prior to administration of the survey. Dr. Hall was an original creator of the survey and continues to work with the members of the RDCTE research group and SEDL (formerly Southwest Education Development Laboratory), the entity that currently promotes and advances
SoCQ work. Dr. Hall verified that the instrument validity and reliability was tested using higher education faculty and that Extension field faculty would be “well inside established norms” (Hall G., Personal Communication, 2011). In the standard survey instrument, respondents scaled a variety of statements about “the innovation” on a Likert scale. The research committee for this project recommended substituting the words “the innovation” within the survey with “renewable energy programming” to ensure correct responses to the instrument. Dr. Hall approved that substitution provided that no other words in the instrument were altered (Hall G., Personal Communication, 2011). A copy of the correspondence is included in Appendix B.

Research Design

Demographic Survey

For this study, demographic information was collected from each participant in order to obtain information regarding age, sex, state of employment, length of employment with Extension, key Extension responsibilities (agriculture, FCS, 4-H, etc), involvement in energy programming, and prior work history. The demographic study was comprised of 10 questions which were asked at the beginning of the survey.

Stages of Concern Questionnaire

This research was conducted utilizing a descriptive survey analysis based on the Stages of Concern Questionnaire (SoCQ), designed by the researchers at RDCTE (Hall, 2006). The SoCQ was a quick-scoring measure of seven concern constructs using a 35-item questionnaire. The standardized instrument (Form 075) (Hall G. E., 2011) was used
in conjunction with a 10-item demographic survey that provided additional analytical detail in addressing the research questions. The instrument was modified to substitute “the innovation” language within the instrument with “renewable energy programming” and to add a demographic survey. The answers to these questions were used to construct concern profiles using seven key measures of concern: Stage 0: Awareness - Measured the level of concern or involvement, Stage 1: Informational - Assessed general awareness and indicated interest in learning more regarding the issue, Stage 2: Personal – measured concerns about the demands the issue might place on the individual and concerns regarding adequacy to meet those demands, as well as concerns related to role with implementing an innovation, Stage 3: Management - measured concerns regarding process and tasks of implementation, such as, but not limited to, efficiency, organizing, managing, scheduling, and time demands, Stage 4: Consequence - measured concerns related to impact on clients in participant’s sphere of influence, Stage 5: Collaboration - measured concerns regarding cooperation and coordination of efforts with others regarding the issue, and Stage 6: Refocusing - measured concerns of universal benefit from the innovation or issue, including the possibility of major changes or replacement of the suggested innovation with a more powerful innovation. (Hall G. E., 2006).

The instrument had strong reliability estimates (test/retest reliabilities ranging from .64 to .86) and internal consistency alpha-coefficients ranging from .64 to .83 (Hall G. E., 2006). The extent to which this instrument has been utilized and tested for reliability was verified through analysis of the historic development of the SoCQ questionnaire, as described in Chapter II.
Data Collection

Several studies have been conducted in recent years that indicate declining response rates in survey data collection. The decline is partially attributed to electronic surveying making data collection easier for researchers. Dillman (2002) expressed concern that, “the current survey mania tends to cheapen and threaten the entire enterprise of surveying” (p. 479). Anseel, Lievens, Schollaert, and Choragwicka (2010) found that many researchers attempted to overcome declining response rates with response enhancing techniques (incentives, reminders, etc.), but that, “when controlling for the use of response enhancing techniques, response rates are indeed declining” (p. 346). Even in mailed surveys, which tended to have higher response rates, mean response rates were 34% to 35.7% for organizational respondents (Anseel, Lievens, Schollaert, & Choragwicka, 2010). When controlling for response enhancing techniques, Anseel et. al found a negative response rate effect of web-based surveys, and recommended that, “researchers should anticipate a somewhat lower average response rate using Internet technologies in comparison to more traditional paper-and-pencil surveys” (p. 347) Factors increasing response rates are advance notice, personalization, identification numbers [rather than names], and sponsorship (p. 347).

Despite lower response rates indicated by electronic survey collection methodologies (Shannon, 2010), data collection in this research was conducted utilizing SurveyMonkey online surveying. A copy of the instrument was provided in Appendix D. This methodology was selected for several reasons. First, within CES it was politically appropriate to request the involvement of Extension faculty through the state Extension Director. Electronic requests for state participation to the Extension Directors
in WY and CO was easily accomplished through e-communication from MT’s Extension Director. Their willingness to participate could be immediately identified. The electronic survey also could easily be forwarded to faculty by the respective directors. Second, the electronic methodology allowed the researcher to track participation levels in three states in real time. Had response rates been abnormally low, this tracking allowed for the methodology to be appropriately addressed in a reasonable time frame, where response rates from mailed surveys would not have been known until the data collection window was closed. Finally, it was not possible to obtain a physical mailing list from human resource departments for each faculty member, but the directors were willing to forward information to their respective online address listserves.

The survey instrument was submitted to the Montana State University Institutional Review Board and was approved on August 29, 2011.

Following a request from the researcher, the Montana State University Vice President of External Relations and Director of Extension, Dr. Douglas Steele, sent an electronic request to engage field faculty in the respective states to Extension Directors in CO and WY on September 20, 2010 (Steele, 2011). A copy of this correspondence is included in Appendix C. On September 20, 2011, Dr. Steele sent an electronic letter to Extension faculty in Montana requesting their participation in the electronic survey (Steele, 2011). The requests by Dr. Steele to support this research were extremely beneficial in legitimizing the research and encouraging participation in all three states.

On September 21, 2011, Dr. Louis Swanson, Extension Director in CO, requested that CO Energy Specialist, Cary Weiner, forward the request for participation in the
survey to CO Extension faculty. Mr. Weiner forwarded the request with a deadline of October 20, 2011. A reminder email was sent by Mr. Weiner in CO on October 10, 2011.

Montana faculty were also asked to respond by October 20. A follow-up reminder request was sent out by the researcher on October 12, 2011.

In WY, Extension Director, Dr. Glen Whipple, requested the participation of Extension faculty on October 2, 2011. Dr. Whipple also sent a follow-up email on October 20, 2011. The survey collection for responses in WY was closed on November 2, 2011.

Of the total possible responses (N= 307), 144 were received, yielding a response rate of 46.9%. Of the 144 received, 126 were usable, yielding a usable return rate of 41.0% (n = 126). The composition of usable responses by state is depicted in Table 3. These response rates were normal for electronic survey collection (Archer, 2008) (Linder, 2002) (Shannon, 2010), however due to the small population size a non-responder survey was conducted to check for sampling biases and to establish whether significant difference in non-responders versus non-responders in CO existed, given the small sample size of CO. Analysis of the non-responder survey was provided in Chapter IV.

Table These response rates were normal for electronic survey collection (Archer, 2008) (Linder, 2002) (Shannon, 2010), however due to the small population size a non-responder survey was conducted to check for sampling biases and to establish whether significant difference in non-responders versus non-responders in CO existed, given the small sample size of CO. Analysis of the non-responder survey was provided in Chapter IV.
Table 3: SoCQ Survey Respondents by State

SoCQ Survey Respondents by State

<table>
<thead>
<tr>
<th>State</th>
<th>Response Count</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana</td>
<td>59</td>
<td>46.8%</td>
</tr>
<tr>
<td>Wyoming</td>
<td>31</td>
<td>24.6%</td>
</tr>
<tr>
<td>Colorado</td>
<td>36</td>
<td>28.6%</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td></td>
</tr>
</tbody>
</table>

Data Processing and Analysis

This study used the *Measuring Implementation in Schools: The Stages of Concern Questionnaire* (George, 2006) manual, SPSS, and Microsoft Excel spreadsheet program. SPSS was utilized for all data analysis. Excel was used to generate SoCQ profiles. The Excel profiling tool was included in the *Measuring Implementation in Schools* manual as part of the recommended analysis supported by the research.

The data was analyzed for missing and incomplete responses. Those respondents who had not completed the instrument were eliminated from the analysis. Of the 144 responses, 126 had completed the instrument.

The data was further analyzed for incomplete responses. In a few instances, a question on the SoCQ was left blank. Following the recommendations of the SoCQ manual (George, 2006, p. 26), the average response for the scale of the missing response
was used to populate the response. Further analysis procedures on each research objective are provided in Chapter IV.

**Use of ANOVA and Post Hoc \( t \)-Test Analysis**

Utilizing SPSS, one-way analysis of variance (ANOVA) was used to evaluate differences between subgroups in the data. ANOVA was selected over multiple regression analysis for several reasons. First, multiple regression analysis is concerned with the predictive ability of an independent variable (such as age) on a dependant variable (SoCQ Stage), whereas ANOVA simply looks to explore statistical significance between and within groups (Pallant, 2007). This research is less concerned with predicting stages by independent variables, and more concerned with whether differences exist. To further understand where significant differences existed within the data, post hoc \( t \)-test analysis was utilized where ANOVA analysis indicated a significant difference.

Second, subgroup sizes differed in this data set. ANOVA allowed for comparison of different group sizes and distributions, where MANOVA analysis assumed normal distributions, similar sample sizes, and is sensitive to outliers (Pallant, 2007).

To reduce Type I Error, post hoc \( t \)-test analysis was used, and a Bonferroni (\( \alpha = .007 \)) adjustment was made in the \( t \)-test to further reduce possibility of Type I Error on those items where statistical significance was indicated in the ANOVA. All constructs were evaluated for skew and kurtosis and Komogorov-Smirnov testing was completed to indicate possible non-parametric distributions. Levene’s test for equality of variance was also used in each ANOVA analysis to ensure that assumptions of homogeneity of variance were not violated.
CHAPTER IV - RESULTS

Introduction

The analysis for this research was derived from data collected from 126 Extension faculty members in MT, WY, and CO through an online survey in the fall of 2011. The purpose of this analysis was to a) measure the present level of field faculty engagement in renewable energy education in MT, WY, and CO, b) describe concerns (as defined by the Concerns-Based Adoption Model) of Extension educators in MT, WY, and CO regarding renewable energy education, c) determine whether MT, WY, and CO field faculty concerns differed by the primary job function, and d) identify CBAM (Concerns-Based Adoption Model) concerns of subgroups of MT, WY, and CO Extension faculty that may influence program involvement with renewable energy education.

This chapter contains the procedures and conventions followed to address the research objectives, including discussion of the population and sample. The chapter presents actual survey responses and separate analyses in support of the research questions. For the total sample, as well as each subgroup of interest, statistical analysis, Stages of Concern Questionnaire (SoCQ) profiles and High Stage Score and Second High Stage Score comparisons are provided. Group averages (expressed as percentiles) reflect the dominant high and low Stage of Concern scores of composite group in the SoCQ profile. Analysis of individual High Stage (peak score) and Second High Stage (second highest score) provides additional insight into the dynamics of concerns. The High Stage and Second High stage score analysis was tabulated in a matrix. This process was
recommended as part of the SoCQ data analysis as it revealed distinct subgroups in the data and reflected complexity of concerns data (George, 2006).

Questionnaire Respondent Demographics

The target population for this research was all Extension educators employed in Montana, Wyoming, and Colorado. Of the total possible responses (n = 307), 144 were received, yielding a response rate of 46.9%. Of the 144 received, 126 were complete and usable, yielding a usable return rate of 41.0%. Table 4 depicts the composition of usable responses by state.

Table 4: SoCQ Survey Participation as a Percentage of State Population

<table>
<thead>
<tr>
<th>State</th>
<th>Total Faculty</th>
<th>Number Respondi</th>
<th>Percent of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montana</td>
<td>90</td>
<td>59</td>
<td>65.6%</td>
</tr>
<tr>
<td>Wyoming</td>
<td>64</td>
<td>31</td>
<td>48.4%</td>
</tr>
<tr>
<td>Colorado</td>
<td>153</td>
<td>36</td>
<td>23.5%</td>
</tr>
<tr>
<td>Total</td>
<td>307</td>
<td>126</td>
<td>41.0%</td>
</tr>
</tbody>
</table>

Montana had a total of 90 Extension faculty (n = 90) and had a usable response rate of 65.6%. Wyoming (n = 64) had a usable response rate of 48.4%. Colorado (n = 153) had a usable response rate of 23.5%.
Respondents completed 10 demographic questions. Of the respondents, 42.9% (n=54) were male and 57.1% (n=72) were female. Table 5 shows that the sex of respondents by state were consistent with the total sample.

Table 5: Sex of Respondents by State

<table>
<thead>
<tr>
<th>Sex</th>
<th>Total</th>
<th>Montana</th>
<th>Wyoming</th>
<th>Colorado</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
</tr>
<tr>
<td>Male</td>
<td>54</td>
<td>25</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>42.9%</td>
<td>42.4%</td>
<td>35.5%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Female</td>
<td>72</td>
<td>34</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>57.1%</td>
<td>57.6%</td>
<td>64.5%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>59</td>
<td>31</td>
<td>36</td>
</tr>
</tbody>
</table>

With regard to educational attainment, 59.2% (n = 74) of respondents held a Master’s Degree, while 34.4% (n = 43) held a Bachelor’s Degree and 6.4% (n = 8) held a PhD. No respondents held less than a Bachelor’s Degree.

Respondents represented a distribution of age ranges. Table 6 presents the respondent age data in total and by state.

Demographic question five sought to determine the employment level of faculty respondents. The majority of respondents (94.4%) (n = 118) indicated full-time employment of at least 40 hours per week. Thirty-six percent (n = 45) of respondents indicated that they have been employed by Extension from 1-5 years. Figure 3 provides a graphical representation of respondents’ time in Extension.
Table 6: SoCQ Survey Respondents by Age and State

<table>
<thead>
<tr>
<th>Age</th>
<th>Total</th>
<th>Montana</th>
<th>Wyoming</th>
<th>Colorado</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
<td>Count</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>Percent</td>
<td>Percent</td>
<td>Percent</td>
</tr>
<tr>
<td>21 to 25 years old</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1.6%</td>
<td>1.7%</td>
<td>3.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>26 to 35 years old</td>
<td>34</td>
<td>16</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>27.0%</td>
<td>27.1%</td>
<td>45.2%</td>
<td>11.1%</td>
</tr>
<tr>
<td>36 to 45 years old</td>
<td>26</td>
<td>12</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>20.6%</td>
<td>20.3%</td>
<td>19.4%</td>
<td>22.2%</td>
</tr>
<tr>
<td>46 to 50 years old</td>
<td>17</td>
<td>12</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>13.5%</td>
<td>20.3%</td>
<td>3.2%</td>
<td>11.1%</td>
</tr>
<tr>
<td>51 to 55 years old</td>
<td>15</td>
<td>8</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>11.9%</td>
<td>13.6%</td>
<td>3.2%</td>
<td>16.7%</td>
</tr>
<tr>
<td>56 to 60 years old</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>12.7%</td>
<td>8.5%</td>
<td>12.9%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Over 61 years old</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>12.7%</td>
<td>8.5%</td>
<td>12.9%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>59</td>
<td>31</td>
<td>36</td>
</tr>
</tbody>
</table>

Figure 3: Respondent Years in Extension

*Years in Extension*
While CO respondents indicated a slightly different profile, all states showed a predominance of respondents in the early stages (up to 10 years of experience) of their Extension careers.

The majority of respondents (80.2%) (n = 101) indicated that they had been in their current position in Extension from less than 1 to 15 years (5.6% (n = 7) less than 1 year, 43.7% (n=55) from 1-5 years and 31% (n=39) from 6-15 years). This information is illustrated in

Figure 44, where the respondents from CO indicate a slightly longer tenure in positions, but a predominance of faculty in their positions less than 15 years can again be seen.

Figure 4: Years in Current Extension Position

<table>
<thead>
<tr>
<th>Years in Position</th>
<th># of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td></td>
</tr>
<tr>
<td>1-5 years</td>
<td></td>
</tr>
<tr>
<td>6-15 years</td>
<td></td>
</tr>
<tr>
<td>16-25 years</td>
<td></td>
</tr>
<tr>
<td>Over 25 years</td>
<td></td>
</tr>
</tbody>
</table>

Colorado  Montana  Wyoming
The research also sought to assess the type of position appointment of the respondents. Respondents were grouped into categories of Ag & Natural Resources, 4-H, Family and Consumer Sciences, Community and Economic Development, and Mixed Appointment, based on the percent of actual time worked in each responsibility type.

Table 7 shows that by this classification, 29.4% (n = 37) of respondents were agriculture and natural resource faculty, 26.2% (n = 33) mixed appointment, 23.8% (n=30) 4-H, and FCS and CDED were 10.3% (n=13) respectively.

Table 7: SoCQ Survey Respondents by Position Type

<table>
<thead>
<tr>
<th>State</th>
<th>Response Count</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Natural Resources</td>
<td>37</td>
<td>29.4%</td>
</tr>
<tr>
<td>4-H (Youth Development)</td>
<td>30</td>
<td>23.8%</td>
</tr>
<tr>
<td>Family and Consumer Sciences (FCS)</td>
<td>13</td>
<td>10.3%</td>
</tr>
<tr>
<td>Community and Economic Development</td>
<td>13</td>
<td>10.3%</td>
</tr>
<tr>
<td>Mixed Appointment</td>
<td>33</td>
<td>26.2%</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td></td>
</tr>
</tbody>
</table>

Response and Non-Response Analysis

A non-responder survey of 7.9% (n=10) of the sample size was conducted to compare demographic data and Stage of Concern mean scores of responders and non-responders to the survey. Non-responder surveys were conducted via telephone and
addressed total of 7 demographic questions and 5 randomly-selected SoCQ questions. Non-responders were also asked to identify the primary reason they did not respond to the survey. Seventy percent of non-responders (n=7) indicated they did not complete the survey because they did not feel it pertained to them, and 30% (n=3) indicated they were too busy to respond. Non-responder demographic responses were compared to those of responders in the categories of age, FTE, state of employment, time in Extension, and prior employment using independent \( t \)-test analysis. No significant results were found when comparing all non-responders to responders nor when comparing non-responders between states. Also important to note was that no differences were found between non-responders in CO and the other states, which was a concern given low response rates from CO. Independent \( t \)-test analysis was used to compare SoCQ scores on 5 randomly selected questions for responders and non-responders. There was no significant difference in the mean scores for each of the questions analyzed. The statistical analysis results were presented in Table 8.

Data were analyzed to determine whether differences existed between early responders and late responders to the survey request. Early responders were defined as those who completed the survey instrument prior to the reminder notice (in MT and CO between September 20, 2011 and October 10, 2011 and in WY between October 2, 2011 and October 20, 2011). As is typical of electronic surveys, the majority of responders were early responders (Shannon, 2010), with 75.4% (n=95) responding prior to the reminder date. Independent \( t \)-test statistical analysis was conducted to compare the
Stages of Concern mean scores for early and late responders on three randomly selected SoCQ questions.

Table 8: Comparisons of Responders and Non-Responders on Randomly Selected SoCQ Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Type</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Error</th>
<th>t</th>
<th>Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOCQ1</td>
<td>Responder</td>
<td>3.65</td>
<td>1.78</td>
<td>0.16</td>
<td>-1.82</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Non-Responder</td>
<td>4.70</td>
<td>1.34</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCQ3</td>
<td>Responder</td>
<td>5.21</td>
<td>1.88</td>
<td>0.17</td>
<td>-0.98</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Non-Responder</td>
<td>5.80</td>
<td>1.14</td>
<td>0.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCQ5</td>
<td>Responder</td>
<td>3.12</td>
<td>1.97</td>
<td>0.18</td>
<td>-1.21</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Non-Responder</td>
<td>3.90</td>
<td>1.85</td>
<td>0.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCQ19</td>
<td>Responder</td>
<td>3.90</td>
<td>1.99</td>
<td>0.18</td>
<td>-0.91</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Non-Responder</td>
<td>4.50</td>
<td>2.32</td>
<td>0.73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCQ23</td>
<td>Responder</td>
<td>4.25</td>
<td>1.93</td>
<td>0.17</td>
<td>0.87</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Non-Responder</td>
<td>3.70</td>
<td>2.11</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was no significant difference in the scores for early and late responders (Q1 - Early Responders, X = 4.42, Std. Dev. = 1.784, Late Responders, X = 4.90, Std. Dev. = 1.66, t = -1.328, p (two-tailed) = .186), (Q2 - Early Responders, X = 3.73, Std. Dev. = 1.97, Late Responders, X = 4.42, Std. Dev. = 1.99, t = -1.695, p (two-tailed) = .093), Q3 - Early Responders, X = 3.01, Std. Dev. = 1.99, Late Responders, X = 3.23, Std. Dev. = 1.93, t = -0.527, p (two-tailed) = .599).
Data Analysis of SoCQ Constructs

The data from each the SoCQ constructs were analyzed for outliers, skewness, kurtosis and normality of the distribution. To determine whether extreme scores were heavily influencing the mean, a 5% Trimmed Mean was calculated. In SPSS, this calculation removes the top and bottom 5% of the cases and recalculates a new mean value (Pallant, 2007). If the mean and trimmed mean values are very different, data sets or outliers at either end of the distribution may be influencing the mean (Pallant, 2007). As presented in Table 9, the mean value and 5% Trimmed Mean value were compared to determine whether extreme scores had strong influence on the mean. Comparison of the mean to trimmed mean values showed that the greatest difference between values was seen in Stage 0, where a difference of .26 was found. While there is not a specific difference between 5% Trimmed mean and mean that determines significance, a difference of .26 is not “very different” from the mean value (Pallant, 2007). In addition, the standard deviations of the scores at each stage were consistent with one another, again indicating that extreme outliers were not influencing the distribution at each stage.

The Komogorov-Smirnov test for normality did indicate possible violations of the assumptions of normality of the distribution at Stage 0 and Stage 1. Analysis of Histograms, Normal Q-Q Plots, Detrended Normal Q-Q Plots, and Boxplots revealed that Stage 0 was slightly negatively skewed (-0.38), indicating results clustered to the right at the higher value of scores. The histogram and Normal Q-Q plot of this data, presented in Figure 5, illustrate that although negatively skewed, no extreme outliers exist.
Table 9: SoCQ Descriptive Statistics, Skewness, Kurtosis, and Normality

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Stage 0</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
<th>Stage 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.12</td>
<td>19.71</td>
<td>17.48</td>
<td>15.62</td>
<td>18.46</td>
<td>17.94</td>
<td>13.45</td>
</tr>
<tr>
<td>5% Trimmed Mean</td>
<td>22.38</td>
<td>19.87</td>
<td>17.60</td>
<td>15.43</td>
<td>18.48</td>
<td>17.98</td>
<td>13.29</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>7.33</td>
<td>6.28</td>
<td>7.44</td>
<td>7.25</td>
<td>6.26</td>
<td>7.93</td>
<td>6.85</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.38</td>
<td>-0.33</td>
<td>-0.25</td>
<td>0.30</td>
<td>-0.01</td>
<td>-0.12</td>
<td>0.25</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.29</td>
<td>-0.19</td>
<td>-0.26</td>
<td>-0.34</td>
<td>0.18</td>
<td>-0.40</td>
<td>0.06</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Significance</td>
<td>.04*</td>
<td>.01*</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.18</td>
</tr>
</tbody>
</table>

* Indicates non-normal distribution

Similar analysis for Stage 1 was conducted given the Komogorov-Smirnov test for normality result of .01. The difference between mean and trimmed mean was .16. The standard was 6.28. The differences in trimmed mean and mean and standard deviation indicate that the data were not unduly influenced by outliers. Histogram and Normal Q-Q Plots provided in Figure 5 illustrated a slightly negatively skewed distribution.

Box Plot analysis did indicate an outlier on the lower end of the distribution as can be seen in Figure 6.
Figure 5: Histogram and Normal Q-Q Plot of Distributions SoCQ Stage 0

Figure 6: Histogram and Normal Q-Q Plot of SoCQ Distributions Stage 1
This respondent was not an outlier on the other stages of the survey. To determine the influence of this outlier, the data were re-evaluated after removing the outlier. No change in the significance of the Komogorv-Smirnov test resulted from removal of the one identified outlier. It was determined that the outlier on this concern would not be removed from the data as the respondent did not unduly influence the Stage 1 normality tests and was not an outlier elsewhere in the data.

In Stage 6, two outliers were identified in the Box Plot analysis (see Figure 8). These respondents were not outliers in other constructs and did not overly influence normality or deviation when data were tested after removing these respondents. Therefore, it was determined that they would not be removed from the data set.
The Komogorov-Smirnov test did indicate non-normal distributions on Stages 0 and 1. According to Pallant, the distribution of these scores could be considered reasonably normal. A significant result is one over .05, where a very significant result might be .000. Stage 0 (.043) is only slightly non-normal. Stage 1 is .01, but this does not necessarily indicate a problem with the scale, more the underlying nature of the construct being measured as “many scales and measures used in the social sciences have scores that are skewed, positively or negatively” (Pallant, 2007, p. 62). This is especially true of social science scales where emotions or concerns are being measured (p. 62). For statistical analysis, parametric techniques assume that the distribution is normal, “most of the techniques are reasonably robust or tolerant of this assumption” especially if sample sizes are greater than 30 (p. 204). To additionally ensure the homogeneity of variance,
Levene’s test for equality of variance was utilized as part of the analysis of variance and t-test analyses.

All of the remaining stages were evaluated for normality and outliers. As reported previously in The Komogorov-Smirnov test for normality did indicate possible violations of the assumptions of normality of the distribution at Stage 0 and Stage 1. Analysis of Histograms, Normal Q-Q Plots, Detrended Normal Q-Q Plots, and Boxplots revealed that Stage 0 was slightly negatively skewed (-0.38), indicating results clustered to the right at the higher value of scores. The histogram and Normal Q-Q plot of this data, presented in Figure 5, illustrate that although negatively skewed, no extreme outliers exist.

Table 9, no significant outliers were found in the remaining stages and Komogorov-Smirnov tests were not significant for the remaining stages, indicating normal distributions.

The constructs were also tested for internal reliability. According to George Hall, and Stiegelbauer, the reliability of the SoCQ instrument has strong correlations of internal consistency ranging from .64 to .83 (George, 2006). In this study, the Cronbach’s alpha coefficient was .78. Values above .7 are considered acceptable reliability (Urdan, 2010, p. 178).

**Data Analysis of the Research Objectives**

As described in Chapter 3, each research objective was addressed using Microsoft Excel for SoCQ profiling and SPSS for data analysis.
Research Objective 1  
Present Level of Engagement

*Measure the present level of field faculty engagement in renewable energy education in MT, WY, and CO.*

The analysis for this question was derived from data collected in Question 10 of the demographic survey: *How many hours do you currently spend on energy education on an annual basis (in the categories of oil and natural gas issues, renewable energy issues, home energy issues, and agricultural energy issues)?* The purpose of the analysis was to establish a) the present level of involvement of faculty in renewable energy education and b) to determine whether the concerns of faculty were associated with their present level of involvement in teaching energy issues. Analysis procedures for this research objective were as follows: The researcher used SPSS to analyze data related to current involvement in energy education. Field faculty responses to the number of hours spent in energy education each year (Question 10 of the demographic survey) were tabulated. A mean value for hours per year in energy education was calculated. Faculty responses were then divided into coded values of 0-20 hours, 21-39 hours, 40-50 hours, and over 100 hours per annum of energy work. The mean values were then utilized to develop faculty SoCQ profiles for each group. SPSS was used to analyze the data and to conduct ANOVA and post hoc *t*-test analysis of the groups by stage of concern. Descriptive statistics of the data are presented in Table 10.
Table 10: Descriptive Statistics of Present Engagement in Energy Education

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Sum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>120</td>
<td>810</td>
<td>6.43</td>
<td>17.13</td>
</tr>
<tr>
<td>Renewable</td>
<td>1520</td>
<td>3739</td>
<td>29.67</td>
<td>141.04</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Energy</td>
<td>1200</td>
<td>3161</td>
<td>25.09</td>
<td>110.16</td>
</tr>
<tr>
<td>Ag Energy</td>
<td>120</td>
<td>1535</td>
<td>12.18</td>
<td>18.93</td>
</tr>
</tbody>
</table>

The data indicated faculty involvement varied significantly. In each category, faculty indicated low mean annual hours of engagement, however, the range and standard deviation results were more indicative. For example, in renewable energy where faculty reported the highest total number of hours of engagement per annum (3739), the resulting mean value of 29.67 with a range of 1520 hours and a standard deviation of 141.04 hours indicated that involvement is inconsistent.

To further evaluate the data, the responses were divided into groups according to total hours in energy education. The groups (0-20 hours, 21-39 hours, 40-50 hours, and over 100 hours) were used to assess engagement. The analysis found that by this classification, 102 faculty members were involved 0-20 hours per annum, 14 from 21-39 hours per annum, 6 from 40-50 hours, and 4 over 100 hours.

Figure 9 provides a graphical presentation of the data.
To further investigate this data, the researcher considered the frequency distributions in each category where respondents indicated no (0) hours of involvement in energy education. In Oil and Gas Issues, 69% (n = 87) of respondents indicated no hours per year of energy education. Similarly, no hours of involvement were reported by 42.1% (n = 53) in Renewable Energy, 42.9% (n = 54) in Home Energy, and 49.2% (n = 62) in Ag Energy.

Using mean values, 92% (n = 116) of respondents indicated less than 40 hours per annum in any category of energy education. When asked about their employment status, 94.4% (n = 118) of respondents indicated full employment or 1 FTE. One full-time-equivalent (FTE) is typically defined at 2080 hours per year. A dedication of 39 hours or less in energy education represented less than 2% of available hours spent in
energy by approximately 92% of Extension faculty. This finding indicated that the majority of Extension faculty were not engaged in energy education at a meaningful level.

The data were further analyzed to determine whether the four faculty members who indicated over 100 hours per annum in energy-related programming should be considered outliers. While their hours spent in energy education clearly differed from the mean (n = 18.32), their responses to the SoCQ instrument were consistent with the larger sample. The mean responses of these individuals were further analyzed using SPSS to verify that their responses were not outliers in any other questions. A SoCQ profile was generated to determine whether differences in concern existed between the subgroups of involvement in energy education. Figure 10 illustrates that, despite involvement in energy education, the profiles of concerns were consistent across groups, with only the Stage 1 Concern (Informational) showing differences between those with minimal to no involvement and those with over 100 hours per year.

As the respondents who indicated over 100 hours per year in energy education involvement did not appear to vary from the other subgroups in the concern profiles, it was determined that they should not be excluded from the analysis as outliers. Analysis of the profile will be discussed in subsequent research objectives.
ANOVA analysis (including a Levene’s test) was conducted to determine whether there were statistically significant differences between groups. A null hypothesis was assumed: There is no statistically significant difference (at an $\alpha$ of .007 with the Bonferroni adjustment) in concerns of Extension educators between groups based on present levels of engagement in energy education. The results of that analysis are presented in Table 11.

There were no statistically significant differences in Stages of Concern between groups based on present level of engagement in energy education.
Table 11: ANOVA Analysis of Respondents by Hours Spent in Energy Education

<table>
<thead>
<tr>
<th></th>
<th>Levene Statistic</th>
<th>ANOVA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Sig</td>
<td>F-Stat</td>
</tr>
<tr>
<td>Stage 0</td>
<td>0.24</td>
<td>0.87</td>
<td>0.24</td>
</tr>
<tr>
<td>Stage 1</td>
<td>1.59</td>
<td>0.20</td>
<td>1.51</td>
</tr>
<tr>
<td>Stage 2</td>
<td>0.95</td>
<td>0.42</td>
<td>0.27</td>
</tr>
<tr>
<td>Stage 3</td>
<td>0.27</td>
<td>0.84</td>
<td>0.38</td>
</tr>
<tr>
<td>Stage 4</td>
<td>0.86</td>
<td>0.47</td>
<td>0.24</td>
</tr>
<tr>
<td>Stage 5</td>
<td>0.05</td>
<td>0.98</td>
<td>0.46</td>
</tr>
<tr>
<td>Stage 6</td>
<td>0.97</td>
<td>0.41</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Research Objective 2
Concerns of Educators by State

Describe concerns (as defined by the Concerns-Based Adoption Model) of Extension educators in MT, WY, and CO regarding renewable energy education.

Analysis procedures used in addressing the research objective are as follows: The researcher used Microsoft Excel to calculate raw scores and relative intensity profiles for the entire sample. This was accomplished using Excel formulas provided as part of the Measuring Implementation in Schools SoCQ manual. The formulas were analyzed to ensure accuracy. High Stage and Second High Stage Scores analysis were used to assist in the data interpretation. High Stage and Second High Stage Scores were recommended as part of the analysis of SoCQ (George, 2006). The SoCQ profile, High Stage, and Second High Stage analysis were also conducted on responses for each state. SPSS was
utilized to further analyze the data using ANOVA and post-hoc t-test analysis to determine whether levels of concern were statistically different between states.

A total of 126 responses of the faculty were analyzed together to address Research Objective #2. The means and raw stage scores of the responses were used to plot a composite Stages of Concerns profile for the sample. This profile, presented in Figure 11, depicts the characteristics of a typical “nonuser SoCQ profile” (George, 2006).

**Figure 11: Stages of Concern Profile (All Respondents)**

“Non-user” profiles represent individuals (or groups) who have not engaged with nor adopted an innovation, in this case “renewable energy programming” (highest concern score is Stage 0). There are three distinct types of non-use defined by Hall and Hord (2011) a) nonuse b)orientation and c) preparation. These will be examined further in
Chapter 5, but the behavioral distinctions between the groups emerged in assessment of the other Stages of Concern (Hall G. E., 2011).

Interpretations of Extension field faculty profiles were derived from the instrument administration guidelines and the Stages of Concern Theoretical Framework (George, 2006). A very high Stage 0 concern was identified in the profile of all respondents. High Stage 0 indicated that respondents were not concerned about the innovation (in this case, renewable energy programming). Stage 0 does not provide an indication whether respondents were users or nonusers of an innovation, but instead indicated the degree of priority that the respondents place on the innovation. The higher the Stage 0 Score, the more respondents indicated that there were other priorities above renewable energy programming.

The profile in Figure 1 also showed a high relative intensity of Stage 1 concern, which indicated the level of interest in learning more about renewable energy programming. Stage 1 did not measure the level of understanding or knowledge that faculty had, but rather indicated whether they wanted to know more. A low Stage 1 score would indicate that respondents felt they knew enough about the innovation, but in this profile, respondents indicated a need for more information about renewable energy programming.

Figure 11 also showed a high relative intensity of Stage 2 (Personal) concern that was within 3% of Stage 3 (Management) concern. Stage 2 indicated the level of personal concern respondents had with regard to consequences about the innovation for them as individuals. High Stage 2 concerns reflected unease about the innovation (though did not
necessarily indicate resistance). Stage 3 concerns were those related to logistics, time, and management (p 53). The SoCQ scoring guide suggested that a difference of only 1 or 2 percentage points between scores should be considered essentially a tie (p. 32) for the person’s level of intensity related to a concern. While a 3-point spread was not considered a tie, this profile does show a very close level of concern between Stage 2 and Stage 3.

Stages 4-6 indicated low levels of concern. Respondents indicated a low level of concern at Stage 4 (Consequence). This low level of concern indicated that faculty had minimal concerns about the effects of renewable energy programming on constituents. The slight tick upward at Stage 5 (Collaboration) indicated some (although low) level of interest or concern with regard to collaborating with others. Higher Stage 5 scores could have indicated some level of interest with regard to what others were doing in terms of renewable energy programming. It was significant that the profile tailed down at Stage 6. A high Stage 6 in a non-user profile indicated that respondents had strong ideas about how an innovation should be accomplished and tended to indicate negative responses to an innovation (p 54). This profile did not indicate an upward tick in Stage 6 and therefore, did not indicate that tendency.

The SoCQ profile was the most frequently used method for interpreting data from the questionnaire. However, first and second high stage score analysis were also recommended. High score and second high score relative frequency analysis yielded information on relationships or patterns of concern. The analysis may also indicate subgroups within a data set with a profile different from the aggregate profile. First and
second high stage relative frequency analysis is calculated from the raw scores (not percentile scores) of the SoCQ data analysis, which helps to further reduce the influence of extreme values that might be obscured in averaging and rounding.

A summary of the High Stage Score and Second High Stage Score analysis for all respondents is provided in Figure 12 and Figure 13. These charts illustrated the high stage score of the overall sample was Stage 0 Concern, with Stage 1 as the second high stage score.

George (2006), the author of the analysis guidelines established for use of the SoCQ instrument, cautioned that a particularly high Stage 0 concern relative to other scores may have indicated that the other scores have little significance (p 53). Because of the developmental nature of concerns, the second high stage score will often be adjacent
to the next highest score (p 34) (a profile with a high Stage 1 score might show a second high Stage 2 score). Grouping of high and second high stage scores will typically occur in Stages 0-3 (which relate to the innovations impact on self and performing tasks) in Stages 4-6 (which relate to impact and collaboration in teaching).

**Figure 13: Second High Stage Score (Total Respondents)**

- The overall SoCQ profile in Figure does show a high Stage 0 concern, followed by a second high Stage 1 score. This indicated that users were not sure what renewable energy programming in Extension entailed and also indicated interest in knowing more about programming in this area. As summarized by the SoCQ analysis guidelines, “The overall profile reflects the interested, not terribly over-concerned, positively disposed nonuser” (p. 39). Respondents were not intensely concerned about consequences of renewable energy programming on constituents or on collaborating with others.
Further analysis of educator concerns in MT, WY, and CO was conducted by dividing the respondents into subgroups by state. Stages of Concern were calculated for each group. A graphical comparison of the groups is provided in Figure 14. As depicted, the three groups were very similar and were representative of “nonuser” profiles. Respondents from Montana indicated a slightly higher concern in Stage 1 (Informational) and Stage 2 (Personal) than did respondents from CO and WY. In CO, respondents indicated only 3% difference between Stage 2 (Personal) and Stage 3 (Management Concerns). In WY, this difference was only 1%, which can be considered a tie for the level of concern (George, 2006).

Figure 14: SoCQ Profiles by State

To ascertain whether unique subgroups existed within the state-to-state comparisons profile, high and second high stage data analysis was conducted. Summary graphs of that analysis are provide in Figure 15 and Figure 16.
High and second high stage score analysis by state again revealed that the majority of respondents were positively disposed nonusers, with concerns concentrated at Stage 0-1.
However, WY respondents did indicate a higher level of concern than the other states in Stages 4-5, which were stages reflecting a concern for impact on constituents and collaboration with other educators.

Analysis of the SoCQ profile and High Stage and Second High Stage Scores provided insight into educator concerns. Statistical analysis was also conducted to compare mean values of educators in each concern construct by state and to determine whether difference in mean levels of concern are statistically different. The results were as follows:

In conducting the statistical analysis, a null hypothesis was assumed: There is no statistically significant difference (at a Bonferroni adjusted $\alpha$ of .007) in concerns of Extension educators between the states. ANOVA analysis was utilized to compare mean values both between the states and within the states. In this analysis, the ANOVA calculations indicated whether there were significant differences in the state of employment (CO, MT, and WY) and the mean level of educator concerns at each stage of the SoCQ analysis. Descriptive statistics and ANOVA analyses were conducted for each stage of SoCQ concern. The results are presented in Table 12.

The Levene’s Test for homogeneity of variance confirms that the assumption of homogeneity between groups was not violated in this analysis (Leven’s significance less than .05) The analysis produced a statistically significant result at $\alpha$ of .05 for variables Stage 1 (Informational) ($F = 7.67, \rho = .000$) and Stage 2 (Personal) ($F = 5.09, \rho = .01$). Therefore, the null hypothesis (indicating no difference between the concerns by the state
of employment) was rejected for Stage 1 and Stage 2 SoCQ Concerns. The null hypothesis was accepted for the remaining stages.

Table 12: Descriptive Statistics & ANOVA Analysis of Responses by Concern Stage & State

<table>
<thead>
<tr>
<th>Concern</th>
<th>Levene Test Statistic</th>
<th>Levene Test Sig</th>
<th>Montana Mean</th>
<th>Montana Std. Dev.</th>
<th>Wyoming Mean</th>
<th>Wyoming Std. Dev.</th>
<th>Colorado Mean</th>
<th>Colorado Std. Dev.</th>
<th>ANOVA F Stat</th>
<th>ANOVA Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0 (Awareness)</td>
<td>2.00</td>
<td>0.14</td>
<td>22.81</td>
<td>7.22</td>
<td>21.71</td>
<td>8.34</td>
<td>21.33</td>
<td>6.63</td>
<td>0.52</td>
<td>0.60</td>
</tr>
<tr>
<td>Stage 1 (Informational)</td>
<td>0.33</td>
<td>0.72</td>
<td>21.85</td>
<td>5.97</td>
<td>17.00</td>
<td>5.60</td>
<td>18.53</td>
<td>6.28</td>
<td>7.67</td>
<td>0.00</td>
</tr>
<tr>
<td>Stage 2 (Personal)</td>
<td>0.89</td>
<td>0.42</td>
<td>19.42</td>
<td>6.79</td>
<td>14.39</td>
<td>7.14</td>
<td>16.97</td>
<td>7.91</td>
<td>5.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Stage 3 (Management)</td>
<td>1.59</td>
<td>0.21</td>
<td>16.10</td>
<td>6.81</td>
<td>14.71</td>
<td>6.59</td>
<td>15.61</td>
<td>8.50</td>
<td>0.37</td>
<td>0.69</td>
</tr>
<tr>
<td>Stage 4 (Consequence)</td>
<td>0.42</td>
<td>0.66</td>
<td>19.00</td>
<td>5.66</td>
<td>18.19</td>
<td>6.64</td>
<td>17.81</td>
<td>6.95</td>
<td>0.44</td>
<td>0.65</td>
</tr>
<tr>
<td>Stage 5 (Collaboration)</td>
<td>3.07</td>
<td>0.05</td>
<td>18.81</td>
<td>6.97</td>
<td>18.81</td>
<td>6.97</td>
<td>15.97</td>
<td>9.69</td>
<td>1.35</td>
<td>0.26</td>
</tr>
<tr>
<td>Stage 6 (Refocusing)</td>
<td>2.49</td>
<td>0.09</td>
<td>14.39</td>
<td>6.04</td>
<td>11.61</td>
<td>8.20</td>
<td>13.50</td>
<td>6.71</td>
<td>1.69</td>
<td>0.19</td>
</tr>
</tbody>
</table>

\( \alpha > .05 \)

Post hoc \( t \)-tests were conducted to further determine where statistically significant difference between the Stage 1 and Stage 2 Concerns might exist, or to determine whether all concerns by state differed from one another at a significant level. Tukey’s Honestly Significantly Different (HSD) test was utilized for the post hoc \( t \)-test. This is a fairly liberal test and is more likely to produce a statistically significant difference than other \( t \)-tests (e.g. – Scheffe) (Urdan, 2010). The following was determined from this analysis for Stage 1 (Informational) Concerns:

- The mean level of Stage 1 Concern of educators in Montana is statistically different from those of educators in Wyoming (mean difference of 4.85) (Tukey HSD test  \( p = .001 \), at  \( \alpha = .007 \)).
– The mean level of Stage 1 Concern of educators in Montana (21.85) was statistically different from those of educators in Colorado (18.52) (mean difference of 3.32) (*Tukey HSD test* $\rho = .026$, at $\alpha = .007$).

– The mean level of Stage 1 Concern of educators in Wyoming (21.71) was not statistically different from those of educators in Colorado (18.52) (*Tukey HSD test* $\rho = .551$, at $\alpha = .007$).

Post-hoc *t*-tests were also conducted for Stage 2 (Personal) Concerns. Results of that analysis are as follows:

– The mean level of Stage 2 Concern of educators in Montana was statistically different from those of educators in Wyoming (mean difference 5.04) (*Tukey HSD test* $\rho = .006$, at $\alpha = .007$).

– The mean level of Stage 2 Concern of educators in Montana was not statistically different from those of educators in Colorado (mean difference 2.45) (*Tukey HSD test* $\rho = .246$, at $\alpha = .007$).

– The mean level of Stage 2 Concern of educators in Wyoming was not statistically different from those of educators in Colorado (mean difference 2.59) (*Tukey HSD test* $\rho = .312$, at $\alpha = .007$).

Research Objective 3
Concerns of Educators by Job Function

*Determine whether MT, WY, and CO field faculty concerns differ by the primary job function.*
Analysis procedures used to address this objective were as follows: The researcher divided the faculty into subgroups based on the responses to Question 9 of the demographic survey. In this question, respondents were asked to indicate the percentage of time they spent working in the categories of natural resources, agriculture, 4-H, family and consumer sciences, and community and economic development. This question sought to overcome differences in job classifications between states and to mitigate differences between position appointments and actual time in various job functions (For example, a position appointment may indicate a 30/30/30/10% split between various job functions, but actual time may be heavily weighted in one area.) During the data analysis, the natural resources and agriculture categories were combined. There were only five respondents who indicated time in natural resources, and all of those respondents also reported time in agriculture. The responses were then tabulated by the percentage of time spent in each area. Any respondent indicating 50% or more time spent in a subject matter area was categorized into that area. (For instance, a respondent indicating 60% of time spent in agriculture was categorized as an agriculture appointment.) No respondents reported a 50%/50% split between categories. Further, a category for “Mixed Appointment” was created to reflect those respondents who did not indicate at least 50% focus in any one area. This “Mixed” category was likely comprised respondents of single field faculty counties. This categorization of positions was done to overcome differences between types of appointments between states.

Following the creation of the subcategories, the researcher calculated a composite SoCQ profile for each subgroup. The study compared profiles for trends and differences.
The High Stage and Second High Stage Score for each subgroup was calculated and comparative analysis was conducted. Using SPSS, a series of ANOVA analyses was conducted to identify any significant differences between groups.

Using the grouping described, 37 respondents (29.4%) were Ag and Natural Resource positions, 30 (23.8%) 4-H, 13 (10.3%) FCS, 13 (10.3%) CD/ED, and 33 (26.2%) were mixed appointments.

A SoCQ profile of the groups was developed and is presented in Figure 17.

Figure 17: SoCQ Profile for Educators by Position Type

No statistically significant differences in levels of concern were identified as all position types were profiled as non-users. Respondents classified in a primary position type of 4-H showed two interesting characteristics. First, the respondents indicated a tie score for Stage 1 (69%), Stage 2 (70%), and Stage 3 (69%) concerns per the SoCQ
scoring manual where a difference of less than 2 was considered a tie. This response indicated that 4-H faculty have equal levels of concern in the need for information, concerns about implications for self (time and energy required, expectations for changes in teaching, etc.) and concerns about management (time allocation, ability to manage all responsibilities, coordination of tasks and people). Also interesting in the 4-H profile was the uptick at Stage 6. While it is important to remember that a high Stage 0 score does overwhelm other responses, an uptick at Stage 6 is an indication of a resistance to the innovation (George, 2006, p. 42). All other groups profiled as positively disposed non-users.

High Stage and Second High Stage score analyses were also conducted. In Figure 18, the relative frequency of Stage 0 concern was again indicated. Community and economic development (CD/ED) faculty did indicate an equal relative frequency of Stage 0 (Awareness) concern and Stage 5 (Collaborative) concern. This scoring pattern suggested that CD/ED faculty were not aware of the innovation, but desired to know what others are doing in this subject. High early adopter scores (0-1) with a high Stage 5 score may have also indicated that faculty did not desire to lead an innovation, but were open to collaborating with others to implement. This was more typical of a high Stage 1 and high Stage 5 score, but may also apply for these faculty.

Second High Stage Score analysis for most position types showed a grouping of high Stage 0 and Stage 1 concerns. Both 4-H and FCS faculty showed high (compared to other groups) relative frequencies in Stage 4 as their second high stage. Stage 4 concerns were those related to implications for learners. Because Stage 0 scores were very high,
caution must be exercised in reviewing information on other stages. The Second High Stage Score data was presented in Figure 19.

Figure 18: High Stage Score by Position Type

Figure 19: Second High Stage Score by Position Type
The SoCQ instrument was a valid, reliable tool and the profiles were sensitive enough to indicate the presence of concern differences between user groups. However, to verify that there were no statistically significant differences in mean levels of concern for each construct between these groups, statistical analyses (ANOVA) were conducted.

Based on the SoCQ profile, a null hypothesis was assumed: There was no statistically significant difference (at a Bonferroni adjusted $\alpha$ of .007) in concerns of Extension educators between position types. Descriptive statistics and single factor ANOVA analyses were conducted for each stage of SoCQ concern. There results were summarized in Table 13.

Levene’s Test for homogeneity of variance results indicated assumptions of homogeneity for this data set were above .05, and therefore were not violated. The ANOVA analysis yielded no significant differences in the mean level of concerns between position types, thus confirming the null hypothesis.
Table 13: ANOVA Analysis of Respondents by Position Type

<table>
<thead>
<tr>
<th>Concern</th>
<th>Levene's Test Statistic</th>
<th>Agriculture Mean</th>
<th>Agriculture Std. Dev.</th>
<th>4-H Mean</th>
<th>4-H Std. Dev.</th>
<th>FCS Mean</th>
<th>FCS Std. Dev.</th>
<th>CDED Mean</th>
<th>CDED Std. Dev.</th>
<th>Mixed Mean</th>
<th>Mixed Std. Dev.</th>
<th>ANOVA F Stat</th>
<th>ANOVA Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0 (Awareness)</td>
<td>.29</td>
<td>.885</td>
<td>21.97</td>
<td>7.34</td>
<td>24.17</td>
<td>6.36</td>
<td>19.92</td>
<td>7.41</td>
<td>19.77</td>
<td>8.48</td>
<td>22.21</td>
<td>7.52</td>
<td>1.23</td>
</tr>
<tr>
<td>Stage 1 (Informational)</td>
<td>.44</td>
<td>.776</td>
<td>19.57</td>
<td>6.50</td>
<td>19.43</td>
<td>6.92</td>
<td>17.54</td>
<td>5.36</td>
<td>22.00</td>
<td>5.37</td>
<td>20.09</td>
<td>6.03</td>
<td>0.87</td>
</tr>
<tr>
<td>Stage 2 (Personal)</td>
<td>.34</td>
<td>.847</td>
<td>17.81</td>
<td>7.33</td>
<td>18.87</td>
<td>8.04</td>
<td>15.85</td>
<td>6.66</td>
<td>18.85</td>
<td>6.18</td>
<td>15.97</td>
<td>7.76</td>
<td>0.88</td>
</tr>
<tr>
<td>Stage 3 (Management)</td>
<td>.58</td>
<td>.679</td>
<td>14.81</td>
<td>7.74</td>
<td>17.50</td>
<td>6.89</td>
<td>13.23</td>
<td>7.72</td>
<td>16.69</td>
<td>8.45</td>
<td>15.33</td>
<td>6.22</td>
<td>1.06</td>
</tr>
<tr>
<td>Stage 4 (Consequence)</td>
<td>.62</td>
<td>.646</td>
<td>18.62</td>
<td>6.39</td>
<td>19.07</td>
<td>7.01</td>
<td>16.62</td>
<td>5.72</td>
<td>20.62</td>
<td>6.78</td>
<td>17.61</td>
<td>5.37</td>
<td>0.89</td>
</tr>
<tr>
<td>Stage 5 (Collaboration)</td>
<td>.68</td>
<td>.606</td>
<td>18.73</td>
<td>8.45</td>
<td>16.70</td>
<td>8.55</td>
<td>15.38</td>
<td>6.80</td>
<td>20.85</td>
<td>7.38</td>
<td>18.06</td>
<td>7.27</td>
<td>1.05</td>
</tr>
<tr>
<td>Stage 6 (Refocusing)</td>
<td>.62</td>
<td>.649</td>
<td>13.57</td>
<td>7.07</td>
<td>14.43</td>
<td>7.23</td>
<td>10.23</td>
<td>5.37</td>
<td>13.08</td>
<td>7.37</td>
<td>13.85</td>
<td>6.56</td>
<td>0.91</td>
</tr>
</tbody>
</table>
Research Objective 4  
Concerns of Educators by Subgroups

*Identify CBAM (Concerns-Based Adoption Model) concerns of subgroups of MT, WY, and CO Extension faculty that may influence program involvement with renewable energy education, based on standardized user profiles generated from the SoCQ (Stages of Concern Questionnaire).*

Data analysis procedures for this objective were as follows: The researcher divided the faculty into subgroups based on the responses to the demographic survey. Subgroups were determined by years in Extension, age of faculty member, and work history. Following the creation of the subgroups, the researcher calculated a composite SoCQ profile for each subgroup. The study compared profiles for trends and differences. The High Stage and Second High Stage Score for each subgroup was calculated and comparative analysis was conducted. Next, a series of ANOVA analyses were conducted to identify any significant differences between groups. When statistical significance existed, post hoc *t*-tests were conducted to determine where the statistical differences might exist.

**Subgroup A: Time in Extension:** In this analysis, respondents were divided into subgroups based on years of employment with Extension. Years of employment categories were listed on the survey instrument (less than 1 year, 1-5 years, 6-10 years, 11-15 years, 16-20 years and over 20 years). An SoCQ profile for the subgroups is presented in Figure 20.
Consistent with the overall profile, the subgroups profile as non-users. However, a few interesting elements emerged in the analysis by time in Extension. First, respondents in Extension from 6-10 years indicated a higher Stage 3 (Management) concern than other groups, especially when compared to those in the 16-20 year group. Also, the over 20 years group indicated a slight uptick at Stage 6, which may have indicated a resistance to the innovation.

To further analyze the data, High Stage and Second High Stage scores were calculated for each of the subgroups. Figure 21.

Figure 21 presents the High Stage Score analysis.
High and second high stage score analyses were recommended to identify unique subgroups with the SoCQ profiles. In this analysis, Stage 0 concern was the primary High Stage Score. Those employed by Extension less than 1 year did indicate a predominate Stage 0 concern, but were relatively lower in the Stage 0 concern and relatively higher Stage 4 (Consequence) concern than other groups. Those employed from 1-5 years were also relatively lower in Stage 0 concern.

Second High Stage concern analysis, presented in Figure 22, showed those employed less than 1 year had a relatively higher Stage 0 score in the second high stage. Stage 1 concern showed high relative intensity for all groups, where alignment between adjacent constructs was expected. There were relatively strong Second High Stage
concerns at Stage 4 for those employed from 1-5 years, and relatively strong Stage 5 concerns for those employed from 11-15 years. However, caution must be exercised in interpreting these scores given the very high Stage 0 concern for each group.

Figure 22: Second High Stage Score by Time in Extension

ANOVA statistics were used to analyze the subgroups. Based on the SoCQ profile, a null hypothesis was assumed: There was no statistically significant difference (at a $\alpha$ of .05) in concerns of Extension educators between subgroups based on time in Extension. Descriptive statistics and single factor ANOVA analyses were conducted for each stage of SoCQ concern. The results are presented in Table 14.

The Levene’s Test for homogeneity of variance confirmed that the assumption of homogeneity between groups was not violated in this analysis. The analysis produced a
statistically significant result at $\alpha$ of .05 for variables Stage 3 (Management) ($F = 2.62, \rho = .03$). Therefore, the null hypothesis (indicating no difference between the concerns by the time in Extension) was rejected for Stage 3. The null hypothesis was accepted for the remaining stages.

Table 14: ANOVA Analysis of Respondents by Time in Extension

<table>
<thead>
<tr>
<th>Stage</th>
<th>Levene Statistic</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Sig</td>
</tr>
<tr>
<td>Stage 0</td>
<td>0.69</td>
<td>0.63</td>
</tr>
<tr>
<td>Stage 1</td>
<td>0.69</td>
<td>0.63</td>
</tr>
<tr>
<td>Stage 2</td>
<td>1.44</td>
<td>0.22</td>
</tr>
<tr>
<td>Stage 3</td>
<td>2.32</td>
<td>0.05</td>
</tr>
<tr>
<td>Stage 4</td>
<td>0.91</td>
<td>0.48</td>
</tr>
<tr>
<td>Stage 5</td>
<td>0.40</td>
<td>0.85</td>
</tr>
<tr>
<td>Stage 6</td>
<td>0.49</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Post hoc $t$-tests were conducted to further determine where statistically significant differences between the Stage 3 concerns might exist between subgroups. The following was determined from this analysis for Stage 3 (Management) Concerns:

- The mean level of Stage 3 Concern of educators between those employed for 6-10 years was statistically different from those employed for 16-20 years (mean difference of 8.13) ($Tukey HSD$ test $\rho = .008$, at $\alpha = .007$)
The mean level of Stage 3 Concern of educators between all other subgroups was not statistically significant at $\alpha = .007$.

**Subgroup B: Age of Faculty Member:** Responses were analyzed by subgroups of age. The categories for age were provided in the survey instrument (21-25 years, 26-35 years, 36-45 years, 46-50 years, 51-55 years, 56-60 years, and over 60 years). A SoCQ profile comparison for the subgroups was developed and was presented in Figure 23. The non-user profile was again consistent between subgroups. Respondents 46-50 years old did show a tie score between Stage 1 (Informational) (Score 80) and Stage 2 (Personal) (Score 78). The respondents aged 21 to 25 showed higher levels of concern relative to others, most notably at Stage 1, Stage 2, and Stage 4. Those 56-60 years old indicated a slight tailing up at Stage 6, which may have indicated resistance.

High Stage Score analysis was conducted for each of the subgroups and the results are presented in Figure 24. Respondents aged 21-25 indicated a lower relative intensity of Stage 0 as their High Stage Score. They also indicated dispersed high stage scores between Stage 1, Stage 2, and Stage 4. The 46-50 and 51-55 year olds also indicated a lesser high stage score in Stage 0, relative to the other groups over 25 years old.
Figure 23: SoCQ Profiles by Age

SoCQ Profiles by Age

Relative Intensity in Percentiles

Stages of Concern

Unconcerned  Informational  Personal  Management  Consequence  Collaboration  Refocusing

- 21 to 25 years old
- 26 to 35 years old
- 36 to 45 years old
- 46 to 50 years old
- 51 to 55 years old
- 56 to 60 years old
- Over 61 years old

Figure 24: High Stage Score by Age

High Stage Score (By Age)

Relative Frequency

Stages of Concern

- 21 to 25 years old
- 26 to 35 years old
- 36 to 45 years old
- 46 to 50 years old
- 51 to 55 years old
- 56 to 60 years old
- Over 61 years old
Second High Stage Score analysis, presented in Figure 25, showed high relative frequencies at Stage 0 for the 21-25 year olds, and high Stage 1 frequencies for those 56-60 years old.

ANOVA statistics were used to analyze the subgroups. Based on the SoCQ profile, a null hypothesis was assumed: There was no statistically significant difference (at a $\alpha$ of .05) in concerns of Extension educators between subgroups based on age of the educator. Descriptive statistics and single factor ANOVA analyses were conducted for each stage of SoCQ concern. The results are presented in Table 15.
Table 15: ANOVA Analysis of Respondents by Age of Educator

<table>
<thead>
<tr>
<th>Stage</th>
<th>Levene Statistic</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Sig</td>
</tr>
<tr>
<td>Stage 0</td>
<td>.72</td>
<td>.64</td>
</tr>
<tr>
<td>Stage 1</td>
<td>1.21</td>
<td>.31</td>
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<td>Stage 2</td>
<td>.91</td>
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<td>Stage 3</td>
<td>2.10</td>
<td>.06</td>
</tr>
<tr>
<td>Stage 4</td>
<td>1.01</td>
<td>.42</td>
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<tr>
<td>Stage 5</td>
<td>.55</td>
<td>.77</td>
</tr>
<tr>
<td>Stage 6</td>
<td>.48</td>
<td>.82</td>
</tr>
</tbody>
</table>

The Levene’s Test for homogeneity of variance confirmed assumptions of homogeneity between groups were not violated in this analysis. The ANOVA analysis did not indicate a statistically significant difference between the subgroups. Therefore, the null hypothesis (indicating no difference between the concerns by age of the educator) was accepted.

Subgroup C: Work History: Respondents were asked to identify their professional background. The question sought to assess whether differences existed between faculty members who had a) only worked in Extension b) had or currently worked in agriculture c) had experience from the private sector or d) had experience from another public sector. Did, for example, faculty members hired from the private sector
view this innovation differently than those who had always been employed by Extension?

Analysis of the subgroups given professional histories was initiated using the SoCQ profile. The profile was provided in Figure 26.

Figure 26: SoCQ Profiles by Work History

All subgroups profiled as positively disposed non-users. Those with experience in agriculture did indicate a tie for level of concern between Stage 2 (Personal) (Score 70) and Stage 3 (Management) (Score 69) Concerns.

High and Second High Stage Score analyses were conducted for each of the subgroups. The results of those analyses were presented in Figures 27 and 28.
The analysis showed strong grouping between high Stage 0 and second high Stage 1 concerns. Those with prior public sector background showed slightly higher frequencies in high score analysis at Stage 5 (Collaboration).

Figure 27: High Stage Score by Work History

High Stage Score (By Work History)
ANOVA statistics were used to analyze the subgroups. Based on the SoCQ profile, a null hypothesis was assumed: There was no statistically significant difference (at a \( \alpha \) of .05) in concerns of Extension educators between subgroups based on work history. Descriptive statistics and single factor ANOVA analyses were conducted for each stage of SoCQ concern. The results were presented in Table 16.
Table 16: ANOVA Analysis of Respondents by Work History

<table>
<thead>
<tr>
<th>Stage</th>
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<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Statistic</td>
<td>F-Stat</td>
</tr>
<tr>
<td></td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Stage 0</td>
<td>.81 .49</td>
<td>.24 .87</td>
</tr>
<tr>
<td>Stage 1</td>
<td>.34 .80</td>
<td>.58 .63</td>
</tr>
<tr>
<td>Stage 2</td>
<td>.45 .72</td>
<td>.54 .66</td>
</tr>
<tr>
<td>Stage 3</td>
<td>1.87 .14</td>
<td>.89 .45</td>
</tr>
<tr>
<td>Stage 4</td>
<td>.12 .95</td>
<td>.86 .46</td>
</tr>
<tr>
<td>Stage 5</td>
<td>.53 .66</td>
<td>.56 .64</td>
</tr>
<tr>
<td>Stage 6</td>
<td>.17 .92</td>
<td>.29 .83</td>
</tr>
</tbody>
</table>

The Levene’s Test for homogeneity of variance confirmed assumption of homogeneity between groups were not violated in this analysis. The ANOVA analysis at \( \alpha \) of .05 for did not indicate a statistically significant difference between the subgroups. Therefore, the null hypothesis (indicating no difference between the concerns by work history) was accepted.
CHAPTER V - CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to determine what Extension field faculty concerns regarding renewable energy programming exist, such that appropriate intervention strategies for curriculum and professional development could be identified. This chapter will summarize the findings for each of the research objectives, in addition to generalized summation and recommendations for further research.

Representative Nature of the Sample

To verify that the sample in this research was representative of the population of Extension faculty in the respective states, the demographics of the sample were compared to a 2007 Western Extension Middle Manager’s survey. Human resource offices in MT, WY, and CO did not regularly compile or report faculty demographics and this survey was the most current reference including the three states studied in this analysis. The Middle Manager’s survey (n = 118) reported 64% (n = 76) of respondents were female and 36% (n = 41) were male, compared to the sample in this research where 57.1% (n = 72) were female and 42.9% (n = 54) were male (Managers, 2007). Distribution of age ranges was consistent with the findings of the 2007 survey (Managers, 2007). The 2007 survey found that 97% of the respondents had been employed by Extension for five years or less (Managers, 2007). This would be consistent with the data in this research, as 5 years have passed since the research was collected. Attrition rates have been low since the economic recession began in 2009. Compared to the 2007 survey, the sample in this
research was also consistent with the prior survey in terms of respondent educational attainment. In 2007, faculty reported 8% (n = 10) PhDs, 76% (n = 89) Master’s Degrees and 100% (n=118) with educational attainment of at least a Bachelor’s Degree (Managers, 2007). From the available comparison data, the demographics of faculty were consistent with the sample demographics and support the conclusion that the sample was representative of the population.

Understanding the “Nonuser”

This research involved Stages of Concern analysis for six groupings of respondents by: total composite, state, primary job function, time in Extension, age of faculty member, and prior work history. The analysis not only included SoCQ profiling, but also High Score and Second High Score evaluation of the data. In all analyses, respondents demonstrated a dominate Stage 0 score, which indicated non-users.

Research Objective #1 measured the present level of engagement. Respondents indicated very low levels of engagement in renewable energy programming, with 92% (n = 116) indicating less than 2% of available FTE hours per annum of any type of energy programming. The 3% (n = 4) of users that did indicate more than 100 hours per year of educational involvement in energy exhibited a non-user profile, suggesting that they did not identify with a larger “programming” initiative. Those users also showed a relatively high Stage 1 Score, which indicated that despite higher levels of involvement, the users had not clearly identified how “renewable energy programming” had been defined and/or applied in educational contexts. The finding that Extension faculty were non-users of
renewable energy programming was consistent with present levels of engagement as determined in Research Objective #1.

Hall and Hord (2011) noted three very distinct groups of non-users identified in SoCQ research. Understanding the distinctions between them was important as appropriate support and assistance varies by type of nonuse (Hall G. E., 2011). Table 17 lists the types of nonusers and a description of each type.

Table 17: Nonuser Types and Descriptions

<table>
<thead>
<tr>
<th>Nonuser Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonuse</td>
<td>State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.</td>
</tr>
<tr>
<td>Orientation</td>
<td>State in which the user has recently acquired or is acquiring information about the innovation and/or has explored or is exploring its value orientation and its demands upon the user and user system</td>
</tr>
<tr>
<td>Preparation</td>
<td>State in which the user is preparing for the first use of the innovation</td>
</tr>
</tbody>
</table>

(Hall G. E., 2011)

The non-user types listed in the table are typically (though not always) sequential, whereby a user moves from a state of lack of awareness (nonuse) to orientation to preparation.

In identifying appropriate interventions for Extension, the research provided several indications that faculty were at a stage of “nonuse”. Both in profiles and in High and Second High Stage Score analyses, users typically exhibited a dominate Stage 0 score, followed by a Stage 1 concern. When users become aware of an innovation and
begin to actively seek and evaluate information, the concern profile shifts – Stage 0 concerns are reduced and other stages increase in relative intensity (Hall G. E., 2011). The SoCQ Profile and subsequent analysis of all respondents showed a Stage 0 relative intensity percentile of 99% and a Stage 1 relative intensity percentile of 72%, which is a nearly textbook nonuse profile (George, 2006).

A few notable differences appeared in the nonuse profile within the subgroups. When comparing SoCQ scores by state, a statistically significant difference in Stage 1 mean value was found between Montana and Wyoming (mean difference of 4.85, Tukey HSD test $\rho = .001$ at $\alpha = .007$) and between Montana and Colorado (mean difference of 3.32, Tukey HSD test $\rho = .026$ at $\alpha = .007$). However, no statistically significant difference was found between Wyoming and Colorado. This may indicate that educators in Montana were more disposed toward an “orientation” stage of nonuse than their Wyoming and Colorado counter-parts. Stage 1 (Informational) concern indicated a general awareness about an innovation and an interest in learning more details about it. High Stage 1 concern relative to other stages indicated that a user was interested in the general characteristics of an innovation, possible effects, and requirements for use, but did not identify concerns about him/herself with regard to the innovation. It was important to remember two things about the Stage 1 findings in this research. First, although Stage 1 was the Second High stage score for most subgroups, the dominant score remained Stage 0. Second, Stage 1 concern can indicate interest, but does not necessarily indicate the effort the user is putting forth in obtaining more information. The Second High Stage 1 score may indicate curiosity and a positively disposed nature of
the user group, but does not indicate the extent to which the user has obtained and considered the information (George, 2006). The profiles in this research may have indicated only a higher level of curiosity and awareness regarding renewable energy programming by faculty in Montana. This could be supported by the fact that, while Montana users did show a slightly higher Stage 2 Concern (70%, versus 63% in Colorado and 55% in Wyoming), the overall profile is consistent with the other states. If Montana faculty had moved into an Orientation state of non-use, it could be expected that the Stage 0 score would be different than the other states and more significant differences in the other stages of concern (Stages 3-6) would have been apparent.

A second subgroup of interest in addressing the state of nonuse appeared in the analysis of High and Second High Scores by age. The relative frequency of Stage 0 as the High Stage Concern was lower for the younger demographics (21-25 and 26-35 year old groups). The 21-25 year old group was almost evenly dispersed in stage of concern between Stage 0, Stage 1, Stage 2, and Stage 4. This would suggest a perceived involvement with the innovation by this user group, however, the Second High Score of Stage 0 indicated limited awareness. It could be interpreted that this group was positively disposed to renewable energy programming, and was prepared to be in the Orientation nonuse stage, but was not aware of a defined innovation or initiative. The 26-35 year old age group showed a more dispersed concern level at the other stages in both High and Second High score analysis, which may imply this group perceived involvement with the innovation. The 56-60 year olds showed a slightly lower High Stage 0 score, but a very high Stage 1 score for their Second High stage. This group appeared to have a demand
for information that was higher than their Stage 0 score – which may imply that they perceived some level of involvement with the innovation and were moving toward an Orientation stage of non-use. However, the 56-60 age group also demonstrated a slight tailing up at Stage 6, which may have indicated resistance to the innovation.

There were three subgroups that identified possible negative disposition to “renewable energy programming”. Those subgroups were the 56-60 age group, faculty with primary responsibilities in 4-H, and those employed by Extension for more than 20 years.

A limitation of the SoCQ instrument is that, while it can identify possible negative disposition to the innovation, it cannot describe the nature of the disposition without further inquiry. There are two factors that should be considered in respect to the subgroups that indicated possible negative disposition: First, the SoCQ does not indicate the level of attitude. Rogers (1971) identified two types of attitudes. They were a) a specific attitude toward the innovation and b) a general attitude toward change (p. 110). The nature of the attitude of the negatively disposed subgroups impacted the implementation strategy. Strategies differed when addressing concerns if the resistance is topical (specific to renewable energy) versus general concerns. Lippitt, Watson, and Westley (1958) noted,

One form of resistance that is most likely to occur at the beginning of the change process is a general opposition to any kind of change. Often this grows out of a combination of fear and ignorance…Fear that [they] will be able to change successfully or that, once accomplished, the change will require things of the people which they are unable to deliver. Only the status quo seems safe; any else seems to carry the threat of failure (p. 83-84).
The tailing up at Stage 6 may have indicated resistance to renewable energy, but given the very high Stage 0 score indicating a lack of knowledge about the topic, it was likely that the resistance from these subgroups was the more general opposition to change as it was a fairly common resistance force.

Second, it was important to remember that a favorable or unfavorable attitude did not always lead to adoption or rejection of an innovation (Rogers, 2003). As people moved from nonuse to orientation and preparation stages, there were many opportunities for an individual to develop or change an attitudinal position. While the initial SoCQ indicated possible negative disposition in these three subgroups, there were many points in the introduction and management of the change process where the attitudes could be positively influenced (Rogers, 2003). This means that those negatively disposed out the outset of change may be persuaded to adopt an innovation. Conversely, those positively disposed may become negative toward the innovation as they learn more or experience stress and anxiety in the change process. Further research is required to understand the nuances and extent of the negative disposition indicated by an uptick at Stage 6 in these SoCQ profiles. Those seeking to implement programming or training for faculty in those groups may wish to further explore the findings so that the implementation strategies can be appropriately crafted. However, all implementation strategies need to consider that attitudinal positions can and will shift. Appropriate change management is essential for all involved, not just these specific subgroups.
The majority of the users profiled as positively-disposed non-users at the nonuse stage. The intervention recommendations for this stage will be further considered in this report.

**Implications of Finding for Each Subgroup**

The following section summarizes the findings for each subgroup analyzed in Chapter 4. While interesting elements of the data analysis were considered in this section, it is important to remember that the very high (99%) relative intensity of Stage 0 concern may negate the importance of other concerns (George, 2006). Interventions may consider the findings of this research in addressing the non-Stage 0 concerns, but they should not be the primary focus of intervention implementation. Because the profiles are so similar, only unique findings for each subgroup are discussed in this section.

**Total Respondents**

As has been discussed, the total respondent profile revealed that faculty are non-users at the nonuse stage. The concerns were highly focused on “self”, or concerns related to the implications of implementation on the user. This is expected in a non-user profile. As implementation begins, task concerns tend to increase while self-concerns decrease (Hall G. E., 2011). This profile did show a very close Stage 2 (Personal) (63%) and Stage 3 (Management) (60%) concern. These scores imply that users were concerned about how this innovation would affect them and how they might need to balance this innovation in the context of existing obligations – even before they were aware of what the innovation entailed. This is not atypical of SoCQ nonuser profile, but
these concerns should be recognized and addressed by defining the expectations of faculty in the development of curriculum and training.

Rogers (2003) offered a means of addressing these Stage 2 and Stage 3 concerns in recognizing that “the compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption” (p. 247). In the case of renewable energy programming, curriculum and training strategies that emphasized the ways in which programming and personnel expectations are compatible with existing efforts of field faculty were likely to help reduce the anxiety associated with adoption. For example, if renewable energy programming were introduced as an entirely new curriculum where faculty were expected to add hundreds of hours of effort without compromising existing work, faculty would like respond with higher Stage 2 and Stage 3 concerns. Conversely, were faculty presented with strategies that allow individuals to begin teaching energy concepts as part of existing programming efforts and introduction of the innovation articulated that adding smaller increments of programming would help them professionally (by being recognized as an adopter by administration and by meeting relevant needs in their communities), faculty could more likely to find “compatibility” of the innovation with existing expectations.

**Respondent Concerns by State**

The findings of the state subgroups have already been discussed. Despite statistically significant mean scores at Stage 1 between Montana and the other two states, the overall profile was very similar. Montana faculty had been slightly more inclined toward seeking information, but because the Stage 0 and other concerns mirrored
Wyoming and Colorado, they should be treated similarly in terms of training and curriculum development.

**Respondent Concerns by Primary Job Function**

Respondents classified as having their primary job function in 4-H showed a tie in relative frequency of Stage 1, Stage 2, and Stage 3 Concerns. These scores reflected concentration of concerns on issues of “self” and “task”. The 4-H group also showed an uptick at Stage 6, indicating resistance to the innovation. According to George (2006), the tailing up tended to imply that the group has strong ideas about how to do things differently. These ideas may have been positive, but were more likely to be negative toward the innovation (p. 54). The relatively high intensity of Stage 1-3 may have implied frustration with Personal or Management concerns that were perceived not to have been resolved, as well as ideas about how the situation should be changed (p. 54). Interpretation of these scores could not be definitively concluded without further qualitative research to ensure accurate interpretation of the data.

Interventions with the 4-H faculty may benefit from interview research with members of this group to better assess and understand their concerns. It was interesting to note that the only known standardized Extension curricula on renewable energy was the National 4-H Wind Project curriculum. Further research should assess whether the reactions of the 4-H group were related to this curriculum effort, or to the overall topic of renewable energy programming. Interview research should examine whether the concerns at Stages 1-3 were specific to renewable energy programming, or if this
subgroup were overwhelmed by other matters and is resistant to any perceived change as described by Lippit, Watson and Westly (1958).

The other subgroup differing in profile from the general non-user profile was the Community and Economic Development (CD/ED) group. This group showed a tied High Stage Score at Stage 0 and Stage 5. Users with this profile showed a desire to know what others were doing, but limited interest in leading the collaboration (George, 2006). Further research was necessary to understand the nature of this split. The profile could have resulted from the nature of community development work being typically more collaborative than other disciplines. Perhaps personnel with those responsibilities seek collaboration when they lack information. Stage 0 concern also indicated the individual views the innovation as an important part of their work. A lower Stage 0 score indicated that the innovation was very important to the individual (George, 2006). Therefore, it may also be interpreted from the Stage 0 concern that this subgroup felt involvement in renewable energy education should be part of their work, but because they lacked awareness of existing resources sought collaboration to address the need. Interview research should be used to gain insights as to the actual nature of this split.

Respondent Concerns by Time in Extension

Those employed with Extension from 6 to 10 years showed a much higher Stage 3 (Management) concern than did the other groups. This implied the group had concerns about logistics, time, and management. Management concern could also have reflected concern over teaching the content. Further research should assess the nature of the higher Stage 3 concern in this group.
The Over 20 years of employment group indicated a slight uptick in Stage 6. This should be investigated further for those looking to implement renewable energy programming change in this demographic.

The research on the Time in Extension subgroup revealed interesting information about the maturity of Extension professionals on the topic of renewable energy programming. In 1969, Francis Fuller developed a model that described how, with increasing experience, educators moved through four levels of concern: unrelated, self, task and impact. This model was an important foundation in the creation of the Stages of Concern constructs. Described by Hall and Hord (2011), Fuller’s research indicated that educators begin with unrelated concerns – those not specific to teaching, and progress to concerns of “self”, with an egocentric frame of reference in terms of what the teaching will be like for “me” and whether “I” can succeed - to concerns of tasks. Task concerns are those related to teaching, but focused on managing the workload and performance-related issues. As experience increases, teachers become focused on impact – where the focus is on what can be done to enhance the learning experience for students and what can be done to improve the teacher’s performance (Hall and Hord, 2011, p. 69-70).

When a new change is introduced, this process is repeated with the educator again beginning to focus on self-concerns before progressing to task and impact concerns. In contrast, curriculum changes that are perceived by the educator to be consistent with existing work may show profiles concentrated on impact – the change is seen as one that can be integrated into the existing teaching effort.
The SoCQ profiles of faculty by time in Extension illustrated that renewable energy programming was a new change in that even experienced educators showed strong self-concerns (Stages 0-2) and only those in the 6-10 year group showing higher relative Task (Stage 3) concerns. The data provided two implications for those seeking to achieve implementation of renewable energy programming in Extension: 1) it cannot be assumed that experienced educators will bypass the concerns process and move directly to consideration of impact. All Extension professionals in this sample illustrate a need to move through the process of unrelated, to self, to task to impact concerns, and 2) initial training and programming will need to address the “self” concerns by being empathetic to the intensity of these concerns and then making efforts to resolve them.

When considering implementation strategies for Extension in renewable energy education, this process of moving from unrelated to self to impact may be addressed by allowing faculty to move through the Perceived Attributes of Innovations as defined by Rogers (2003) (p. 16). The Perceived Attributes were:

1. **Relative Advantage** – faculty need articulation of the relative advantage of adopting renewable energy programming. Advantages may be meeting relevant constituent needs, adding programming that is new to Extension and likely not being offered in their area (strategic differentiation), positive performance evaluations, opportunities to take a leadership role in creating programming in a new (to Extension) subject matter. Identifying adoption as a means of accomplishing a greater purpose may help faculty move beyond “self” and “task”.
2. *Compatibility* – to reduce concerns of “self” and “task”, faculty can be provided with opportunities to incorporate renewable energy programming in existing efforts. An example of how this might be accomplished could be providing an agricultural educator with a 15 or 20-minute program on solar fencing alternatives that the educator could incorporate into a range tour. Using this example, the educator is able to add new content and enrich an existing program, without needing to fully adopt all elements of renewable energy programming.

3. *Complexity* – The extent to which renewable energy is perceived as complex and hard to understand will influence rates of adoption. These concerns will be concerns of self (How will I understand this? What happens if I fail? What if I give inaccurate information? Etc.) and concerns of task (How will I find time to learn all of this information? How will I add all of this work to my existing responsibilities? Etc.) Therefore, curricula that make it easy for faculty to both understand and teach relevant concepts in renewable energy are more likely to be adopted. Extension administration or specialists may need to provide tiers of curriculum where faculty can opt to engage at a lower level of complexity, but may also opt to increase knowledge and provide programming at a higher level of complexity.

4. *Triablity* – Rogers defines triablity as the extent to which the innovation can be “tried” prior to adoption (p. 16). In the case of renewable energy, programming options that allow faculty members to try lower risk
implementation (perhaps a 15-30 minute programming) may address this concern. Methods for incorporating energy education in existing programming may also allow faculty to “try” energy programming without having to commit to an educational series or a more typical (in Extension) 60-90 minute programming format where technical expertise is more likely expected of the educator.

5. Observability – The extent to which the results of adaptors of the innovation can be observed by others will influence rates of adoption. In the case of renewable energy, observability can be integrated both in terms of educators sharing impacts, results and efforts with one another; and though the development of double-loop communication strategies, whereby continuous improvement mental modes create a cultural expectation of adoption (Lezotte, 2002). Simple methods of observability can be webinars hosted by those who have implemented renewable energy programming, listserv communications where individuals can share experiences and impacts, share sessions at conferences, social media share groups, or quarterly conference calls for exchanging successes, frustrations, and other experiences. While more sophisticated communication strategies are possible, these suggestions could easily implement with limited fiscal support.

Moving faculty from concerns of self and task to impact will require developing curriculum and training initiatives that allow these perceived attributes to be tested and considered by faculty.
Respondent Concerns by Age of Faculty Member

Some of the dynamics of age have been discussed previously, but the data revealed that self concerns (Stages 0-2) were much higher in those aged 21-25 than the other groups. The group most closely aligned with the 21-25 group was those aged 46 to 50 years old. Those ‘Over 61’ showed lesser concern at each stage than did the other ages and the group was statistically different from the 21 to 25 year old group at Stage 3. Although the 21-25 year olds showed relatively higher concerns at all stages and the Over 61 group showed decidedly less concern at all stages, analysis of the groups from age 26 to age 61 showed varied level of concern between the groups and showed that the concern level was not directly related to age.

Respondent Concerns by Work History

The question of work history was posed to establish whether concerns varied according to professional background. Would those from a private sector or agricultural background show a different profile than those always employed by Extension? The analysis revealed no differences in concern profiles based on work history.

Analysis of Findings Relative to the Principles of Change

The majority of the subgroups in the research were positively disposed nonusers and all respondents were at the nonuse stage. Therefore, this research was best discussed in the context of implementing change and moving faculty into use of the innovation of “renewable energy programming”. Hall and Hord (2011) and those involved with the
research of change (from RDCTE in the 1970s to present) have identified the patterns that occur in the change process as basic principles, which “are no longer debatable points, for they summarize the predictable aspects of change” (p. 5) Therefore, consider the research data for each of the Principles of Change:

Change Principle 1: Change is Learning

To achieve improvement, unsuccessful practices must be changed which requires learning. Change research found that stating a behavior change is required will not be successful unless those implementing the change are able to engage in learning (Hall G. E., 2011). Hall and Hord (2011) provide two examples of the need for learning. A very simple example is a man who decides that rather than walk, he will get to a distant location using a bicycle. Deciding to use a bicycle does not make him competent or skillful in accomplishing the task. However, once he learns to ride, he is able to use the bicycle proficiently in going to multiple locations. As another example, a teacher is required to implement a new inquiry-oriented math curriculum. The “teacher proof” teaching directions work when students respond to lessons with the correct answers and understanding, but when students deviate from the script, the teacher is unable to adapt and apply the curriculum to meet the class needs. Only after the teacher learns the practices is she able to apply them and improve the learning of students (Hall G. E., 2011). The learning process will also apply to Extension educators on the topic of renewable energy programming.

Extension faces two challenges in addressing this change principle. First, the High Stage 0 score across all subgroups established the need for faculty to learn the
innovation. This will require Extension to define “renewable energy programming” and to define the expectation for faculty. How is successful implementation defined? What materials, curriculum and supporting resources are available in implementation? The most telling information from the research that indicates “renewable energy programming” has not been defined is provided by the 3% of respondents involved in more than 100 hours of energy education per year. Despite significantly more involvement in energy education than their Extension counterparts, this group was consistent with other faculty in terms of a 99% relative intensity of Stage 0 concern – meaning the group did not identify with a defined “renewable energy programming” innovation.

The second challenge in addressing this change principle layed in faculty learning “renewable energy” in general. Extension faculty primary responsibilities were typically in the categories identified in this research (agriculture and natural resources, family and consumer sciences, 4-H, and community and economic development). Given the primary responsibilities of faculty and the current low levels of energy programming involvement identified in this research, it should not be assumed that faculty have background in energy, or more specifically in renewable energy. Forston (2006) summarized the complexity of learning renewables as, “There is no simple track for learning the renewable energy ropes. Nor is there a one-size-fits all option that will work…There are countless variables to consider when learning about the viability of renewables” (p. 2). Research should be conducted to assess actual levels of knowledge and skill in energy, however, it is likely that faculty will need to learn renewable energy (terms, technologies,
calculations, etc.) to effectively implement education - in addition to learning the renewable energy programming curricula. Using the analogy of the math teacher from above, this means that the teacher not only needs to learn the new curriculum, she needs first to learn math. This is an incrementally more difficult task than simply introducing a new curriculum.

The creation of expertise in the majority of Extension faculty members on multiple renewable technologies (wind, solar photovoltaic, solar hot water, geothermal, micro hydropower, etc.) in the near term is unrealistic. This level of learning requires significant fiscal and time investment. Extension administration may identify one individual per technology or a “renewable energy specialist” who can address technical complexity of many systems, but the majority of faculty will require means of engagement that does not require extensive technical knowledge and experience at the start. As an example, teaching “all” of small wind may not be realistic for a faculty member new to energy, but key concepts can be broken out that allow faculty to begin teaching elements of small wind with confidence that they are teaching from quality non-biased, research based curriculum resources. As faculty gain experience and confidence, additional technical knowledge and complexity can be introduced. In other words, Extension must find ways to make the complex simple and teachable for faculty in order for them to begin adopting the innovation.

Extension administration must determine the extent to which field faculty will be expected to learn and teach renewable energy. The level of investment required to provide technical competence and depth in renewable energy in field faculty who do not
have energy background is extensive. This is especially true for states where the land-grant university has eliminated mechanical arts outreach and education functions, such as Extension agricultural engineering.

For new faculty, Extension administration might consider whether pre-service course work or field experience in energy is required. If so, coordination with colleges preparing future Extension personnel might be required to ensure course offerings in energy.

Change Principle 2: Change is a Process, Not an Event

Change research has established that change is not accomplished by an announcement that change will occur or through a one-time event or training. Note Hall and Hord (2011), successful change implementers, “allow at least three to five years of implementation and budget the resources needed to support formal learning and on-site coaching for the duration of this [learning] phase” (p. 8). This change principle explains why, despite years of Extension administration stating a desire for faculty to engage in renewable energy programming as evidenced in the literature review, field faculty remain at a 99% relative intensity at Stage 0 concern. For faculty to become engaged, the expectations must be specifically defined, the learning process must begin, and the process must be continually reinforced and supported until change has been adopted.

Lippitt, Watson, and Westly (1958) established a process for planned change appropriate for addressing Extension adoption of renewable energy programming. The phases of planned change are Phase I: Development of a Need for Change, Phase II: Establishment of a Change Relationship, Phase III: Clarification of the Problem, Phase
IV: Establishing Goals and Intentions of Action, Phase V: Transformation of Intentions into Actual Change Efforts, and Phase VI: Generalization of Change (p. 131-142). These phases were included in the foundations of RCDTE work, but discussing them in the context of Extension provides possible action steps for beginning the change process.

The first phase could be summarized as problem awareness, where the need for change is recognized and clarified. Lippitt, Watson, and Westly note, “problem awareness is not automatically translated into a desire for change” (p. 131). In the case of Extension, this may be especially relevant. Extension has demonstrated (as evidenced in the literature review) an awareness of the demand for renewable energy education. However, the organization has fallen short of succinctly defining what elements of renewable energy are to be addressed by Extension and clarifying expectations for faculty. A tangible step for each Extension state might be to define the problem and articulate the desired level of change. Extension should consider, for example, that renewable energy is a multi-faceted topic including: commercial wind and solar development and associated high voltage transmission line construction, small home, farm and ranch applications, community-scale projects, and public policy. Extension is not likely to create expertise in all of these areas immediately. Defining an area of focus and establishing curriculum resources in that area may be an important first step in defining the problem.

Phase II involves the establishment of relationship. The establishment of a relationship in the change process is defined by Lippet, Watson and Wesley (1958) as the relationship of the members of the organization with a “change facilitator” – the
individual responsible for implementing the change (p. 133). For Extension, this requires that an individual in each state be tasked with training field faculty in the implementation of renewable energy programming. Montana, Wyoming, and Colorado have each created positions to address Extension energy (a coordinator in Wyoming, a specialist in Colorado, and an associate specialist in Montana). This is an important step in the process. States might consider whether expectations for those positions are explicit terms of the involvement of field faculty. As with all specialist positions in Extension, it is possible for materials and programming to be delivered from specialists to consumers, without engagement of field faculty. The specialist-to-consumer model does accomplish some level of energy outreach, but as discussed in the literature review, those evaluating Extension as a whole may not perceive Extension to have an energy presence if field faculty are not involved in outreach efforts. While it is not essential that the state energy professional be the change facilitator in Extension, it may be logical given existing investment in those positions.

Lippet, Watson, and Westly (1958) define the third phase as clarifying the problem (p. 138). This may seem redundant to the first phase, but in practice is very different. In Phase I, the organization is considering the need and desire to change. The third phase requires clearly establishing what changes will be required, assessing the organizational needs and desires, and collecting information about the change process. The SoCQ assessment can be used in data collection. The SoCQ analysis in this research indicates that change facilitators will not only need to overcome Stage 0 (Unconcerned), but also need to address Stage 1 (Informational) Concerns. As faculty work to move
from a nonuse to an orientation state, they will seek information (Hall G. E., 2011). The informational stage will not only involve understanding the content faculty will be expected to teach, but also the expectations associated with implementation: How many hours are faculty expected to teach? How will faculty performance be evaluated? What are the benefits/consequences of adopting/not adopting the innovation? The Extension change facilitator must be prepared to provide both content and information on the implications for faculty. The change agent must also acknowledge and address Stage 2-3 Concerns – As faculty move from the orientation state to the preparation state, they will seek information, support, and reassurance with regard to Personal (Stage 2) and Management (Stage 3) concerns. Extension must be prepared to address these concerns and offer support to faculty. A possible example of implementation strategies that address these concerns might again involve programming that is easy to implement with existing efforts (e.g. - an FCS agent learns how to include energy education as part of food safety preservation programming). A second possible strategy may be incremental increases in energy programming. Rather than expect that the majority of Extension faculty move from less than 20 hours per year of education to over 100, perhaps an expectation is that faculty complete one programming effort in the first year, where the first effort might be only 15 minutes of presenting or a series of articles in the local newspaper. This also addresses the element of triablity described by Rogers (Rogers, 2003).

The fourth phase is the establishment of goals and intentions of actions. At this point in the process the change facilitator becomes a less critical player and the change
process is pervasive throughout the organization. It is here that the support and articulation of goals and intentions from Extension administration is critical. This and the remaining phases (transforming into actual change efforts and the generalization of change) are essential to successful change implementation. However, the strategies used in these phases depend upon the earlier phases, so they will not be discussed in detail here. Extension must be aware that many phases of the change process exist and will need to be fostered and supported for several years in order for the desired change to take place.

Change Principle 3: The Local Organization is the Primary Unit for Change

Even though external organizations may encourage and even require renewable energy programming from Extension, the key organization for making change is the local organization. In the case of a campus or school, this unit is the localized leadership unit. In Extension, this unit is the state Extension office. Hall and Hord (2011) assert that even though the state is part of county, regional and federal systems, “the [state] staff and leaders will make or break any change effort, regardless of whether it is initiated from inside or outside” the organization (p. 9). It is the responsibility of the local leadership organization to establish the expectations for change and to seek appropriate external resources to support the change effort.

In Extension engagement in renewable energy, this leadership will mean both defining “renewable energy programming” and providing the learning, support, and resources for effective implementation. It will also require appointing a change facilitator tasked with implementation.
Change Principle 4: Organizations
Adopt Change – Individuals Implement Change

This principle reveals its importance when considering the historical context of Extension in renewable energy education presented in the literature review when compared to the levels of adoption found in the research. Extension administration and funders have articulated a desire for Extension to engage in energy programming for decades. However, the majority (92%) of faculty invest less than 20 hours per year in energy outreach and score 99% relative intensity at Stage 0 (Unconcerned) in group analysis. The data illustrates that Extension must address change at the individual level in order for renewable energy education to be implemented. While not all interventions can be addressed on an individual basis, the patterns of transition through the concern process should be anticipated and addressed as change is implemented. Many changes should be targeted to subgroups, and many others directed at the organization as a whole, while retaining emphasis on the individual elements of change (Hall G. E., 2011, p. 10). The support of individuals in Extension can be more difficult than on a traditional campus as faculty are geographically dispersed. The support of individuals will need to be cognitively considered as intervention strategies are developed.

Change Principle 5: Interventions are the Key to the Success of the Change Process

The various actions, events, and activities that can influence the adoption process are known as interventions. While trainings and workshops are the most obvious type of intervention, Hall and Hord (2011) caution that to be effective, trainings and workshops need to be supplemented with other interventions. Short, intense, and applicable
interventions can be highly effective in helping faculty to engage in the change process (p. 12). Hall and Hord (2011) suggest appropriate interventions at the state of nonuse might include:

- Acknowledge that little concern about the innovation is legitimate and okay.
- Share some general information about the innovation in hopes of arousing some interest in it.
- Suggest and describe how the innovation might be related to an area that the person(s) is concerned about.
- Decree that the use of the innovation is required.
- Encourage the person(s) to talk with others who are interested in or using the innovation (p. 299)

Conversely, inappropriate interventions are:

- Communicating the lack of concern to others, thereby discouraging their interest.
- Continuing to accept/tolerate the lack of concern while others are engaged (p. 299)

Given that Extension faculty are non-users at the nonuse stage, the interventions suggested by Hall and Hord are appropriate.

Intervention strategies will shift as faculty become more aware of the innovation. For example, appropriate interventions change as users move from nonuse (Stage 0) to informational (Stage 1). At Stage 1, Hall and Hord (2011) suggest that interventions provide general descriptive information and that interventions are spread over time and provided in a variety of mediums and contexts. Appropriate interventions at this stage are:

- Share general descriptive information about the innovation through short “elevator speeches”, email, brochures, short media presentations, and staff meetings.
- Provide information contrasting what the individual is presently doing with potential advantages of use of the innovation.
- Express enthusiasm for consideration of the innovation.
- Hear from others who are excited about what they are doing with innovation.
- State realistic expectations about the benefits, costs and effort needed to use the innovation (p. 299-300).

Intervention strategies continue to evolve as high stage concerns evolve. In general, the interventions shift from being very specific about what is to be adopted to a more collaborative approach where modifications and adaptations of the innovation are encouraged.

In Extension renewable energy programming, the types of interventions should be phased to address changing needs as levels of adoption increase. Initially, the change facilitator for each state will need to develop short and longer-term strategies for supporting change. Hord et al (1987) (p. 76-78) suggest strategic planning for intervention might include the following:

- Develop and Support Organizational Arrangements – this intervention work will include developing and preparing all of the necessary elements for educators before implementation can begin. This will include providing for curriculum, materials, guidelines, regulations, policies, funding, equipment and all other items that create structure and provide for the management of the change process. Funding is typically a constraint that needs to be considered and addressed prior to implementation. Extension change facilitators will need to consider the support and resources necessary to address individual needs once the change process is initiated.
Training: no matter how appealing or in-depth materials may be, “with most innovations, teachers need training to clearly understand how to use them” (p. 76). In Extension, the training plan will need to include a mix of methods that teach specific technologies and technical knowledge, as well as instruction on the materials faculty are to use in teaching the concepts. It is not likely that a one-time intensive training will accomplish this objective. As described in the Stage 1 appropriate interventions, it is likely that Extension will need to begin by defining a curriculum or set of materials that faculty are expected to teach. This may be a significant issue for states that do not have curriculum resources, as they must first develop a standardized set of materials. From that point, a multitude of short interventions will be necessary. This may mean an initial 3-4 hour training describing why Extension is adopting renewable energy programming, followed by an overview of the curriculum. This initial training accomplishes two objectives. The first is to orientate faculty to the materials. Second, it provides initial awareness of both an expectation to teach renewable energy and an awareness of a defined “programming” resource. Subsequent interventions may include webinars on specific topics related to teaching the materials in the curriculum. More in-depth technical sessions (either in-person workshops or webinars) specific to each technology can serve to enhance specific subject matter knowledge. The change facilitator might also partner with field faculty to demonstrate the curriculum in public workshops whereby the local educator coordinates an energy event and the change facilitator teaches the workshop using
the curriculum. The local educator might be invited to co-teach the program.
Repeated small interventions will likely be necessary and the interventions will vary by state.

- Consultation and Reinforcement: These interventions are less formal and more personalized to individual needs and are usually a follow up to more formal training (p. 76) In Extension, this may mean the change agent identifies individuals who are trying to implement energy education and works with them to craft programming specific to their local needs. It may involve recruiting expert speakers who can support programming efforts on specific topics or providing resources unique to the community.

- Monitoring: Monitoring is important in ensuring successful improvement efforts and in helping faculty recognize that their implementation and improvement is a priority. For Extension, monitoring should involve using standardized evaluations so that faculty performance and programmatic impacts can be consistently assessed following programming efforts. These evaluations are also critical in reporting effort and impact to funders of Extension. Monitoring also enables the change facilitator to track adoption and to identify subgroups resisting implementation.

- External Communication: The change agent will need to support implementation efforts by informing others (the public, funders, administration, etc.) of successful implementation and impact. This not only increases awareness and support for Extension, but also helps to create a cultural expectation of adoption.
• Dissemination: These actions involve the change facilitator broadcasting information about the best practices to encourage others to adopt the innovation.

As Extension in Montana, Colorado and Wyoming are currently at the non-use state and will likely move to the informational stage, examples of successful implementation may help others to understand how to apply renewable energy programming in their own work. To start, these examples might be very simple, but show an improvement in engagement.

The change facilitator in each state will need to monitor faculty as they progress through the various stages and adapt intervention strategies accordingly. For example, when faculty begin expressing Stage 2 concerns, interactions with faculty might involve more empathic interventions addressing their personal concerns (Hall G. E., 2011). At Stage 3, the interventions should shift to more “how to do it” recommendations and interventions (Hall G. E., 2011).

Change Principle 6: Appropriate Interventions Reduce Resistance to Change

Change research suggests that when concerns are correctly identified and addressed proactively, resistance is typically mitigated. The SoCQ research is helpful in addressing this change principle in the following ways:

– The research shows that faculty do not have concerns about the concept of teaching renewable energy. Unlike the example of sustainable agriculture where faculty were found to have predisposed bias against the topic, the SoCQ profiles did not indicate this to be the case in renewable energy – at the
current level of understanding (which is low) about the topic. If faculty were resistant to renewable energy or perceived that the topic would have negative impact on constituents, high Stage 4 and Stage 6 concerns would likely have appeared in the profiles. There were some subgroups with upticks at Stage 6 and further research should be done in those subgroups to determine the nature of their resistance, but the majority of faculty were positively disposed to renewable energy programming. Therefore, implementers of renewable energy programming change need not spend excessive time working to address resistance to the subject on matters of principle. Provided that Extension remains dedicated to providing non-biased, research based information, this concern does not appear to be a primary issue.

It could be presupposed that the failure of Extension to become engaged with renewable energy is a result of over-tasked employees – faculty too busy and too overwhelmed to consider a new programming effort. The SoCQ analysis identified that the failure of Extension to engage in renewable energy programming is more likely linked to a lack of clear understanding of what Extension expects in “renewable energy programming”. There was also an identified lack of information, both about the content to be taught and the expectations of faculty. While Stage 2 (Personal) and Stage 3 (Management) concerns will need to be addressed as implementation efforts proceed the primary concern of faculty at present is in understanding what and how renewable energy programming is to be implemented.
Calabrese’s (1982) problem identification matrix (PIM) is based on the concept that in order to address a problem, we must first define it correctly. The SoCQ research has defined that the initial problem lies in the lack of awareness and information. These issues need to be addressed by the specified change facilitator in each state for implementation to begin. It is important for Extension to note that as implementation begins, additional research will be required. Faculty concerns will change as their understanding of the innovation increases. This research can be done using subsequent SoCQ analyses which will help the change facilitator recognize when faculty have moved from one stage to another. However, two other tools are provided in change research that may also be considered: the Innovation Configuration and Levels of Use instruments, which are designed to assess concerns and implementation barriers after the change process has been initiated (Hall G., 2003).

In the initial stages of change implementation, reducing resistance to change is important. The change facilitator needs to respect and understand divergent opinions, but the high levels of non-use indicate that faculty must first understand what is being required and how they might use the innovation. For the leadership of the change facilitator to be credible, however, Fullan argues, “Leaders should have good ideas and present them well (with the authoritative element) while at the same time seeking and listening to doubters (aspects of democratic leadership). They must try to build good relationships to be effective (be affiliative) even with those who may not trust them.” (Fullan, 2007, p. 42). For the change facilitator, being alert to differences of opinion is vital. The change facilitator must manage the change and ensure double-loop
communication early in the process. In other words, while prior planning and accurate assessment of the appropriate interventions may reduce conflict, conflict is not something that should be avoided or eliminated as implementation begins. Instilling the attributes of a learning organization described by Rowe (2010) will require that diversity of opinion focused on improvement of Extension be allowed and encouraged.

Change Principle 7: Administrator Leadership is Essential to Long-Term Change Success

Hall and Hord (2011) report,

> A central theme of advocates of bottom-up changes is that those nearest the action have the best ideas of how to accomplish change. Many implementers believe that they do not need any involvement from or with those above them. But here again, the findings of research and experience argue for a different conclusion (p. 13).

Change research has found that unless organizational administration supports and legitimizes change, it will be short lived. Even those bottom-up efforts that seemed to have great energy and faculty buy-in were discarded when the change initiators either opted to limit their involvement or left the organization (Hall G. E., 2011). For change to become ingrained in Extension, leadership in Extension will need to legitimize renewable energy programming, support the efforts of those tasked with implementation, and find resources to encourage the continued use of the innovation. Montana, Colorado, and Wyoming have all taken an important first step by identifying an energy specialist, which demonstrates a commitment to renewable energy outreach. Each state should determine the extent to which field faculty involvement is expected and should determine whether the energy specialist is also the designated change facilitator for field faculty engagement. Field faulty need to be made aware of administration’s expectations for
their involvement and need to know that administration has endorsed a change facilitator. The administration’s support of and encouragement to participate in trainings will help to reinforce the implementation strategies of the change facilitator. To the extent that it is appropriate, Extension administration might also consider how performance evaluations or less formal recognitions can be used to reward field faculty engagement in renewable energy programming.

There are many elements of renewable energy education implementation that will require Extension administration involvement in order for long-term success to be achieved. Examples include:

- Identify expertise and resources that are available to Extension specialists and field faculty. As an example, if a state no longer has an agricultural engineering program, identify resources that could be made available to support renewable energy education for agricultural operations. Could a relationship be formally created with a college of engineering within that state’s university? Could a relationship be formally created with another land grant university? Extension field faculty success will hinge upon the quality and availability of resources available to support programming implementation.

- Recognize that even highly competent Extension specialists will require supplemental research-base and resources to effectively implement training across multiple technologies. Renewable energy is a multi-faceted topic, as is a more traditional Extension subject, like agriculture. Extension readily accepts that a beef nutrition expert may not have extensive background in forage management,
even though the topics are related. Much the same, an expert in solar energy may have a working knowledge of wind energy, but may not be prepared to teach and support field faculty at an equal level on both topics. Clear expectations of performance and well-defined scopes of work for specialists will be needed to set direction and to ensure that field faculty needs are met.

- Define levels of competence and essential understandings that are expected of faculty. This consideration should include both expectations for existing faculty and expectations for new employees. Are all employees expected to teach energy? If not, who might be assigned the task? Will position descriptions, position announcements, and performance evaluations included energy? These considerations may involve discussions with energy specialists, but typically fall outside the scope of responsibility of an energy specialist.

- Determine the level of faculty engagement and social engagement that is considered appropriate with regard to NIFA reporting requirements. Ensure that energy specialists are aware of these standards and have adequate resources to achieve those measures.

Change Principle 8:
Facilitating Change is a Team Effort

Change research argues that the entire organization needs to be engaged for change to take effect. Leadership, program implementers, administrators, educators, and support staff need to all be aware of the change and begin taking steps toward
implementation. In Extension, this principle becomes both very important and very
difficult.

The team effort is important in implementing renewable energy for several
reasons. First, research shows that unless the entire organization is aware of and
participating in the change it will not be successful. Second, it is unlikely that Extension
will be able to create energy-specific field faculty positions given current budget
constraints. This means that energy will need to be integrated into existing teaching
efforts. Therefore, the efforts to incorporate renewable energy will need to involve those
in all disciplines (agriculture, 4_H, FCS, CD/ED, etc.) for it to be pervasively included in
outreach. Third, because of the geographically dispersed nature of Extension offices,
support of the individual and consistency in encouraging change can only be achieved if
all players are involved.

In regard to including renewable energy programming in each discipline,
Extension change facilitators might consider Rogers’ (2003) discussion of the use of
Opinion Leaders – those who can informally influence other individual’s behavior (p.
362) in each of the disciplines. For example, the change facilitator might identify a field
faculty member in agriculture who is an opinion leader for other agricultural field faculty.
The change facilitator might work with that opinion leader to design a program or
outreach effort that is beneficial for the opinion leader, but uses the innovation. The
involvement of the opinion leader with the innovation is likely to encourage other
agricultural faculty members to become involved.
Change facilitators might also seek to understand the existing communication networks of field faculty. Rogers (2003) defines these networks as “interconnected individuals who are linked by patterned flows of information” (p. 363). Individuals may determine their adoption of an innovation based on the communications within their network (Rogers, 2003). In Extension, the communication networks may take time for the change facilitator to understand. Because of the geographically dispersed nature of field faculty, communications take place within a variety of subgroups. Faculty may relate on a basis of job type (agricultural faculty communicate with other agricultural faculty), based on time of hire (newer faculty related to other newer faculty), location, etc. Understanding the networks in each state will be important for the change facilitator in three primary ways: 1) Positive feedback about renewable energy programming communicated through these informal networks will improve the rate of adoption. 2) Negative tones spread in the networks will require the change facilitator to become aware of those communications and to devise appropriate intervention strategies to address the concerns. Because Extension is not housed in one facility, negative disposition can spread throughout a state without the leadership being aware of the disposition. 3) The change facilitator might best identify means of establishing double-loop communication if the existing communication networks are well understood.

However, for Extension administration the need to promote and encourage change in renewable energy programming may prove difficult. While Extension administration has indicated interest in engaging faculty, publically advocating renewable energy programming change (perhaps over other programming areas) may be politically
sensitive. In this time of constrained budgets, Extension offices may find vacancies or reduction of resources in traditionally supported educational areas. Advocating change in renewable energy programming may require public perception management to ensure that supporters of Extension do not perceive a letting go of traditional efforts in lieu of a more “politically” supported topic, such as renewable energy. McDowell (2003) argues that the balance between needing to address societal demands and retaining the support of traditional Extension constituents is a long-standing and complex issue, but that it must be addressed for Extension to remain relevant. The need for this balance may also provide a strong argument for renewable energy education to take place within existing programming efforts. In other words, the perception management can occur by emphasizing that Extension is not forgoing outreach in (for example) agriculture, but Extension is adding information about energy in agricultural work.

**Change Principle 9: Mandates Can Work**

Mandates can be effective strategies in implementing change. Mandates make the priority and expectation for implementation clear. However, mandates fail when they are not supported by other elements of the change implementation strategy (ongoing learning, communication, support of faculty, etc.) (Hall G. E., 2011). Extension may benefit from mandates that energy will be incorporated into outreach work. However, for this to be effective, Extension leadership in each state must first define “renewable energy programming” expectations and must have staff and resources in place to support implementation.
For Extension, renewable energy programming mandates will differ over time. To start, faculty need specific direction (an established curriculum, expectations for performance, etc). This need is indicated by the high Stage 0 concern of faculty. The mandate to become involved must be specific for faculty to understand what is being mandated. However, as implementation increases, the nature of the mandate for involvement should shift to one of providing leadership and structure, while allowing faculty to adapt and change the innovation. Fullan (2007) provides an example of the change in leadership processes as faculty adopt the innovation,

The leader becomes the context setter – not an authority figure with solutions. Once folks at the grass roots realize they own the problem, they also discover that they can help create the answer – and they get after it very quickly, very aggressively, and very creatively, with a lot more ideas than the old-style strategic direction… it works because people on the ground usually know what’s going on (p. 111).

Rogers (2003) discusses the importance of allowing faculty to change the innovation in his discussions of re-invention. As the innovation is adopted, people find new applications, modifications, and improvements on the original innovation (p. 17). The end result is a more applied innovation and usually a more creative product than the original. While the initial mandate for involvement may be required in Extension, leadership must shift to allow this level of creativity over time. Mandates in the context of renewable energy education in Extension are not the “teacher-proof” curriculum described in early days of the National Defense Education Act. Rather, mandates in this context should include basic standards and guidelines for implementation of renewable energy education. Extension specialists, supported by administration, should provide
essential understandings and benchmark participation levels expected of faculty. The expectations should be included in position descriptions and performance accountability should be tied to those expectations, but the faculty members should be allowed latitude to adapt and modify curriculum to meet localized needs.

Change Principle 10: The Context Influences the Process of Learning and Change

Hall and Hord (2011) argue that there are two contextual factors that influence learning and change. One is the physical attributes of the organization. The second are the “people factors” – the attitudes, beliefs, and culture of those in the organization. The research of Rowe (2010) with regard to evaluation of Extension as a learning organization indicates that this change principle will be a difficult one for Extension to manage. First, Extension does not have a physical structure in which to influence organizational dynamics. Faculty are dispersed throughout each state. Second, faculty are limited in their interactions with one another. The limited interaction makes it more difficult to create and sustain enthusiasm for the change. It also allows for negative dispositions toward the change to exist and spread without the knowledge of those leading the implementation efforts. For Extension to be successful in addressing this change principle, strategies for consistent contact, double-loop communication and support of faculty will need to be considered (Lezotte, 2002).

Here too, Extension strategies may differ from the initial need to provide information and training, to one of fostering communication and creativity. The SoCQ research and measurement of current involvement show that faculty will need information to begin teaching renewable energy. However, as faculty learn the
innovation, the need for information will decline. Brown and Duguid (2000) discuss the current social phenomenon of sheer volumes of information leading to “information glut”. They note, “For all information’s independence and extent, it is people, in their communities, organizations, and institutions who ultimately decide what it all means and why it matters” (p. 18). Extension change facilitators in each state will need to develop support and communication structures that foster these human elements of change implementation for renewable energy to evolve beyond an initial mandate for faculty participation.

Summary

Implementing renewable energy education in Extension is a complex challenge. The challenge is not one of information. A search of the Internet produces abundant information on renewable energy. The challenge is not one of simply expressing a desire to engage Extension in energy outreach. The literature review provides evidence of a stated desire for engagement from the late 1970s. The challenge is not one of needing encouragement from external entities. Again, the literature review shows multiple supporters and funders of Extension articulating desire for outreach on the topic. The challenge IS one of understanding the needs and concerns of individuals tasked with implementation, while also adapting the organization to support those individuals. Note Brown and Duguid (2000),

Envisioned change will not happen or will not be fruitful until people look beyond the simplicities of information… to the complexities of learning, knowledge, judgment, communities, organizations, and institutions (p. 213).
Addressing the complexities of engaging Extension field faculty in renewable energy programming will require dedication and strategic change management practices.

Based on the research, the following action steps are recommended for implementing renewable energy programming in MT, WY, and CO.

1. Extension administrative leadership in each state must clarify what “renewable energy programming” entails. Specifically, leadership must define areas of renewable energy in which the organization intends to focus (e.g., Small home technologies, commercial development issues, community energy, etc.) and the level of depth that is considered adequate to meet societal needs given available resources.

2. Standardized materials should be developed for faculty. While an abundance of information is available on each technology, faculty need resources vetted by Extension specialists and that are consistent in the manner in which they present information. Consistency in materials will help faculty to learn both the teaching materials and the technical elements of renewable energy more quickly.

3. Extension leadership must define the expected level of field faculty involvement for current faculty. Leadership must make clear the expectation to faculty and be prepared to support implementation efforts, with specific focus on addressing Stage 0-3 concerns in the near term.

4. A change facilitator in each state must be identified. Extension leadership must validate and articulate the role of the change facilitator to field faculty.
5. Strategic interventions need to be developed by the change facilitator that provide for two types of faculty learning – learning about the expectations of renewable energy programming and learning about renewable energy. Strategies for training and support of faculty need to be developed in each state. Strategies should seek methods of implementation that allow faculty to incorporate renewable energy training in to existing programming efforts. Support needs to be ongoing and focused on meeting individual needs while also addressing subgroup and organizational needs.

6. Communications strategies need to be integrated as part of the implementation effort. The strategies need to connect faculty to one another, as well as to the state level. Enthusiasm and learning about the innovation will require faculty to connect and support one another in implementation efforts. State-level leadership will need to receive constant feedback from faculty in order to adapt and enhance programming efforts to support implementation needs.

7. The change facilitator will need to allow for a phasing out of the facilitation role. This process should also allow for users of the innovation to begin creatively adapting and applying their learning. The change process should encourage organizational learning and connectivity of the people that will make change real and valuable for Extension.

These recommendations will aid Extension administration and specialists in structuring and implementing renewable energy programming. However, it should be recognized that the majority of faculty cannot be expected to engage beyond a basic
level in renewable energy education unless significant resources are devoted to professional development. For example, faculty may be trained to discuss fundamentals of small wind energy or solar hot water systems, but are unless they are certified or extensively trained, should not engage in siting systems or recommending system configurations unique to a home or specific site. It will be important for Extension to define realistic expectations for field faculty engagement and to further ensure that the availability of expert-level resources be clearly defined for Extension constituents.

**Suggestions for Further Research**

Further research may be warranted on the three subgroups that indicated a tailing up at Stage 6 of the SoCQ research. Those groups included the 56-60 age group, faculty with primary responsibilities in 4-H, and those employed by Extension for more than 20 years. Interview research with members of each of these subgroups may provide insights as to the resistance, specifically whether the resistance was related to the innovation of renewable energy programming or related to change in general. Interview research might also be utilized to assess Community and Economic Development faculty to better understand their tie score between Stage 0 and Stage 5 levels of concern. Interview research should also be conducted with those employed from 6-10 years to better understand their higher Stage 3 concerns.

There may have been overlap between those 56-60 years old and those employed by Extension for more than 20 years. The amount of overlap is dependent on when the
employee’s career began. Further research could be conducted to evaluate dynamics that contributed to both of these subgroups indicating an uptick at Stage 6. However, strategically these groups likely represent demographics with the potential for shorter-term employment with Extension. The research may prove interesting, but change management strategies should not seek to target these groups unless they are opinion leaders in Extension.

Research should be conducted as to what levels of energy expertise exist within current Extension faculties. A Delphi study methodology may be appropriate in assessing knowledge and skills at increasing levels of depth. More basic needs assessment tools may not accurately ascertain skill levels if respondents are have limited background in energy (e.g. – People may not know what they don’t know.)

As states begin implementing the change process, continued evaluation and research of faculty concerns is recommended. The Stages of Concern Questionnaire may be used to compare concerns of faculty as the change process evolves, however less formal assessment might also indicate progression of faculty through the various stages of concern. The Innovation Configuration and Levels of Use instruments are designed specifically to assess faculty concerns and implementation efforts and may provide rich insights for change facilitators as the process evolves. Any significant resistance to the innovation should be assessed using the SoCQ to understand the nature of the resistance and the levels of faculty concern.

Evaluation research related to continuous improvement should be implemented as a tenet of becoming a learning organization. Learning organization texts provide a
variety of evaluation matrixes that might be used to assess Extension in this process. The elements of the learning organization will be critical to long term adoption and evolution of renewable energy programming in Extension.


WEDA. (2009). *Western Region Extension Energy Inventory and Survey Results*. Corvallis: WEDA.


WSARE Survey. (2010, April 2). Western Region Extension Program Updates. Bozeman, MT.

APPENDICES
APPENDIX A

IRB TRAINING CERTIFICATE
CITI Collaborative Institutional Training Initiative

Data or Specimens Only Research Investigators Curriculum Completion Report
Printed on 11/23/2010

Learner: Sarah Hamlen (username: b51r998)
Institution: Montana State University
Contact Information: 118 Smith River Road
White Sulphur Springs, MT 59645 USA
Department: Extension
Phone: 406-299-7679
Email: shamlen@montana.edu

Data or Specimens Only Research - Basic/Refresher: No direct contact with human subjects.

Stage 1. Basic Course Passed on 11/23/10 (Ref # 5275803)

<table>
<thead>
<tr>
<th>Required Modules</th>
<th>Date Completed</th>
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<tbody>
<tr>
<td>Belmont Report and CITI Course Introduction</td>
<td>11/23/10</td>
</tr>
<tr>
<td>History and Ethical Principles</td>
<td>11/23/10</td>
</tr>
<tr>
<td>Informed Consent</td>
<td>11/23/10</td>
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<tr>
<td>Social and Behavioral Research for Biomedical Researchers</td>
<td>11/23/10</td>
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<td>Records-Based Research</td>
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<tr>
<td>Research With Protected Populations - Vulnerable Subjects: An Overview</td>
<td>11/23/10</td>
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<tr>
<td>Conflicts of Interest in Research Involving Human Subjects</td>
<td>11/23/10</td>
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Date Completed:
- Belmont Report and CITI Course Introduction: 11/23/10, 2/3 (67%)
- History and Ethical Principles: 11/23/10, 7/7 (100%)
- Basic Institutional Review Board (IRB) Regulations and Review Process: 11/23/10, 4/5 (80%)
- Informed Consent: 11/23/10, 4/4 (100%)
- Social and Behavioral Research for Biomedical Researchers: 11/23/10, 3/4 (75%)
- Records-Based Research: 11/23/10, 1/2 (50%)
- Research With Protected Populations - Vulnerable Subjects: An Overview: 11/23/10, 4/4 (100%)
- Conflicts of Interest in Research Involving Human Subjects: 11/23/10, 1/2 (50%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator
APPENDIX B

PERSONAL CORRESPONDENCE
From: gerry.hall@unr.edu  To: Sarah Hamlen  Subject: Re: Use of SoCQ Request  Date: Wednesday, September 07, 2011 1:44:01 PM

Sarah: Thank you for the email. I am pleased to know of your interest in CBAM and especially the SoCQ. See my responses to your questions below (IN CAPS):

"""Sarah Hamlen"""" 08/07/2011 08:50:28 AM—Dear Dr. Hall,

From: "Sarah Hamlen" <sarahm@montana.edu>  To: <gerry.hall@unr.edu>  Date: 09/07/2011 08:50 AM  Subject: Use of SoCQ Request

Dear Dr. Hall,

I am writing to you with regard to the use of the SoCQ instrument with a University Extension field faculty population. I am conducting graduate research and would like to use the Stages of Concern Questionnaire to assess field faculty concerns related to implementation of renewable energy programming.

I do, however, have several questions with regard to the use of the instrument in a non-k-12 population. Would you be so kind as to help me address these concerns? I understand the instrument was normed with k-12 populations. WE ALSO HAD PARALLEL POPULATIONS OF HIGHER EDUCATION FACULTY. Do you have samples of research using SoCQ on adult educator populations? (If so, anything specific to University faculty and/or Extension field faculty would be preferred.) SEVERAL OF OUR EARLY STUDIES WERE OF TEACHER EDUCATION FACULTY, SUBSEQUENTLY WE HAVE DONE SEVERAL STUDIES WITH MEDICAL SCHOOL FACILITIES. I have reliability and validity established with adult educator populations? WE ALSO HAVE DONE STUDIES AND PROJECTS IN BUSINESS SETTINGS. Would you recommend a pilot study to establish reliability and validity for field faculty? I DON'T THINK YOU NEED TO BE WORRIED ABOUT THE SOCQ APPLING TO EXTENSION FACULTY. THEY SHOULD BE WELL INSIDE THE ESTABLISHED NORMS. My graduate research committee has recommended substituting the language "the innovation" in the survey instrument with "renewable energy programming". I AM OK WITH THAT SUBSTITUTION. WE DO THIS SOMETIMES. JUST DO NOT CHANGE ANY OTHER WORDING IN THE ITEMS.

Any information you might provide is greatly appreciated. YOU HAVE NOT MENTIONED WHICH FORM OF THE SOCQ YOU ARE WORKING WITH. HOPEFULLY IT IS THE NEWEST ONE (FORM 075). ALSO, DO YOU THE TECHNICAL MANUAL FOR THIS FORM OF THE SOCQ? INCLUDE THE NEWEST EDITION OF IMPLEMENTING CHANGE (THIRD EDITION, 2011)?
Assuming you do not have concerns over use of the instrument or the above questions, might I obtain permission to use SoCQ from you? YOU HAVE MY PERMISSION. PLEASE FEEL FREE TO STAY IN CONTACT WITH ME, IT IS BEST THAT WHEN YOU HAVE QUESTIONS, YOU ASK THEM.

HAVE FUN WITH YOUR STUDY.

Best regards,

Sarah A. Hamlen Community and Energy Resource Associate Specialist  
P.O. Box 172230  
Bozeman-MT  
-59717-2240 Phone:  
406-259-7679
APPENDIX C

REQUEST FOR INVOLVMENT OF WY AND CO
September 19, 2011

Dr. Lou Swanson
Vice President for Engagement and Director of Extension
136 Student Services Building
Fort Collins, CO 80523-1030

Dear Lou,

As you are aware, University Extension programs are increasingly tasked with providing renewable energy education programming to our constituents. Extension involvement in energy seems to emerge in many venues, from the Association of Public and Land Grant Universities initiatives to conversations at the Western Extension Directors Association meetings. We, as Directors, are continually reminded of Extension’s potential roles in energy education. However, while we are being asked to increase our educational outreach in energy, we also face tight financial times and a need to more effectively balance our resources to meet existing constituent needs.

In Montana, we are working to make energy a core focus of Extension-related work. To effectively integrate energy-related programming, we feel it is essential that we engage field faculty in outreach efforts. We do recognize that field faculty require assistance in integrating renewable energy into already full schedules, and that they will need professional development training. To maximize the benefits of our programming and training efforts, we feel it is important to understand the needs and concerns of field faculty. To that end, Extension Energy Associate, Sarah Hamlen, has designed a research project to help us better assess the concerns of field faculty. The research utilizes theory from the Stages of Concern Model and more specifically, the valid and reliable Stages of Concern Questionnaire to assess the most effective means of accomplishing renewable energy programming implementation.

We know that your state Clean Energy Specialist, Gary Weiner, is already working hard to develop resources for faculty. We hope that anything we learn through this research could help to enhance his efforts and would be happy to share any programming or professional development strategies that emerge as part of this research.

I would ask that you please disseminate the link to the following survey (https://www.surveymonkey.com/s/SoCC) to your field faculty. In order for this research to be statistically significant, Ms. Hamlen seeks a response rate of 75%. As you know, this is an ambitious goal. Your assistance in helping her to collect surveys from your state would be greatly appreciated.

Thank you for your time and consideration. If you have any questions or concerns about this research, please contact Sarah Hamlen at 406-209-7679 (hamlen@montana.edu) or Dr. Shannon Arnold, research supervisor, at 406-994-6603 (shannon.arnold@montana.edu).

Sincerely,

Douglas L. Steela, PhD
Vice President for External Relations
Director of Extension
September 19, 2011

Dr. Glen Whipple, Extension Director
Agriculture College, Room #103
Administration Office – Dept. 3354.
1000 E. University Avenue
Laramie, WY 82071

Dear Glen,

As you are aware, University Extension programs are increasingly tasked with providing renewable energy education programming to our constituents. Extension involvement in energy seems to emerge in many venues, from the Association of Public and Land Grant Universities initiatives to conversations at the Western Extension Directors Association meetings. We, as Directors, are continually reminded of Extension’s potential roles in energy education. However, while we are being asked to increase our educational outreach in energy, we also face tight financial times and an need to more effectively balance our resources to meet existing constituent needs.

In Montana, we are working to make energy a core focus of Extension-related work. To effectively integrate energy-related programming, we feel it is essential that we engage field faculty in outreach efforts. We do recognize that field faculty require assistance in integrating renewable energy into already full schedules, and that they will need professional development training. To maximize the benefit of our programming and training efforts, we feel it is important to understand the needs and concerns of field faculty. To that end, Extension Energy Associate, Sarah Hanlen, has designed a research project to help us better assess the needs of field faculty. The research utilizes theory from the Concerns Based Adoption Model and more specifically, the valid and reliable Stages of Concern Questionnaire to assess the most effective means of accomplishing renewable energy programming implementation.

We know that your state Extension Energy Coordinator, Milton Granger, is already working hard to develop resources for faculty. We hope that anything we learn through this research could help to enhance his efforts and would be happy to share any programming or professional development strategies that emerge as part of this research.

I would ask that you please disseminate the link to the following survey (http://www.surveymonkey.com/s/6nQ3Q) to your field faculty. In order for this research to be statistically significant, Ms. Hanlen seeks a response rate of 75%. As you know, this is an ambitious goal. Your assistance in helping her to collect surveys from your state would be greatly appreciated.

Thank you for your time and consideration. If you have any questions or concerns about this research, please contact Sarah Hanlen at 406-209-7679 (sarahl@montana.edu) or Dr. Shannon Arnold, research supervisor, at 406-994-6663 (shannon.arnold@montana.edu)

Sincerely,

Douglas L. Steele, Ph.D
Vice President for External Relations
Director of Extension
APPENDIX D

SURVEY INSTRUMENT
Extension Energy SoCQ

Introduction

Thank you for agreeing to participate in this survey. This research project will aid in the development of energy programming and in-service training opportunities for Extension field faculty. Your time is greatly appreciated!

This survey should take about 10 minutes to complete.

*1. You are being asked to participate in a study regarding the implementation of renewable energy programming in Extension. You have been chosen for participation in this study because of your position as member of field faculty at a Land Grant University within Cooperative Extension. This survey will help to identify the concerns of field faculty with regard to including renewable energy programming in county or region level educational efforts. This may help us to better understand professional development and curriculum needs.

The study is completely voluntary. If you agree to participate, your responses will be anonymous and confidential. The online survey will take approximately 10–15 minutes to complete.

There are no risks beyond the minimal associated with your participation in this study. The survey answers will be used to achieve insight into the curriculum and professional development needs of field faculty in renewable energy education.

If you have questions regarding this research, the data collection or analysis process, or plans for dissemination of results, you may contact Sarah Hamlen at (406) 209-7679 or email: shamlen@montana.edu or Dr. Shannon Arnold at (406) 994-6663, or email: Shannon.arnold@montana.edu. If you have questions or concerns about your rights as a human subject involved in this research, you may contact Dr. Mark Quinn, Institutional Review Board Chairperson, at (406) 994-4707, or email: mquinn@montana.edu.

By clicking on the “Next” button to continue this survey, you are indicating that you have read the above informed consent and understand there are no personal benefits, consequences, or costs associated with participation in this study. By entering your name, you voluntarily agree to participate in this research. You understand that you may later refuse to participate, and that you may withdraw from the study at any time.

Enter your name to agree to these terms:
## Extension Energy SoCQ

### About You...

In this section of the survey, you will provide information regarding your position and experience with Extension.

### 2. In which state are you employed:
- [ ] Montana
- [ ] Wyoming
- [ ] Colorado

### 3. What is your age?
- [ ] 21 to 25 years old
- [ ] 26 to 35 years old
- [ ] 36 to 45 years old
- [ ] 46 to 60 years old
- [ ] 61 to 65 years old
- [ ] 66 to 70 years old
- [ ] Over 70 years old

### 4. What is your sex?
- [ ] Male
- [ ] Female

### 5. What is your highest level of educational attainment?
- [ ] Less than a Bachelor's Degree
- [ ] Bachelor's Degree
- [ ] Master's Degree
- [ ] PhD

### 6. Is your position full time or at least 40 hours per week (including any grant-funded work)?
- [ ] Yes
- [ ] No
7. How many years have you been employed by Cooperative Extension? Please indicate your total years of employment with Extension, not just this position.

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- Over 20 years

8. How many years have you been in your current position?

- Less than 1 year
- 1-5 years
- 6-15 years
- 16-25 years
- Over 25 years

*9. Please indicate the percentage (enter only the number - eg. 30 NOT 30%) of time you dedicate each year to the following programming areas. Please answer according to how your time actually is spent, rather than what might be indicated in a position description.

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<th>Natural Resources</th>
<th>Agriculture</th>
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<td>Family and Consumer Sciences</td>
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<td>Community and/or Economic Development</td>
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</table>

10. What is your professional background?

- I have always been employed by Extension.
- I was/am employed by the private sector/self employed.
- I was/am an agricultural producer.
- I was previously employed by the public sector.
Extension Energy SoCQ

11. How many hours do you currently spend on energy education on an annual basis?

Oil and gas issues
Renewable energy issues
Home energy issues
Agricultural energy issues
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<th>Stages of Concern Questionnaire</th>
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The purpose of this questionnaire is to determine the concerns of Extension educators regarding renewable energy programming. Please respond to the following statements in terms of your present concerns, involvement, or potential involvement with renewable energy education in Extension. We do not hold to any one definition of this program, so please think of it in terms of your own perceptions of what it involves. If there are questions that are completely irrelevant to you, please indicate ‘0’ on the scale. Thank you for taking the time to complete this task.
Extension Energy SoCQ

Stages of Concern Questionnaire

All questions on this section of the survey will use a seven-point Likert scale which appears at the top of the questions in the actual survey:

0 = Irrelevant  
1-2 = Not True of Me Now  
3-4 = Somewhat True of Me Now  
5-7 = Very True of Me Now

12. Please respond:

0 = Irrelevant  
1-2 = Not True of Me Now  
3-4 = Somewhat True of Me Now  
5-7 = Very True of Me Now

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<th>Question</th>
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<td>I am concerned about constituents' attitudes about renewable energy programming.</td>
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<td>I now know of some other approaches that might work better.</td>
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<td>I am more concerned about another programming area.</td>
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<td>I am concerned about not having enough time to organize myself each day.</td>
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<td>I would like to help other faculty members in their use of renewable energy programming.</td>
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<td>I have very limited knowledge about renewable energy programming.</td>
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<td>I would like to know the effect reorganization on my professional status.</td>
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<td>I am concerned about conflict between my interests and responsibilities.</td>
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<td>I am concerned about revising my use of renewable energy programming.</td>
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<td>I would like to develop a working relationship with both our faculty and outside faculty using renewable energy programming.</td>
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<td>I am concerned with how renewable energy programming affects constituents.</td>
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<td>I am not concerned about renewable energy programming at this time.</td>
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<td>I would like to know who will make the decisions in renewable energy programming.</td>
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<td>I would like to discuss the possibility of using renewable</td>
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### Extension Energy SoCQ

**energy programming.**

| I would like to know what resources are available if we decide to adopt renewable energy programming. | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| I am concerned about my inability to manage all that renewable energy programming requires. | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| I would like to know how my teaching is supposed to change. | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
| I would like to familiarize other departments or persons with the progress of renewable energy programming. | ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ |
13. Please respond:

0 = Irrelevant
1-2 = Not True of Me Now
3-4 = Somewhat True of Me Now
5-7 = Very True of Me Now

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<th></th>
<th>0 Irrelevant</th>
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<td>I am concerned about evaluating my impact on constituents.</td>
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<td>I am completely occupied with things other than renewable</td>
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<td>Coordination of tasks and people is taking too much of my</td>
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<td>I would like to know how renewable energy programming is better than what we have now.</td>
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14. What other concerns, if any, do you have at this time? (Please describe them using complete sentences.)