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How are Electric Utilities Responding to the Impact of Renewables? Exploring an Integrative Approach to Ambidextrous Business Behavior

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How are Electric Utilities Responding to the Impact of Renewables?

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By

Robert Thomas Casey, Jr.

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ACCEPTANCE

This dissertation was prepared under the direction of Robert Thomas Casey, Jr. Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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LIST OF ABBREVIATIONS

ARRA – American Recovery and Reinvestment Act of 2009

ASI – Advanced Solar Initiative

BOD – Board of Directors

CAA – Clean Air Act

CPP – Clean Power Plan

CPS – Carbon Pollution Standards

DER – Distributed Energy Resources

PUC – Public Utility Commission

CVF – Competing Values Framework

Co-op – Electric Cooperative

DSIRE* – Database of State Incentives for Renewables and Efficiency

DSM – Demand-Side Management

ECSC – Electric Cooperatives of South Carolina

EPA – Environmental Protection Agency

EU – Electric Utilities

G&T – Generation and Transmission

GEMC – Georgia Electric Membership Corporation

GMP – Green Mountain Power

GPC – Georgia Power Company

HEI – Hawaiian Electric Industries

IOU – Investor-owned Electric Utility

IRP – Integrated Resource Plan

KIUC – Kaua'i Island Utility Cooperative

kWh – Kilowatt hour

NEM – Net-Metering

NERC – North American Electric Reliability Corporation

NRECA – National Rural Electric Cooperative Association

OA – Organizational Ambidexterity

PPA – Power Purchase Agreement

PSC – Public Service Commission

PV – Photovoltaics

REC – Renewable Energy Credit

ROI – Return on Investment

RPS – Renewable Portfolio Standard

SM – Sensemaking

VEC – Vermont Electric Cooperative

VER – Variable Energy Resource

ABSTRACT

How are Electric Utilities Responding to the Impact of Renewables?

Exploring an Integrative Approach to Ambidextrous Business Behavior

By

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April 20, 2015

Committee Chair: Dr. Karen Loch

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In the U.S., clean energy goals and the move towards a clean energy economy are causing the electric power sector to add emerging and innovative renewable energy resources into their generation mix. Electric utilities (EU) face a monumental challenge to create, deliver, and capture value from emerging and disruptive technologies. This study seeks to address the impact of solar photovoltaics on the EU market by investigating the role of business model changes within the domain of urban and rural U.S. electric utility organizations. By integrating the evolving EU business model with the Competing Values Framework (CVF), a new lens is created to assess the changing and evolving business behavior within the EU industry. Furthermore, a predictive and prescriptive tool emerges associated with organizational ambidexterity (OA). Finally, four lessons are presented that will help EU leaders become more anticipatory, adaptable, and responsive in this changing renewable environment.

I INTRODUCTION

Recently, the Senate Energy and Natural Resources Committee held a hearing that examined the state of technological innovation related to the electric industry. Senator Lisa Murkowski (R-Alaska), chairman of the committee, stated that "*a combination of market forces, technological innovation, and policy directives at both the federal and the state levels could well result in an unprecedented transformation of the electricity sector*" (U.S. Senate Committee on Energy and Natural Resources, March 2015). This transformation is not just a U.S. phenomenon but across the globe the electric power sector has added emerging and innovative renewable energy resources into their electric power generation mix to fight climate change and resource depletion. Electric utilities (EU) in the U.S. are now faced with a challenge of negotiating, managing, and responding to emerging and disruptive renewable technologies.

The U.S. electric power industry has three types of EU service providers: 1) investor-owned utilities, 2) electric cooperatives, and 3) municipal electric utilities. Since investor-owned electric utilities (IOU) serve more than two-thirds of the urban U.S. population and electric cooperatives (Co-op) serve about three quarters of the U.S. landmass they were included in this study. IOUs and Co-ops have significant structural and operational differences. An IOU is a privately-owned electric utility whose stock is publicly traded, is cost-of-service regulated by the state and is authorized to achieve an allowed rate-of-return. A Co-op is a private, not-for-profit business governed by their consumers and generally exempt from Federal income tax laws. Federal guidelines require that all Co-ops have democratic governance and operate at cost. Consumers elect local boards that oversee the Co-op which must return revenue above what is needed for operation to the consumer. A Co-op generates, transmits, and/or distributes supplies of electric energy to a specified area not being serviced by another utility. Most electric cooperatives were initially financed by the Rural Utilities Service and typically serve rural America (U.S. EIA, 2014). Table 1 summarizes the main characteristics of both types of EUs.

Table 1 IOU and Co-op Characteristics

Investor-owned Electric Utilities (IOU)	**Electric Cooperatives (Co-op)**
1. Fiduciary obligation to earn as large a margin as possible.	1. Non-profit institutions run by the customers that the Co-op region serves.
2. Take advantage of accelerated depreciation and investment tax credits.	2. Exempt from state regulations and Federal income tax.
3. Serve more than two-thirds of the US population.	3. Federal and regional governments contribute management expertise, financial support, and grants to promote agriculture and to allow service to rural America.
4. Subject to different regulations than publicly-owned utilities and Co-ops.	4. Acquisition of actual energy and ancillary services are performed to reduce cost.
5. Average of 2,200 employees and 315,000 consumers per IOU.	5. Average of 57 employees and 10,000 consumers per Co-op. Co-ops cover three quarters of U.S. landmass.

IOUs and Co-ops have been slow to change in the last 35 years. However, IOUs and Co-ops have recently witnessed an ever-growing and continuous pressure to change due to the disruptive technology of solar energy. A 2013 report from the Edison Electric Institute shows the degree of impact of these disruptive forces and proposes a possible electric utility death spiral due to decreases in solar PV cost, increases in regulatory environment pressure, and changes in customer behavior due to government incentive programs (Figure 1).

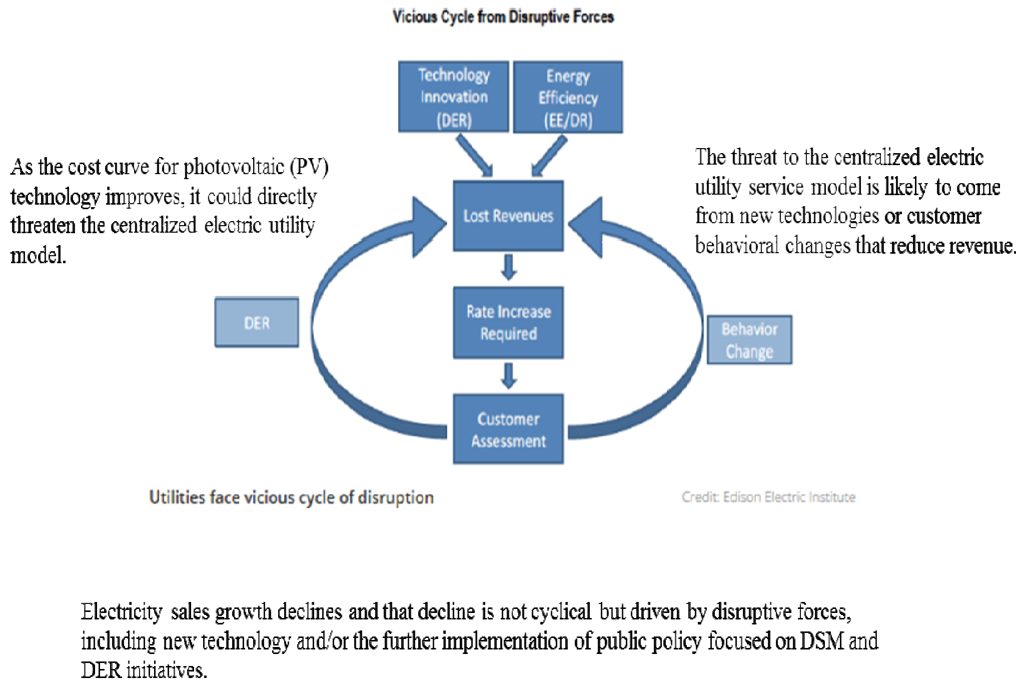


Figure 1 Electric Utility Disruptive Innovation (Solar Energy)

As technological and economic changes challenge and transform the EU business model, these changes (or “disruptive challenges”) arise due to a convergence of factors:

> *“…falling costs of distributed solar generation and other distributed energy resources (DER); increasing customer, regulatory, ...government environmental programs to encourage selected technologies; the declining price of natural gas; slowing economic growth trends; and rising electricity prices in certain areas of the country.”* (EEI, 2013)

Decreases in sales growth create a downward cycle which is driven by disruptive forces. This decrease in revenue causes EUs to raise rates to cover fixed costs, thereby prompting customers to consider the further implementation of alternative technologies. Therefore, the threat to the centralized EU business model is very likely to come from these new solar photovoltaic technologies and the related customer behavioral changes that reduce electrical load. (EEI, 2013)

The purpose of this study is to consider the effects of solar photovoltaics on the EU market. Specifically, it investigates the role of EU business model changes within the domain of IOU (urban) and Co-op (rural) U.S. electric utility organizations. By using an integrative approach with Cameron, Quinn, DeGraff, and Thakor's (2006) Competing Values Framework (CVF) and Richter's (2011) EU business model, an assessment can be made to understand how IOUs and Co-ops have changed between 2009 and 2014. Through this assessment, a predictive and prescriptive tool emerges that enables EU leaders to interpret to what extent they have shown ambidextrous behaviors to embrace solar energy and how they can become more anticipatory, adaptable, and responsive to a shifting environment.

The two research questions to be addressed in this study are: 1) *How have EUs responded to a shift in their environment from 2009 - 2014 due to a disruptive solar technology?* and 2) *What are the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs in response to a disruptive solar technology?*

I.1 Electric Utility Background

To better grasp and respond to what is happening in their environments, IOUs and Co-ops use an integrated resource planning (IRP) process which evaluates the costs and benefits of both demand-side and supply-side resources to develop the least total-cost mix of electric utility resource options over a twenty-year period (U.S. Department of Energy).

The Tri-State Generation and Transmission Co-op in Colorado, which serves 18 distribution Co-ops with generation and transmission resources, says the IRP has become a formal process prescribed by law in some states as a result of some provisions of the Clean Air Act amendments of 1992 (Tri-State IRP, 2010). This process is a critical tool for balancing the ability to see new opportunities while maintaining a focus on current operating advantages. An IRP is typically submitted every three years by the EU to the state's Public Service Commission (PSC) for approval (GPC IRP, 2013). The IRP is like organizational radar, allowing decision-makers to develop an early warning system for potentially devastating disruptive technologies, third-party competitor developments, and other electric utility industry shifts.

Some state IRP rules have remained unchanged since they were first implemented; other states have amended, repealed, and in some cases reinstated their IRP rules. Rules that have been amended often reflect current concerns in the electric industry such as fuel costs and volatility, the effects of power generation on air and water, issues of national security, electricity market conditions, and climate change, as well as individual state concerns. At Georgia Power Company, the 2013 IRP results were formulated by using multiple scenario planning cases which evaluated the impacts of three different fuel price views and three different carbon/renewable generation views (GPC IRP, 2013). Co-ops typically propose a 15 year resource planning process that is revised every 5 years. Co-ops are not regulated by the state PSC and therefore are not required to submit a long-term resource plan for approval.

Both the IOU and Co-op are being impacted by the emergence of solar PV which has been triggered primarily by two pieces of federal legislation. The first piece of legislation, the American Recovery and Reinvestment Act of 2009 (ARRA), is an economic stimulus package enacted by the 111th United States Congress in February 2009 and signed into law on February 17, 2009, by President Barack Obama (Pub. L. 111–5). The ARRA (Figure 2) is an \$800 billion economic stimulus package aimed at job creation and the promotion of investment and consumer spending. This act allocated $4.3B in tax credits to homeowners for energy efficiency improvements (2009 - 2010 extended to 2016), $21.5B for energy infrastructure, and $27.2B for energy efficiency and renewable energy research and investment. The second piece of legislation, under the Clean Air Act (CAA), is President Obama's Climate Action Plan (CAP) which includes two sections: Section 111(d) commonly called the Clean Power Plan (CPP) and Section 111(b) commonly called the Carbon Pollution Standards (CPS). How did these two pieces of legislation trigger the growth of solar energy use and technology?

President Obama's Climate Action Plan, which encourages use of renewables and is supported by the U.S. Environmental Protection Agency (EPA), has been introduced in three stages. The plan first proposed cutting carbon pollution from new and existing power plants by creating targets for fossil-fuel carbon dioxide emissions and mandated that CO_2 emitted from fossil-fuel based generation must be reduced by 30 percent by 2030 as compared to 2005 levels. Current proposals include a specific emission reduction target for year 2030 for each state with a one year deadline for an implementation plan to meet the targets. The EPA CAA Fact Sheet (U.S. EPA) shows these milestones:

1. January 2013, EPA proposed standards to limit carbon pollution from new power plants.
2. June 2014, EPA proposed the CPP to limit carbon pollution from existing power plants.
3. June 2015, EPA plans to propose a federal plan to meet CPP goals for comment.
4. June 2016, proposed due date for states to submit compliance plans to EPA.
5. June 2020, proposed beginning of the CPP compliance period.

The CAA proposes to let states meet emission targets for power plants through plant upgrades, by switching from coal to natural gas, and by improving energy efficiency or promoting renewable energy. Many industry groups are insisting that the EPA limit itself to more modest efficiency gains that could be made in power plants alone lest energy rates increase dramatically across the nation. According to the ruling, if a state does not develop an effective implementation plan, the EPA can impose a federal plan (U.S. EPA, 2015).

Due to these regulatory changes, the emergence of solar PV energy is becoming a disruptive force in the EU utility-side grid business model landscape.

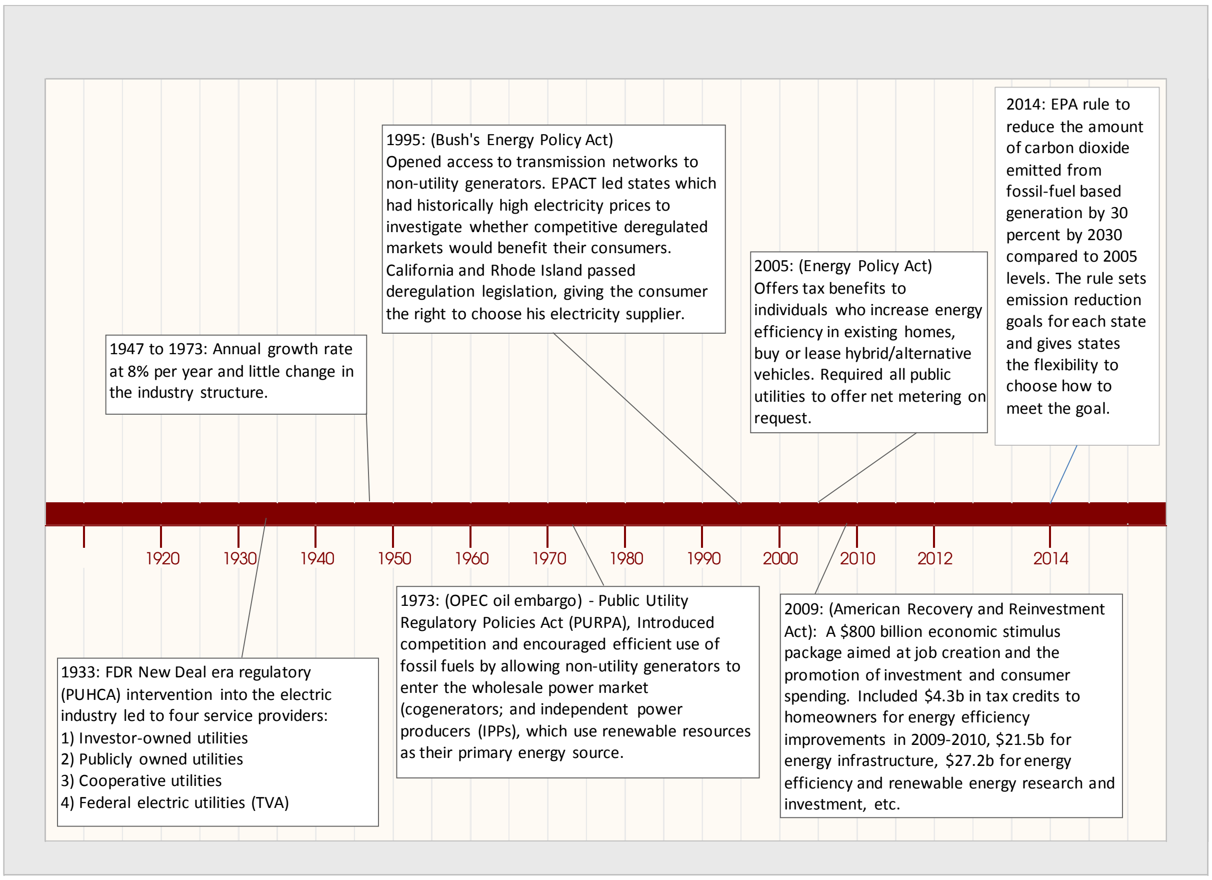


Figure 2 Evolution of the Electric Utility Industry Regulatory Environment

I.2 Disruptive Innovations

Disruptive technological innovations disturb the established trajectory of performance improvement and often destroy the value of existing competencies (Tushman & Anderson, 1986). A major characteristic of disruptive technologies is that they are rarely directly employed in established markets, but instead change the architecture of the market in the medium and long term (Christensen & Bower, 1996).

The theory of disruptive technological change provides insight into the impact of different renewable energy technologies for electric utilities:

1) Disruptive technologies generally “create entirely new markets through the introduction of a new kind of product or service” (Christensen & Overdorf, 2000, p.72).
2) The concept of “architectural” (Henderson & Clark, 1990) or “integrative” (O’Reilly & Tushman, 2004) innovations recognize the fact that many innovations do not require breakthrough technology to have major disruptive impacts on markets. These architectural innovations essentially take core technologies and ideas that already exist and combine them in new and novel ways to achieve an innovation that is greater than the proverbial sum of its parts (Henderson & Clark, 1990; O’Reilly & Tushman, 2004).

This author believes that distributed solar energy is both an architectural innovation and a new market technology based upon the industry reaction to the disruptive impact on the vertically integrated EU business model. Solar panel architecture (customer-side designs) allows electric energy to be produced and then used where the consumer load is located reducing the need for the electric grid and lowering the requirements for large EU resources. It can also be argued that third-party customer-side solar leasing systems meet the criterion of creating “new markets” as witnessed by the emergence of numerous companies offering leasing options to homeowners. Finally, the emergence of new products and services that support these designs also constitute a new market.

II LITERATURE REVIEW

Theory elaboration entails the application of new concepts borrowed from other theoretical perspectives to explain the focal phenomena (Braxton et al., 1997; Thornberry, 1989). This qualitative research uses theory elaboration to draw on, extend, and organize important ideas from EU Business Model changes and OA behaviors in response to the challenges introduced by the emergence of solar PV. The goals of this study are 1) to develop an integrative approach to assess EU business model changes to understand how IOUs and Co-ops have changed between 2009 and 2014 and 2) to develop a predictive and prescriptive tool that allows EU leaders to interpret to what extent they have shown ambidextrous behaviors in embracing solar energy and to determine how they can become more anticipatory, adaptable, and responsive in a shifting environment.

II.1 EU Business Model

Osterwalder and Pigneur (2009: 14) explain a business model as "the rationale of how an organization creates, delivers, and captures value". A business model also functions as a valuable tool for analysis and management in engaged scholarship (Zott & Amit, 2008) and as an organizational tool to build comprehensive groupings to help understand business phenomena (Baden-Fuller & Morgan, 2010). As an organizational decision making tool, the business model concept also helps executives and managers develop techniques to plan, design, construct, operate, change, and interpret their business (Wirtz et al., 2010). Richter (2011) states that many definitions of an EU business model encompass four basic elements: the value proposition, the customer interface, the infrastructure, and the revenue model. Richter's (2011) EU business model is used in this study as a structural template to describe the organizational composition

(Chesbrough & Rosenbloom, 2002) and to examine, compare, and contrast EU companies in a structured manner.

The Richter (2011) EU model contains two “sides”: the utility-side and the customer-side, which are analyzed throughout this study. A utility-side solar array encompasses a large scale project with capacity between two and a few hundred megawatts. For example, a typical 30 megawatt solar array requires approximately 200 acres of property and a connection to the transmission grid for operation. The value to the EU is bulk generation of electricity; electricity is fed into the grid and delivered to the customer in the traditional manner of coal, gas, and nuclear power plants. Just as Teece (2010) describes, the utility-side generation business model describes how EU organizations deliver value to customers and investors at a reduced cost, attracting consumers to pay for that lower cost value, and then transforming the revenue into a profit or service.

The second model is the customer-side distributed solar photovoltaics (PV) generation (roof-top) installation. A roof-top installation is typically attached to a residential or commercial facility close to the point of consumption. A building can be completely supplied with electricity to the point that it is “net-metered”. Net-metering (NEM) allows electricity customers who wish to supply their own electricity from on-site generation to pay only for the net energy they obtain from the utility. PV systems can at times export excess power to the grid which is then credited to the consumer’s bill. The possible value of solar PV to the EU would be providing a full service package that includes financial solar panel leasing and maintenance, energy consulting services, and net-metering. Richter (2013) states that EUs in Germany believe distributed solar

PV generation has no value chain proposition and therefore have not ventured into this new market. In this U. S. study, the customer-side renewable energy business model, depicted in Figure 3, is being explored and accepted as a model which both IOUs and Co-ops have adopted between 2009 and 2014.

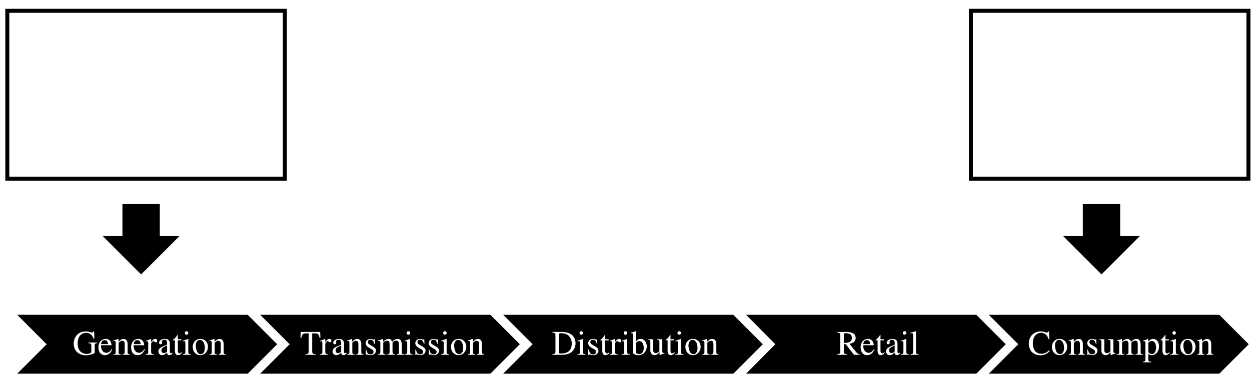


Figure 3 Richter (2011) EU Renewable Energy Business Models

Fundamentally EU business models are changing due to decreases in solar PV cost, increases in regulatory environment pressure, and changes in customer behavior due to government incentive programs. Is it possible that the renewable energy issues that impact the EU organization will be debated and resolved in an EU model regulatory component? For the purpose of this study, the business model refers to the Richter (2011) renewable energy nomenclature with a fifth business model component of "regulatory" added by the author because the U.S. the electric utility industry is regulated at all government levels: federal, state, and municipal. Table 2 provides an overview of the Richter (2011) Business Model with the added regulatory component.

Table 2 EU Business Model Components

Component	Utility-Side Business Model	Customer-Side Business Model
Value Proposition - is the bundle of products and services that creates value for the customer and allows the company to earn revenues.	Bulk generation of electricity fed into the grid	Customized solutions and energy related services
Customer Interface - comprises the overall interaction with the customer. It consists of customer relationship, customer segments, and distribution channels.	Electricity as commodity and customer pays per unit	Customer is involved in energy generation by hosting the generation system and sharing benefits with the utility. Long-term customer relationship.
Infrastructure - describes the architecture of the company's value creation. It includes assets, know how, and partnerships.	Small number of large scale assets and centralized generation	Large number of small scale assets and generation close to the point of consumption
Revenue - represents the relationship between costs to produce the value proposition and the revenues that are generated by offering the value proposition the customers.	Revenues through feed-in of electricity. Economies of scale from large projects and project portfolio.	Revenue from direct use, feed-in and/or from services. High transaction costs.
Added:		
Regulatory - Federal and State mandates and credits	Environmental mandates incentivizing third-party solar PV ownership. Variable energy resources reduce grid reliability.	Net metering and solar garden legislation promotes distributed generation. EU experiences lost revenue and cross-subsidy issues.

Solar PV technology has the potential to affect components of the EU Business Model. The presence of a third-party entity owning a utility-side or customer-side solar system effects the typical IOU and Co-op business model with opposing interests creating a context in which the interaction between EU leaders and stakeholders (consumers and policymakers) are important to recognize (Elsbach, 1994). The business model for an IOU is a guaranteed return-on-investment (ROI) as established by a state regulatory agency, the PSC. The IOU can recover its cost through rate increases or exercising fixed cost infrastructure tariffs to keep the investor interests in check. The business model for a Co-op is very different from a customer service context. Its Board of

Directors (BOD) is typically comprised of business owners within the Co-op's service territory and rate increases are scrutinized by the Co-op's customers, not a state agency. What is common between an IOU and a Co-op is that solar PV may erode revenue through its use at the industrial, commercial, and residential levels.

Although IOUs and Co-ops are both negatively affected by the emergence of solar PV where revenue is concerned, differences also exist. IOUs and Co-ops often have divergent interests (i.e. investor-owned vs. customer-owned and regulated vs. unregulated) resulting in customer tension stemming from conflicts between rural versus urban customer service goals. Moreover, the relatively small size of Co-ops makes leaders and key stakeholders easily identifiable, whereas IOUs are typically very large and management heavy insulating the needs of the customer from business drivers.

To exacerbate the solar PV issue, policymakers have encouraged disruptive competing solar energy through various subsidy programs such as tax incentives, renewable portfolio standards, and net-metering, where the pricing structure of utility services allows customers to engage in the use of new technologies consequently shifting costs and lost revenues to remaining non-participating customers (EEI, 2013). Thus, the ongoing growth of solar energy will continue to be a disruptive negative force in the EU industry. The potential impact of solar PV on the EU industry, their customers, and regulatory agencies is shown in Figure 4 and Table 3. As shown, the negative impact on the EU industry reveals an unclear value proposition for the development of an economically sustainable revenue model. Thus, EUs may be far from reaching organizational ambidexterity in the field of renewable energy.

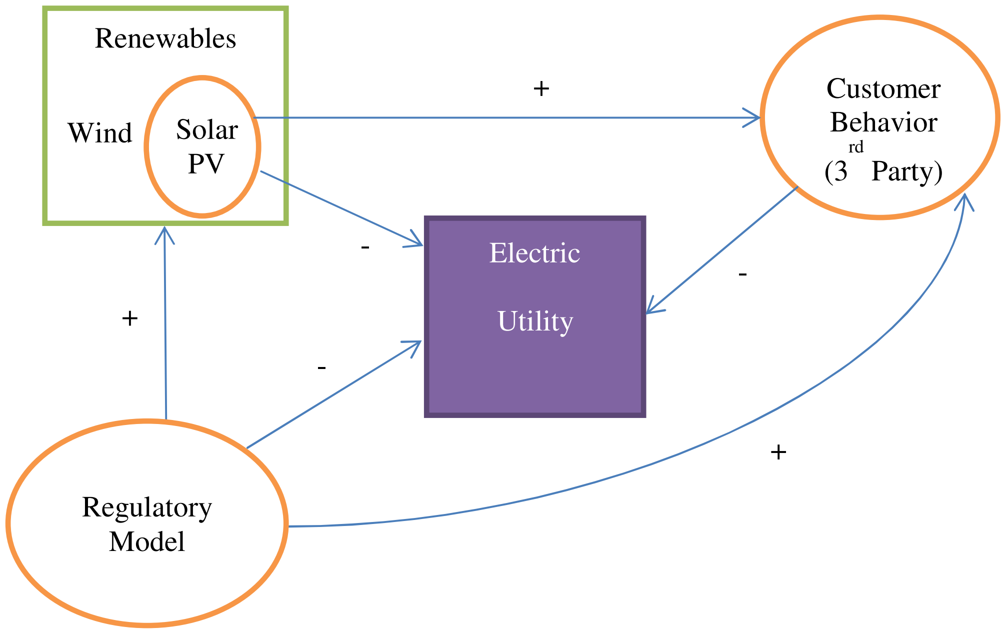


Figure 4 Electric Utility Solar PV Disruptive Model

Table 3 Electric Utility Solar PV Disruptive Character

	IOU	Co-op
Utility-Side	• EPA (CPP) • VER ($) • IOU Guaranteed Cost Recovery • **Increased Rates**	• EPA (CPP) • VER ($) • Third-party ownership • **Increased Rates**
Customer-Side	Urban America • Elitist Enterprise • Regulatory Market Dependent • **Non-solar Cost-sharing**	Rural America • Less Market • Regulatory Market Dependent • **Non-solar Cost-sharing**

II.2 Organizational Ambidexterity

Organizational ambidexterity (OA) is the ability to pursue two different objectives simultaneously (Porter, 1980). OA is a mental balancing act for managers of maintaining the current core business while developing radically new products and services for the future of the organization (Tushman & O'Reilly, 1996; March, 1991). Organization scientists have adopted the human trait of ambidexterity (an ability to use both hands with equal skill) as a metaphor to describe competent organizations. Thus, the theory of organizational ambidexterity suggests that organizations are successful in the long term when they are able to exploit their existing capabilities while developing new exploratory competencies (Tushman & O'Reilly, 1996).

Companies tend to divide their attention and resources between exploration and exploitation, which are seen in the literature as two broad types of qualitatively distinct learning and knowledge processes (Floyd & Lane, 2000; March, 1991). Exploration implies organizational behavior characterized by variance-increasing activities including search, discovery, experimentation, risk-taking and innovation, whereas exploitation is characterized by variance-decreasing activities including disciplined problem solving, refinement, implementation, efficiency, production and selection (Cheng & Van de Ven,1996; March,1991). Organizations look to expand their capacities to successfully confront intensifying paradoxes and effectively manage contradictory challenges to ensure their viability and competitiveness in an increasingly turbulent environment in which multiple and inconsistent contextual demands can emerge (Smith & Tushman, 2005; Tushman & O'Reilly, 1996). The management of these organizational paradoxes, contradictions, and conflicts (Poole & Van de Ven, 1989) is crucial in keeping an organization viable and enabling it to adapt and survive in the face of environmental disturbances.

Birkinshaw and Gibson (2004) distinguish between two forms of organizational ambidexterity - structural ambidexterity and contextual ambidexterity. Researchers have determined that structural ambidexterity (Tushman & O'Reilly, 1996) and contextual ambidexterity (Gibson & Birkinshaw, 2004) are important for the growth of the ambidextrous organization.

Structural ambidexterity is the structural separation and coordination of entities into those focused on exploration and those focused on exploitation, often with different performance metrics where it involves splitting into different organizational units (Tushman & O’Reilly, 1996). Splitting into different organizational units is one structural ambidexterity process that copes with the dilemma of balancing exploration and exploitation. O'Reilly and Tushman (2004) examined several different structural responses to disruptive change and determined that separating the organization responsible for dealing with a disruptive change from the existing business with coordination at the senior executive level is the organizational template most closely associated with structural ambidexterity. The second structural ambidexterity process that some organizations use is focused on the organizational characteristics and competencies required to sense new opportunities and threats, seize upon them, and then reconfigure the organization to take advantage of the opportunities or counter the threats (O'Reilly & Tushman, 2004). The theoretical framing describes the three key capabilities in the structural ambidexterity literature as the “tripartite taxonomy” of sensing, seizing and reconfiguring (Teece, 2007, 2010).

Contextual ambidexterity is the ability for individuals within the organization to balance the needs for alignment and adaptability (Gibson & Birkinshaw, 2004) where it involves creating an organizational context and responding to the organizational stimuli that inspire, guide, and reward people to act in a certain way (Ghoshal & Bartlett, 1997). Contextual ambidexterity allows exploitation and exploration behaviors to grow, exist, and emerge in the same organizational unit. Gibson and Birkinshaw (2004) have shown that the four established characteristics of organizational context, as described by Ghoshal & Bartlett (1994), namely discipline, stretch, support, and trust, are good indicators of contextual ambidexterity (Gibson & Birkinshaw, 2004). In addition to these four organizational characteristics, Birkinshaw and Gibson (2004) also identified four individual behaviors associated with contextual ambidexterity (Birkinshaw & Gibson, 2004, p. 49) which are initiative, cooperation, communication, and multitasking.

Birkinshaw and Gibson (2004) explain that contextual ambidexterity is the collective orientation of the employees toward the simultaneous pursuit of alignment and adaptability. The key to contextual ambidexterity is empowering employees to make day-to-day decisions on how to balance exploration and exploitation, rather than having those decisions come from senior management. To do so, it is necessary for senior management to create an organizational context that provides support for individual employee decision-making roles and more generalist positions (Birkinshaw & Gibson, 2004).

Specifically for this study, questions remain concerning the drivers for determining the EU organizational ambidexterity type to pursue for the different solar PV dynamics. Primarily, this study seeks to understand EU organizational solar PV issues that give rise to paradoxes and concessions to enhance long-term competitiveness (Gibson & Birkinshaw, 2004).

The two research questions to be addressed in this study are: 1) *How have EUs responded to a shift in their environment from 2009 - 2014 due to a disruptive solar technology?*

Another expectation is to determine to what extent IOUs and Co-ops have shown ambidextrous behaviors during this time period. Also, an investor-owned utility (IOU) may have a different strategy of how to structure its business model compared to an electric cooperative (Co-op) because the IOU serves primarily urban customers and the Co-op serves rural customers. This potential difference leads to the second research question: 2) *What are the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs in response to a disruptive solar technology?*

II.3 Sensemaking

To examine the EU business model changes through a problem-solving process, the framework of this study begins with a critical organizational activity - "sensemaking" (Weick, 1995). According to Weick, Sutcliffe, and Obstfeld, (2005) sensemaking is a way of creating a shared understanding that is plausible enough for a group to move toward action. Industry leaders use sensemaking activities such as environmental scanning and issue interpretation to determine the impact and control mechanisms necessary for organizational decisions and strategic change (Gioia & Thomas, 1996). Other stakeholders such as consumers and legislators use sensemaking activities to construct their global strategy (Pratt, 2000) and position (Gephart, 1993).

Many EUs have established a resource planning process for their environmental and economic sensemaking awareness. For example, a rolling three year integrated resource scenario planning (IRP) process is being used by Georgia Power Company (GPC) to help it be more responsive (ambidextrous) to the changing environment, as stated by an executive during a recent interview (Roberts, personal communication, October 29, 2014). A study of the social processes of sensemaking (Teece, 2007, 2010) suggests that with the advent of a disruptive technology, integrated resource scenario planning (IRP) is a critical tool for fostering organizational ambidexterity (OA) behaviors. An example of an IRP process (TVA IRP, 2010):

1. **Identify Public Issues and Relevant Concerns**
    - Accumulate relevant issues and concerns from customers, employees, environmental groups, and other key stakeholders.
2. **Translate Public Issues and Concerns into Evaluation Criteria and Resource Options**
    - Develop statements that reflect EU and stakeholder values to translate into an evaluation criteria. For example, impacts on rates, environment, and fuel prices are considerations in evaluating various future resource strategies.
3. **Identify Possible Future Conditions (Uncertainties)**
    - Concerns and uncertainties are translated into future conditions. For example, high growth in electricity sales, high cost of natural gas, and increasing air emission controls in response to global warming are various future conditions.

4. **Construct Scenarios**
    - Scenarios are created and discussed in terms of its relevant attributes and objectives. Scenarios are then evaluated using modeling and simulation techniques to measure their performance against the evaluation criteria.
5. **Use Trade-Off Analysis to Find the Best Strategies for the Future**
    - Once a set of feasible scenarios are developed, trade-offs are considered under the different future conditions. Discussions on trade-offs within the EU and stakeholders focus on how well various strategies might be able to meet selected evaluation criteria.

Past studies (Maitlis, 2005; Carmeli & Halevi, 2009) have examined the critical roles played by leaders and stakeholders in the social processes of sensemaking. Maitlis's (2005) four forms of the social processes of organizational sensemaking can help to identify the degree to which leaders and stakeholders engage in "sensegiving". Maitlis (2005) said that sensegiving is the attempt to influence others' understanding of an issue. Maitlis states,

> *"Each of the four forms of organizational sensemaking guided, fragmented, restricted, and minimal is associated with a distinct set of process characteristics that capture the dominant pattern of interaction. They also each result in particular outcomes, specifically, the nature of the accounts and actions generated"* (p.21).

For this study Maitlis's (2005) four distinct forms of the social processes of organizational sensemaking *guided, fragmented, restricted,* and *minimal* were used for two purposes. First, there was a need to organize the business model changes into the dominant patterns of interaction between the EU leader and the stakeholder (consumer, policymaker). These interactions or aggregate observable responses to internal (EU leaders) and external (stakeholders) were witnessed through the interviews conducted, recognized as behaviors (stimuli) and grouped into Maitlis's four distinct forms. Second, the four behavioral groups were placed into Maitlis's (2005) 2x2 framework (Figure 5) and overlaid onto the Cameron (2006) Competing Values Leadership Framework (CVF) framework described in the next section.

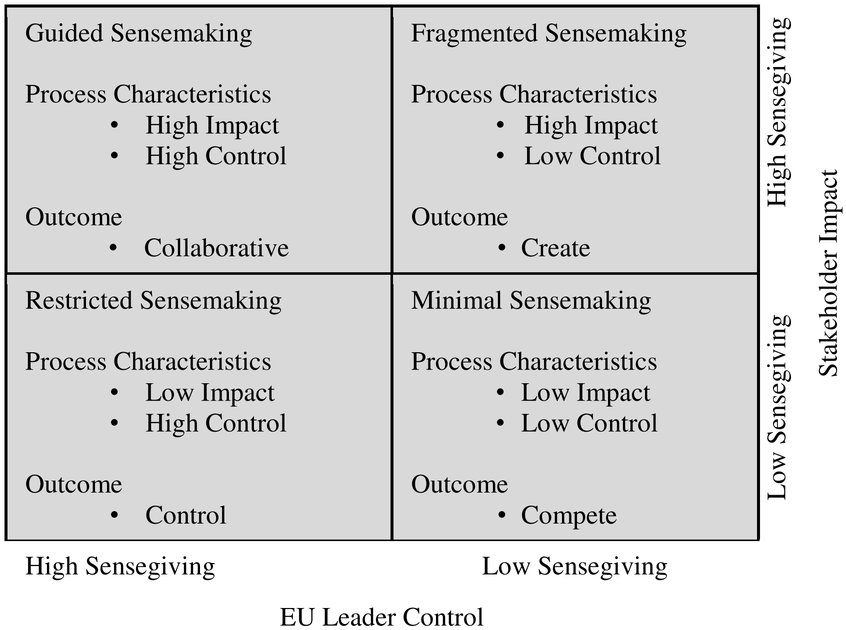


Figure 5 Four Forms of Organizational Sensemaking

II.4 Competing Values Framework

Competing Values Leadership Framework (CVF) highlights the trade-offs, inherent tensions, contradictions, and paradoxes that face organizations and their leaders as they navigate complex and changing environments (Cameron, 2006). The basic framework is comprised of two dimensions that express the tensions or competing values that characterize all organizations. The center horizontal axis separates the continuum between flexibility, adaptability, and exploration and the continuum of control, alignment, and exploitation (as shown in Figure 6). The center vertical axis separates the continuum between efficient internal processes and capability versus external positioning and opportunities related to stakeholders such as competitors, customers and investors. Each continuum highlights dichotomous performance criteria such as internal versus external orientation (horizontal axis) or flexibility versus control (vertical axis). Each quadrant has been labeled to describe its most notable characteristic. The CVF defines each quadrant: Collaborate (upper left), referring to team, group, fellowship among collaborators; Create (upper right), referring to the ability of people to collaborate in new, creative, and innovative ways; Compete (lower right), the ability to focus on results, attainment, and attention to the competitive landscape and external positioning; and Control (lower left), the ability to create, operate, and maintain structures and systems that support organizational control and learning (Cameron & Quinn, 2006, 2011). The two upper quadrants share an emphasis on energy and flexibility. The two bottom quadrants emphasize control and stability. The two left-hand quadrants are both focused on internal capabilities whereas the two right-hand quadrants are externally focused. Contradictory elements are found through comparison of the diagonally, or diametrically, opposite quadrants (Figure 6).

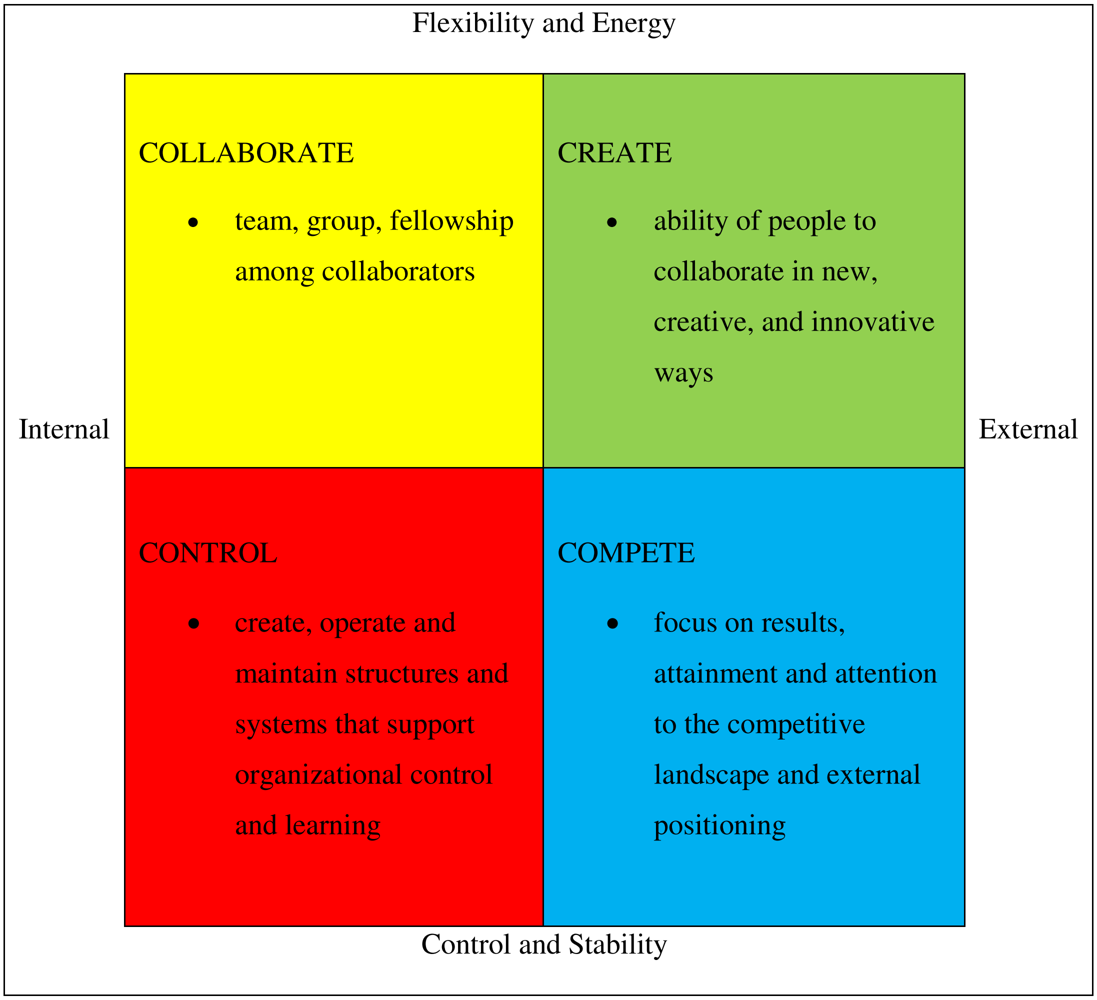


Figure 6 Competing Values Leadership Framework (CVF)

III STUDY DESIGN

This study uses a multiple case design (Lee, 1999; Yin, 2007) in which EU business model components are traced retrospectively beginning in 2009 through 2014. CEO annual reports, regulatory maps, and integrated resource plans are collected for each of the EUs interviewed. Interviews of key executives / managers from 11 electric utilities in 4 of the 10 states ranked highest in 2013 annual PV capacity additions of solar energy in the U.S. were conducted (Figure 7). The fifth state, Vermont, one of the most progressive distributive customer-side business model solar states in the nation, was also recommended in a pilot interview with the National Rural Electric Cooperative representative from Washington D.C. Four pilot interviews were completed with EU executives and managers and one additional interview with a SolarCity executive. SolarCity is America's largest third-party solar power provider. Table 4 shows EUs interviewed by region, name, state, territory served, type, and interviewee title.

Qualitative methods are well suited to the study of dynamic processes, especially where these processes are composed of individuals' interpretations (Gioia & Thomas, 1996; Hinings, 1997). Qualitative research typically examines issues from the perspective of the participant and is frequently used in the study of organization members' constructions and accounts (Dutton & Dukerich, 1991; Isabella, 1990). This study uses an explorative qualitative research strategy to address the two research questions. The retrospective approach will be used in order to gain an in-depth understanding of how EU business models have changed since the beginning of the American Recovery and Investment Act of 2009 through 2014 (see Timeline Figure 2).

Selection of interview candidates (Figure 7) involved a multi-step process. A recruitment script was sent to selected IOU and Co-op executives and managers within the five selected states. If a reply was not received within two weeks, a phone call was made to the prospective executive or manager. If they agreed to an interview, an informed consent form was e-mailed to the interviewee for signature. On occasion, the interviewee recommended a key executive or manager to contact. Those references proved to be very valuable in Vermont, Colorado, and the Carolinas.

The states that were selected aligned across four regions of the U. S. (Southeast, Northeast, Midwest, and Pacific). Each EU region has specific solar PV characteristics and inclinations that are likely to be factors in how an EU responds. The location may impact the direction of the issues and EU controls used to implement solar resources into their generation mix. For example, the Southeast region has some of the lowest electrical consumer rates in the country and some of the oldest and most established electric utilities.

The Northeast region has higher electricity rates than the Southeast and their natural gas supply is limited due to confined pipeline access resulting in higher electric heating costs. The EU industry regards this region as highly progressive with new technology; there is a need to understand the EU impact and control mechanisms that are being proposed to reduce fuel costs.

The Midwest has an influx of renewables associated with the wind belt and highly stringent renewable portfolio standards enacted by the states. Finally, the Pacific region (specifically Hawaii) presents national renewable leadership in solar installations and the highest electric rates in the United States. In addition, four pilot interviews were completed to confirm that the interview protocol is a comprehensive solar PV emergence discussion instrument. Last, the

SolarCity interview was done to understand the solar emergence from an EU customer-side third-party business model competitor's perspective. The interview protocol (Appendix A) is designed to match each of Richter's (2001) business model components. Because data collection is intensive, fifty percent of the interviews were conducted face-to-face and the other fifty percent were conducted by telephone.

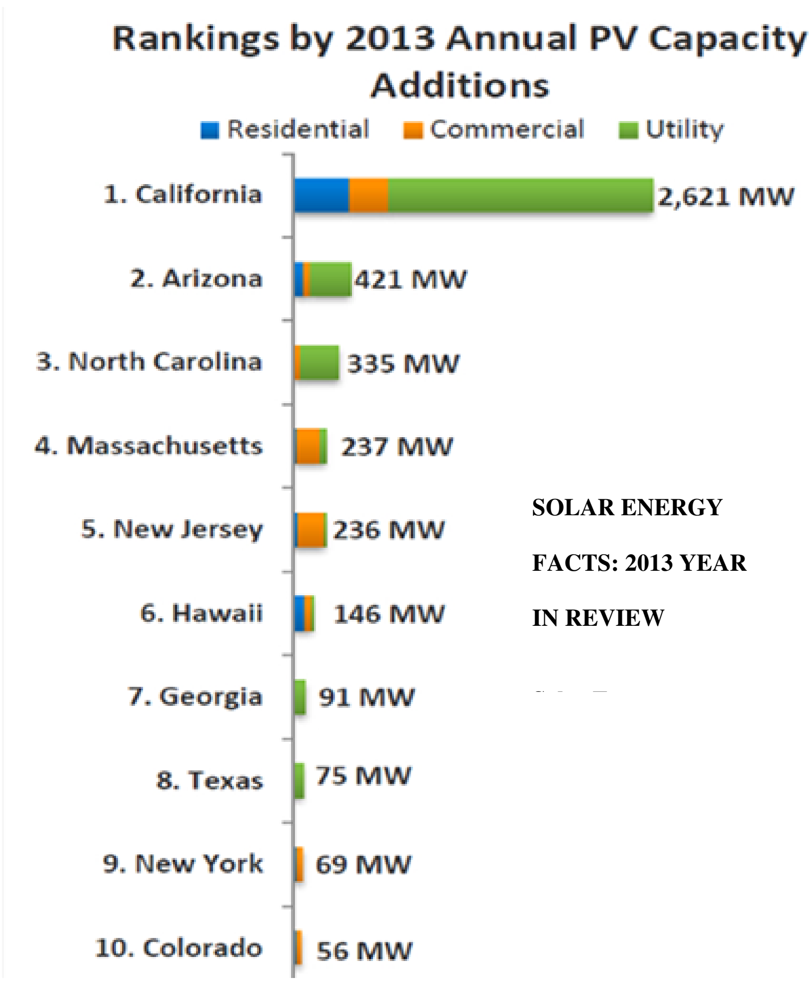


Figure 7 2013 Solar State Rankings

Table 4 Summary of Interview Data Sources

Region	Interviews & CEO Reports	State	Service Territory	Investor-Owned Utility	Cooperative	Title
Pacific	Kaua'i Island Utilities Cooperative	Hawaii	Kaua'i		x	Power Supply Manager
Pacific	Hawaiian Electric	Hawaii	Oahu, Maui, Hawaii Island, Lanai and Molokai	x		Communication Specialist
Midwest	Tri-States Generation & Transmission Association	Colorado	Colorado, Nebraska, New Mexico and Wyoming		x	Sr. Manager of Government Relations
Midwest	Sangre de Cristo Electric Association	Colorado	Colorado		x	Energy Use Advisor
Northeast	Vermont Electric Cooperative	Vermont	Vermont		x	CEO
Northeast	Green Mountain Power	Vermont	Vermont	x		Director of Government Affairs
Southeast	Georgia Power Company	Georgia	Georgia	x		Vice President of Pricing and Planning
Southeast	Georgia Power Company	Georgia	Georgia	x		Green Energy Program Manager
Southeast	Georgia Electric Membership Corporation	Georgia	Georgia		x	Vice President of Government Relations
Southeast	Electric Cooperatives of South Carolina	South Carolina	South Carolina		x	Vice President for Government Affairs
Southeast	Duke Energy	South Carolina	South Carolina, North Carolina, Florida, Indiana, Ohio, Kentucky	x		Manager of Renewable Strategy
Southeast	Santee Cooper	South Carolina	South Carolina		State-owned	Sr. Vice President of Customer Service
Pilot Interviews						
Southeast	Georgia Transmission Corporation	Georgia	Georgia		x	Sr. Vice President of Transmission Policy
Southeast	Georgia Transmission Corporation	Georgia	Georgia		x	Vice President of Transmission Planning
	National Rural Electric Cooperative Association	United States	United States		x	Assistant Director of Regulatory Counsel
Pacific	Anza Electric Cooperative	California	Southern California		x	General Manager
Pacific	SolarCity	Hawaii	AZ, CA, CO, CT, DE, HI, MA, MD, NJ, NV, NY, OR, PA, TX, WA, and DC			Director Policy and Electricity Market

The similarity of the 11 electric utilities (4 investor-owned and 7 electric cooperatives) allows for meaningful stratified comparisons across the EU industry leaders and the stakeholders involved, while the diversity and the differences between the EUs provide a reasonable basis for generalizability. The retrospective approach is used in order to gain an in-depth understanding of how EUs business models are changing and becoming more ambidextrous in response to solar PV.

The unit of analysis is the organizational level. The interviews are self-reports by senior managers of what their respective organizations have done and are doing, of prevailing attitudes towards solar PV and of their assessment of how well they are doing. Interviews are transcribed and then coded with the aid of NVivo and Leximancer software; secondary data is coded with Leximancer software. Both software programs are content analysis tools, however NVivo requires the researcher to define the coding scheme whereas Leximancer generates its own schema using word counts, word clustering, and proximity. Leximancer is also a text analytics tool that can be used to analyze the content of collections of textual documents and to display the extracted information visually.

The Leximancer information is displayed by means of a conceptual map that provides a bird's-eye view of the material, representing the main concepts contained within the text as well as information about how concepts are related. The conceptual map allows the user to view the conceptual structure of a body of text, as well as perform a directed search of the documents. The interactive nature of the map permits the user to explore examples of concepts, their connections to each other, as well as links to the original text. Leximancer provides both a means of quantifying and displaying the conceptual structure of text and a means of using this information to explore interesting conceptual features. The 2009 and 2013 CEO reports and the IRP data were imported into the Leximancer software for conceptual map comparison.

Another secondary source of data is the regulatory map for each state which is compiled using the Database of State Incentives for Renewables & Efficiency (Solar, D. S. I. R. E. 2012) which is funded by the U.S. Department of Energy. DSIRE was established in 1995 and is currently operated by the N.C. Solar Center at N.C. State University with support from the Interstate Renewable Energy Council, Inc. The map includes state mandated renewable portfolio standards or renewable state goals (Figure 8). A renewable portfolio standard (RPS) has been established in 29 states plus the District of Columbia and Puerto Rico. States shown in red have an RPS whereas states in orange have a renewable state goal. For example, Hawaii has a state mandated standard that a percentage of their load (40% by 2020) must be served by renewable resources or they will be penalized. Colorado, also in red, has a state renewable mandate that requires that 30% of the IOUs load and 10% (recently changed to 20%) of the Co-ops load must be served by renewable resources by 2020. Typically, monetary penalties are enacted when RPS (red) standards are not met whereas RPS (orange) goals are typically tied to warnings to comply or monetary penalties may be enforced.

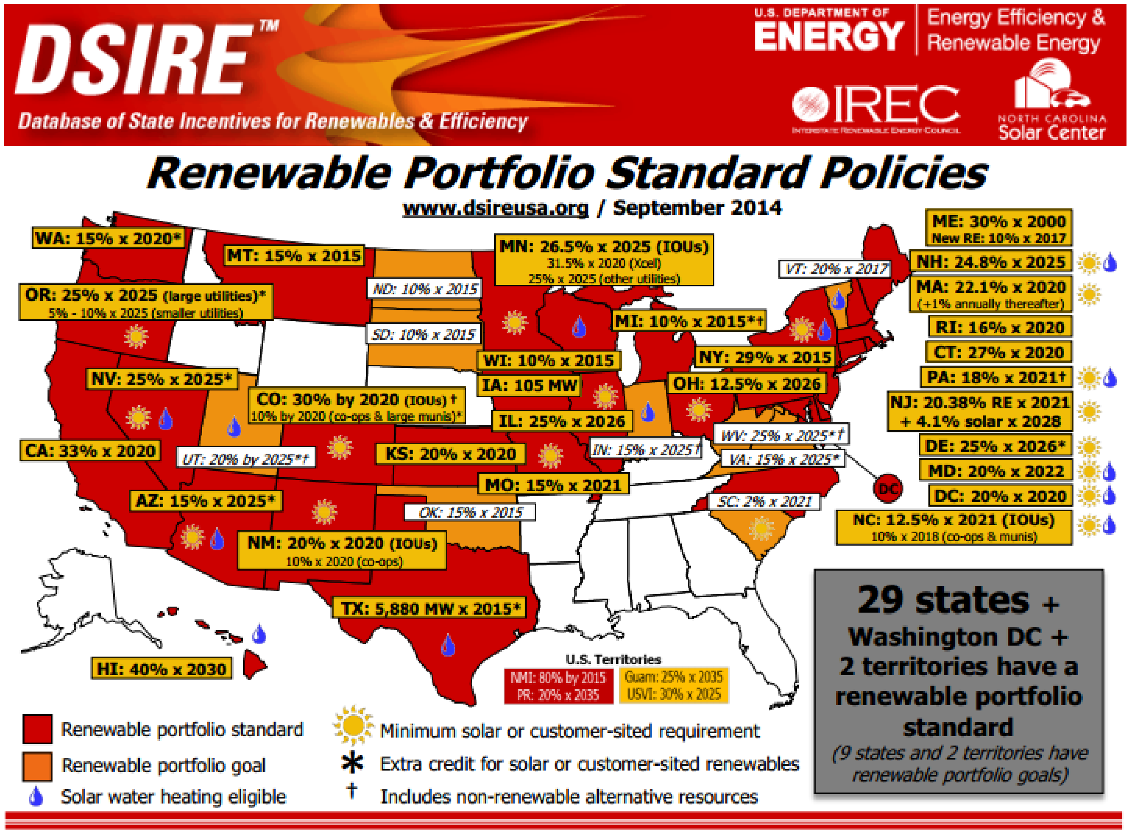


Figure 8 State Renewable Portfolio Standards

Interviews, CEO reports, and the regulatory map for each state are analyzed using Richter's business model components from both a utility-side and customer-side perspective (Table 2). The EU utility-side responses are expected to be more robust and complete because of their substantial experience resulting in more and larger projects. In addition, it might be expected that the Co-ops are lagging behind the IOUs in their response to disruptive technology and changing environment, perhaps due to a lack of resources to manage the work.

III.1 Data Analysis

The data analysis is comprised of three stages. Stage 1 is comprised of several steps of data reduction. First, all 16 interview narratives (IOUs, Co-ops, and SolarCity) are coded into NVivo using the interview protocol responses associated with the four Richter (2011) business model components with the additional fifth regulatory component. The four IOU and seven Co-op narratives under study are then summarized into a 2x5 matrix for each EU. The matrix uses the characteristics of impact (stakeholder driven) and control (EU leader response) on one axis and the five EU business model components on the other. These characteristics help to interpret the business model behaviors and strategies associated with the stakeholder (consumers and policymaker) and EU leader interactions (Maitlis, 2005). Next, the Leximancer conceptual maps are developed from the interview and secondary data for longitudinal EU leader business model comparisons. Finally, a Competing Values Framework (CVF) is created for each EU to interpret ambidextrous behaviors. In the second stage, the first research question is addressed: 1) *How have EUs responded to a shift in their environment from 2009 - 2014 due to a disruptive solar technology?*

In the third stage, the second research question is addressed: 2) *What are the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs in response to a disruptive solar technology?*

The analyses are described in detail below and shown in Figure 9.

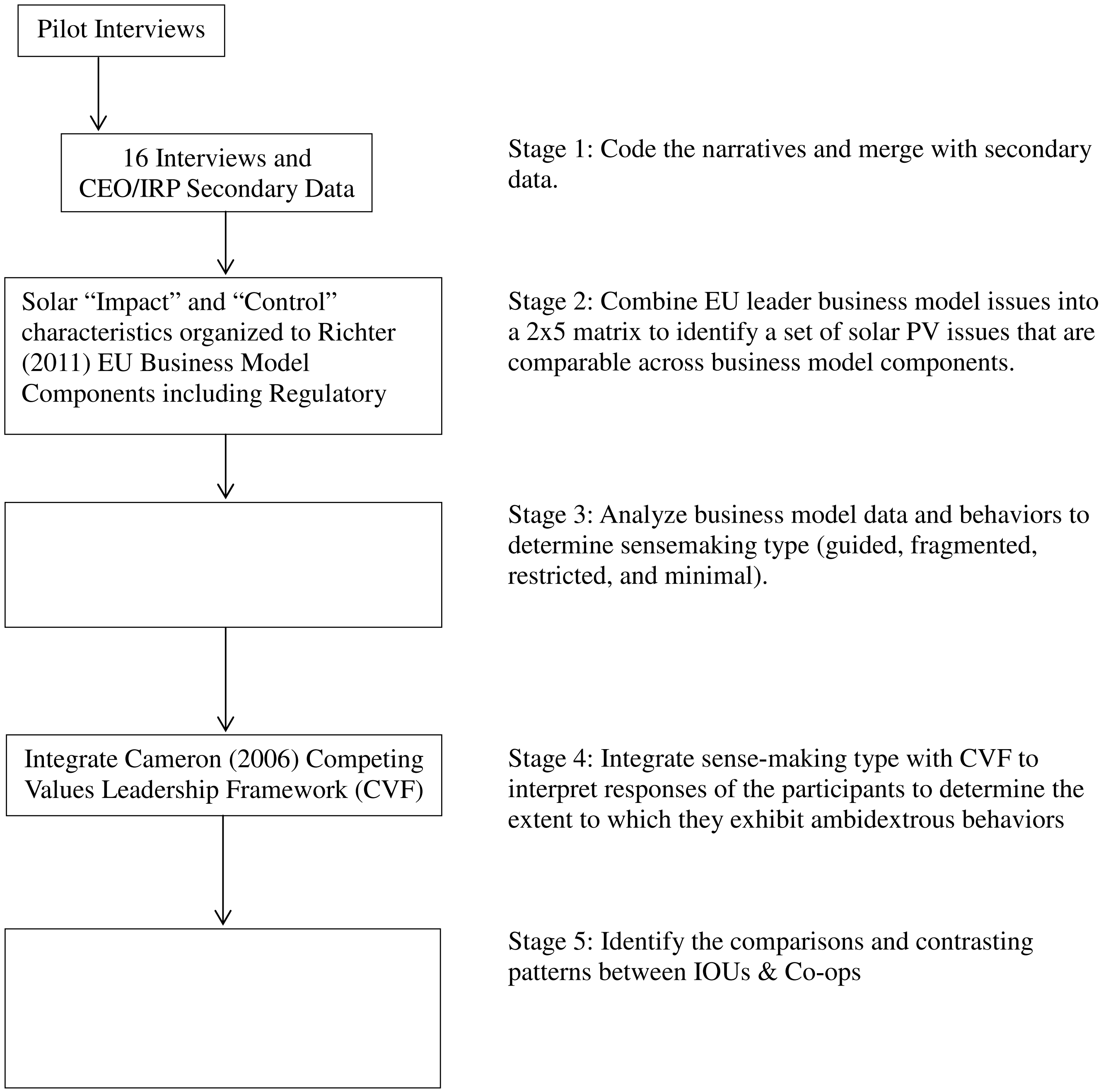


Figure 9 Data Analysis Flow Chart

III.1.1 Stage 1 - Code the narratives describing the EU business model process

The initial data analysis stage begins with coding both the primary interviews and secondary data sources using solar PV EU business model issues (Eisenhardt & Bourgeois, 1988). The primary data source is comprised of the 16 EU interviews using an instrument protocol derived from Richter's (2011) four EU business model components and the additional regulatory component. The secondary data source is comprised of the EU 2009 and 2013 CEO annual reports, EU IRP documents, and the state regulatory maps from the same 11 EUs. These are processed using Leximancer to allow automatic coding of organizational issues. The solar PV issues that are identified in the interviews, annual reports, and IRP documents that involve a concern are mapped to one of Richter's EU business model components. A typical issue must meet two criteria for inclusion. The first criterion is that an issue must be mentioned in all EUs, in all IOUs, or in all Co-ops. Meeting this criterion requires a process of data reduction (Strauss & Corbin, 1998) in which the solar issues are divided into subset characteristics within the business model components. The second criterion for inclusion is that data should be available from both the interviews and annual reports or IRP documents. The expectation is to have at least two subset issue characteristics within each Richter EU business model component: (1) Value Proposition: utility-side (grid reliability) and customer-side (energy conservation); (2) Customer Interface: utility-side (competition) and customer-side (distributed energy involvement); (3) Infrastructure: utility-side (centralized generation) and customer-side (net-metering or community solar); and (4) Revenue: utility-side (ownership) and customer-side (cross-subsidies). A fifth business model component is added to include Regulatory: utility-side (EPA carbon) and customer-side (leasing and net-metering).

III.1.2 Stage 2 - Identify the four forms of EU Leader and Stakeholder Interactions

In searching for patterns of interaction in sensemaking (SM) there is a necessity to look for consistencies in EU executives and managers. Patterns are revealed through a series of steps. First, it is important to identify key EU leaders who controlled and/or were impacted by solar PV in their EU and examine their contribution to the business model changes. The analysis of the interview narratives may reveal various EU leaders as either playing major roles in virtually all solar PV business model component issues or making critical contributions to two or three issues. Next, by combining certain EU leader business model issues into a 2x5 matrix, it may then be possible to identify a set of solar PV issues that are comparable across business model components. Then, EU leader and stakeholder interactions are analyzed to identify how EU leaders contributed through various sensegiving activities. Statements or activities that involve providing plausible descriptions and explanations of extracted cues and constructing sensible environments for others (Weick, 1995) are included as bulleted EU leader sensegiving impact and control behaviors (2x5 matrix for each EU). For each EU there is a determination of which of the four forms of sensemaking (guided, fragmented, restricted, or minimal) is prevalent by counting the number of bulleted items and their frequency of involvement and determining the behavioral strength/intensity associated with the model changes to which they contributed through sensegiving activities. Finally, a CVF emerges for each EU to help understand and interpret their behaviors associated with the 2009 - 2014 EU business model changes. These findings are used to answer the first research question: 1) *How have EUs responded to a shift in their environment from 2009 - 2014 due to a disruptive solar technology?*

In the third stage, the second research question is addressed: 2) *What are the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs in response to a disruptive solar technology?*

III.1.3 Stage 3 - Identify the differing patterns between IOUs and Co-ops

Identification of differing patterns requires focusing on the stakeholder accounts of EU impact and EU leader actions of control associated with solar PV in their electric service territories. Comparing the EU leadership in conditions of dynamic change is done by tracing through the 2x5 EU business model matrices developed above for each EU CVF. This comparison leads to a set of descriptors that capture the differing business model patterns and ambidextrous behaviors between IOUs and Co-ops. Through this iterative cross-case analysis, descriptions of the differing patterns and behaviors are determined for each region. For these patterns, a Co-op is generalizable to a medium-sized not-for-profit enterprise where an IOU is generalizable to a large-sized private organization. An overview of data analysis is shown in Figure 9 and the CVF template in Figure 10.

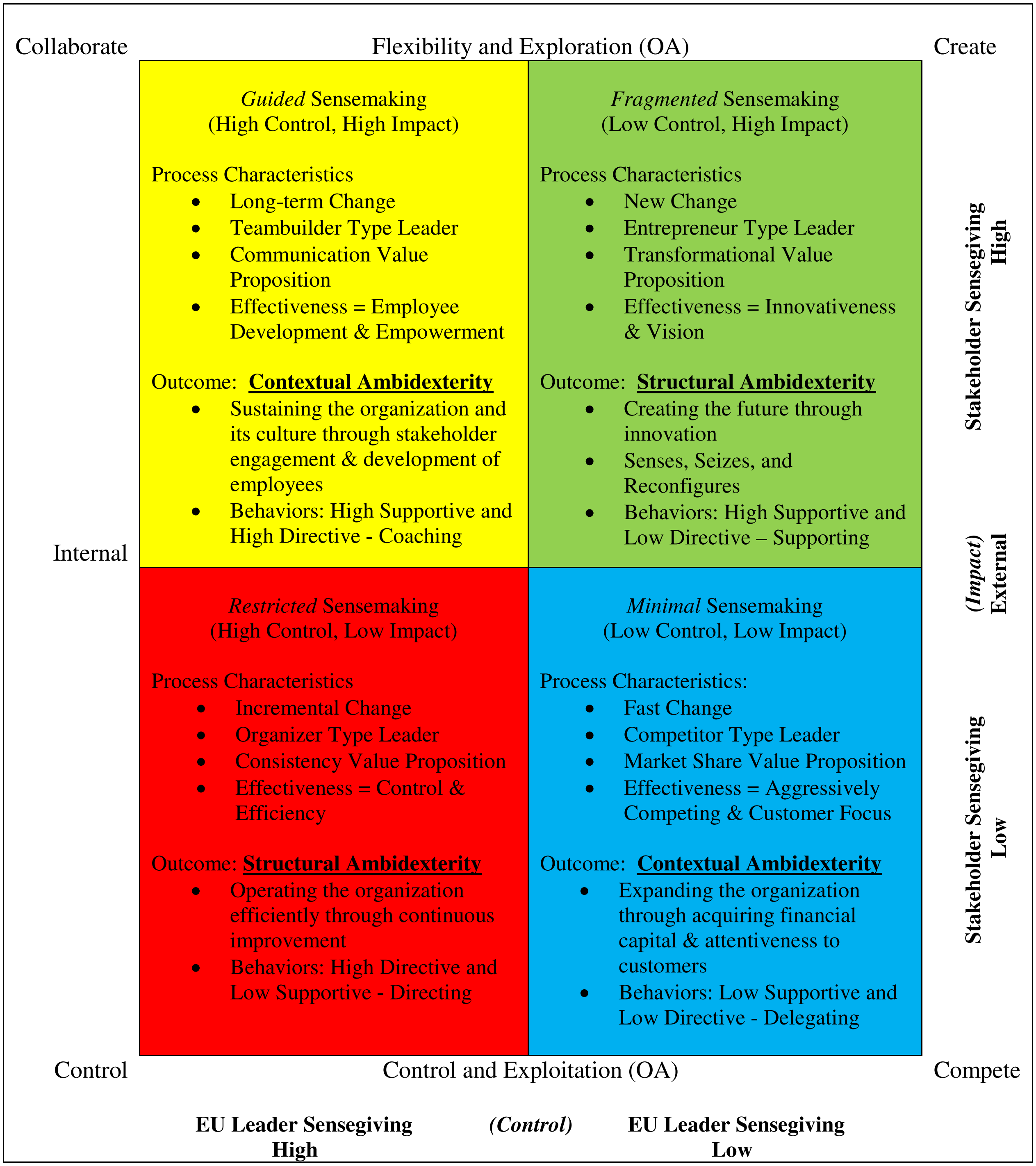


Figure 10 Integrating Business Model Changes with CVF to Interpret OA

IV RESULTS

This section presents the results from the 16 interviews with investor-owned and electric cooperatives within five states that are considered solar forerunners in the United States (SEIA, 2013, 2014). The results address the impact of solar photovoltaics on the EU market first by state and then by region. Next, the EU business model changes and OA behaviors that have helped EUs respond to a shift in their environment from 2009 - 2014 are discussed and finally the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs are considered.

IV.1 Hawaii - Pacific Region: KIUC (Co-op) and HEI (IOU)

IV.1.1 Guided Sensemaking and Contextual Ambidexterity

Hawaii has the nation's most expensive electricity because it relies on imported fuels for more than 90% of its total energy, pushing prices up to an average $0.34 per kWh (kilowatt hour) for 2014 (prices through November), compared to 11 cents per kWh for the national average. Imported oil currently accounts for around 71% of Hawaii's electricity generation, followed by 16% from coal and 13% from renewables. These high prices have given solar a competitive edge. According to the U.S. Energy Information Administration (EIA, 2013), wind and solar in Hawaii are economically attractive alternatives, especially as their technology costs have come down in recent years. Between 2010 and 2014, solar capacity has soared across Hawaii's main islands. By 2030, Hawaii expects to triple its solar capacity and have renewables supply 65% of the state's electricity (SEIA, 2014). Hawaii's Renewable Portfolio Standard (RPS) targets 15% renewables by 2015, 20% by 2020, and 40% by 2030. Typically Co-ops are not regulated by the state's public utility commission (PUC), but in Hawaii, KIUC is mandated to meet the RPS standard just like HEI.

Data analysis reveals KIUC and HEI business model components that are highly collaborative value-enhancing activities resulting in the *guided* form of SM. The focus of these organizations is on building cohesion through consensus and satisfaction through organizational involvement. KIUC and HEI's 2009 to 2014 trajectories point to collaboration signifying that contextual OA had developed and was increasing during the time period (See Figure 11 Leximancer bar chart).

The KIUC and HEI leaders were very active in constructing and promoting understanding and explanations of the solar energy business impact on their service territories with customers, legislators, and the Hawaii Public Utility Commission (HPUC). At the same time, KIUC and HEI were also actively engaged with stakeholders in attempting to collaborate on policies for cost-sharing by implementing a fixed solar charge and proposing an avoided-cost for net-metering rates. These proposed policies were *guided* primarily by KIUC and HEI with the HPUC.

KIUC and HEI business model component analysis also identified value-enhancing activities within the competing values "Compete" framework that included aggressiveness and forcefulness with HPUC in the pursuit of market share (rate decoupling) and utility-side solar ownership competitiveness. The HPUC continues to implement regulatory obstacles forcing HEI to own no solar generation. Peter Rosegg, HEI Communication Specialist, explains, "W*e have an isolated system and we're under a lot of pressure from the HPUC not to own generation at all, much less for us to go venturing into the utility-side solar area that we have no experience in.*"

The HPUC generation ownership position has created some tension with HEI. If third-parties own the majority of the solar generation, then HEI loses some control of operations which may affect reliability. Losing utility-side generation control and customer-side market share through the solar emergence in Hawaii reinforces the need for HEI and KIUC to increase the capability of enhancing their value creating competencies, specifically within their infrastructure and distribution services. In 2013 HEI estimates that $38 million was shifted to non-solar customers for grid upkeep. As the core mission of any organization is to create value, KIUC and HEI have established goals that their shareholders (IOU) and customer-owners (Co-op) are expecting from them. KIUC's goal is to reduce residential bills by 10% over next 10 years, generate 50% of electricity by renewables by 2023, reduce carbon levels to 1990 levels by 2023, establish a rate structure to decouple margin from sales level to minimize subsidies between customer classes, and to recover more of the actual cost of service through fixed charges. In this environment, there is a need for Collaboration and Competitiveness. Cameron (2006) describes this leadership behavior as speedy teamwork or urgent collaboration or "*Autonomous Engagement*". (See Figure 42)

This integration of positive-opposites quadrants "Collaborate" and "Compete" or paradoxical leadership behavior describes an EU leader that emphasizes teamwork and collaboration as well as speed and urgency. Cameron (2006) explains, "*leaders that act with autonomous engagement actively seek involvement, but with secure and well-grounded motives.*" The integration of these two contradictory concepts within an organization have enabled Hawaii's EUs to create a contextually ambidextrous organizational environment that identified new ways to create organizational value.

IV.1.2 Hawaii business model changes and OA

KIUC, who serves the island of Kauai (5% of Hawaii's population), has been a leader in utility-side solar power installations where their power supply mix will soon reach 15% solar and 40%

renewable. By contrast, HEI's territory is more populated and the solar PV focus of HEI has been on customer-side solar. The HPUC has forced its attention on HEI leaving the utility-side generation business model, becoming more distribution service-based, and continuing to increase their 11% customer-side solar mix.

For example, the Leximancer 2009 CEO reports show that KIUC and HEI consider solar energy a value proposition to Hawaii. The Leximancer 2013 CEO report shows that KIUC, who was beginning to install utility-side solar, is concerned about its grid; HEI, who was beginning to become oversubscribed on customer-side solar, has concerns about losing its customer market share to SolarCity. The KIUC and HEI interview data reveals concerns with net-metering, solar cost-sharing, and grid operations. These utility-side and customer-side issues have forced the EUs to change their business models pointing to an evolving ambidextrous organization that is enhancing its value creating competencies, specifically within its infrastructure and distribution services. When business model components are linked to the Collaborate and Create CVF leadership dimension, an EU organizational ambidexterity type emerges.

EU leaders from the Co-op, IOU, and the HPUC recognize that there is value for all parties in meeting the state Renewable Portfolio Standard (RPS) in that renewables can effectively reduce generation costs to half. Customer issues like net-metering, solar cost-sharing and grid operations were recognized through interactions in meetings with investors, consumers, and legislators which were organized systematically and typically planned in advance.

Both EUs have managed solar grid operations without adding additional departments or organizations. HEI noted in its interview that the degradation of revenue and increase in operational demands have been discussed and partially resolved in the regulatory environment where stakeholder engagement and knowledge of the issues benefit the whole. Recently, HEI and HPUC leaders have focused special attention on the backlog of customer-side rooftop requests in an effort to reduce the installation queue list. With approximately 48,000 current statewide solar customers and 500,000 potential customers, KIUC and HEI have teamed up with SolarCity and industry subject matter experts to understand the problem and develop stakeholder solutions. The concern is large amounts of rooftop solar energy overloading the capacity of the grid. Overall, controlling the impact of the solar energy emergence via intelligent, systematic and coordinated business model changes reveals contextual ambidexterity behaviors as shown within the CVF Collaborate and Create dimensions.

IV.1.3 Identified differing business model patterns of HEI (IOU) and KIUC (Co-op)

The results in Tables 5 and 6 reveal by product of analysis that *guided* SM in the state of Hawaii is prominent because the solar impact and control construct affects all five EU business model components. A common theme throughout these analyses is that the regulatory component is a foundation for the other four EU business model components. This regulatory foundation allows stakeholders time to work with legislators to develop systematic and controlled approaches to reconfiguring constructions of the solar energy emergence. In Hawaii, the strong competitive edge of solar allows the state HPUC and EUs to engage easily and to incorporate the viewpoints of the many different stakeholders. In addition, KIUC and HEI identified that they did not develop new solar departments to handle the additional solar utility-side and customer-side rooftop growth. All of these results reveal that KIUC and HEI are both displaying contextual ambidexterity which emerged as a more decentralized business model on the solar challenges. Brad Rockwell, KIUC Power Supply Manager explains,

> *"We thought solar would be an easy thing to do. I think one of the keys to success was putting the development of it on the power plant guys, basically in my department, because then it wasn't like you had a separate department away from the operational guy that was trying to develop a renewable. I think a lot of utility companies try to do that—they kind of create a separate special renewable group and then you get the renewable guys are trying to develop stuff and push the envelope and then these operational guys are coming with—ah, don't screw up—you know they come up with all these really harsh criteria that are almost impossible for the renewable guys to meet because they don't want the conventional units to be impacted whatsoever. So by the fact that our boss put it on us to make it work, we're not able to point the finger at anyone except ourselves if it doesn't work. I think we're doing that as much as anyone I've heard of. Like I said, we have physically added only one body to do all this."*

An interesting finding in Hawaii is the impact of the regulatory component on the nature of subsequent EU actions. For example, the collaborative partnership with SolarCity and various research labs allowed HEI and KIUC to understand and resolve the operational constraints of heavily solar connected circuits and, with the help of the HPUC, communicate these results to the stakeholders. This proactive collaborative research opened up the queue and reduced the backlog of customer-side rooftop solar requests. Thus these activities were based on a shared interaction of KIUC's and HEI's competitive context and the value of collaboration which facilitated the consistency of their EU control mechanisms over time.

Table 5 KIUC Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	Consumer Savings	Staffing to manage the customer-side solar requests	Excess generation on an islanded system	High cost of power	RPS Negotiations
	Utility-side and Customer-side solar ownership	Lost (SolarCity) Market Share	Cost-sharing	Net-metering	Net-metering
EU Control	Operational Flexibility discussions with stakeholders	Member Communication and Engagement	Battery smoothing for frequency variations with intermittent solar	Renewables driven by BOD	Fixed solar charge
	Employee Involvement	Solar contractor collaboration	Technology improvements	Replace oil with solar - lower rates	Avoided Cost
	Cohesion through Consensus	Provide distribution Services		Unbundle net-metering rates	Engineering Collaboration

Table 6 HEI Interview Common Issues and Response

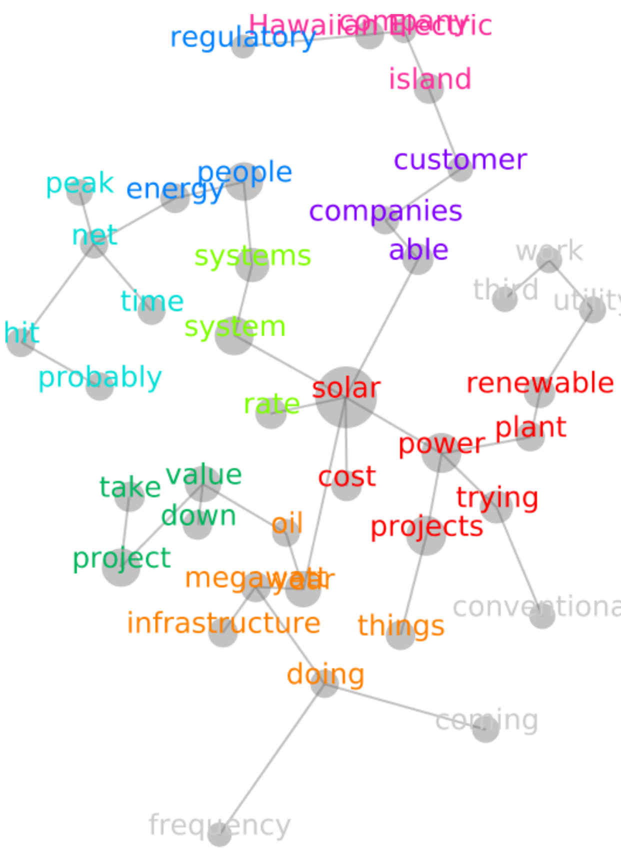
	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	Consumer Savings	Staffing to manage the customer-side solar requests	Established reliable EU infrastructure and operating system	Highest rates in the country at 35 cents per kilowatt hour	State Residential Energy Income Tax Credit of 35%
	Customer-side solar ownership	Lost (SolarCity) Market Share	In 2013, $38 M shifted to non-solar customers for grid upkeep	Net-metering	Net-metering
EU Control	Employee Involvement	Consumer and Policymaker relationships	HPUC forcing HEI to bid all new utility-side solar to third-parties to reduce generation ownership	Renewables driven by HPUC	Retail rate structure is outdated and does not address the issue of unrecovered fixed cost
	Guaranteed Cost Recovery Through Rates	Provide distribution Services	Established reliable EU infrastructure and operating system.	HPUC recognizes that there needs to be some interim and long-term revenue changes	Issued technical requirements for solar installations

IV.1.4 Analysis for Hawaii

Interviews and CEO reports were analyzed with the Leximancer text-mining software where words that occur very frequently are treated as concepts. The software includes an interactive concept-mapping function which provides an overview of the conceptual structure of the data set that assists in interpretation. Leximancer produced a set of concept maps that facilitated an analysis showing how ideas and concepts in EU business models have changed from 2009 - 2014. The analysis was designed by tagging solar as the category of interest and the EU business model components (value, customer, infrastructure, revenue, and regulatory) as concepts to investigate. A software generated bar chart identifies the most prominent concepts within the particular category – defined via a measure of the combination of their strength and frequency characteristics (see Figure 11). The relative frequency is a measure of the conditional probability of the concept given the category. That is, how likely is it that the concept "customer" is mentioned in the solar category? Strength is a measure of the conditional probability of the category given the particular concept. On the graph, by looking at the position of the individual concepts, it is possible to determine the closeness of their semantic relationship to other concepts. The prominence of a concept in the data set is indicated by the size of the dot - the more prominent, the concept, the larger the dot. If a concept sits close to solar it is, in relative terms, more associated with that concept. Similarly the more central a concept's location on the map, the more it is shared with other concepts. Leximancer also ranks compound concepts and concept count from the original base data.

For example the KIUC interview was mapped in Figure 11. The "customer" concept is the most prominent concept within the "solar" category. This is not surprising since KIUC is a Co-op and the customers are the owners of the EU. Not shown in the bar chart but identified in the Leximancer report is that the most prominent concept pair was "value" and "infrastructure" and that these two concepts, along with "rate", were mentioned most in the interview.

Each EU is evaluated using the Leximancer data map related to the business model changes that occurred during the shift in their environment from 2009 - 2014. The discernable business model patterns that differ between investor-owned (urban) and electric cooperative (rural) are recorded in Table 19.

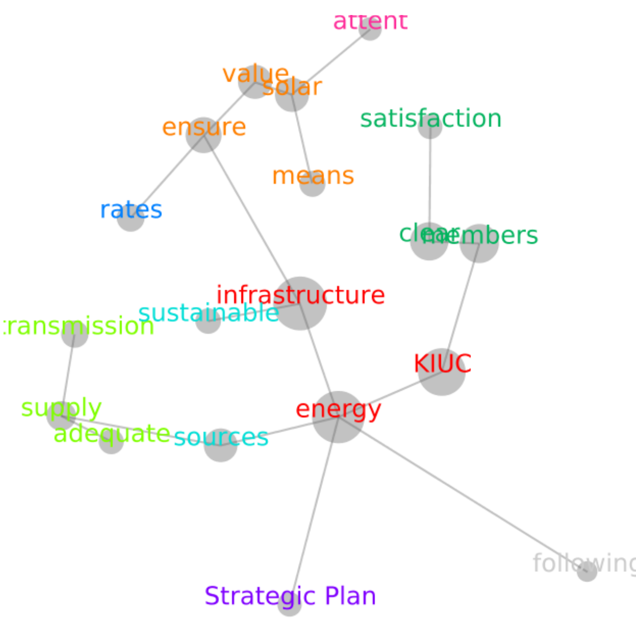


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customer	8	80	2.2
regulatory	6	60	1.6
value	13	46	1.3
infrastructure	10	45	1.2
rate	8	36	1.0

Figure 11 KIUC Interview (Co-op #1 - Leximancer)

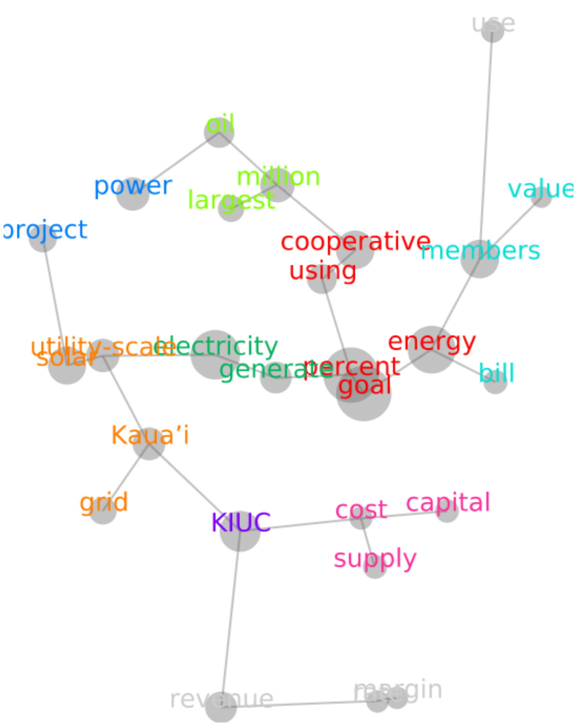


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	100	100	3.3
rates	43	75	2.5
members	57	36	1.2
infrastructure	100	31	1.0
strategic plan	< 1	< 1	0.0

Figure 12 KIUC 2009 CEO Report (Co-op #1 - Leximancer)



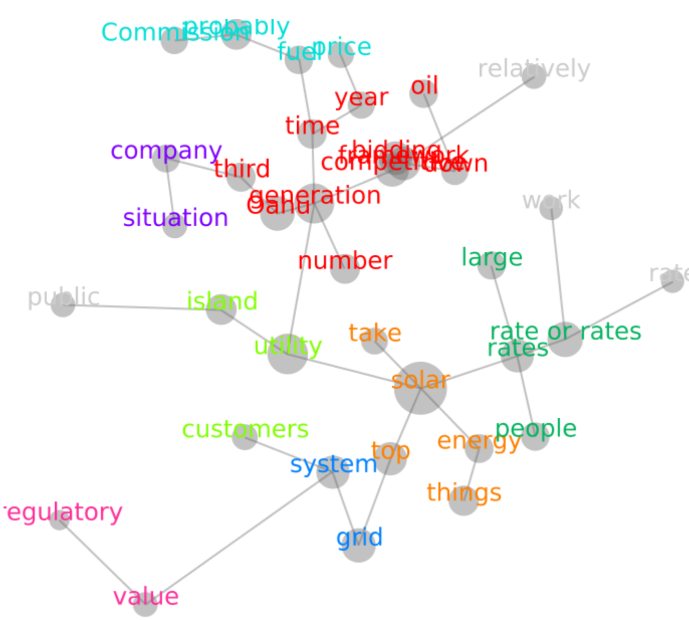
2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
grid	25	50	1.9
revenue	13	14	0.6
members	13	11	0.4
value	< 1	< 1	0.0
bill	< 1	< 1	0.0

Figure 13 KIUC 2013 CEO Report (Co-op #1 - Leximancer)

The analysis of KIUC identifies that the focus of the CEO in 2009 was that KIUC's rates were increasing due to the dependence on foreign oil for generation and their customer-owners were questioning the viability and value of adding solar to the existing infrastructure (electric grid). In 2013, the CEO focus was on installing more utility-side renewables (solar and bio-mass) to the transmission grid. The concern about operability with intermittent resources had decreased and utility-side solar appeared to be the best strategy to prevent customer-side lost revenue and increase customer satisfaction by lowering rates. In 2014, the interview revealed that the value of installing utility-side solar and biomass increased as customer rates decreased. The Leximancer bar chart report reveals a larger focus on stakeholder discussions at the regulatory level. As solar was taking a primary role in the generation mix, the regulatory component was becoming more popular for customer-side installations utilizing net-metering. In summary, the solar utility-side business model has become a supporting innovation for KIUC and the customer-side business model market has been slow to develop because third-party providers like SolarCity do not see a need for a market presence yet with such a small market share.

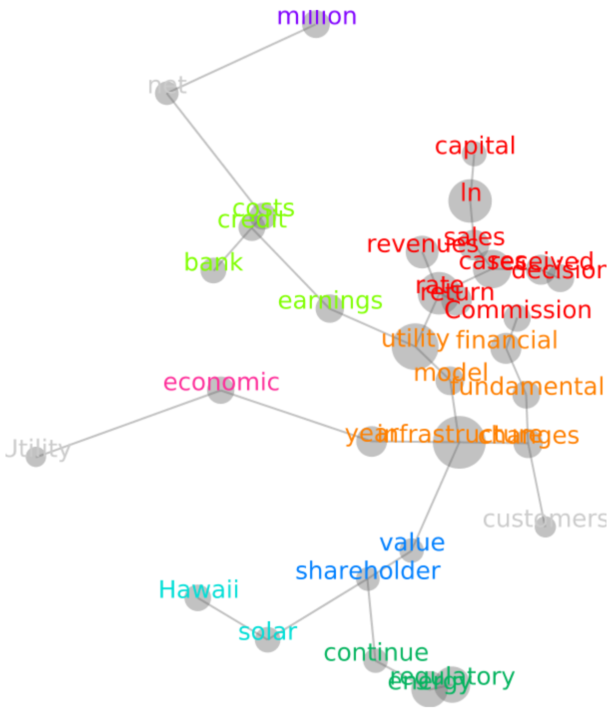


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customers	16	71	2.3
grid	28	50	1.6
rate or rates	19	42	1.4
value	3	12	0.4
regulatory	< 1	< 1	0.0

Figure 14 HEI Interview (IOU #1 - Leximancer)

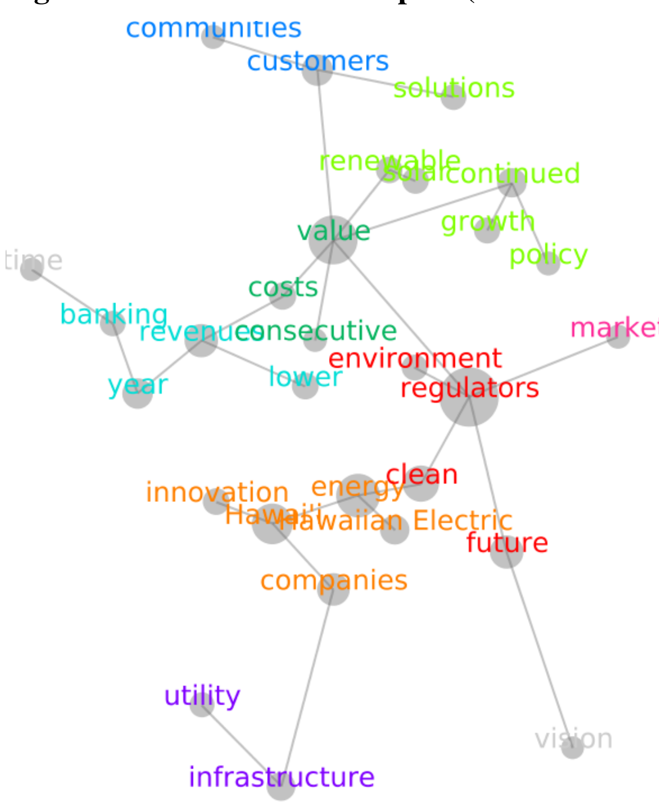


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	17	33	3.3
regulatory	50	21	2.1
infrastructure	50	15	1.6
customers	< 1	< 1	0.0
revenues	< 1	< 1	0.0

Figure 15 HEI 2009 CEO Report (IOU #1 - Leximancer)



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customers	75	37	3.5
revenues	50	25	2.3
regulators	100	13	1.2
value	50	10	0.9
infrastructure	< 1	< 1	0.0

Figure 16 HEI 2013 CEO Report (IOU #1 - Leximancer)

The analysis of HEI identifies that the focus of the CEO in 2009 was on shareholder value, infrastructure erosion discussions at the HPUC, and regulatory environment on renewable solar energy. The concern was that the fundamental EU business model was changing. In 2013, the CEO focus shifted to the needs of the customers and how solar energy was being debated at the regulatory level with the HPUC. There was much less focus on the infrastructure and more concern about lost revenue through customer-side rooftop installations (net-metering). The value proposition appeared to be in renewables particularly solar to lower fuel costs. In 2014, the interview conversation focused on the insurgence of solar within the HEI service territory and the concerns that it brought to grid management and cost-sharing rates. There was also a focus on third-party ownership of large utility-side solar. HPUC wants HEI to stay out of the solar generation business and become a distribution service provider to keep costs down. In summary, the HEI business model is changing to a distribution provider with an increase in engineering services for grid management. Due to the increase in SolarCity rooftop leasing and increase in third-party utility-side solar ownership, HEI is getting squeezed into the distribution service market. Changes in the regulatory environment from 2010 - 2014 were minimal and Hawaii has shown a steady growth emergence of solar with a very friendly net-metering environment for the consumer. In 2013, $614 million was invested in Hawaii to install solar for home, business and utility use. This is a 22% increase over the previous year. Solar installed prices have reduced by 8% from last year and 34% from 2010. Table 7 provides a regulatory overview of the present federal and state credits available along with the IRP, EU goals, RPS and net-metering status.

Table 7 Hawaii Solar Regulatory Summary from DSIRE*

1. Federal: Residential Renewable Energy Tax Credit established by the Energy Policy Act of 2005 of 30% that expires 12/31/2016. Business Energy Investment Tax Credit (ITC) expanded by the American Recovery and Reinvestment Act of 2009 of 30% reduced to 10% after 12/31/2016.
2. State: Commercial, Residential, and Multi-family Energy Income Tax Credit of 35%.
3. IRP framework adopted by HPUC in 1992, KIUC formed in 2002, HPUC adds Clean Energy Scenario Planning to IRP in 2010, 2013 HPUC rejects HEI IRP.
4. KIUC Goals: Reduce residential bill by 10% over next 10 years, generate 50% of electricity by renewables by 2023, reduce carbon levels to 1990 levels by 2023, establish rate structure to decouple margin from sales level to minimize subsidies between customer classes and to recover more of the actual cost of service through fixed charges. KIUC (Kauai has 5% of state's population) is presently at 13.3% renewables in 2014 with a 71% potential for 2020.
5. RPS: Cooperative and IOU must comply with 15% renewable energy net sales by 12/31/15, 25% by 12/31/20, and 40% by 12/31/2030.
6. Net-Metering: 100 kW limit for HECO, MECO, HELCO customers with a 15% per circuit distribution threshold. KIUC limit is 50 kW per customer with a 1% peak demand threshold. Net excess is credited to customer's bill at the retail rate at approximately $0.34 per kilowatt-hour (kWh).

**DSIRE is the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. Established in 1995, DSIRE is operated by the N.C. Clean Energy Technology Center at N.C. State University and is funded by the U.S. Department of Energy.*

IV.2 Colorado - Midwest Region: Tri-State (Co-op) and Sangre de Cristo (Co-op)

IV.2.1 Guided Sensemaking and Contextual Ambidexterity

Colorado has some of the lowest rates in the country at approximately 12 cents per kWh and ranks as having one of the best net-metering policies in the country. According to the U.S. Energy Information Administration (EIA) in 2013, 64% of the electricity generated in Colorado came from coal, 20% from natural gas, and 17% from renewable energy resources. Colorado's RPS requires IOUs to provide 30% of their generation from renewable energy resources by 2020, surprisingly the city of Aspen's goal is 100% renewable resources by 2015, and Co-ops serving 100,000 or more meters must comply with 20% by 2020.

Data analysis reveals Tri-State and Sangre de Cristo Electric business model activities are collaborative value-enhancing *guided* SM activities. The focus of these EU organizations is on the integration of organizational involvement with policymakers and consumer advocates. Tri-State's and Sangre de Cristo's 2009 to 2014 behavioral trajectories point to a *guided* form signifying that contextual OA had developed and was increasing during this time period (Figure 43). In this environment the EU leaders demonstrate patience, support, and compassion for consumers but also demonstrate power and challenges for stakeholders to improve. Cameron (2006) identifies this leadership behavior as "*Caring Confrontation*" where leaders are "patient and powerful, compassionate and bold, selfless and challenging" (Cameron et.al, 2006, p. 80). For example, the Colorado Public Utility Commission (CPUC) continues to implement regulatory obstacles against EUs forcing Tri-State to build and purchase additional and unnecessary solar generation to meet the Co-op RPS mandate of 20% by 2020. Dave Lock, Sr. Manager, Government Relations, explains; *"The Colorado RPS was at 10% then just two years* *ago the legislature increased it to 20% without warning and now it is at 20% for Co-ops and 30% for IOUs."*

In this regulatory environment, there is a need for collaboration (Caring) and competition (Confrontation). This integration of positive-opposites or paradoxical leadership behavior establishes an EU leader that emphasizes the welfare of the state before personal interests, but also challenges stakeholders and employees to live up to a high standard leader type model. Cameron (2006) explains that people respond to leaders that "tell it like it is", challenging mediocrity but practicing kindness and compassion. These CVF behaviors enabled Colorado EUs to create a contextually ambidextrous organizational environment that identified new ways to create organizational value.

IV.2.2 Colorado business model changes and OA

The business model components identified were value-enhancing activities within the CVF Compete quadrant that included *minimal* sensemaking requiring confrontations and challenges with the CPUC in the pursuit of market share (residential rate decoupling), Co-op regulation pressures, and utility-side solar grid upgrade costs. This *minimal* SM form and CVF dimension (Competing) characterizes the impact of solar installations in varying degrees throughout the country. For example, Dave Lock explains the sensitivity surrounding the fact that the Co-ops are not regulated by the CPUC except for the RPS,

> *"For the RPS, yes, that's an interesting question, because there is great sensitivity as to whether or not we're regulated. Of course, we don't want to be. So what the Legislature did is that we have to write a report and submit it to the CPUC on an annual basis to show what our progress is toward reaching the 20% goal, but they have no authority over us. There is nothing in the Statute that describes what happens if we don't meet it. I mean, there is no penalty, there's nothing, so theoretically, a member of one of our Co-ops could sue us and say you aren't meeting the standard and a court would decide whether we are or not and if we're not, I'm sure that they would then order us to. But we're planning on complying."*

An additional issue lies with the differences in an IOU like Xcel Energy Colorado and a Co-op like Tri-State Colorado in regard to cost recovery. Dave Lock explains,

> *"Xcel is doing the same thing that we're doing; they're just integrating solar into their business model. You know, as a vertically integrated IOU, it's a little different, you know they can go to the CPUC and get cost recovery for the capital investments they are making, so they are incentivized to actually build the stuff on their own rather than do a Power Purchase Agreement (PPA), like we do, because when they build on their own they can get a rate of return on that invested capital. It's good for the shareholders, arguably maybe not so great for their customers, but that's the approach they take. Of course, for the Co-ops, the customers are our owners, and we're trying to provide power to them at the least amount of cost that we possibly can."*

In Colorado EU leaders are also working to define what value creation means to them in regard to the EPA Clean Power Plan. With 67% of the Colorado electric capacity coming from coal and an EPA 30% reduction mandate looming to reduce carbon-based fuel emissions by 2030, EU leaders will have to confront stakeholders with an energy resource plan that will increase rates. Cameron's (2006) "*Caring Confrontation*" leadership behavior in Colorado has helped EUs make their desired patterns clear to their employees and stakeholders with a focus on key value drivers that motivate employees and create a competitive roadmap to prevent rate increases and loss of market share.

Another example of *minimal* sensemaking (SM) occurred two years ago in the Colorado legislative session. Without warning Colorado's RPS was increased from 10% to 20%. The EUs were not prepared for rebuttal and are now dealing with the consequences. Bill Bennett with Sangre de Cristo Electric described the RPS change in the following way:

> *"Senate Bill 252, was introduced with only a handful of days left in the Session, no discussion with Tri-State, no discussion with the Colorado Rural Electric Authority (CREA), our statewide cooperative organization, no discussion with any Cooperative, they just introduced it and passed it because they had the votes, and it caused an outrage in the State….There was extreme outrage over the way they handled that."*

Sensegiving from the EU leaders and legislators was *minimal* at that time, but EU leaders have since engaged with regulators and policy makers regarding over-regulation to confront the impact and control through caring and ownership. This CVF positive-opposite leadership behavior is another step toward contextual ambidexterity. In 2012, Xcel Energy (IOU) in Colorado opened the door with a new type of distributed energy service, community solar gardens. Community solar gardens are centrally located solar arrays whose output is shared by within county subscribers who pay an upfront or monthly payment to the developer. These gardens are located close to the load reducing the necessity for large transmission lines. Xcel sets up the program and has publicly endorsed the community solar garden product. The garden's energy is sold to Xcel at a retail rate plus renewable energy credit (REC) and then credited to the subscribers at the avoided cost rate. Solar gardens enable small business and people who live in an apartment, don't have a sunny roof or can't afford a full solar array to buy or lease a piece of an array. The annual savings for a one kilowatt share in one of the Boulder gardens is about $270, according to Clean Energy Collective, a Carbondale-based company developing 11 Xcel solar gardens. Solar gardens laws have been established in Colorado, Delaware, Maine, Massachusetts, Vermont, and Washington, and are pending in California, the District of Columbia, and Maryland.

IV.2.3 Identified differing business model patterns of Tri-State (Co-op) and Sangre de Cristo (Co-op)

Solar processes have impacted the EU business model from 2009 - 2014 in Colorado. In 2009, EU leaders and stakeholders had variable understandings of a variety of renewable energy perspectives and EU actions of control that created *minimal* sensemaking. For example, in 2013 the policymakers increased the Co-op RPS percentage to 20% from 10% without any collaborative discussion involving the Co-ops. These accounts of impact also tended to accumulate over time in legislative committees. In 2013, Colorado EU leaders and stakeholders initiated a change from *minimal* to *guided* sensemaking. EU behavior changed to a "*Caring Confrontation*" concept when the EUs instituted a renewed focus on customer service to their Co-op member systems, investors, and stakeholders. This was also true for the city of Aspen when they changed their goal to 100% renewable by 2015. Ken Anderson, Tri-State Executive Vice President & General Manager, states in 2014,

> *"In 2013, 52 megawatts of Co-op renewable energy projects were constructed or under development. Tri-State persists in analyzing our approach to cost effectively address an expanded Colorado renewable energy mandate passed by the state legislature of which the major components become effective in 2020. We had a renewed focus on customer service to our member systems, and instituted an advisory council on demand response and energy shaping products to support the success of these important initiatives. Tri-State continues to be engaged with regulators and policy makers regarding over-regulation of utilities in the environmental, energy policy and reliability sectors, and we continue to take steps to support compliance, reduce liabilities, control costs and create efficiencies in these areas."*

A 2013 Colorado Energy Report prepared for the Colorado Office of Economic Development provides evidence of EU support for a caring and supportive behavioral change,

> *"Colorado is at the center of this diversity and technology innovation, which presents both great challenges and great opportunities, e.g., questions such as how do we manage a grid that is fed by the sun and the wind as well as traditional sources; how do we plan a transportation system in a city, a region or a nation when multiple vehicle types and fuel types are demanded? Colorado's great opportunity is to develop a collaborative environment where the state's abundant and diverse energy resources and technology innovations can be united and integrated to allow the industry to grow in a manner that will provide energy solutions that serve the state, national and global markets."*

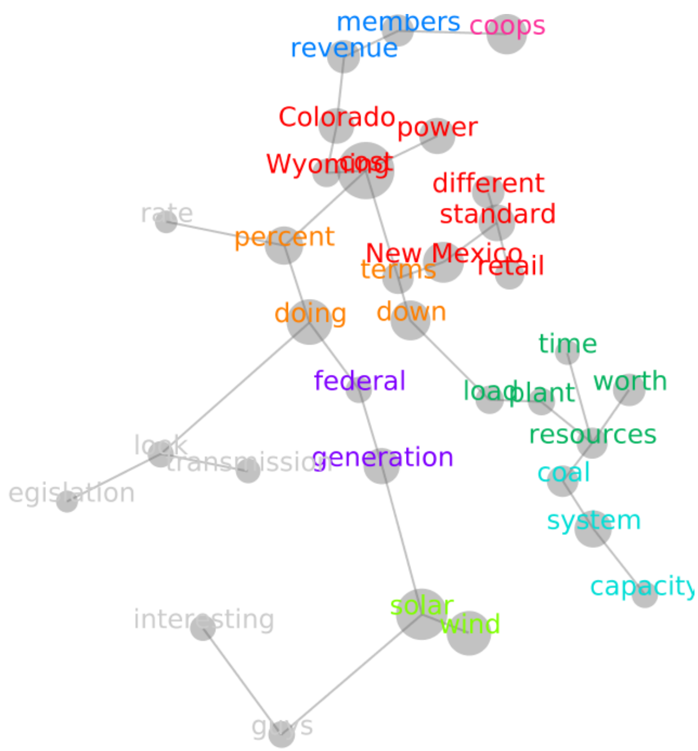
Birkinshaw and Gibson (2004) cite "organizational isolation" as a possible inhibitor to success in ambidexterity situations. The concept of organizational isolation is that separate exploration organizations often lose touch with the needs of the core business. This describes what happened in Colorado in 2009. Structural ambidexterity was not working and a change was needed. When the EU leaders found the balance between having patience, support, and compassion for consumers and stakeholders and knowing when to challenge legislators, contextual ambidexterity emerged. As revealed in the examples above, the impact of the regulatory component on the nature of subsequent EU actions was significant.

Table 8 Tri-State Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	Third-party solar services	Lost Market Share (SolarCity)	Utility-side solar would require transmission upgrades that are very costly	Community solar gardens with no aggregate capacity limit	Provides transmission to other states with a single postage stamp rate (socialized solar)
	Utility-side ownership	Leasing	Excess Net-metering	Net-metering	In 2013, the legislature increased the RPS from 10% to 20% without warning.
EU Control	Employee Involvement	Renewed focus on customer service	Cost-sharing (Fixed Charge)	Renewables driven by BOD	Need cost recovery mechanisms for owning solar rather than third-party PPA
	Provide distribution Services	Solar contractor collaboration	Solar (VER) discussions with stakeholders	Building Solar Gardens	Engaged with regulators and policy makers regarding over-regulation

Table 9 Sangre de Cristo Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	Third-party solar services	Lost Market Share (SolarCity)	Interconnection requirements	Community solar gardens with no aggregate capacity limit	Federal Tax Credit
	Utility-side ownership	Leasing	Excess Net-metering	Net-metering	Fear that RPS will increase again
EU Control	Employee Involvement	Renewed focus on customer service	Cost-sharing (Fixed Charge)	Renewables driven by BOD	Lobbying to unbundle Retail Rate
	Distribution Services	Solar contractor collaboration	Distribution services	Co-op has Solar Tariff	Engaged with regulators and policy makers regarding over-regulation



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
revenue	10	25	1.0
worth	10	22	0.9
transmission	5	16	0.7
members	< 1	< 1	0.0
legislation	< 1	< 1	0.0

Figure 17 Tri-State Interview (Co-op #2 - Leximancer)

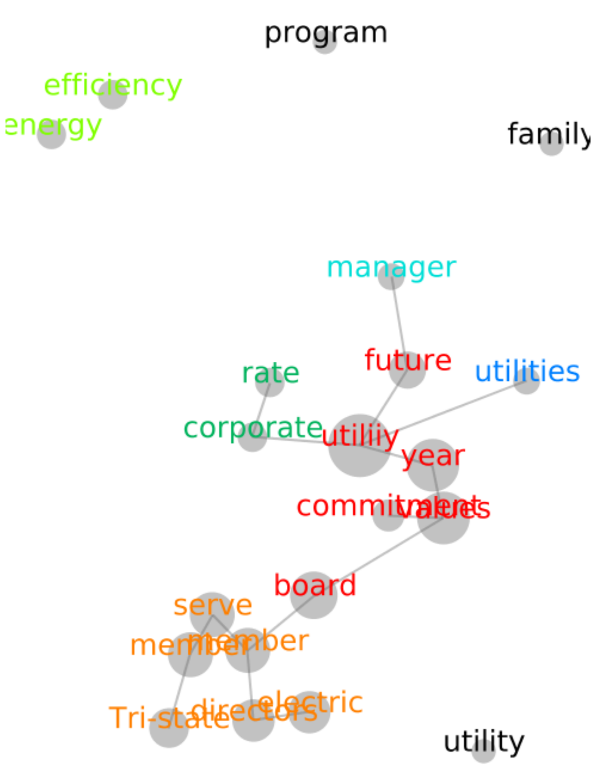


Figure 18 Tri-State 2009 Ceo Report (Co-Op #2 - Leximancer)

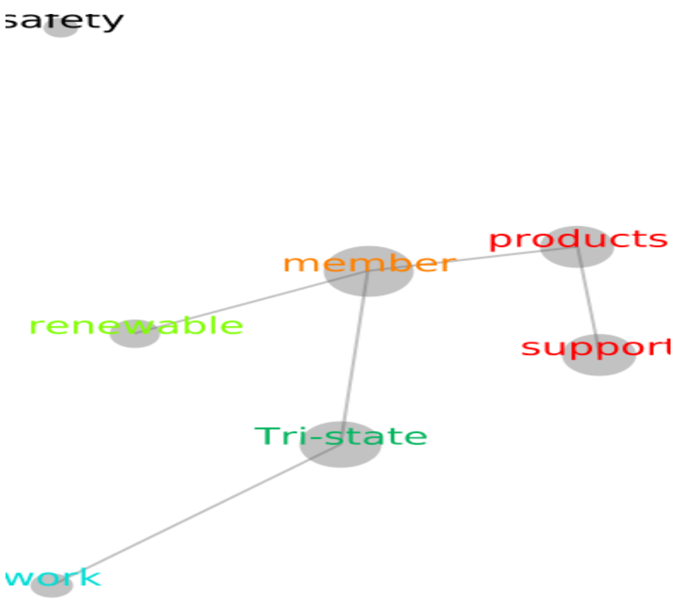
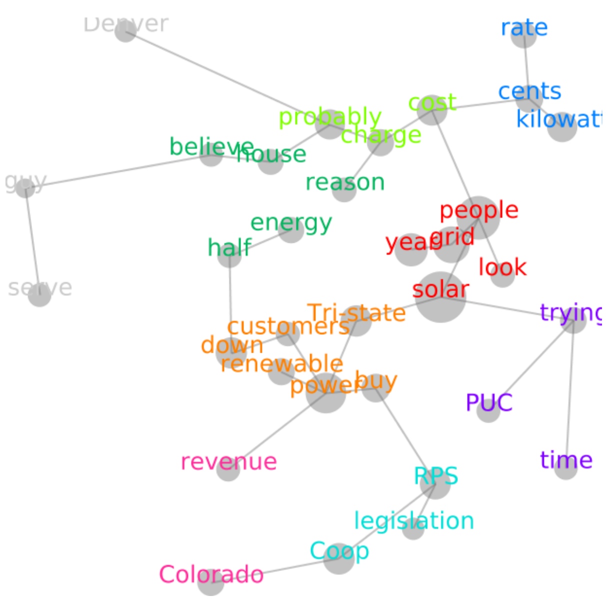


Figure 19 Tri-State 2013 CEO Report (Co-op #2 - Leximancer)



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customers	14	80	2.5
legislation	7	50	1.6
grid	14	36	1.2
revenue	7	33	1.1
serve	3	16	0.5

Figure 20 Sangre de Cristo Interview (Co-op #3 - Leximancer)

The analysis of Tri-State and Sangre de Cristo will be combined because they are both Co-ops and have similar business model issues. Tri-State identifies that the focus of the CEO in 2009 was on the stakeholder relationships and future resource commitments. The relationship with stakeholders was contentious and needed a refocus after the recent RPS change without warning. In 2013, the CEO reported Tri-State was addressing the Colorado renewable energy mandates passed by the state legislature in a cost effective manner. Both Co-ops initiated a renewed focus on customer service for their customers and Tri-State instituted an advisory council on demand response and energy shaping products to support the success of stakeholder relationships. In 2014, the conversation was primarily on lost revenue and how Tri-State would allocate cost for the solar mandates in Colorado to Wyoming and New Mexico when they were using a single transmission postage stamp rate for all of the states. Cost allocation and increased rates have affected the consumers of Colorado due to the additional costs associated with customer-side and utility-side solar. Variable energy resources (solar and wind) are replacing very reliable fossil-fueled plants to meet the RPS percentage. In summary, as the EU business model has changed, so has the EU behavior to a "Caring Confrontation" concept as shown when the EUs instituted a renewed focus on customer service to their stakeholders. Table 10 below provides a perspective of the present renewable portfolio standard (RPS), investment tax credits (ITC), and renewable goals within the state.

Table 10 Colorado Solar Regulatory Summary from DSIRE*

1. Federal: Residential Renewable Energy Tax Credit established by the Energy Policy Act of 2005 of 30% expires 12/31/2016. Business Energy Investment Tax Credit (ITC) expanded by American Recovery and Reinvestment Act of 2009 of 30% reduced to 10% after 12/31/2016.
2. State: Exemptions from state sales tax through 7/20/19, Xcel (IOU) performance-based incentive, and various utility and city tax rebate programs
3. RPS: City of Aspen goal is 100% by 2015. IOU must comply with 30% by 2020. Electric cooperatives serving 100,000 or more meters must comply with 20% by 2020 with a distributed generation provision. Cooperatives serving less than 100,000 meters 10% by 2020 with a distributed generation provision. Municipals 10% by 2020.
4. Net-Metering: Capacity is limited to 120% of average annual consumption for IOU customers. Capacity is limited to 10 kW for residential and 20 kW for non-residential cooperative and municipal customers. Meter aggregation is allowed for IOU customers and community solar gardens are allowed.

IV.3 Vermont - Northeast Region: Green Mountain (IOU) and VEC (Co-op)

IV.3.1 Restricted Sensemaking and Structural Ambidexterity

Vermont like Colorado has been very friendly to solar and ranks as one of the best net-metering states in the country. Vermont does not have an RPS but there is an established renewable generation goal of 20% by 2017, 75% renewable by 2032, and 90% by 2050. According to the U.S. Energy Information Administration (EIA), nuclear power accounted for 70% of the electricity generated within Vermont in 2013, a higher share than any other state and 20% of Vermont's net electricity generation was produced from conventional hydroelectric power. In 2011, Vermont had the lowest carbon dioxide emissions from electricity generation among the 50 states. Vermont's residential rate is approximately 17 cents per kWh.

The *restricted* form of sensemaking occurred when the EU business model changes were highly controlled by the EUs while experiencing low impact by the emerging solar PV technology (Figure 44). This form of SM was typified by Vermont Electric Cooperative (VEC) and Green Mountain Power (GMP) in the state of Vermont. In each of these cases, EU leaders who engaged in high levels of sensegiving developed processes to control the issues they encountered, whereas stakeholders tended to accept the solar energy emergence impact with relatively few attempts to provide alternative viewpoints or control. Dave Hallquist, CEO of VEC, when asked if the Co-op can control the third-party solar emergence states,

> *"We're going to try and compete with a community net-metering offering where we use utility-side solar. Our philosophy is that we can build it a lot cheaper than they can. Our data shows that less than one-third of our members have locations that are even ideal for that situation. If we hit 11 or 12%, you know the market is declining for those roof top solar developers. We think if we do a good community net metering offering, it's a better deal than roof top solar because you don't have to do solar panels on your roof or your*

> *yard—you get all the benefits but you don't have to worry about operational maintenance. We could offer a better deal."*

Both EU leaders interviewed at VEC and GMP displayed "Control" quadrant (confidence and assuredness) and "Create" quadrant attributes (openness and teachableness). Cameron (2006) describes this as "*Teachable Confidence*" leadership behavior. Teachable confidence is facing the unknown and continually moving forward so as to co-create a new reality (Cameron, 2006).

This openness to change and entrepreneurial confidence was noticed in both interviews and emerged in the Leximancer CEO reports. The EUs recognize that their state is in a rare position with a 90% generation dependence on nuclear and hydro. This allows them to be forerunners in the renewable EU market with a low risk factor. They can manage a controlled experiment, whereas a state that has to retire fossil-fuel generation and replace it with renewables has a higher reliability risk factor. Vermont is losing revenue due to the emergence of third-party leasing and net-metering (NEM). VEC and GMP are demonstrating structural ambidexterity because they have sensed an opportunity to add electric services (community NEM, electric vehicles, and HVAC) that will supplement their lost net-metering revenues; they are seizing those opportunities through a "*Teachable Confidence*" leadership behavior in working with the VPUC. The next and final step for GMP is the reconfiguration of its business model to a service-based customer model instead of a vertically integrated generation, transmission, distribution service model.

IV.3.2 Vermont business model changes and OA

One example of business model changes is when *restricted* sensemaking was seen in this year's proposed RPS bill. VEC and GMP, jointly with the Department of Public Service (consumer advocate), proposed legislation that will allow the RPS to be credited for offsetting electric transportation, heating and cooling. With some consumer advocate support, regulators and stakeholders are confident that this “behind the meter” advantage will be approved and should be included in their business model as an RPS credit for the EUs.

EU leaders in Vermont have one of the most open net-metering policies in the country and believe that in the future, EUs will move away from the traditional vertically integrated utility model towards a more distributed, service-based model. VEC and GMP are positioning their business plan models to accomplish this goal. A few key stakeholders, VPUC, and legislators have engaged in private meetings with VEC and GMP leaders in which they are listening to the distributed, service-based model proposal. Sensing this new opportunity, seizing, and then reconfigure the organization to take advantage of the opportunity describes the three key capabilities in structural ambidexterity.

The Leximancer 2009 CEO report shows that GMP and VEC were concerned about their future energy needs and if the transmission grid was not as important to their business model. The Leximancer 2013 CEO report shows that VEC and GMP were focused on regulatory issues, rates, and net-metering associated with solar energy.

IV.3.3 Identified differing business model patterns of GMP (IOU) and VEC (Co-op)

The controlled nature of *restricted* sensemaking produced a limited interpretation of the future and how the focus should be on improving through incremental change. This singular focus resulted not from VEC and GMP leaders working to integrate and synthesize multiple perspectives with stakeholders, but from a lack of alternatives and explanations on the dominant EU solution (i.e. distributed service-based business model). Although EU leaders in Vermont may generally have broader understandings of some issues than do individual consumers and investors (Hambrick & Mason, 1984), their perspectives do not include the variety of perspectives that exist across a range of interested consumers and investors. However, the CEOs are willing to listen and learn. For example, in a group net-metering case, 500 kilowatt systems are being built and used for group net-metering where the developer may only have one or two big solar customers. EU leaders are requesting a limit to this type of community solar garden approach because it does not appear to benefit the community or the EU. VEC and GMP leaders are displaying humility, teachableness, confidence, and assuredness behaviors by considering a new EU business model and listening to multiple perspectives of residential and commercial consumers. For example, Robert Dostis, Green Mountain Power Director of Government Affairs, explains how they will recover lost revenue,

> *"So the solar build out has begun in Vermont…Green Mountain will be at 15% solar by the end of 2016….The way our law is now, if our customers produce enough solar power, they can bring our billing down to zero… so the concern is that they are using the system in every form but they're not paying towards it, and then the amount of revenue to the utility is declining… We have to bring in new revenues into our company to offset the revenues that are lost. And that will happen in two ways—one is by electrification of both heating and transportation so we'll see an increase in load, and the second is new products and services that we will be offering our customers that will bring new revenues into the company while at the same time reducing our customers overall expense—not only in the electric sector but also in the thermal sector and in the transportation sector."*

The specific needs of VEC and GMP to reduce the solar impact produced a *restricted* sensemaking process describing a highly specific Control CVF behavior for action. In 2012, both EUs realized they were losing some of their consumers due to third-party roof-top leasing. The EUs in Vermont are mandated to pay 20 cents per kWh for net-metering when the current EU retail rates are 17 cents per kWh. Specifically, the EUs are losing market share and have to create new business opportunities. Dave Hallquist, CEO for VEC, described the future like an entrepreneur by focusing on new change,

> *"Solar leasing companies were out there badmouthing the utility seller—you know, saying that we're not ready to make the change—so we successfully reversed that because we aggressively got out and started building community solar and started to market the concept…. So, we truly believe, and I'm speaking for Vermont, of course—I'm not sure where the rest of the nation is--but in Vermont our concept is that we think transmission is a bad investment—we think we've got to start focusing on distributive generation, and that is our focus."*

VEC and GMP leaders, who are characterized by "*Teachable Confidence*" in this study, have more influence and create more value by integrating positive-opposite "Control" and "Create" behaviors as described by Cameron's (2006) CVF quadrants. So how are VEC and GMP creating new value? Co-ops are building community solar gardens and staying involved with the latest battery storage technology, creating value for their members. The IOUs are using the state regulatory programs to procure power purchase agreements (PPA) with third-party utility-side solar owners and, as GMP says, creating new markets by developing an "*Extreme Energy Makeover*" program to serve more like a general contractor for home energy improvements. Converting consumers to a total electric plan (from natural gas) would supplement the lost revenue from roof-top solar. Specifically, both EU leaders are creating value by proposing a change or revision to the RPS with the backing of the Department of Public Service (consumer advocate) to allow credit for offsetting electric transportation, heating, and cooling installations. Dave Hallquist, VEC CEO, stated,

> *"If we can take our 90% carbon free footprint and create incentives for our members to go out and put in air/heat pumps to convert to higher efficiency electric systems for their heating, and electric vehicles, we're going to get credit for that. There is an opportunity to sell a hell of a lot more kilowatt hours by incorporating transportation, heating, and cooling into our portfolio."*

O'Reilly and Tushman (2007) point out that structural ambidexterity is focused on the organizational characteristics and competencies required to sense new opportunities and threats, seize upon them, and then reconfigure the organization to take advantage of the opportunities or counter the threats.

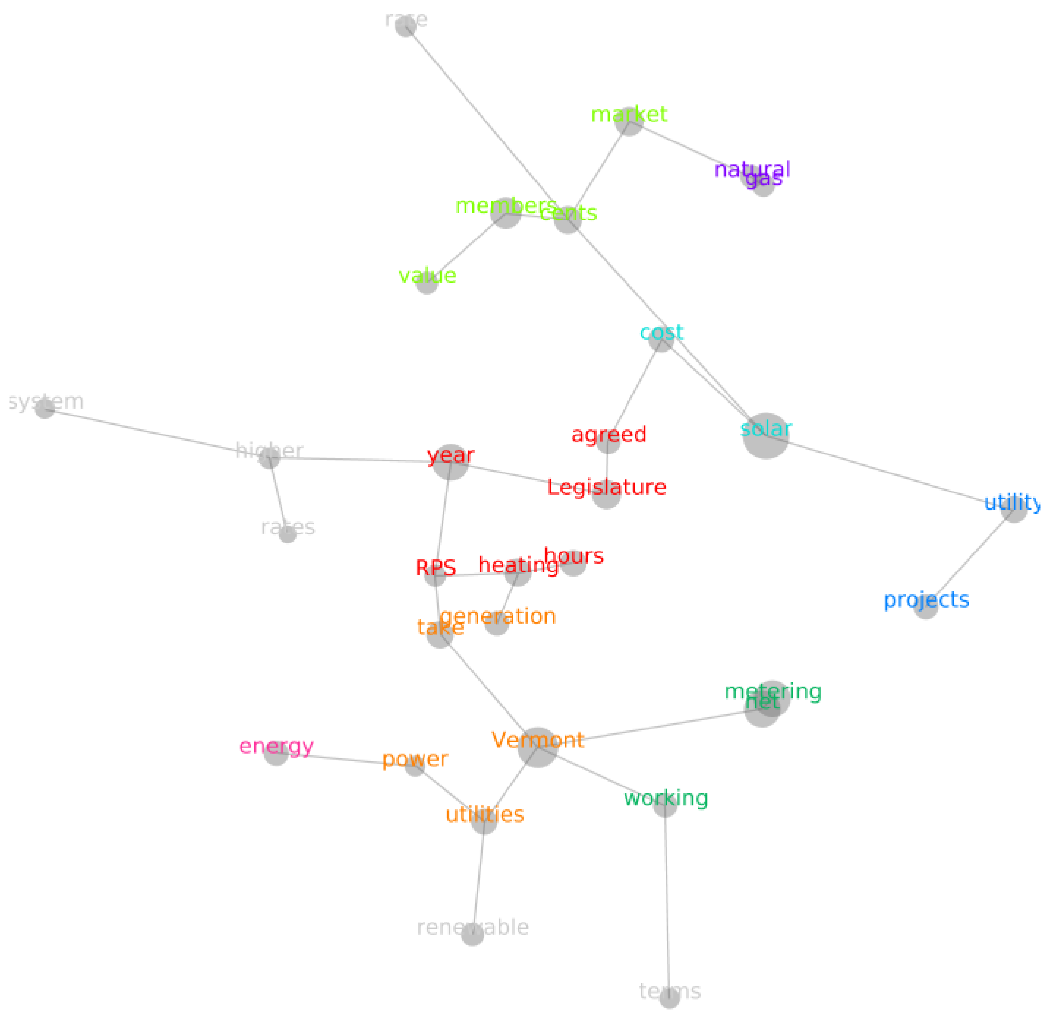
Table 11 VEC Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	4 yrs. ago incentives were to take people off of electricity	Residential roof-top handled by third-parties and is aggressive	Excess net-metering	Pay retail, plus three cents for net-metering	Aggressive Net-metering Law.
	Liberal group promoting aggregate net-metering (community solar)	Non-solar customers should not see rate increase because they are covering more of the standard costs	If EU serves 72% of the load then must take 72% of the power output of the Renewable Standard Offer projects	371 installations causing a cross-subsidy of about $587,000	Three renewable programs direct EUs in how much renewable they have in their portfolio
EU Control	Solar opportunity with an open BOD	Increased the peak demand cap to 15% and reserved 4% of for community net-metering	Have to focus on distributive generation	Create incentives to put in air/heat pumps and electric vehicles	Proposal to allow RPS credit for offsetting transportation and heating and cooling
	Adding transportation and HVAC portfolio	Solar customers should pay a tariff	Converting to a distribution service model	Solar customers should pay a tariff	Solar customers should pay a tariff

Table 12 GMP Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder	Retail rate plus	Net-	Serves 72% of	Net-metering	Three different

Impact	4 – 5 cents depending on the size of the system	metering causing declining revenue	the State, must take 72% of the power output of the Renewable Standard Offer projects	causing declining revenue	renewable programs direct utilities in terms of how much renewable they have in their portfolio
	Net metering limit goes up to 500 kW	Third-Party Leasing	Excess net-metering	Retail rate plus 4 – 5 cents depending on the system	SPEED law (Sustainable Economic Enterprise & Development)
EU Control	Solar Gardens	4% of load is from solar and will be 15% by end of 2016	First IOU to go to Distribution service model	Cost recovery through the rates (cap on ROE)	Proposal with consumer advocate to allow RPS credit for offsetting transportation and heating & cooling
	Electrification of heating and vehicles	Solar customer tariff	Community Solar	Electrification of heating & vehicles	Regulatory Support

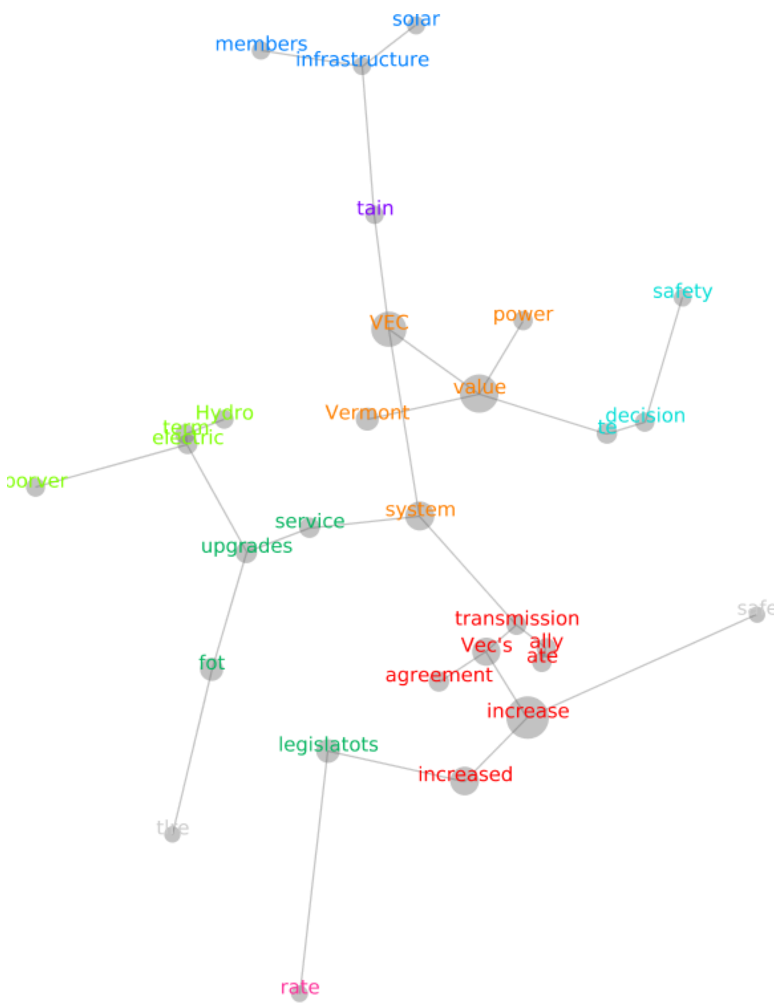


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
members	11	25	1.0
value	6	25	1.0
rate	6	20	0.8
legislature	6	16	0.6
system	6	14	0.5

Figure 21 VEC Interview (Co-op #4 - Leximancer)

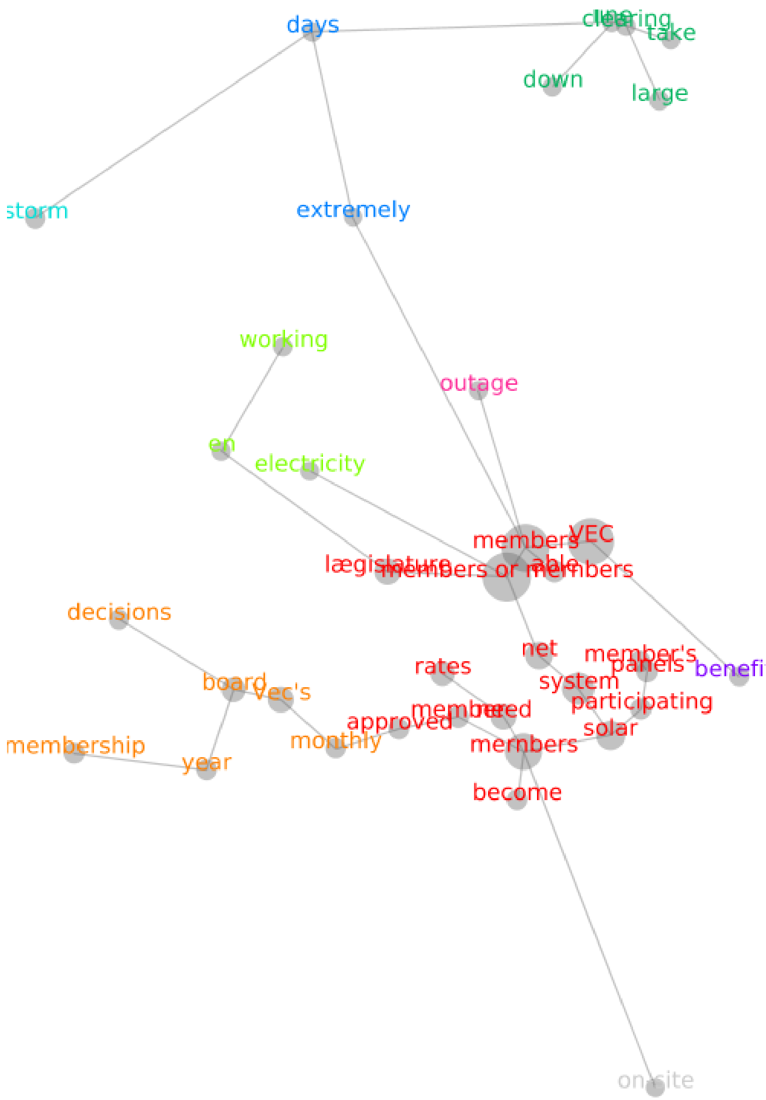


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
infrastructure	33	50	10.3
members	33	33	6.9
value	67	18	3.8
legislatots	< 1	< 1	0.0
rate	< 1	< 1	0.0

Figure 22 VEC 2009 CEO Report (Co-op #4 - Leximancer)



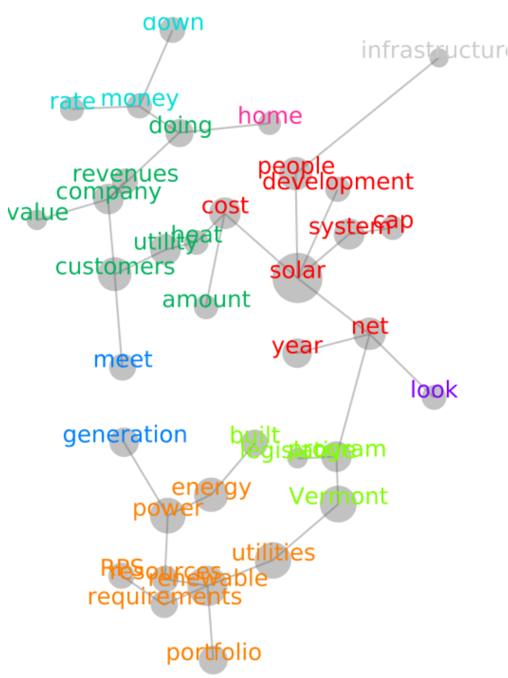
2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
system	78	63	3.7
benefits	11	33	1.9
rates	22	33	1.9
members or members	100	29	1.7
lægislature	22	25	1.4

Figure 23 VEC 2013 CEO Report (Co-op #4 - Leximancer)

The Leximancer analysis of VEC in 2009 (Figure 22) reveals a concern for the transmission grid and its value moving forward with the increase in customer-side solar. Third-party solar leasing was increasing with the potential to erode revenue. There was a growing concern that if the solar PV disruptive technology takes root, it could eventually impact the EU's residential market. In 2013, the Leximancer report (Figure 23) shows a significant shift in the EU business model. The concepts under study were more central in the mapping around solar and the regulatory component was highlighted. VEC had moved into the "Create" CVF quadrant as a result of changing its behaviors toward residential customer service by developing community solar projects and getting more involved with customer electricity needs in the home. In 2014, the interview (Figure 21) revealed that net-metering was still a concern, but the transformation to a distribution service organization was becoming a reality. In summary, the regulatory relations appear to be strong with VEC, thereby effectively allowing VEC to build community solar facilities and customer energy services in the home thereby reducing costly RPS projects and increasing revenue.

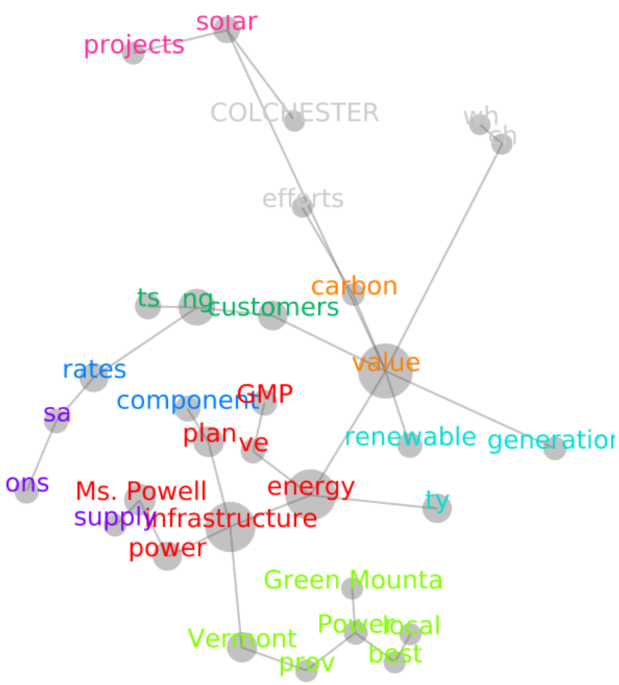


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
legislative	4	50	1.9
customers	19	41	1.6
revenues	8	40	1.5
value	< 1	< 1	0.0
infrastructure	< 1	< 1	0.0

Figure 24 Green Mountain Interview (IOU #2 - Leximancer)

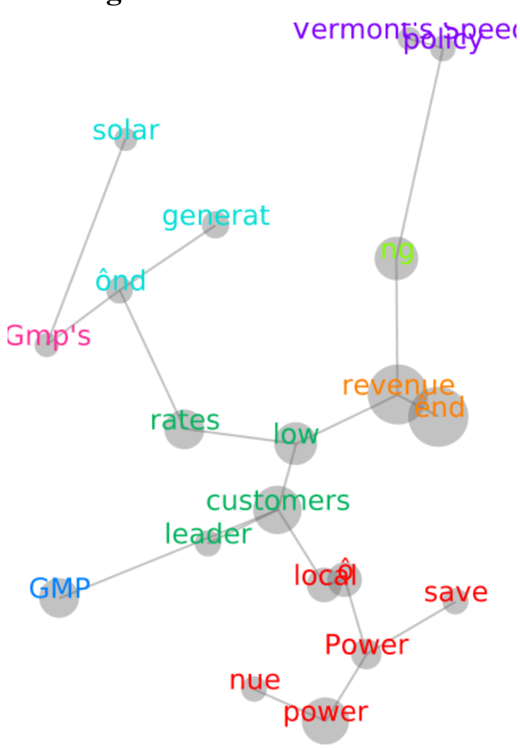


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
rates	23	33	1.5
customers	23	33	1.5
carbon	8	25	1.1
value	62	20	0.9
infrastructure	38	16	0.7

Figure 25 Green Mountain 2009 CEO Report (IOU #2 - Leximancer)



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
policy	50	33	4.8
gmp	50	11	1.6
power	50	9	1.3
revenue	50	7	1.0
customers	< 1	< 1	0.0

Figure 26 Green Mountain 2013 CEO Report (IOU #2 - Leximancer)

The Leximancer analysis of GMP in 2009 reveals similar results to VEC in that there was a concern for the transmission grid and its value moving forward due to the increase in solar from customer-side rooftop installations. Rates were increasing in response to loss in revenue realized from net-metering, resulting in unfair cost-sharing for non-solar customers thus creating behavioral changes for the residential market. In 2013, it appears that GMP was concerned about the loss of revenue from net-metering and wanted to move their business model towards distribution services, but the process was slower than VEC. This slower process to change may be attributed to the size of the IOU and the fact that it is regulated by the VPUC. The GMP Leximancer mapping shows that revenue, customers, and rates are pointing to net-metering as still being a concern. In 2014, the interview data revealed that while solar concepts were becoming more prevalent, GMP was becoming more active by creating community solar gardens as well as new programs that encouraged the electrification of residential heating and promotion of electric charging stations for vehicles. From 2009 - 2014 VEC and GMP have made significant business model changes. The primary difference was a change in the value proposition for both companies. The popularity of customer-side rooftop solar, third-party leasing, and ownership encouraged EUs to create a new revenue model more focused on customer services. Vermont has one of the friendliest net-metering policies in the country and consumers are taking advantage. The EUs are installing community solar gardens to negate this lost revenue. Table 13 provides a regulatory overview of the present position of the federal and state credits available along with the RPS and net-metering status.

Table 13 Vermont Solar Regulatory Summary from DSIRE*

1. Federal: Residential Renewable Energy Tax Credit established by the Energy Policy Act of 2005 of 30% that expires 12/31/2016. Business Energy Investment Tax Credit (ITC) expanded by American Recovery and Reinvestment Act of 2009 of 30% reduced to 10% after 12/31/2016.
2. State sales tax exemption for systems up to 250 kW. GMP performance-based (net-metering systems only) incentive of $0.06 credit per kWh in addition to the value of the net-metering for 500 kW systems.
3. Enacted legislation in 2009 that retail electricity providers must purchase electricity generated by eligible renewable energy facilities up to 2.2 MW through the Sustainably Priced Energy Enterprise Development (SPEED) Program via long-term contracts with fixed rates. RFP process caped the rates at avoided cost rate.
4. Small-scale renewable energy incentive program that allows systems that generate 1,000 kW/year of DC capacity can receive up to $2,850.
5. Do not have an RPS but there is an established renewable goal of 20% of electricity needs with SPEED by 2017, 75% renewable by 2032, and 90% by 2050.
6. Net-Metering: 500 kW limit for all systems other than military (2.2 MW) and micro-CHP (20 kW). Aggregate capacity limit of 15% of utility's peak demand (1996 peak minimum). Excess is credited to customer's next bill at retail rate. Group meter aggregation allowed and 15 kW or less system follow an expedited permitting process.

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IV.4 Georgia and Carolinas - Southeast Region: Georgia Power Company (IOU), Georgia Electric Membership Corporation (Co-op), Duke Energy (IOU), Electric Cooperatives of South Carolina (Co-op), Santee Cooper (State-owned)

IV.4.1 Restricted Sensemaking and Structural Ambidexterity

In 2013, Georgia was ranked seventh in the U.S. with 91 MW of solar installed by Solar Energy Industries Association (SEIA). Georgia and South Carolina residential retail rates are approximately 11.5 cents per kWh. Georgia's four existing nuclear reactor units accounted for 27% of the state's net electricity generation, coal accounted for 33%, natural gas for 34%, and renewable energy for 6%. Georgia ranked tenth in the nation in net electricity generation and eighth in retail sales of electricity. In 2015, Georgia has a new solar H.B. 874 that amends Georgia law to allow energy produced by solar panels to be factored into a lease or financing arrangement by consumers. This legislation applies only to solar installations for an individual home or business and limits solar production to the consumer's energy needs. Georgia does not have a state mandated RPS or a voluntary renewable energy goal.

In 2014, S.B. 1189 was approved in South Carolina mandating the creation of a voluntary Distributed Energy Resource (DER) Program and establishing new net-metering rules. The legislation allows participating utilities to recover costs connected to meeting a 2021 RPS target of 2% aggregate generation capacity from renewable energy sources. The bill also mandates that the PSC create a program to offer nonprofits easier access to renewable energy and to incentivize residential customers to become customer-generators by purchasing or leasing renewable generation equipment.

In Georgia and South Carolina *restricted* sensemaking was found in varying degrees within the five EUs that serve the two states. Each EU tended to await others' interpretations of an issue, which typically came in response to some external trigger. Georgia Power Company (GPC) stated,

> "*Waiting and watching other jurisdictions helped them learn a lot of things to do and not to do. Not being the first mover was beneficial because waiting a little longer until the solar costs came down allowed us to structure our solar market in a way that was beneficial for everybody, not just to those who install the solar but to the other customers who do not install roof-top solar."*

Solar impact to the EU business plan processes was low, with a few stakeholders discussing the issue or seeking to offer their opinions. At the same time, some EU leaders made an attempt to organize ways of promoting their interpretations of solar issues and gather the views of their stakeholder groups in a systematic way at the regulatory level. The transfer from *restricted* SM form to *fragmented* SM enabled parties to interpret the solar energy situation and synthesize the perspectives of multiple stakeholders, initiating the "Create" CVF dimension (Figure 45). Cameron (2006) describes this type of paradoxical leadership based on hope and vision found in the "Create" CVF quadrant and the behaviors of Reason and Practicality within the "Control" CVF quadrant. With the Southeast region having the lowest electric rates in the country, the EU leaders displayed both practical and visionary tendencies. Logical optimism and realistic enthusiasm describe leaders that have developed "*Practical Vision*" behaviors where they can see both the realities and practicalities of the present and the possibilities in the future.

IV.4.2 Georgia and South Carolina business model changes and OA

The CVF "Create" dimension describes a behavior of innovative change which results in hope and vision. The data shows that the EU leaders in the states of Georgia and South Carolina are visionaries and have implemented practical vision by combining hope and optimism with reason and logic. This behavior triggers breakthrough thinking. For example, Georgia Power stated,

> *"We don't have an RPS here, we don't have a renewable portfolio standard and we think that is absolutely the wrong way to go….We don't have a goal, we don't have a standard, we have no infringement on the Territorial Act…we've maintained our avoided cost methodologies, all of those things are very important to customers over the long term."*

But GPC has implemented a new organizational structure to handle the solar workload and initiated an "Advanced Solar Initiative" program per requirements of their PSC approved IRP. GPC explained,

> *"We have created a separate organization, and even within my organization there is a team specifically designated to do utility-side and a team specifically designated to do distributed generation (DG), because they are so different in dealing with a 4 or 5 KW on a residential customer's house is way different than a 50 megawatt solar farm….We've had to change because we've gotten so much solar...190 megawatts of DG is bigger than almost every state out there….We project that our renewable percentage by 2020 is going to be somewhere around 2% on a capacity basis."*

Cameron (2006) says that leaders who develop "*Practical Vision*" can see both the realities of the present and the possibilities in the imagined future. The behavioral trajectory from 2009 to 2014 has been along a positive-opposite creative value framework where EU leaders were focused on incremental change in the "Control" dimension and a transformational new change in the "Create" dimension. During this four to five year period, EU leaders began by making little attempts to shape understandings of an appropriate solar perspective with stakeholders or influence how others saw a particular issue because the impact of solar energy was very restricted. But as the EU business model components became affected, behaviors changed and the impact of solar required a new value creation dimension.

The Leximancer 2009 CEO report shows that Georgia Power (IOU) and GEMC (Co-op) were concerned about the value proposition that renewable energy brought to the EU and the customer. The cost to meet the Federal emission reduction requirements appeared to be the main concept under review. In 2013, the focus was still on the EPA restrictions but the discussions were moving into the regulatory environment with the PSC. The impact to the infrastructure with fossil-fuel plant retirements and solar additions became more important. The 2014 interview results revealed business model shifts that were significant. Customer rates associated with solar build out and regulatory policies came to the forefront in the mapping. The net-metering leasing bill and the replacement of a dispatchable coal resource with a solar variable resource was discussed. In summary, the data shows that the EU business model is shifting toward a model dominated by the regulatory business model component.

Duke Energy (IOU) and ECSC (Co-op) results were very similar to GPC and GEMC. This substantiates the grouping of these IOUs and Co-ops into a Southeast Regional category.

IV.4.3 Identified differing business model patterns between IOUs and Co-ops

Instances of *restricted* and then *fragmented* sensemaking led to positive-opposite behaviors to create value for consumers and investors. Initially, in 2009, stakeholders failed to offer spontaneous solutions to the solar issues, and as EU leaders neither encouraged them to do so nor put forward their own interpretations, SM in the *restricted* form produced only simple examples of impact. As a result, IOU and Co-op leaders focused on improving internal processes to increase efficiency. But as solar PV material costs decreased and regulatory pressures increased, EU leaders and stakeholders started to grasp the narratives of solar issues that might provide some basis for value creation. For example EU leaders and stakeholders, who struggled with the issues initially, began to sense that they needed to work together to develop better solutions. They began to engage in sensegiving with respect to the issue and not avoid conflict as they had done a few years earlier. After years of uncertainty and procrastination in legislation, the IOU and Co-op leaders and the PSCs suggested flexible net-metering and leasing arrangements that would avoid judicatory procedures. The *fragmented* SM enabled the interpretation of the solar energy situation to take place with multiple stakeholders, initiating the "Create" CVF dimension. IOUs started demonstrating structural ambidexterity. The resource constraints and the lack of solar growth in the rural areas allowed Co-ops to absorb the workload with existing processes and procedures demonstrating contextual ambidexterity. As growth increases, the expectation is that the urban Co-ops will be the first to move from a contextual ambidextrous environment to a structural environment.

When single explanations of impact become multiple narratives, communication transforms from the *restricted* SM to a more *fragmented* SM form of communication. These multiple narratives that served as a catalyst for change included a new cost benefit analysis through government subsidies, the "Fifth Amendment in the Bill of Rights" position that homeowners were taking on private property rights (owner's exclusive authority to determine how private property is used), and manufacturing cost reductions for solar PV. The previous simple interpretation of the explanation of impact had produced very weak foundations and EUs developed a "Control" behavior that did not motivate change from anyone. The earlier simple accounts of impact acted as discursive resources for EU leaders as they attempted to respond to an issue (Weick, 1993) - doing little to foster either motivation (reasons for action) or imagination (insight).

In South Carolina, with new legislation allowing IOUs and Co-ops to recover solar incentives offered to homeowners and with the approval of third-party leasing of roof-top solar, Duke Energy was the first to implement change through incentive proposals. Duke Energy explains,

> *"The net-metering, we're going to require going forward, in South Carolina…is to put a second meter out there at our cost, or we're going to call it a distributive energy resource cost and charge it through this budget that the General Assemble is giving us.…We're going to get that interval data, in the most efficient way we can. So we've got to do sampling now of all the renewables…to really understand what benefits they're bringing to the system, what are they drawing from us, when are they putting stuff out there, and in a way that our rates group does not currently do it. We are pushing change within the company in our rates group, in our metering group, in our IT group--that's been our mandate, we must push for the change. South Carolina for us is a Petri dish, it's the first state where we have a legislative mandate to revise net-metering, where we have a legislative mandate to provide customers with the price signals to adopt solar in a distributive generation fashion and a roof top fashion."*

This decision demonstrates that Duke Energy has sensed an opportunity to recover their solar incentive costs and is seeking to understand the dynamics of the solar market in South Carolina with a Creative behavior. Georgia was soon to follow with its own Creative behavior through its regulatory business model. The proposed Georgia HB 874 amended current Georgia law to allow energy produced by solar electric generators to be factored into a lease or financing arrangement by consumers. GEMC (Co-op) explains the solar industry position,

> *"The solar industry has become really aggressive in lots of different ways over the last four to five years in Georgia…"* The solar lobby *"…got smart and started hiring lobbyists that had success with conservative issues and shifted their messaging from an environmental message to a property rights message. They started going to the more conservative side of the Republican caucus, some might consider themselves to be "tea party."*

The GEMC continues by explaining the proposed bill,

> *"In 2014, Representative Mike Dudgen proposed a leasing Bill; EUs …had a resounding message given to us that this issue is not going to go away. Wouldn't it be better if the utilities sat down at the table and drafted the Bill with something you can live with and equally addresses your concerns, as opposed to just fighting this Bill year after year, because eventually you're going to lose and you're going to have to live with whatever that Bill is, so why not draft one yourselves…"*

GPC and GEMC were heavily involved in this piece of legislation which is considered a win-win in that it fairly addresses the needs of both EUs and consumers. As stated earlier, "*Practical Vision*" has taken shape in both states with a bit of variability in timing between IOUs and Co-ops based on available resources and solar growth rates. The realities of the present and the possibilities in the imagined future are transforming the EU leadership to an organizational ambidextrous form that makes sense.

Table 14 GPC Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	735 MW Advanced Solar Initiative program for utility-side and customer-side	Customers get into solar for environmental reasons, hedging, and rate security	Unfair cost-sharing	Roof-top solar with one meter offsets their usage – lost revenue.	Clean Power Plan (EPA)
	Bid out the DG market to lower payouts	Solar is more dominant in the urban areas	Solar variability and not able to dispatch	Fossil-fuel plant closings will increase rates	Leasing on customer-side solar
EU Control	Two meter - Residential buy at retail rate, GPC buys at avoided cost. 20 yr. contracts	Still not cost effective to install roof-top solar	New solar organization created to adapt to solar emergence	100% fuel recovery, so it's just a pass through and not in our base revenue requirements.	Have a Public Service Commission that is supportive of renewables and solar in particular.
	Avoided cost for net-metering	Need to decouple residential rates	Two meter - Residential buy at retail rate, GPC buys at avoided cost. 20 yr. contracts	The two meter solution: Customer buying at retail rate, GPC doesn't lose revenue, no other customers are subsidizing.	No RPS, no solar goals, no infringement on the Territorial Act, maintained the avoided cost methodologies

Table 15 GEMC Interview Common Issues and Response

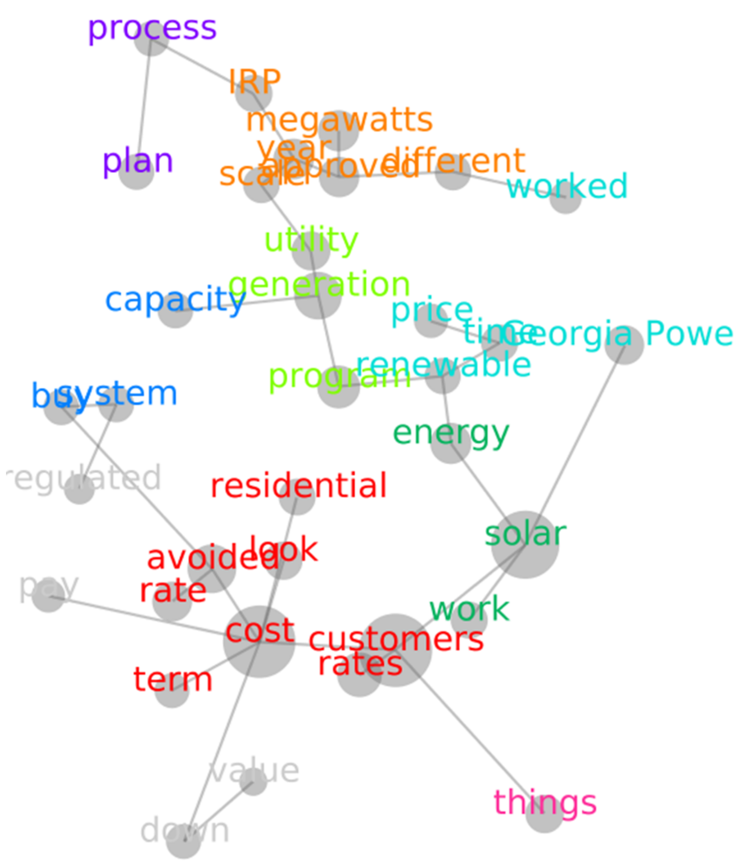
	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	GPC funding of a new unregulated division that markets and operates solar leasing will impact the Co-ops	Customers get into solar for environmental reasons, hedging, and rate security	Unfair cost-sharing	Roof-top solar with one meter offsets their usage – lost revenue.	Clean Power Plan (EPA)
	Co-ops can get into the leasing business for customers in their territory.	Solar bills that allow exceptions to the CUVA Covenants which is the Conservation Use Covenants (tax benefit)	Excess net-metering on circuits	Fossil-fuel plant closings will increase rates	Leasing bill for customer-side solar
EU Control	Co-ops considering the two meter design- Customer buys at retail rate, GEMC buys at avoided cost.	Still not cost effective to install roof-top solar	New solar absorbed within existing organization	Net-metering aggregate limits	Have a Public Service Commission that is supportive of renewables and solar in particular
	Avoided cost for net-metering	Need to decouple residential rates	Solar tariff to cover fixed costs.	The two meter solution: Customer buying at retail rate, GEMC doesn't lose revenue, no other customers are subsidizing.	No RPS, no solar goals, no infringement on the Territorial Act, and maintained the avoided cost methodologies

Table 16 Duke Energy / Santee Cooper Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	IOUs must normalize the investment tax credit across the twenty year life	Customers get into solar for environmental reasons, hedging, and rate security	Unfair cost-sharing	Roof-top solar with one meter offsets their usage – lost revenue.	Clean Power Plan (EPA)
	Solar is a threat because in a PPA we don't own an asset or get a rate of return on it, and at some time a PPA is a debt on the balance sheet	Leasing bill for customer-side solar	Solar variability and not able to dispatch	Fossil-fuel plant closings will increase rates	Leasing bill for customer-side solar
EU Control	Two meter - Residential buy at retail rate, Duke buys at avoided cost. 20 yr. contracts	Bill allows EUs to offer consumers choices, to adopt solar and buy it down. Does not disrupt our revenue model	You decouple your rate from the solar such as you're still meeting your earnings as a minimum requirement	100% fuel recovery, so it's just a pass through and not in our base revenue requirements.	Bill allows cost recovery, a budget, and a directive from the General Assembly to offer incentives
	Avoided cost for net-metering	There is a healthy debate within Duke Energy as to whether or not we should be in the roof-top business	Solar tariff to cover fixed costs.	Two meter solution: Customer buying at retail rate, Duke doesn't lose revenue, no other customers are subsidizing.	Adapt to the solar environment, operationally and staffing-wise, and Co-operate it and make it part of our business

Table 17 ECSC Interview Common Issues and Response

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory
Stakeholder Impact	Must file a new net metering tariff with the Public Service Commission tied to a methodology and system value.	Customers get into solar for environmental reasons, hedging, and rate security	Unfair cost-sharing	Roof-top solar with one meter offsets their usage – lost revenue.	Clean Power Plan (EPA) will increase transmission rate
	Must file a Distributive Energy Resource Plan that sets cap on incentives for solar with a 2% peak demand limit by 2021	Leasing bill for customer-side solar	Co-ops do not own any generation in SC, they buy wholesale from Duke and Santee Cooper	Fossil-fuel plant closings will increase rates	Leasing bill for customer-side solar
EU Control	Two meter - Residential buy at retail rate, Co-op buys at avoided cost.	Co-ops are in the business of delivering value. One day what we're going to sell will look like energy services or grid services	Increase Distribution Services for the customers	100% fuel recovery, so it's just a pass through and not in our base revenue requirements.	SC bill allows cost recovery, a budget, and a directive from the General Assembly to offer incentives
	Avoided cost for one-meter net-metering	Fixed monthly payment may be the future just like cell phones	Solar tariff to cover fixed costs.	Two meter solution: Customer buying at retail rate, Co-op doesn't lose revenue, no other customers are subsidizing.	New bill allows Co-ops adapt to the solar environment



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	3	100	2.9
utility	9	50	1.4
customers	47	47	1.4
rates	10	33	1.0
regulated	< 1	< 1	0.0

Figure 27 GPC Interview (IOU #3 - Leximancer)

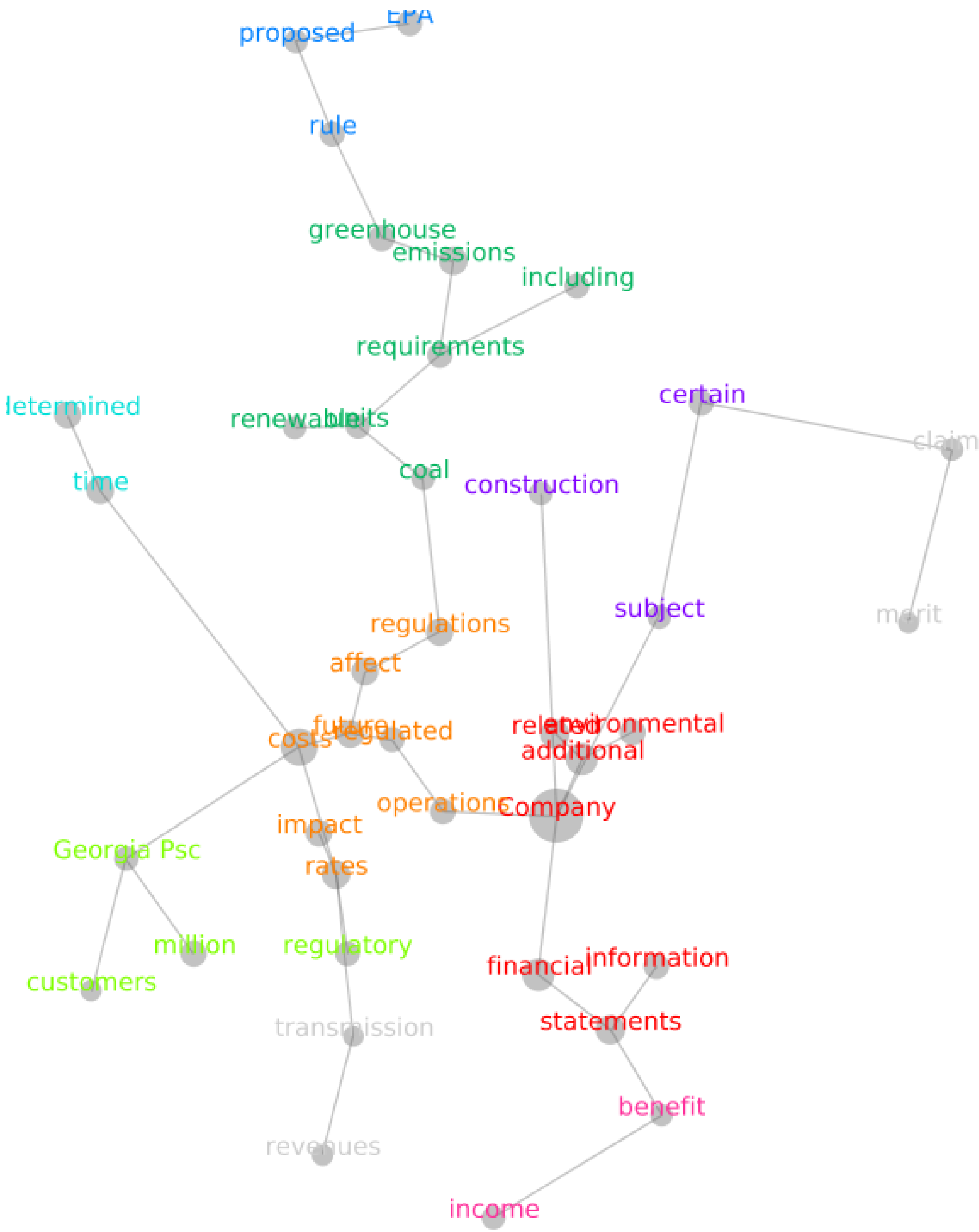


Figure 28 GPC 2009 CEO/IRP Report (IOU #3 - Leximancer)

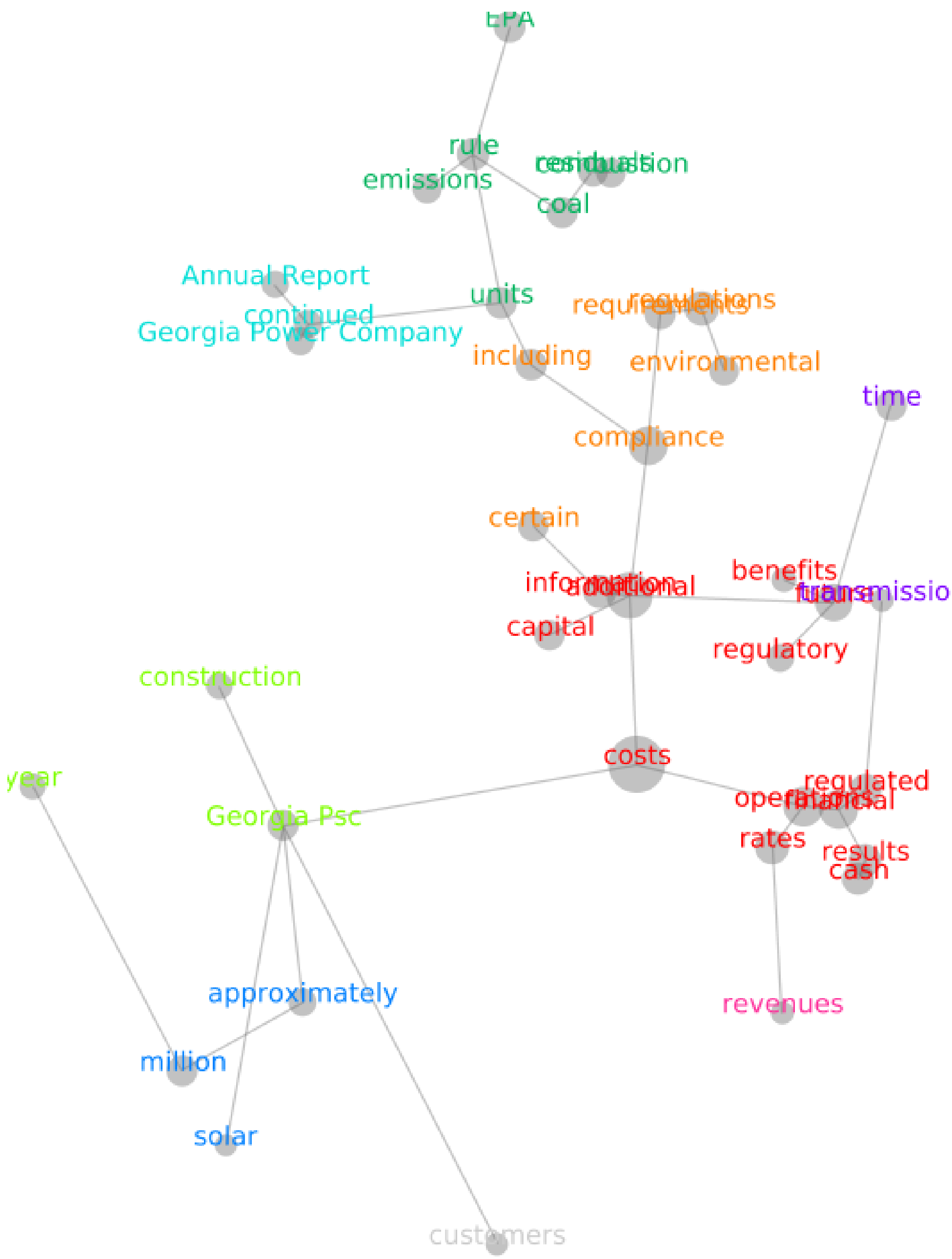


Figure 29 GPC 2013 CEO/IRP Report (IOU #3 - Leximancer)

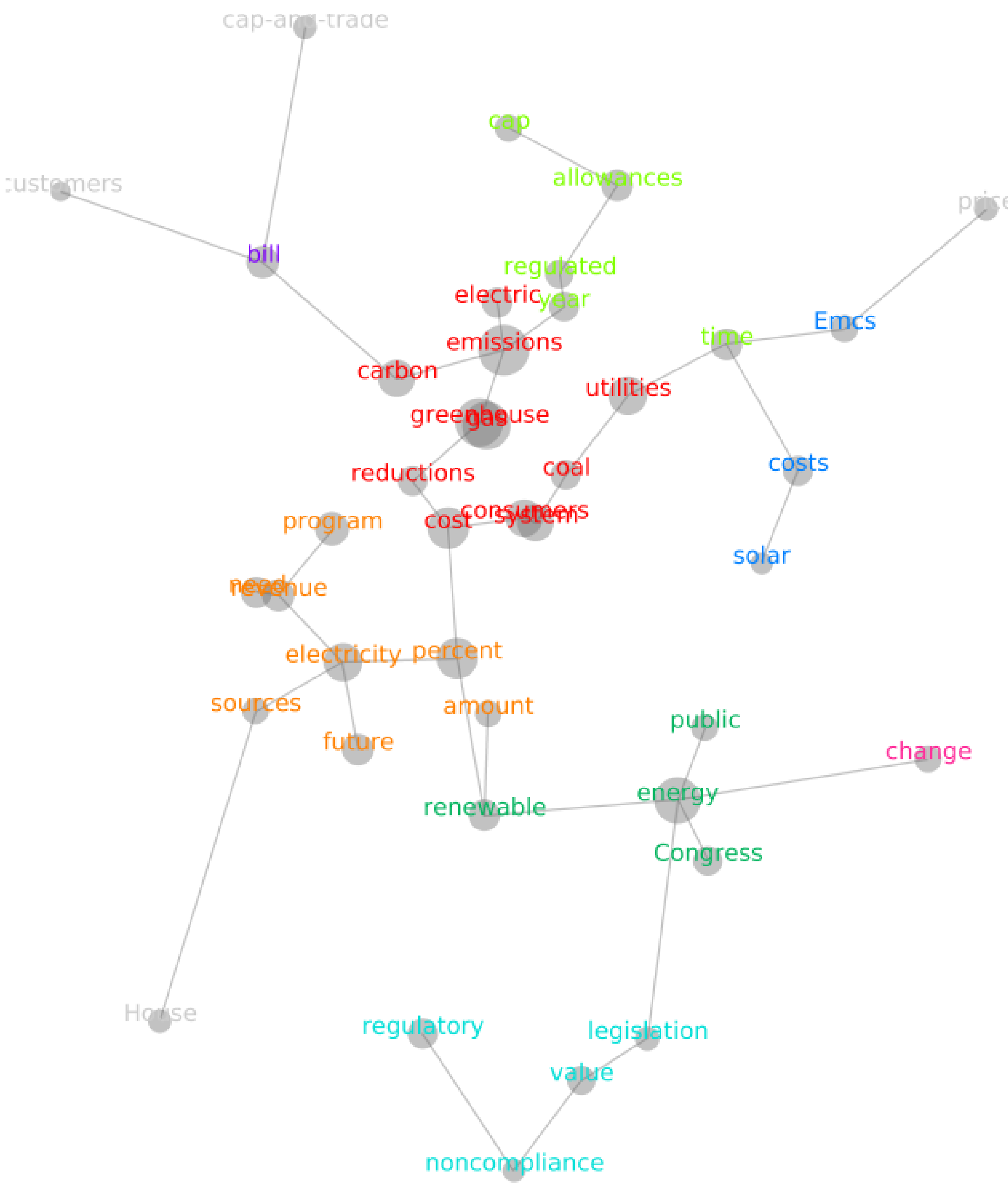


Figure 30 GEMC 2009 CEO Report (Co-op #5 - Leximancer)

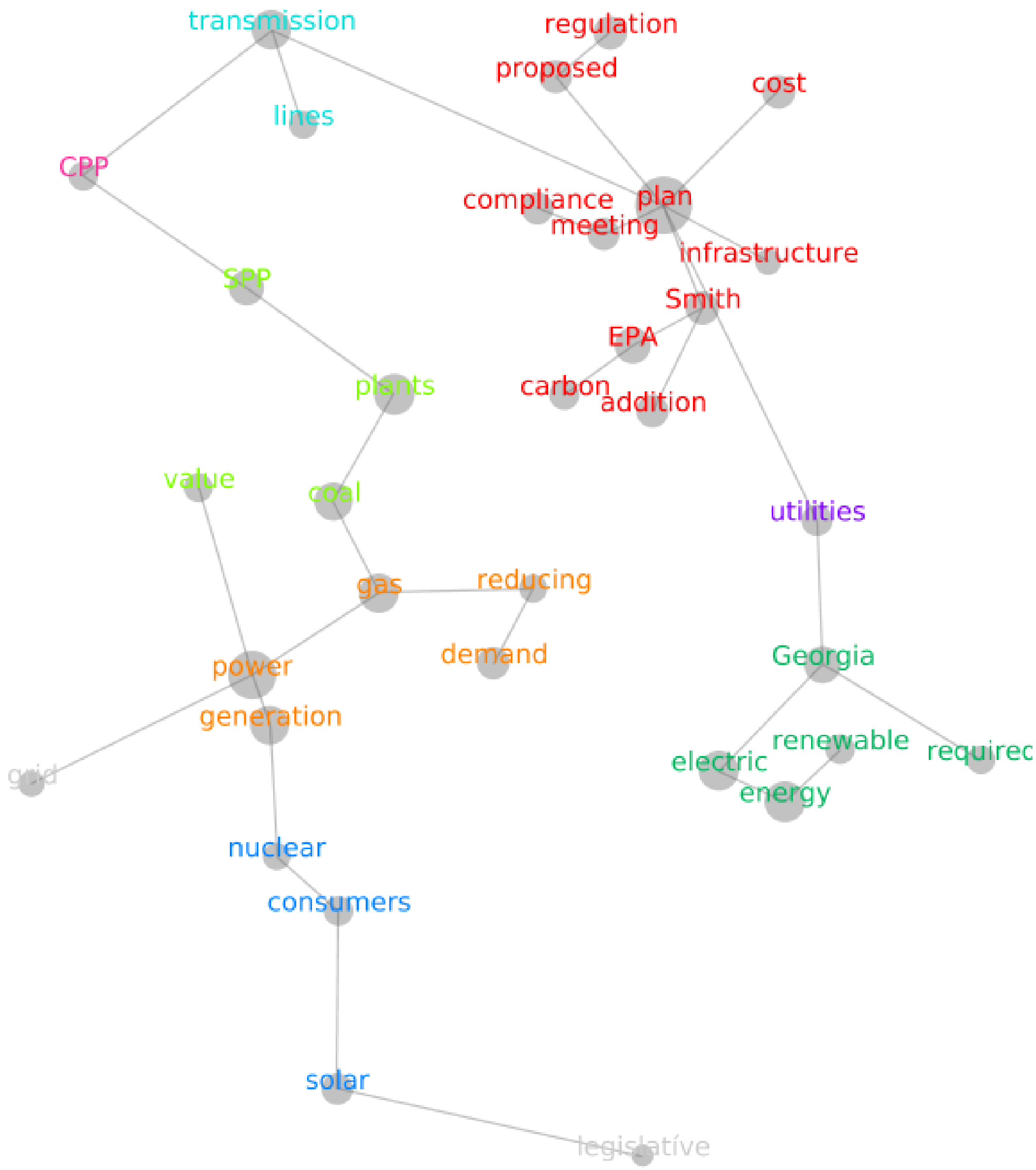
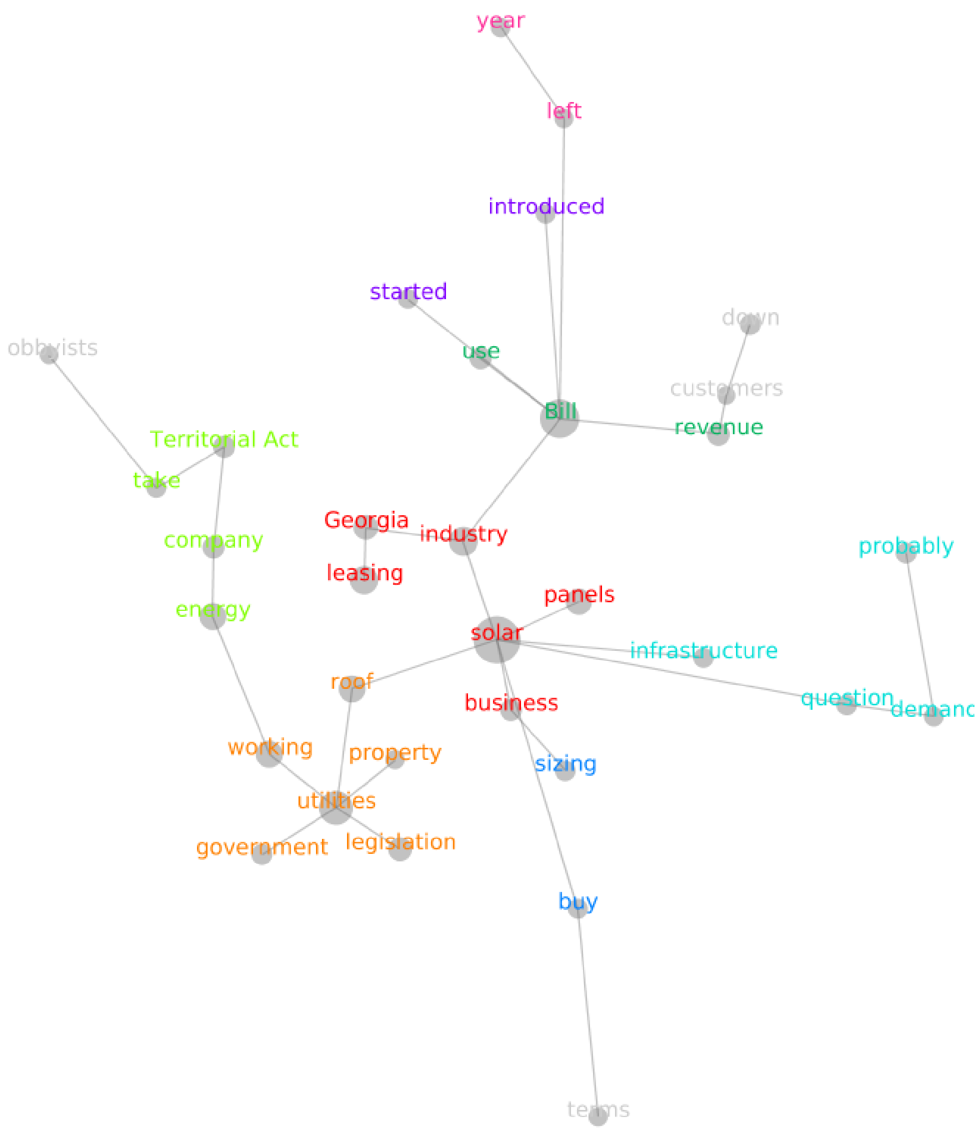


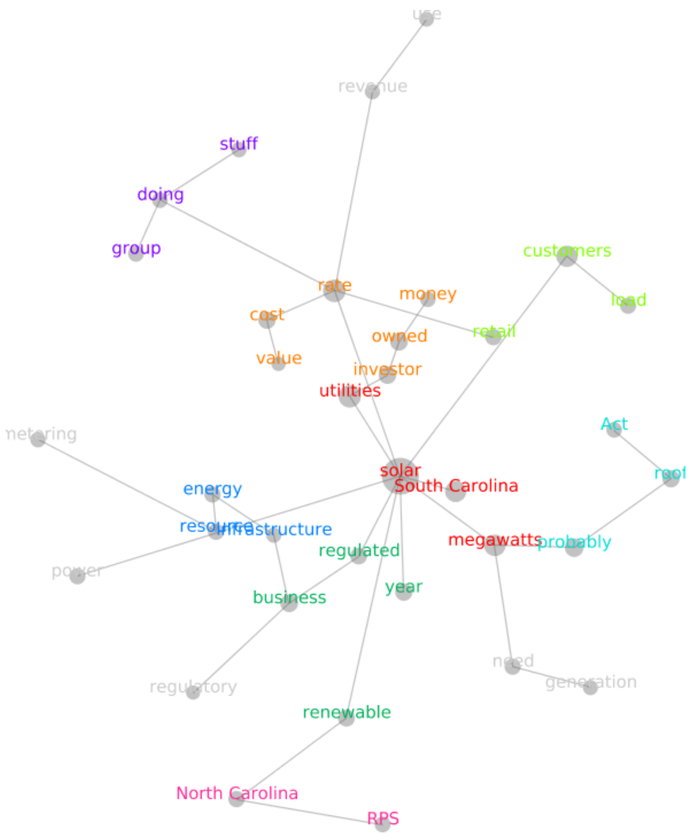
Figure 31 GEMC 2013 CEO Report (Co-op #5 - Leximancer)



Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customers	4	100	2.7
infrastructure	8	66	1.8
legislation	11	54	1.5
revenue	11	54	1.5
working	15	47	1.3

Figure 32 GEMC Interview (Co-Op #5 - Leximancer)

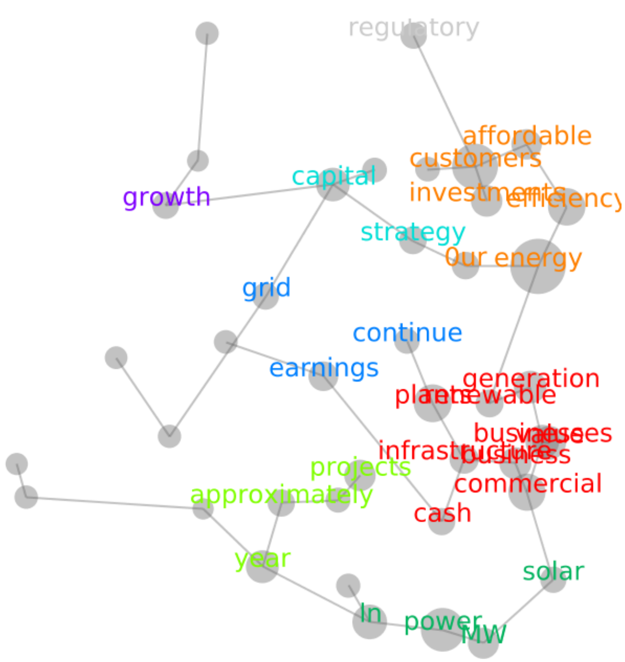


2. **Ranked Concepts for Categories**

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	2	100	1.8
revenue	4	66	1.2
infrastructure	4	66	1.2
customers	22	63	1.1
regulatory	1	33	0.6

Figure 33 Duke Energy Interview (IOU #4 - Leximancer)

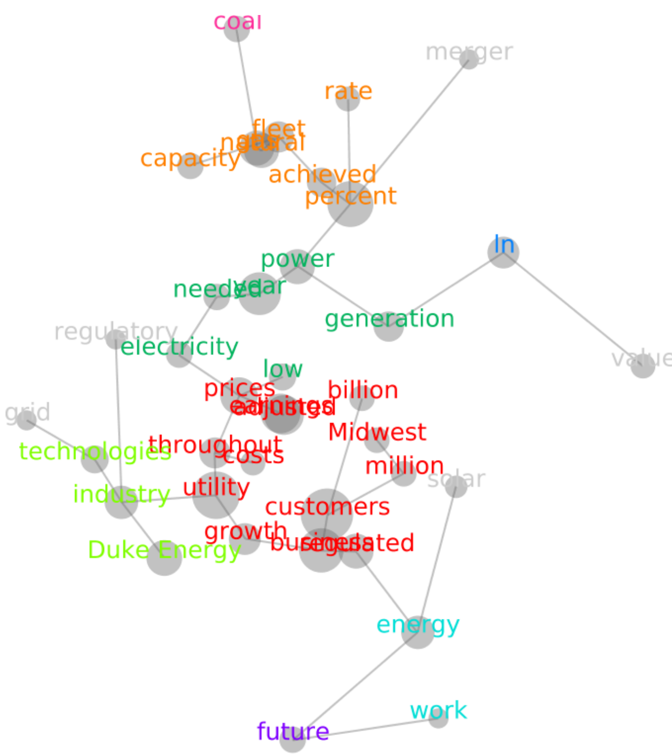


2. **Ranked Concepts for Categories**

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	30	27	5.2
customers	20	5	1.1
regulatory	< 1	< 1	0.0
infrastructure	< 1	< 1	0.0
revenue	< 1	< 1	0.0

Figure 34 Duke Energy 2009 CEO Report (IOU #4 - Leximancer)

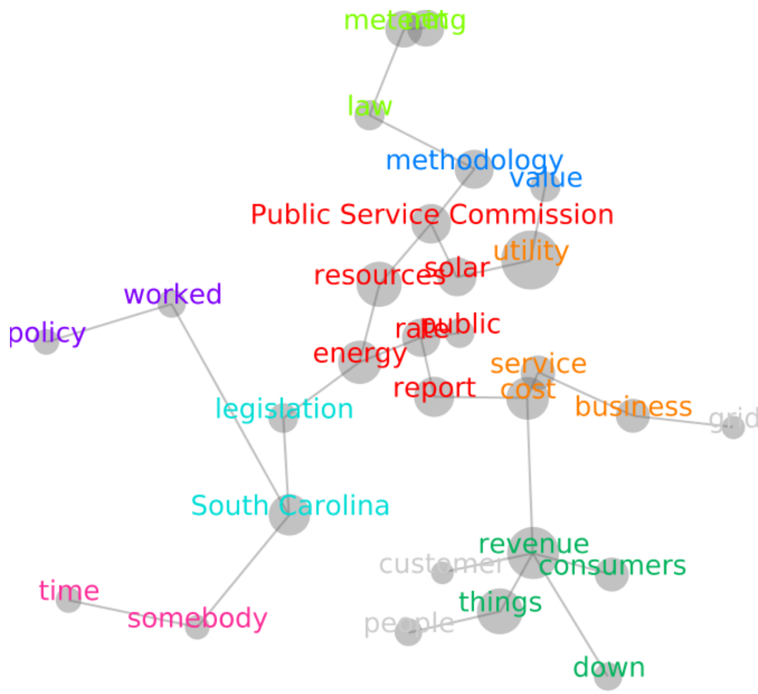


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	50	10	9.2
customers	50	4	4.0
regulatory	< 1	< 1	0.0
rate	< 1	< 1	0.0
grid	< 1	< 1	0.0

Figure 35 Duke Energy 2013 CEO Report (IOU #4 - Leximancer)

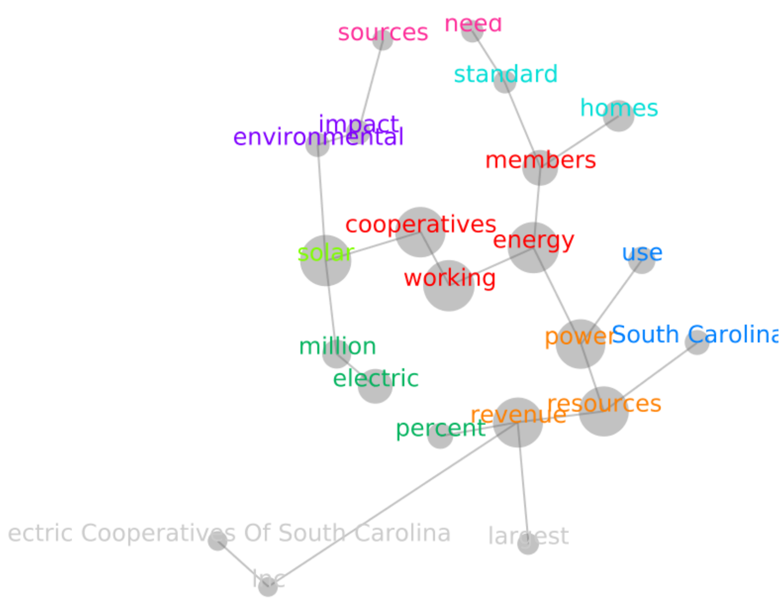


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
customer	14	50	4.8
value	29	50	4.8
grid	14	25	2.4
revenue	43	23	2.2
legislation	14	16	1.6

Figure 36 ECSC Interview (Co-op #6 - Leximancer)

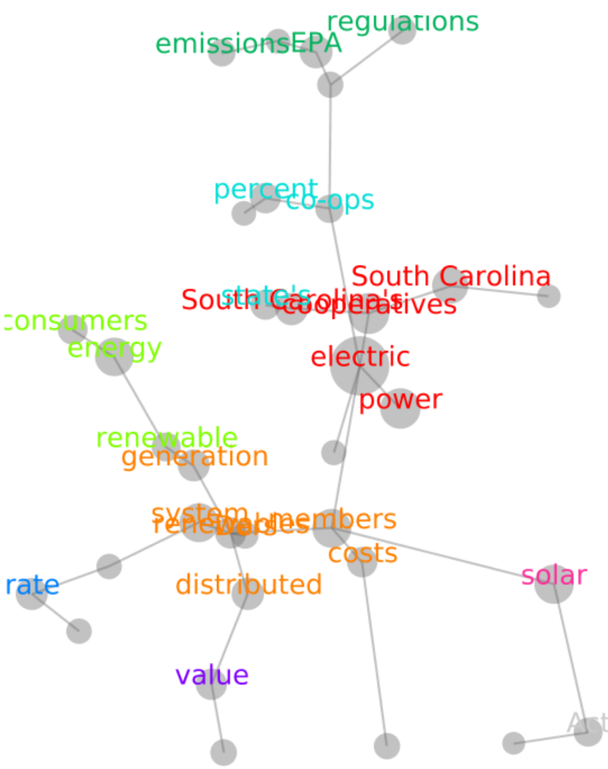


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
members	50	100	1.7
energy	100	100	1.7
working	100	100	1.7
revenue	95	95	1.6
electric cooperatives of south carolina	5	50	0.9

Figure 37 ECSC 2009 CEO Report (Co-op #6 - Leximancer)

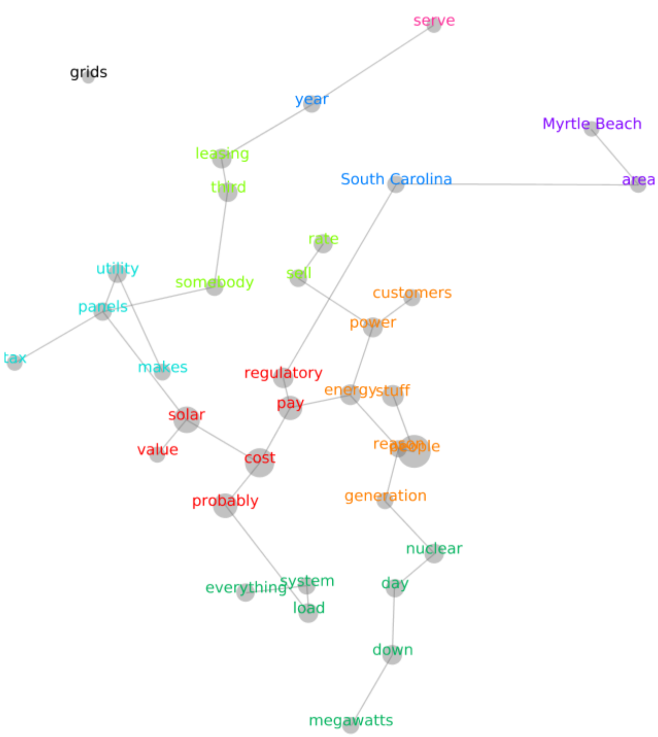


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
regulators	9	40	2.6
value	4	10	0.7
rate	< 1	< 1	0.0
grid	< 1	< 1	0.0
consumers	< 1	< 1	0.0

Figure 38 ECSC 2013 CEO Report (Co-op #6 - Leximancer)

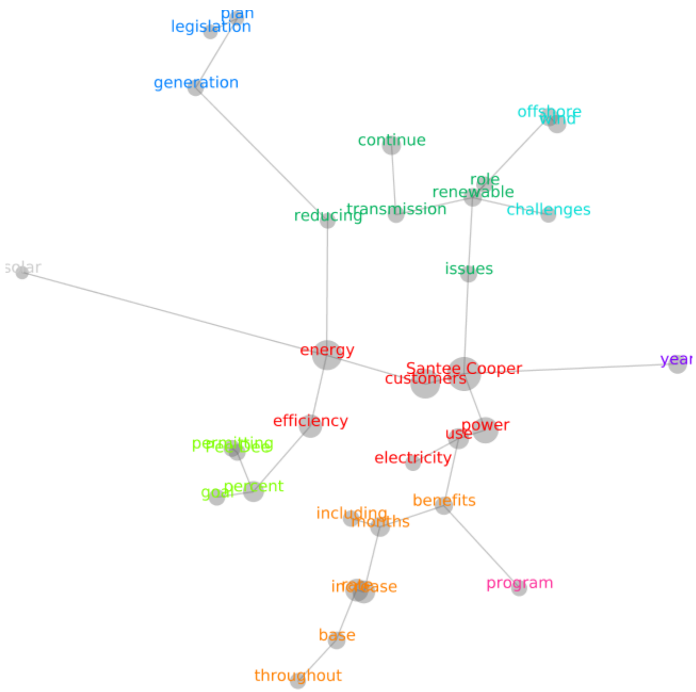


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
value	8	33	2.1
regulatory	8	20	1.3
rate	4	8	0.5
grids	< 1	< 1	0.0
customers	< 1	< 1	0.0

Figure 39 Santee Cooper Interview (Leximancer)

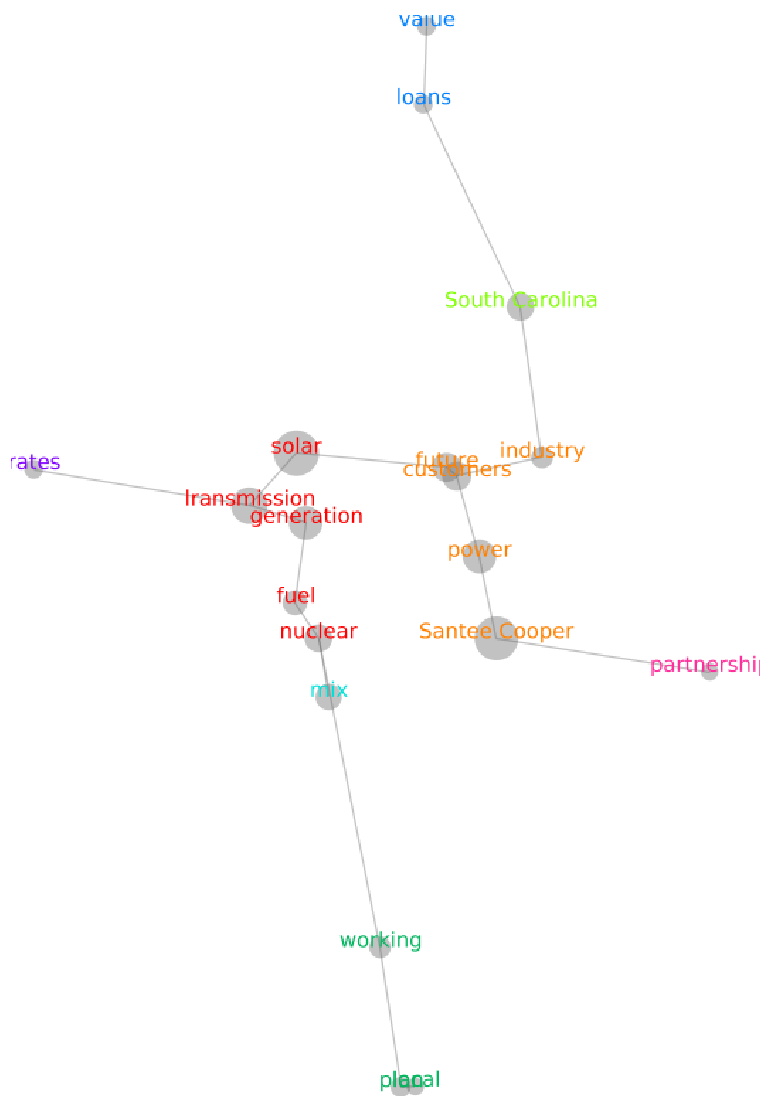


2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
legislation	< 1	< 1	0.0
customers	< 1	< 1	0.0
transmission	< 1	< 1	0.0
benefits	< 1	< 1	0.0
rate	< 1	< 1	0.0

Figure 40 Santee Cooper 2009 Report (Leximancer)



2. Ranked Concepts for Categories

Category: solar

Concept	Rel Freq (%)	Strength (%)	Prominence
lransmission	67	100	4.7
customers	17	50	2.3
value	17	50	2.3
rates	17	50	2.3
plan	< 1	< 1	0.0

Figure 41 Santee Cooper 2013 CEO Report (Leximancer)

In summary, from 2009 - 2014, GPC/DUKE and GEMC/ECSC have made minimal business model changes. The primary change was that the IOUs moved to a structural ambidextrous frame within their corporations to manage the solar energy market. For Georgia and South Carolina, the popularity of customer-side rooftop solar third-party leasing and ownership may grow for residential and commercial entities upon legislation approval. The EUs are positioning themselves for change by controlling their existing processes and structures to prepare for the future. With the lowest rates in the U.S., the demand or need for solar PV is not as strong giving EUs more time to prepare. At present, the drivers for solar change in this region are the EPA Clean Power Plan and state regulatory pressures. The IOUs have changed more than the Co-ops by restructuring departmental resources, developing solar initiatives for utility-side solar additions, and agreeing to a solar leasing bill for customer-side roof-top customers. The primary growth of solar is in the urban areas which allow the Co-ops, who serve rural customers, time to align themselves to the initiatives that have been successful with GPC and Duke. Table 18 provides an overview of the federal and state credits and RPS and net-metering status.

Table 18 Georgia and South Carolina Solar Regulatory Summary from DSIRE*

1. Federal: Residential Renewable Energy Tax Credit established by the Energy Policy Act of 2005 of 30% expires 12/31/2016. Business Energy Investment Tax Credit (ITC) expanded by American Recovery and Reinvestment Act of 2009 of 30% reduced to 10% after 12/31/2016.
2. Net-Metering: All utilities must offer bidirectional or single directional metering to customer generators up to 10 kW for residential and 100 kW for commercial applications. The aggregate capacity limit is 0.2% of a utility's peak demand from the previous year. The excess is credited at a predetermined rate. South Carolina: System Capacity Limit: 20 kW for residential; 1000 kW or 100% of demand for non-residential. Aggregate Capacity Limit: 2% of average retail peak demand for previous 5 years. Net excess credited to customer's next monthly bill.

V DISCUSSION

V.1.1 Effects of the EU Business Model and Competing Values Framework on OA

The framing of the solar PV EU leader business model changes acts as an important guide to help determine EU organizational ambidexterity (OA). Specifically, this researcher continues the efforts of Richter (2011), Maitlis (2005), and Cameron (2006) by using theory elaboration to propose a new conceptualization for determining EU organizational ambidexterity in response to an emerging disruptive technology. Richter's (2011) EU Business Model, Maitlis (2005) sensemaking forms, and Cameron's (2006) Competing Value Leadership Framework are used in an integrated manner to determine the EU leadership behavior that affects OA decision making. This study uses at least 55 solar energy issue domains (five business model components x 11 electric utilities) to differentiate between OA types.

Examining the interviews, CEO reports, and IRP raw data in relation to this conceptualization leads to important findings for the first research question: *How have EU business model changes and OA behaviors helped EUs respond to a shift in their environment from 2009 - 2014 due to a disruptive solar technology?*

A description of the CVF EU leadership behaviors derived from the sensemaking forms is necessary to reveal the extent of an EU's organizational ambidexterity. These descriptions indicate the emergence of four different CVF leadership behavior types that were present in different regions of the U.S. and answer the first research question. Figures 42 through 45 graphically illustrate the CVF behavioral framework for each EU region and corresponding organizational ambidexterity.

In the Southeast region, EU leader behavior is *restricted* and in the CVF "Control" quadrant due to low stakeholder involvement and high EU leader control. However, the study shows that when the regulatory business model component is active, stakeholder sensegiving explanations increase requiring EU leaders to move to the *fragmented* behavior which corresponds to the CVF "Create" quadrant that is highly explorative and engaged. One important aspect of the "Create" dimension is that when *fragmented* behaviors occur by EU leaders and stakeholders, **structural** OA is displayed to efficiently implement innovative and visionary regulatory policies that were approved by EUs and stakeholders thus benefitting both parties. For example, sensemaking improved from *restricted* to *fragmented* in the CVF "Create" quadrant in Georgia when consumers and state representatives presented a private property rights justification for rooftop solar leasing instead of the weaker environmental benefit perspective. EU leaders recognized that the focus on an individual's private property rights had more judicial merit allowing a positive climate for change with stakeholders. The regulatory catalyst for EU leader positive-opposite behavior change can be described as utilizing "<u>*Practical Vision*</u>". The integration of the "Control" and "Create" quadrants can be a key to effective structural ambidextrous leadership. Cameron (2006) points out that achieving "<u>*Practical Vision*</u>" is a product of combining optimism and reason with a byproduct of intuition and insight. Leaders with this behavior can see realties and practicalities as well as possibilities and prospects of the future. The integration of these two contradictory concepts reveals a behavior that was found within the EUs in the Southeastern region demonstrating structural ambidexterity for the IOUs and Co-ops within the urban areas.

In the Northeast region, VEC and GMP leaders are also displaying *restricted* and *fragmented* sensemaking and together they are characterized by "<u>*Teachable Confidence*</u>". Vermont stakeholders are actively incorporating renewables into the state's portfolio and VEC (Co-op) and GMP (IOU) are not opposing this approach. EU leadership behaviors show attributes of the

CVF "Control" quadrant (confidence and assuredness) and the CVF "Create" quadrant (openness and teachableness). Teachable confidence is facing the unknown and continually moving forward so as to co-create a new reality. As GMP changes from a vertically integrated IOU model to a distributed service model, the EUs are accepting this change as a positive step toward an effective transformation. Vermont is one of the first states taking steps to move away from the traditional vertically integrated utility model and create a structural change towards a more distributed service-based model. The integration of these two contradictory concepts is a key behavior that can support effective structural ambidexterity.

In the Midwest region, Colorado is similar to other states in that the regulatory environment is where solar issues are explained and actions are negotiated and resolved for solar PV. When EU leaders find a balance between having patience, support, and compassion for consumers and stakeholders and knowing when to challenge legislators, a contextual ambidextrous "*Caring Confrontation*" environment emerges. When a collaborative behavior exists and high levels of EU leader control correspond to rich explanations from the stakeholders, a *guided* sensemaking form exists in the CVF "Collaborate" quadrant. The OA behavior is highly explorative, supportive, and directive. The positive-opposite to this dimension is the CVF "Compete" quadrant and *minimal* sensemaking. In this regulatory environment, misunderstandings can create tension for both parties initiating a need for a balance between collaboration (Caring) and competition (Confrontation). This integration of positive-opposites, or paradoxical leadership behavior, establishes an EU leader that emphasizes the welfare of the state before personal interests but challenges stakeholders and employees to also live up to a high standard leader model. Cameron (2006) explains that people respond to leaders that 'tell it like it is', challenging mediocrity while practicing kindness and compassion. The integration of paradoxical leadership behaviors reveals that the Colorado Co-ops have created a contextually ambidextrous organizational environment to manage the regulatory impact of solar PV.

In the Pacific region, KIUC and HEI have increased their *guided* sensemaking from 2009 to 2014. Sensemaking solar process characteristics reveal a "Collaborate" quadrant strategy. As Cameron (2006) explains, the prescription for organizational effectiveness in a complex, unpredictable, and threatening business environment with hyper-turbulence is a flexible, autonomous, self-governing workforce. KIUC and HEI also display the *minimal* sensemaking form when fast change is necessary. KIUC's collaborative strategy to empower the existing power supply department to quickly develop a "Compete" strategy for third-party financing, construction, and ownership of utility-side solar while maintaining the existing operations and maintenance functions in-house reveal an "*Autonomous Engagement*" behavior and contextual ambidexterity. The integration of these two contradictory concepts was shown by Hawaii's EUs creating a contextual ambidextrous organizational environment that identified new ways to create organizational value.

V.1.2 Patterns that differ between IOUs and Co-ops (Refer to Table 19)

The second important finding of this study answers the research question: *What are the discernable business model patterns and OA behaviors that differ between investor-owned (urban) and electric cooperative (rural) EUs in response to a disruptive solar technology?* This finding concerns the interaction of Richter's (2011) business model changes between two different EU organizational types and their ambidextrous behaviors. As each of the Competing Values Leadership Framework (CVF) dimensions are analyzed alongside the Richter's (2011) business model components, an emergence of either structural or contextual organizational ambidexterity develops within each EU. From this analysis, each EU type (Co-op and IOU) takes on a more specific form of organizational ambidexterity.

This study finds that within the value proposition component, the majority of the IOUs are utilizing structural ambidexterity and Co-ops are using contextual ambidexterity. IOUs are using structural ambidexterity for a variety of reasons. First, the IOUs serve most of urban America where the majority of residential roof-top installations are occurring. The implications of solar requests such as permitting, advanced land purchasing, environmental surveys, interconnection studies, bidding contracts, design, record keeping, and stakeholder interaction create increased time demands that cannot be met with the existing organization as was noted in the interview with Georgia Power. Also, an investor-owned utility must coordinate and implement a PSC approved integrated resource plan within an allotted amount of time. Finally, IOUs own most of the fossil-fueled coal plants that are being affected by the EPA Clean Power Plan which requires them to shift to alternative generation resources like solar. These factors led IOUs to use structural ambidexterity.

Alternatively, Co-ops are using contextual ambidexterity. They have restrictions on resources for solar and fewer of their customers are installing customer-side solar. Rural farmers and large agricultural areas cannot afford the upfront capital necessary to install solar. Some customers in rural areas have sold their land to third-party utility-side solar generation developers. The Co-ops are utilizing existing processes and procedures to manage limited solar installations demonstrating contextual ambidexterity.

Within the customer interface business model component, most of the IOUs utilize structural ambidexterity and Co-ops use contextual ambidexterity to handle the solar customer-side solar PV market. The Pacific region offers a different perspective which shows the need for structural ambidexterity with IOUs. In Hawaii, KIUC's consumer retail rates have fallen significantly from 34 cents per kWh to 21 cents per kWh due to the implementation of utility-side solar and bio-mass plants supplanting the use of expensive oil-fired generation. Interview data in reference to highly controversial topics like roof-top solar indicates that KIUC maintained positive customer relations whereas HEI struggled with customer relations. Because IOUs serve more urban customers and have the added pressures from third-party solar leasing entities, they are impacted significantly from consumer friendly regulatory mandates like net-metering. HEI difficulty with customer relations is due to its back-log of roof-top customer requests that have not been processed due to operational issues and the significant presence of SolarCity pressuring policymakers to open up the market. It appears from the data that HEI should consider moving toward a structural framework like other large IOUs have done due to the extreme popularity of customer-side solar within their service territory.

In reference to infrastructure, Co-ops and IOUs are using contextual ambidexterity to handle this business model component. The emergence of solar PV has had a significant impact on operations. IOUs are vertically integrated where they own generation, transmission, and distribution systems requiring a stricter reliance on operational issues. The increase of renewables on the grid has caused technical grid voltage and frequency reliability problems that must be studied and resolved. Additional grid upgrades to resolve these issues will increase retail rates and exacerbate the solar cost-sharing arguments. Tri-State in Colorado states that their cross state postage stamp transmission rate structure does not take into account the additional RPS requirements in Colorado and causes them to overcharge other states for transmission services and undercharge Colorado. IOUs and Co-ops are also asking for approval to decouple retail rates into a fixed and a variable component to eliminate over charging non-solar customers and under-charging solar customers.

An unexpected finding is that VEC and GMP in Vermont are forerunners in the formation of a distributed service model that could reduce the reliance on the transmission grid. Third-party distribution solar gardens in Colorado and Vermont have changed the EU infrastructure business model component as specific customers are switching to solar array service. The general opinion of the EUs is that the EPA Clean Power Plan will force the retirement of older fossil-fueled power plants and incentivize the need for utility-side solar plants. This will increase the dependence on solar PV causing operational service issues and costs to increase. It is the belief of this author that the EUs will not sacrifice reliability by significantly increasing utility-side dependence on solar until they resolve these operational service issues. If the EPA Clean Power Plan is not amended to allow EUs more time to incorporate technical advances (smartgrid technology) to resolve the operational issues then solar PV growth will slow down on the utility-side forcing EPA fines and EU costs to increase. In either EPA scenario the increased EU costs will be passed to the consumer which will create a consumer behavioral shift to install roof-top solar PV, as solar material costs continue to decrease. The best solution is for policy-makers and EUs to utilize guided sensemaking to develop a Collaborative / Competitive EU Competing Values Leadership (behavioral) Framework. This behavior will enhance and incorporate a positive decision-making process that may include incentives and penalties as drivers for CO_2 EU reduction with realistic implementation milestones.

In summary, the IOU and Co-ops are both using existing processes and procedures to plan their transmission grids. The use of contextual ambidexterity is appropriate in this system planning area until either the EPA Clean Power Plan regulations accentuate the need to retire fossil-fuel power plants and increase the solar PV resource percentage to a serious operational level or North American Electric Reliability Corporation (NERC) requires excessive EU compliance mandates.

In relation to revenue, structural ambidexterity dominates this business model component for both IOUs and Co-ops. The biggest difference between IOUs and Co-ops is found in relation to revenue. IOUs are regulated by the state PSCs and guaranteed a rate that will allow recovery of their costs through rate increases. The Co-ops do not have a guaranteed cost recovery mechanism and are concerned that the BOD representatives, who are their customers, may disallow additional costs for customer-side and utility-side solar. There continues to be internal EU discussions on whether EUs should take advantage of the solar leasing market and move toward a distribution service model. This business model component is the most volatile today in reference to loss of market share. It typically deals with issues like solar cost-sharing, decoupling of retail rates, and net-metering. IOUs and Co-ops have found that it is best to work together on these issues to improve the possibility of beneficial revenue legislation.

The regulatory model component was added because it is the foundation for the other four components of the business model. In the U. S. most Co-ops and IOUs have their own government relations departments to handle the lobbying and negotiations associated with controversial revenue business model topics. So, structural ambidexterity is used in this business model component. The regulatory component is the most active of all of the business model components in regard to the issues of impact and the actions associated with the control of solar PV within the EU environment. In 2009 most of the IOUs and Co-ops did not focus on solar PV because they had strong regulatory control mechanisms in place (i.e. Territorial Act Laws) that prevented residential consumers from leasing roof-top solar panels. However, the EU regulatory component became a key part of the business model as the EU industry experienced a transformation between 2009 and 2013 when federal and state government incentives were enacted, EPA CO_2 reduction mandates were approved, solar PV costs decreased and state RPS mandates began.

Collaborate	Flexibility and Exploration (OA)	Create

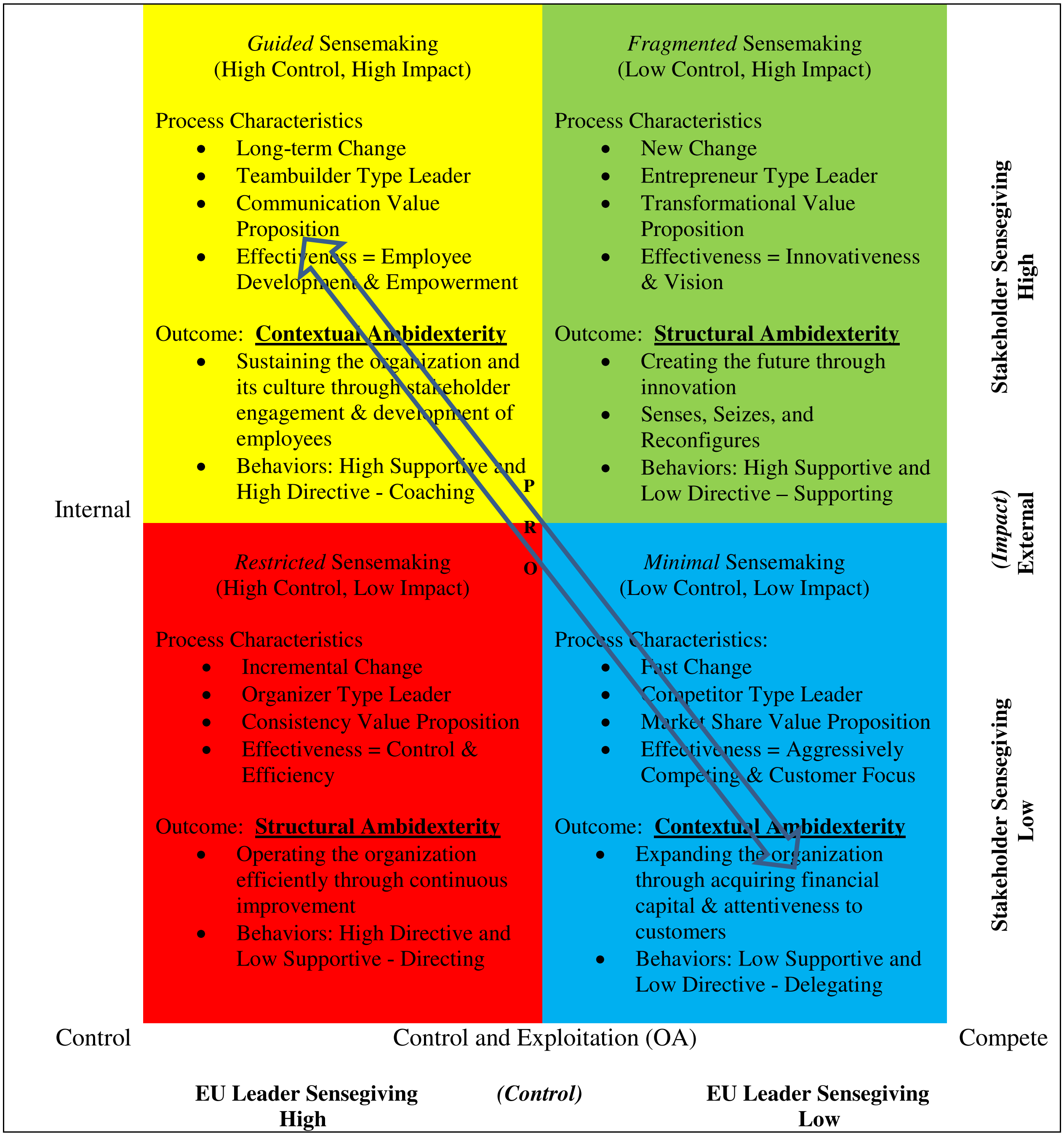


Figure 42 OA Analysis using Sensemaking Forms and CVF for Solar PV (Hawaii)

Collaborate Flexibility and Exploration (OA) Create

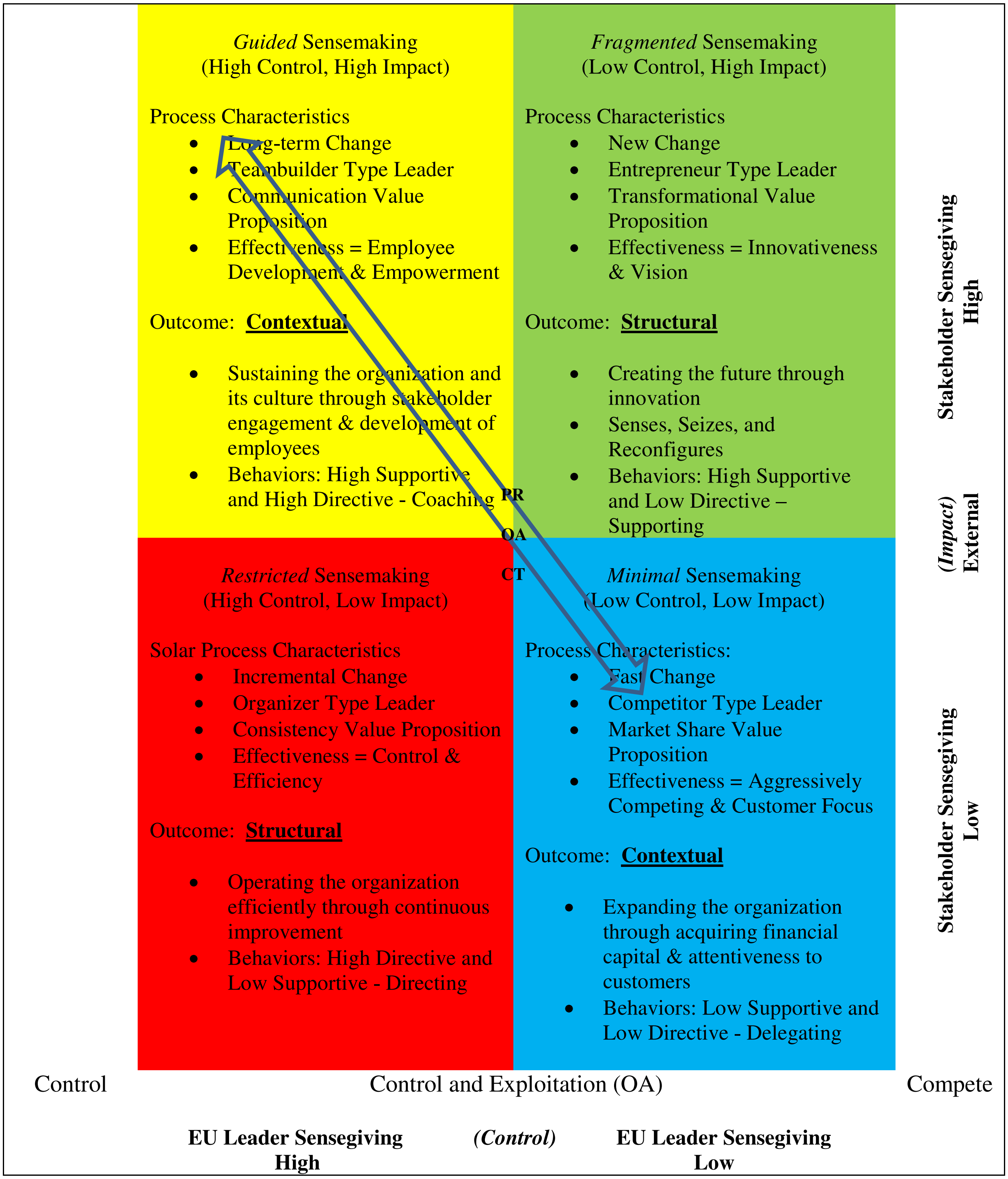


Figure 43 OA Analysis using Sensemaking Forms and CVF for Solar PV (Colorado)

Collaborate Flexibility and Exploration (OA) Create

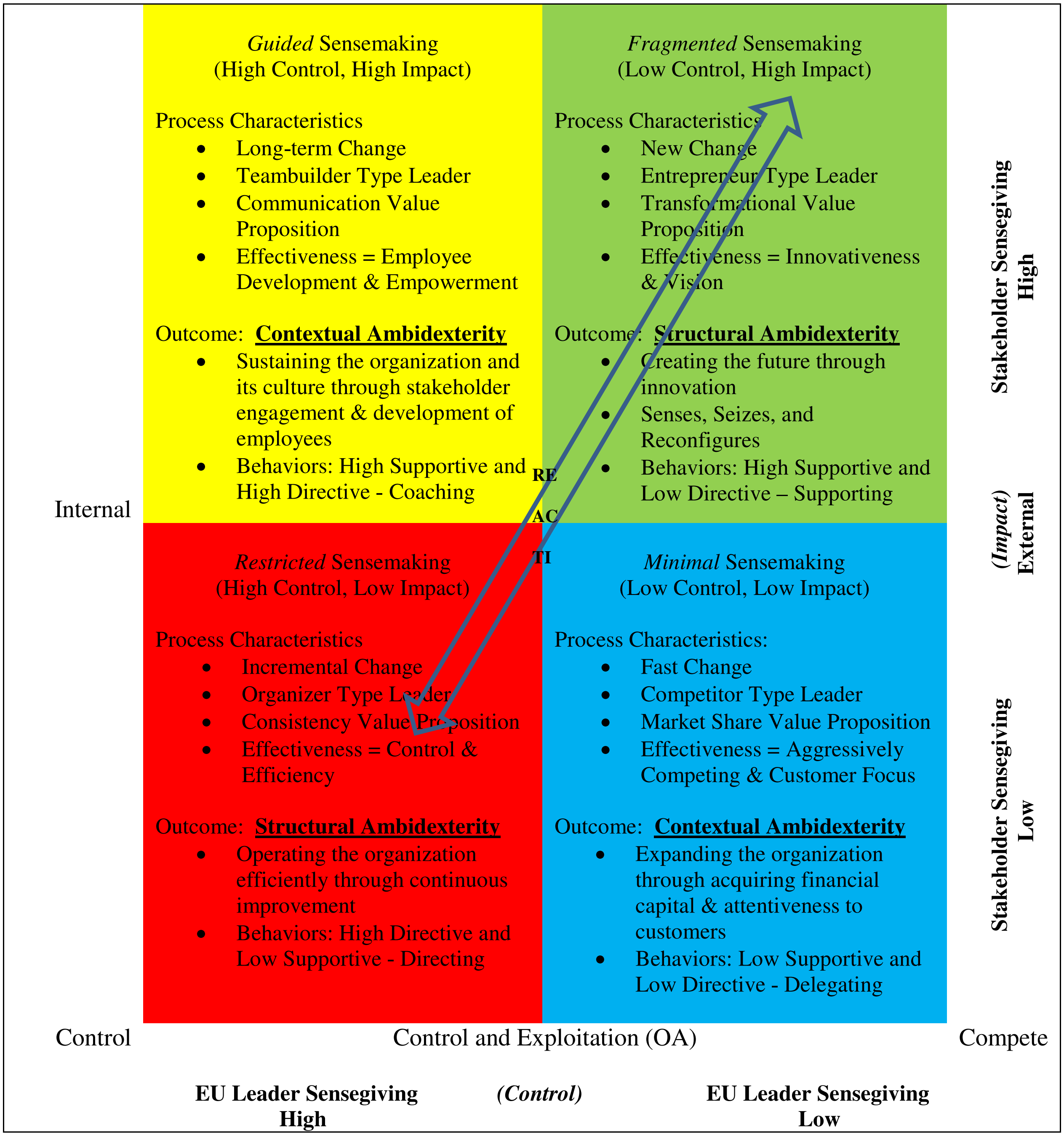


Figure 44 OA Analysis using Sensemaking Forms and CVF for Solar PV (Vermont)

Collaborate	Flexibility and Exploration (OA)	Create

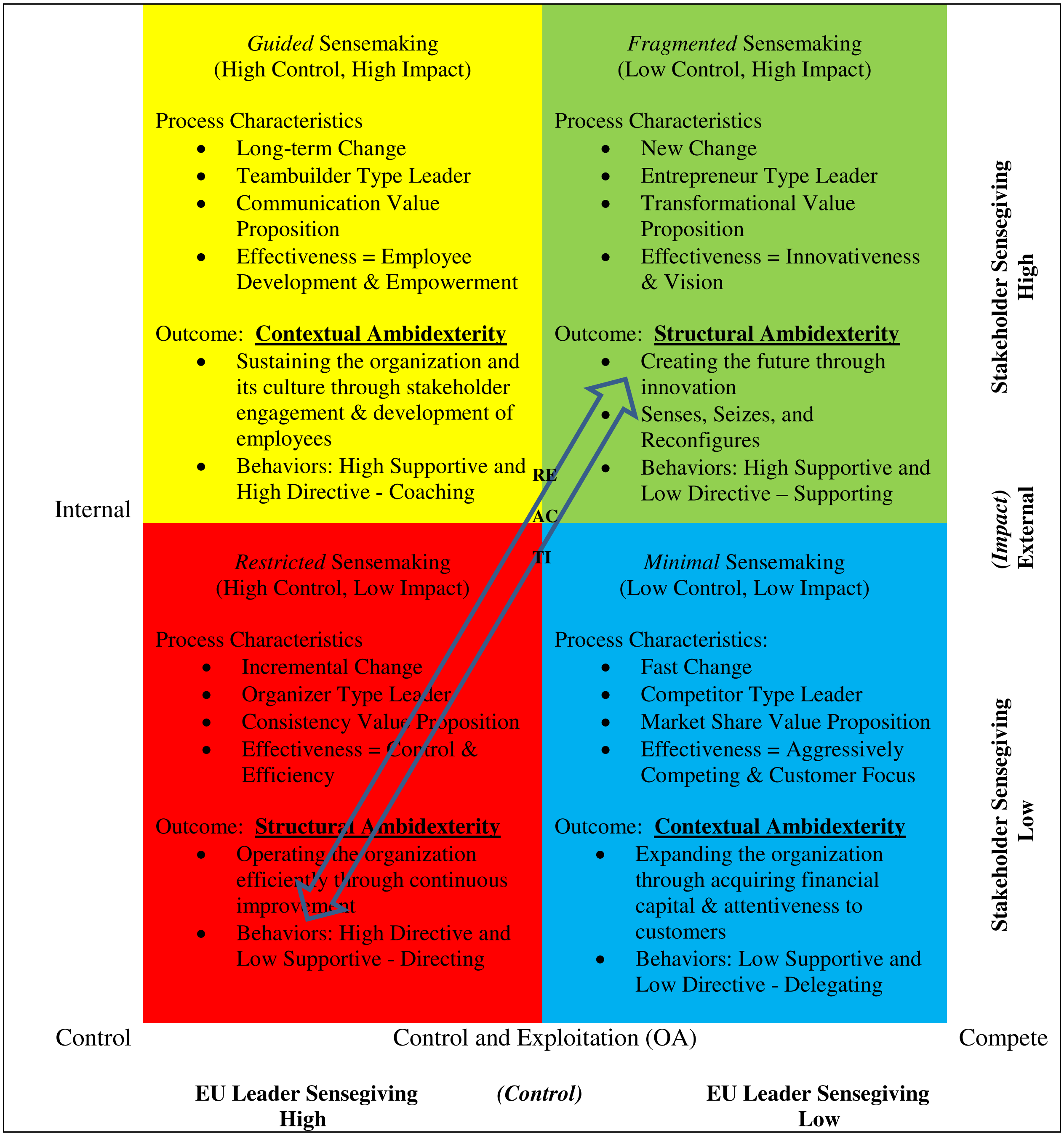


Figure 45 OA Analysis using Sensemaking Forms and CVF for Solar PV (Georgia)

Table 19 Discernable patterns that differ and agree between a IOU and Co-op

	Value Proposition	Customer Interface	Infrastructure	Revenue	Regulatory

Region	Impact	Control	Impact	Control	Impact	Control	Impact	Control	Impact	Control
SE IOU Structural Ambidexterity	**CPP** / Leasing	Advanced Solar Initiative	Customer Environmental driven	Investor	Operational Reliability	Separate Business Unit	Low - NEM Leasing	Utility-Side **ROI**	Regulated	No RPS **Control** **Create**
SE Co-op Contextual Ambidexterity	**CPP** / Leasing	Green Electricity Tariffs	Customer Environmental driven	Board	Operational Reliability	Existing Resources	Low - NEM Leasing	Utility-Side **Need of Region**	Un-regulated	No RPS **Control**
NE IOU Structural Ambidexterity	**3rd Party Leasing**	Energy Service Provider, **Solar Gardens**	Customer Environmental driven	Investor	Operational Reliability	Distributed Service Model	**NEM Leasing**	Utility-Side Need of Region	Regulated	No RPS **Create**
NE Co-op Structural Ambidexterity	**3rd Party Leasing**	Energy Service Provider, **Solar Gardens**	Customer Environmental driven	Board	Operational Reliability	Distributed Service Model	**NEM Leasing**	Utility-Side Need of Region	Un-Regulated	No RPS **Create**
Midwest IOU Structural Ambidexterity	**RPS,CPP Solar Gardens**	Utility-Side PPA	Customer Environmental driven	Investor	Operational Reliability	Separate Business Unit	NEM Leasing	Utility-Side **ROI**	Regulated	RPS **Collaborate**
Midwest Co-op Contextual Ambidexterity	**RPS,CPP Solar Gardens**	Utility-Side PPA	Customer Environmental driven	Board	Operational Reliability	Existing Resources	NEM Leasing	Utility-Side **Need of Region**	Partially Regulated	RPS **Collaborate**
Pacific IOU Contextual Ambidexterity	**Solar City Leasing**	Utility-Side PPA	Customer Environmental driven	Investor	Operational Reliability	Existing Resources	**NEM Leasing**	Utility-Side **ROI**	Regulated	RPS **Collaborate** **Compete**
Pacific Co-op Contextual Ambidexterity	**Lower Rates**	Utility-Side Ownership	Customer Environmental driven	Board	Operational Reliability	Existing Resources **Battery Storage**	NEM	Utility-Side **Need of Island**	Partially Regulated	RPS **Collaborate** **Compete**

VI CONCLUSIONS AND LIMITATIONS

This study makes three important contributions to the EU business model and to organizational ambidexterity literature.

First, the study identifies, develops, and uses an integrative approach (tool) to assess business model strategies and business behavior within an electric utility during the emergence of a disruptive technology. Drawing on, extending, and organizing important ideas from the business model explanations and narratives through sensemaking allowed the business model components to be organized into four behavioral forms (guided, restricted, fragmented, and minimal). These forms were then integrated into the Competing Values Leadership Framework to investigate how electric utility leaders position their organizations to address the challenges of solar PV. This framework is a contribution to the area of concern.

Second, the addition of a regulatory component to the EU business model was a contribution to the conceptual thinking of the business model framework during the emergence of a disruptive technology. It was added to Richter's (2011) EU business model because within the U.S. there is a strong presence of the regulatory arm. Federal and state governments have enacted rules and defined responsibilities to ensure a clean environment. The regulatory model component improved the EU business model interpretations of the solar PV issues that impacted the EUs and stakeholders along with the actions to control market share. The emergence of solar PV technology, which is becoming a cost effective energy resource for individuals and EUs, has and will continue to disrupt the vertically integrated EU business model. The regulatory component contribution is a critical component to influence the EUs strategy and operational decision-making. The differing issues and associated actions to mitigate the impact of solar emergence for

Co-ops and IOUs are resolved through the strong presence of the regulating side of the EU business model. Thus, the addition of a regulatory component to the EU business model is necessary.

The third contribution is a predictive and prescriptive instrument that allows EUs an opportunity to assess what type of ambidextrous business behavior best aligns and adapts within their EU in the presence of a disruptive technology. Organizational ambidexterity can allow EUs to align and adapt to the presence of a solar PV disruptive technology. By integrating the evolving EU business model with the Competing Values Framework (CVF), a new lens is created allowing EU Co-op and IOU organizational ambidexterity schema to become visible. The contribution focuses on the process of collecting and using current EU issues, structural, and operational data (through an interview process) and longitudinal CEO report data, evaluating the processes of solar impact and organizational control (sensemaking), and then linking the commonalities to the Competing Values Leadership Framework to determine a leadership positive-opposite behavioral value predictive trajectory. This behavior or situational leadership style projects whether the organizations are using contextual or structural organizational ambidexterity. This process can be used to analyze the state of an EU and help determine a course of action.

There are a number of limitations within this study. One consideration is that the sample size was small - 11 EUs throughout the U.S. were studied with 5 pilot interviews. These electric utilities represent a mix of IOU and Co-op leaders that were grouped in four U.S. regions (Southeast, Northeast, Midwest, and Pacific). This mix helped to examine and understand business model changes and determine how organizational ambidexterity differed nationally in the presence of a disruptive technology. It is the belief of this author that sampling EUs within the 2013 top 10 ranked annual solar PV capacity additions in the U.S. and understanding their business model behavioral changes in four distinct U.S. regions makes this research generalizable across other EUs nationally. Also, there is a possibility that the four forms of EU organizational behaviors identified here may not be an exhaustive description of the OA type or behavioral trajectories of all EUs.

VII IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

This study has four important practical lessons:

The first lesson stems from the realization that IOUs or Co-ops can learn from each other. These particular findings recognize that some EU leaders are "early adopters" and are ahead of the disruptive technology curve. EU leaders can learn from these findings and, through sensegiving communication with each other, can determine the Competing Values Framework that best fits their needed behavior. For example, Georgia Power mentioned that they waited and learned from the successes and failures of other organizations before they implemented their Advanced Solar Initiative. This study provides an integrated approach of a predictive (CVF behavioral trajectory) and prescriptive (integrative tool to assess business model strategies) schema necessary to interpret how an EU's business model is changing and to what extent it is showing ambidextrous behaviors. This research also points to a type of core leadership behavior that is relevant to companies who are combating a disruptive technology like solar energy. For instance, *guided* and *minimal* sensemaking positive-opposite processes creating "*Autonomous Engagement*" behaviors may be particularly valuable in a high customer interface business model component situation that requires the development of rich, multifaceted narratives for ongoing and spontaneous actions, such as establishing or re-writing net-metering requirements or developing non-solar cost-sharing legislation. The cooperative KIUC on the island of Kauai in Hawaii has led the way in this type of leadership. Its EU leaders have empowered its employees to take a solar leadership position and reduce customer costs by half. They are truly the electric utility "petri dish" for customer interface.

The second practical lesson is that an EU should be open to change and have the entrepreneurial confidence to consider changing or modifying its business model if needed. Vermont has made that decision and is now a forerunner in the conversion from a vertically integrated EU to a distributed service organization. The EUs in Vermont are utilizing a "*Teachable Confidence*" in that their business model consists of a energy makeover consulting service to supplement lost revenue, the installation and operation of a community distributed PV garden system, as well as the promotion of electric vehicle charging stations. This distributed service business model is the first step towards a distributed generation market. Many EUs have not recognized the value proposition of this type of community service level technology for a profitable business plan. Standardization of processes and the aggregation of volume could make this a niche market worth pursuing.

The third lesson is that the federal and state governments are focused on developing legislation to reduce CO_2 emissions from fossil-fuel power plants, initiating the growth of renewable resources into the EU generation mix, and thereby reducing consumer costs by opening opportunities for third-party competition within the utility-side and customer-side solar market. Government has little regard for variable energy resource operational issues and believes that EUs will find technical solutions that will not increase customer rates. The legislation mandating emission controls for EUs will change the EU business model forcing more EUs out of both the generation market and the residential energy supply market. More cooperative EUs will likely become distributed service entities and IOUs will create wholesale generation companies (i.e. Southern Company subsidiary Southern Power) to compete with third-party utility-side solar and wind generation companies across the U.S. These changes will require EUs to create a future through innovation, employee development, consistent incremental change, and attentiveness to the needs of the customer. A descriptive and predictive integrative approach allows EUs to assess their business model strategies and align and adapt their business behaviors to provide a cost effective and reliable electrical power system through the dimensions shown in the Competing Values Framework. The objective is to give EUs a behavioral alignment tool that is flexible enough to make position moves ahead of the external stakeholder pressures allowing EUs to develop organizational radar to stay ahead of the curve.

The final lesson learned from this research is that there will be operational issues associated with variable energy resources like wind and solar as they become a part of the generation resource mix. These operational issues will be studied by planning engineers and costly projects will have to be incorporated into the transmission grid to relieve voltage and frequency constraints. Today, the North American Reliability Corporation (NERC) has the authority to administer compliance standards on every corporation that generates, operates, and maintains an EU. If these standards are not met, fines may be executed on corporations. The enforcement of these compliance standards has increased workloads to excessive levels within EUs since 2007. The variable energy resource (VER) expansion will force NERC to develop stringent reliability standards to maintain the current level of reliability. This will increase costs and create additional facilities that would not have been built with generation resources that are not dependent on wind or solar. This additional cost will have to be absorbed by consumers or EUs. The hope and vision for the future is that as renewable generation increases, EUs can grow and adapt in a way that reduces consumer cost and is beneficial to their organizations and to the consumer. However, we know that more compliance will require additional cost to develop reliability standards, but through the emergence of increased technology to resolve operational issues and collaborative behaviors between the EU industry and policymakers, any substantive disruptive technology can be incorporated into an EU business model.

The future research will include further qualitative studies with second and third tier solar ranked states to help gain more insight and to confirm the behavioral results. Another area of future research concerns the integration of the Maitlis four sensemaking forms with the Competing Values Framework between organizational departments. For example, in departments where efficient organizational processes are critical there would be more instances of restricted and fewer instances of guided sensemaking. Changing the unit of analysis to the department could lead to determining the ambidextrous behaviors necessary to improve efficiencies between department efficiencies. In order to develop an understanding of organizational ambidexterity, researchers need to acknowledge the integrative prescriptive process through the examination of the sensemaking contextual forms most conducive to the Competing Values Framework. Finally, a quantitative study using the same set of EU leaders could be conducted to confirm the forms of OA in this study.

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IX APPENDIX A: EU INTERVIEW PROTOCOL

The Role of Organizational Ambidexterity in Electric Utilities in Mitigating and Embracing Solar Photovoltaic Technology

Interview Protocol

Interview guidelines

- At the beginning of the interview, the participant will be informed about the purpose of the study.
- The oral consent of the participant will be sought before asking any questions.

Electric Utility and Executive/Manager's background	
1.	What is your job title and how long have you held this position?
2.	How long has your company been in operation?
3.	Where is your company based?
4.	What is your service territory and annual demand?
5.	Is your company a Cooperative, Investor-Owned, or Municipal?
6.	Could you describe your renewable energy portfolio responsibilities?

Electric Utility Solar Energy Business Model	
1.	Could you describe your organization's utility-side solar photovoltaic business model? What is your present utility-side solar PV capacity?
2.	Could you describe your organization's customer-side solar photovoltaic business model? What is your present customer-side solar penetration?
3.	Could you outline the general process you go through when initiating an RFP to install utility-side solar options?
4.	Could you outline the general process you go through when contacted by a consumer looking to install solar options?
5.	What are the advantages and disadvantages of solar energy for your electric utility?
6.	How have you organized internally to handle the utility-side and customer-side solar PV interconnection requests?
7.	How have you responded to the changing landscape in terms of your attitude, and actual organizational response? Is this question related to infrastructure?
8.	What are your future plans for handling these requests if they increase?

Electric Utility's Value Propositions	
1.	Could you describe how the utility-side solar PV projects provide a value to your organization?
2.	Could you describe how the customer-side solar PV projects provide a value to your organization?
3.	How do you adapt and change to this new solar PV disruptive technology and still balance the exploitation of your existing resources with the exploration of new solar capabilities?
4.	Do you provide customized solutions or energy related services for your customers? If yes, please describe.

Electric Utility's Customer Interface	
1.	How do you provide renewable energy to your customers with utility-side solar PV projects? How do you inform your customers about costs?
2.	Can you describe your community solar generation model and how your customers get involved?
3.	How do you establish a long-term customer relationship?

4.	Can you describe your Net-Metering solar program for small, medium, and large applications? How do you inform your customers about costs?
5.	Can you explain why some electric utilities pay solar PV consumers the retail price and some pay the avoided energy cost for wholesale power?
6.	How do you receive community feedback for your business services?

Electric Utility's Infrastructure	
1.	Can you describe how you have refined your business model framework to accept solar PV technology?
2.	Can you compare and contrast the differences of how an urban vs. rural electric utility might approach the changing landscape and growth of renewable solar fuel sources?
3.	What are your solar PV operational obstacles due to the variability of cloud cover and the complications of customer-side net metering pricing policies?

Electric Utility's Revenue Model	
1.	Can you describe your revenue stream through the feed-in of renewable solar energy?
2.	Can you describe how the economies of scale from large utility-side projects provide tax credits, public support, and/or revenue?
3.	How do you handle the high transaction costs associated with Net-Metering, Community Solar, and utility-side third-party solar arrays?
4.	Can you describe your customer-side energy efficiency programs, solar training services, and/or solar panel lease plans that might counteract lost revenue?
5.	How can you differentiate your solar energy services from other competitors like SolarCity? Explain your utility-side solar services and customer-side solar panel leasing program, if applicable.
6.	What is your opinion about the solar business trends and growth in your service territory in reference to lost revenue?

Electric Utility's Regulatory	
1.	Can you describe how the changing regulatory environment will affect your solar PV utility-side and customer-side business model?
2.	Does your state have a RPS or state solar mandates? If so, please describe.
3.	What are the regulatory obstacles for your electric utility now and in the near future?

VITA

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SUMMARY

- BSEE, Georgia Institute of Technology, 1981
- MBA, Brenau University, 2012
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- Experience in electric utility construction project management, system planning, and substation design.
- Highly motivated, disciplined and resourceful. Interact productively with people and perform quality work.

EDUCATION

Georgia Institute of Technology, Atlanta
Bachelor of Science, Electrical Engineering
- Electric Power System Design and Protective Relaying
- Substation Engineering and Project Management

Brenau University, Gainesville, GA
Masters Business Administration
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EXPERIENCE

2010 – 2015

Manager, Georgia Transmission Corp., Tucker, GA
- Managed the electric utility transmission planning department, including giving work direction and review of all capital projects to provide electric service to the Georgia Electric Membership Cooperatives in Georgia.

2003 – 2010

Manager, Georgia Transmission Corp., Tucker, GA
- Managed the substation maintenance department, including leadership and direction to crews for preventive, corrective, and emergency maintenance of transmission and distribution electric power substations.
- Managed the electric system protection department with state-of-the-art substation control designs and protective relay applications.

1981 – 2002

Supervisor, Georgia Power Co., Macon, GA
- Managed and coordinated the planning, execution, and guidance of the electric utility power delivery activities.

PROFESSIONAL

- 2014 Best Poster Award at the EDBAC (Executive Doctorate Business Administration Conference) in Tulsa, OK
- Member of IEEE (Institute of Electrical and Electronics Engineers)
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