Humboldt RESCO Planning Workbook

Prepared for: California Energy Commission

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SCHATZ ENERGY RESEARCH CENTER

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1. Introduction

In 2009 the California Energy Commission awarded the Redwood Coast Energy Authority a Renewable-based Energy Secure Community (RESCO) grant to evaluate and plan for RESCO opportunities for Humboldt County, California. A RESCO is a community that obtains the majority of its energy supply (electricity and fuel) from local renewable energy resources, thereby making itself more energy secure. The goal of the Humboldt County RESCO project was to develop a strategic action plan for Humboldt County to develop its local renewable energy resources in an effort to meet 75 percent to 100 percent of the local electricity demand as well as a significant fraction of heating and transportation energy needs.

Midway through the Humboldt County RESCO project, the team made a decision to rebrand the project to make it more easily understood and better perceived by the local community. A new name, RePower Humboldt, was chosen and used from then on. For the purposes of this report the terms Humboldt RESCO project and RePower Humboldt project are used interchangeably.

Purpose of the Humboldt RESCO Planning Workbook

The purpose of the Humboldt RESCO Planning Workbook is to outline Humboldt County's RESCO strategic planning process so that other communities can learn from the experience and can employ similar strategic planning methods in their quest for renewable energy security.

Organization of the Humboldt RESCO Planning Workbook

The Humboldt RESCO project involved a set of defined tasks. This planning workbook is organized according to those tasks. Section 2 provides an overview of the Humboldt RESCO planning process. Then in Sections 3 through 10 each task is described in some detail. For each task we provide a description of the goals and objectives, the actions taken, the data and/or information sources used, the task deliverables, and the key lessons learned. Note that the results of the Humboldt RESCO study are not covered in this planning workbook. See alternate project documents for the study outcomes, and for more detail on the methods employed. Appendix A provides a web link where all Humboldt RESCO project documents can be accessed. Also provided in Appendix A is information for key contacts associated with the project. Appendix B contains the scope of work for the project as specified in the California Energy Commission grant agreement.

Unique energy characteristics of the Humboldt region

Humboldt County has some unique energy characteristics that might make some of the techniques employed and/or key findings and lessons learned peculiar to this study. For example, Humboldt County is rather isolated. There are only two major transmission lines (115 kV) that connect the Humboldt area electric grid to the larger statewide grid at Cottonwood in the Central Valley just south of Redding. This means that the Humboldt area electric load is fairly easy to define, and that power generated in the Humboldt area will typically be used in the area. Other unique characteristics include the fact that Humboldt has a relatively small

peak electric demand (approximately 170 MW) and a wealth of local renewable resources (in the form of biomass, wind, wave and small hydro). Humboldt already meets a large portion (>25 percent) of its electric demand using local forest biomass resources at three biomass power plants in the area. Also, Humboldt has a rather large portion of early adopters in the area of clean energy technologies, including rooftop solar electric systems and hybrid electric vehicles. The reader should consider these unique community characteristics before assuming the techniques and lessons learned in this study will be transferrable to his or her community.

2. Overview of the RESCO Planning Process

Humboldt RESCO project goals and objectives

The initial goal of the Humboldt County RESCO project was to develop a strategic action plan for Humboldt County to develop its local renewable energy resources in an effort to meet 75 percent to 100 percent of the local electricity demand, as well as a significant fraction of heating and transportation energy needs. As the project developed, however, it became clear that a plan with a solitary goal of increasing the amount of locally generated renewable electricity was not optimal. Instead, the project team modified the planning goal to minimize greenhouse gas emissions in a cost-effective manner by increasing the use of local renewable resources and deploying key enabling technologies, such as plug-in electric vehicles. The plan would assess a full range of renewable resources and identify an integrated mix that can be coupled with energy efficiency and demand management to best meet the county's needs and best capture associated environmental, economic, and social benefits. The plan would specify a long-term development strategy and identify near-term steps the County should take.

Project objectives included:

- Identify and assess various integrated mixes of renewable energy resources and technologies that will allow Humboldt County to meet most or all of its electricity needs and a large fraction of its heating and transportation energy needs using locally available renewable energy resources.
- Identify and assess renewable energy resources and technology options that are currently ready for commercial development, as well as those that offer promise for long-term development.
- Identify integrated renewable energy resource and technology options that will function acceptably on Humboldt County's local electricity grid.
- Identify possible development structures and financing and ownership options that could accelerate the development of local renewable energy resource and technology options.
- Conduct an economic analysis of various resource and technology options and identify the most favorable solutions that optimize environmental, economic, and societal benefits for the community.

- Identify potential regulatory and political hurdles that will need to be overcome to allow for comprehensive renewable resource development and propose possible solutions.
- Identify and engage key stakeholders and develop a plan to successfully cultivate community support.
- Compile project information into a succinct, action oriented strategic plan that reports the study's findings and lays out a clear path to move the community forward in developing its renewable energy resources.
- Document the Humboldt RESCO strategic planning process in a workbook that can be used by other communities seeking RESCO status.

Project team description

The project team included the Redwood Coast Energy Authority (a Joint Powers Authority or JPA), the Schatz Energy Research Center at Humboldt State University (a university research group), and Pacific Gas and Electric Company (the local investor owned utility).

The Redwood Coast Energy Authority (RCEA) was the prime contractor. RCEA was formed in 2003 with the purpose to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient and renewable resources available in the region. RCEA represents seven local municipalities (the Cities of Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Trinidad and Rio Dell), the County of Humboldt, and the Humboldt Bay Municipal Water District. As a JPA, RCEA is governed by a board composed of representatives from each of its member jurisdictions and is authorized to plan and help implement a RESCO vision for Humboldt County. As the regional energy authority, the County Board of Supervisors has designated RCEA to implement Energy Element strategies on a regional basis through a Comprehensive Action Plan for Energy. The RCEA Board adopted a resolution (Resolution number RCEA 2009-1) to pursue and carry out this proposed RESCO project.

The Schatz Energy Research Center (SERC) at Humboldt State University supported RCEA in this project. SERC was founded in 1989 with a mission to promote the use of clean and renewable energy resources. Over the years SERC has been involved in extensive research, planning, design, and analysis activities for the development and implementation of sustainable energy systems, including energy efficiency, solar, wind, small hydro, biomass, and hydrogen and fuel cell technology for portable, stationary, and transportation applications. SERC and RCEA have worked together since RCEA's inception. SERC has conducted local energy analysis, training, and public outreach services on behalf of RCEA. In 2005, SERC worked closely with RCEA to develop an Energy Element for Humboldt County's General Plan Update. Through this effort SERC gained substantial knowledge of local energy use characteristics and the availability of local renewable energy resources and opportunities for their development.

Partnering on this RESCO project with RCEA and SERC was the local investor-owned utility, Pacific Gas and Electric Company (PG&E). PG&E has ambitious goals to reduce their greenhouse gas emissions and to increase the portion of renewable resources they provide to

their customers in an environmentally sustainable and economically efficient fashion. As part of this project they provided technical data, technical assistance, and collaborative partnership.

Lesson learned:

One lesson learned from this project is the importance of fielding a strong project team to carry out the planning analysis and stakeholder and public process activities. The three key components that allowed the Humboldt RESCO project team to function adeptly were: (1) a strong technical lead that could perform the resource, technology, and economic analyses (this role was filled by SERC), (2) an entity that is well positioned and connected in the community and can lead the public process (this role was filled by RCEA), and (3) a willing utility partner that can provide technical assistance and information (this role was filled by PG&E).

Project tasks and the planning process

Humboldt RESCO project tasks were as follows:

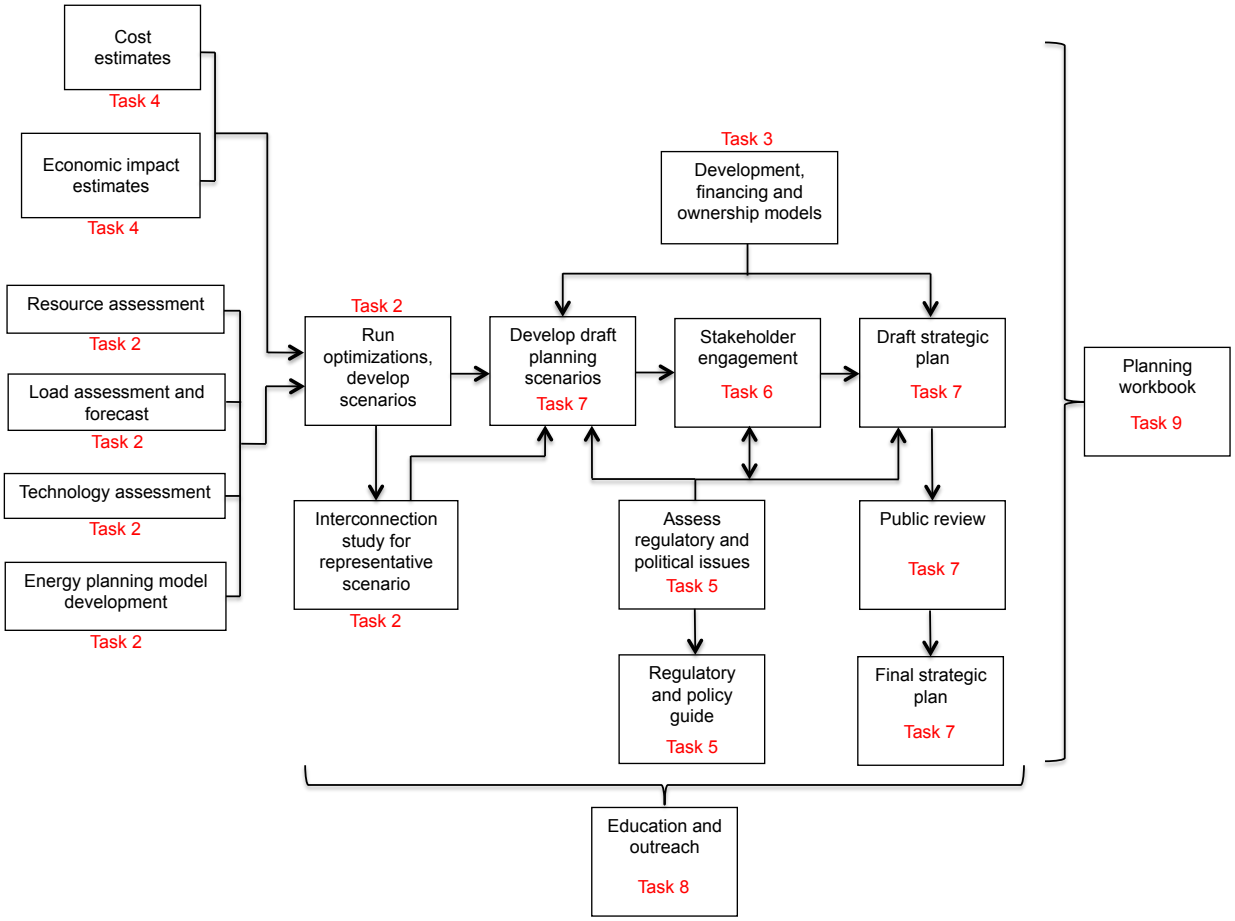
- Task 1 – Administration and reporting, including organizing and convening a Professional Advisory Committee
- Task 2 - Assess resource and technology options
- Task 3 - Examine development, financing, and ownership options
- Task 4 - Conduct economic analysis
- Task 5 - Examine regulatory and political issues
- Task 6 - Conduct stakeholder analysis
- Task 7 - Develop strategic plan
- Task 8 - Create community outreach plan
- Task 9 - Develop planning workbook

The project team's approach was to first conduct the technical and economic analyses (Tasks 2 and 4) to identify available energy resources and technologies, assess their ability to meet renewable energy goals within system constraints, and assess their economic efficiency. In addition, the team assessed financing and ownership options (Task 3) that could be used to develop local renewable energy projects. The team also assessed the regulatory and political framework (Task 5) that renewable energy projects would be subjected to. These research efforts resulted in a set of technical background documents that supported the strategic planning process.

Once the project team had compiled this information, they began engaging local stakeholders (Task 6) to solicit their input in crafting a strategic plan. The team prepared a draft strategic plan (Task 7), shared the plan with the larger community (Task 8), and solicited public input. Based on public feedback the team modified the strategic plan to better reflect the community's sentiment. Finally, the team developed a planning workbook (Task 9) to document the RESCO planning process and make it accessible to other communities that may want to pursue RESCO development. At key stages in the project, the team shared methods and outcomes with a

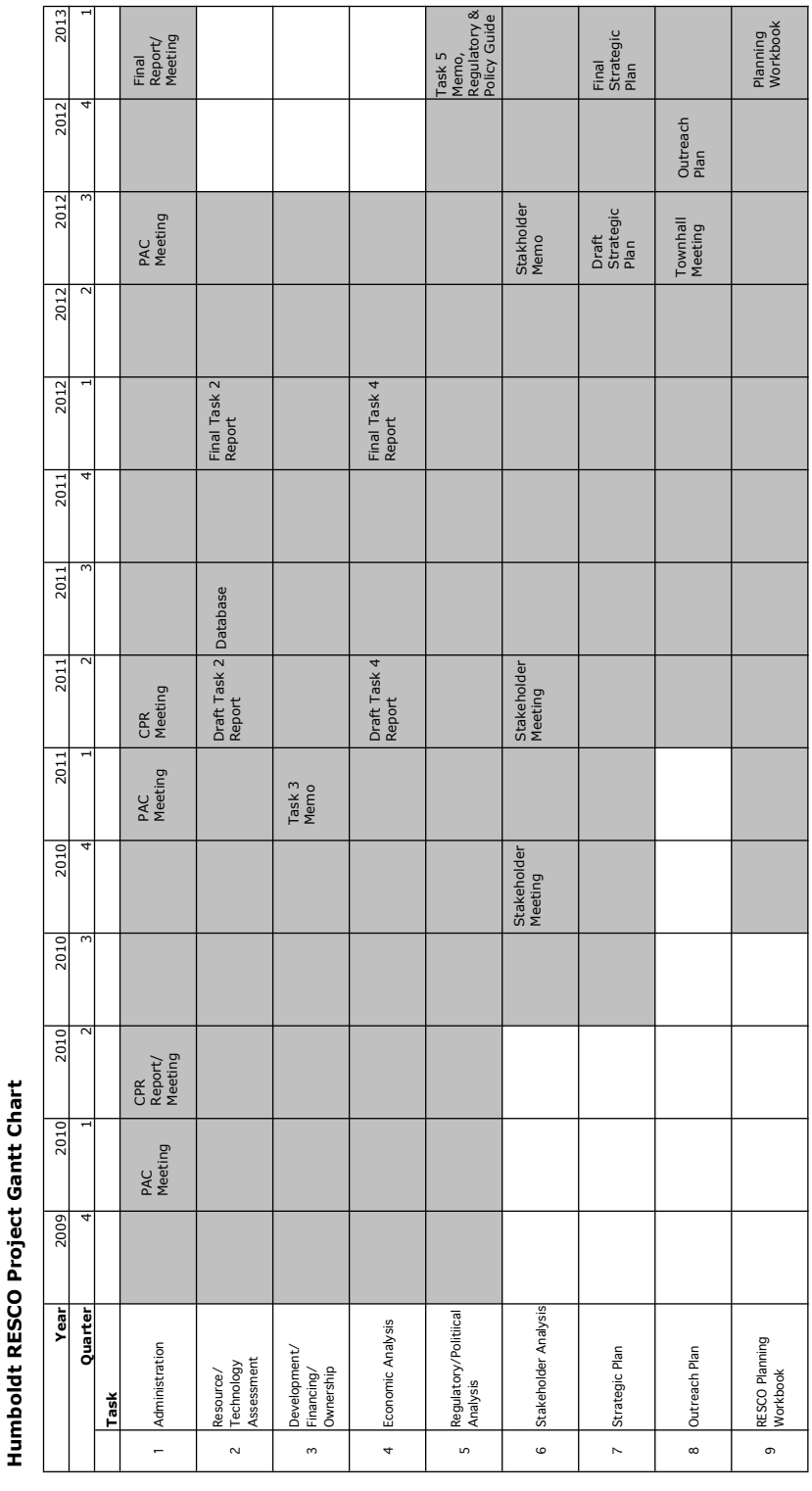
Professional Advisory Committee (PAC), and the PAC posed clarifying questions and provided recommendations. Figure 1 presents a task flow chart; Figure 2 provides a Gantt chart that illustrates the timing of various project tasks and key deliverables.

Figure 1: Humboldt RESCO Project Task Flow Chart



Source: Schatz Energy Research Center.

Figure 2: Humboldt RESCO Project Gantt Chart



Note: CPR = Critical Project Review
Note: PAC = Professional Advisory Committee

Source: Schatz Energy Research Center.

Project deliverables

- *Humboldt County Renewable Energy Secure Community: Resource and Technology Assessment Report*. Zoellick, Jim, Colin Sheppard and Peter Alstone. (Schatz Energy Research Center, Humboldt State University). 2012.
- *Humboldt County as a Renewable Energy Secure Community: Database of Local Renewable Energy Sources and Current/Projected Energy Demands*. Sheppard, Colin. (Schatz Energy Research Center, Humboldt State University). 2011.
- Humboldt RESCO Task 3 Memo: Renewable Energy Development, Ownership and Financing Options
- *Humboldt County as a Renewable Energy Secure Community: Economic Analysis Report*. Hackett, Dr. Steven C., Luke Scheidler, and Ruben Garcia Jr. (Schatz Energy Research Center). 2012.
- RePower Humboldt Task 5 Memo: Regulatory and Political Issues – Challenges to Implementing the RePower Humboldt Strategic Plan
- *Regulatory and Policy Guide on Renewable Energy and Energy Efficiency for Humboldt County Local and Tribal Governments*, Schatz Energy Research Center, February 2013.
- Humboldt RESCO Task 6 Memo: Stakeholder Analysis
- *RePower Humboldt: A Strategic Plan for Renewable Energy Security and Prosperity*, Schatz Energy Research Center, February 2013.
- RePower Humboldt Community Outreach Plan
- Humboldt RESCO Planning Workbook

3. Professional Advisory Committee (Task 1)

Goals/objectives:

The purpose of the Humboldt RESCO professional advisory committee (PAC) was to:

- Provide technical and professional guidance on the research and planning work being done.
- Provide input that would make the results of the study more realistic, more valuable, and more likely to be implemented.
- Provide input that would improve the relevance of the study on a state and national level.

Actions:

The project team recruited PAC members in December of 2009. The team made an effort to recruit members from energy policy and research organizations who could provide strong technical guidance. The project team also sought participation from PG&E, the local incumbent

investor-owned utility, as well as from regional players in the municipal utility sector. Finally, the team invited local government partners and representatives from the local biomass energy industry, which has a strong presence in Humboldt County, to participate in the PAC. Table 1 lists the organizations that participated in the Humboldt RESCO PAC.

Table 1: Humboldt RESCO Professional Advisory Committee

Organization	Topic Area
National Renewable Energy Laboratory (2 participants)	Energy policy and research
Transportation Sustainability Research Center and Pacific Clean Energy Application Center, UC Berkeley	Energy policy and research
California Institute for Energy and the Environment, UC Berkeley	Energy policy and research
E Source	Private energy consultant
Pacific Gas and Electric Company	Local incumbent investor-owned utility
Sacramento Municipal Utility District	Regional municipal utility
Northern California Power Agency	Not-for-profit agency that provides support to community-owned utilities
Humboldt County Community Development Services Department	Local government
City of Eureka and Redwood Coast Energy Authority Board	Local government
DG Fairhaven Power, LLC	Local biomass power plant operator

Source: Schatz Energy Research Center.

PAC members were asked to participate in three two-hour meetings over the course of a two-year period (note that the project was later extended from a two-year to a three-year period). Members were invited to participate in-person or via phone and web conferencing. Members were informed that they might also be called upon infrequently to provide individual guidance or feedback. In total, PAC members were asked to commit to 10 to 20 hours of time over the full project period. PAC members were asked to sign a form stating their commitment.

The project team convened three PAC meetings, one in March of 2010, one in February of 2011, and one in September of 2012. All meetings were held at the Schatz Energy Research Center at Humboldt State University in Arcata, California. PAC members either attended in person or participated via teleconference and/or web conference. PAC members were provided with an

agenda prior to each meeting, and a PowerPoint presentation made available via web conferencing served to guide the content of each meeting. Feedback from PAC members focused primarily on the resource and technology assessment, the economic analysis, and the strategic plan development. Table 2 outlines the content covered in each of the three Humboldt RESCO PAC meetings.

Table 2: Overview of Humboldt RESCO Professional Advisory Committee Meetings

PAC Meeting	Discussion Topics
Meeting 1 (March, 2010)	Project overview, goals and objectives, background information regarding existing regional energy characteristics, overview and key questions regarding Task 2 (Resource and technology assessment) and Task 4 (Economic analysis) methodology
Meeting 2 (February, 2011)	Review project overview, Task 2 methodology and preliminary results, Task 4 methodology and preliminary results, Task 3 overview (Development, financing, and ownership options), Task 7 (Strategic plan development) - key stakeholder criteria, long-term vision and near-term next steps
Meeting 3 (September, 2012)	Review of draft strategic plan, key findings, challenges, next steps, key questions, recommendations

Source: Schatz Energy Research Center.

Lessons learned:

- Convening a professional advisory committee required minimal effort and offered the project team a useful external perspective. They provided valuable guidance and suggestions and helped ensure that the project methodology, analysis, and results were relevant and applicable to meeting project goals and objectives.

4. Resource and Technology Assessment (Task 2)

This section discusses the resource and technology assessment. A more detailed description of this work can be found in the *Humboldt County Renewable Energy Secure Community: Resource and Technology Assessment Report* (Zoellick et al., 2012).

Goals/objectives:

The goal of Task 2 was to identify integrated mixes of renewable energy resources and technology options that would allow Humboldt County to meet most or all of its electricity needs and a significant fraction of its heating and transportation energy needs using locally available renewable energy resources. An additional objective was to identify the resource and technology portfolios that could most cost effectively reduce greenhouse gas emissions.

In order to achieve these goals and objectives the project team answered a key set of overarching questions.

- What are local energy needs?
- What are available local energy resources?
- Can local resources be used to meet local needs?
- At what cost (addressed in more detail in Task 4)?
- What are the greenhouse gas implications?
- What are the electric grid implications?
- What are the job and economic development implications (addressed in Task 4)?

Actions:

In order to answer the questions posed above the project team engaged in the following set of activities:

1) Gathered background information from available literature and other information resources.
2) Examined available energy supply and demand models for simulating future energy scenarios. A key issue was the ability to assess the match between supply and demand of local electricity resources. Developed custom energy simulation model.
3) Used the simulation model to conduct an energy scenario analysis. Assessed various energy supply and demand options. Assessed cost and greenhouse gas implications. Sought optimal solutions (i.e., greatest benefit at fixed cost).
4) Assessed electric grid impacts.

These key activities are discussed further below. In addition, the team developed a set of representative energy scenarios that could be used for development of the strategic plan.

Compilation of background information

The project team conducted research and compiled information in the following topic areas to answer the following sets of questions. See Zoellick et al. (2012) for more details on the information that was compiled and a corresponding list of references.

- Identify regional energy consumption characteristics
    - How much energy is used?
    - In what forms (electricity, natural gas, gasoline, diesel, propane, biomass, etc.)?
    - In which sectors (residential, commercial/building type, industrial, agricultural)?
    - For which enduses – electricity (lighting, motors, etc.), transportation, heating?
    - Where does it come from (generated and/or sourced locally, imported)?
    - How has it varied/increased over time?
    - How does energy consumption vary over the hours of the year?
- Identify what local energy resources are available
    - What quantities?
    - Where are they located?

    - For intermittent renewable resources (solar, wind, wave) what sort of availability is there over the hours of the year?
    - What sort of issues might there be (siting, local impacts, etc.)?
- Identify which energy conversion technologies are available for utilizing local resources
    - Are they commercially mature?
    - How efficient are they?
    - How much do they cost?
- Identify energy efficiency opportunities
    - What opportunities are available to use energy more efficiently and/or alter the demand for energy (timing and/or quantity)?
    - How much do these energy efficiency measures cost and how do they perform?
    - Which of them are appropriate for this region?
- Identify fuel switching opportunities
    - What opportunities are there to switch or substitute fuels or energy sources (e.g., electricity for transportation rather than gasoline or diesel, biofuels, etc.)?
    - What are the characteristics and availability of alternative fuel vehicles, especially electric vehicles? What are realistic estimates of potential adoption levels?
    - What opportunities are there for heat pumps for electric heating? Heat pumps with thermal storage?
- Identify energy storage opportunities
    - How important is it to be able to store power?
    - What opportunities are there for storing intermittent renewable energy resources (like wind, wave, and solar)?
    - What technologies are available?
    - Are they commercially ready?
    - Are they appropriate for the region?
    - What are their performance characteristics?
- Identify electric grid integration issues
    - How well will the local supply resources and the local energy demands match up on an hourly basis?
    - What will the impacts be to the electric grid if substantial quantities of new renewable resources are added to the local grid?
    - What impact will the introduction of substantial quantities of intermittent resources have?
    - Will infrastructure upgrades be required and if so at what cost?

Energy simulation modeling

A key issue to be examined was the ability to match local energy supply and demand profiles. If a temporal mismatch in supply and demand existed, then energy import/export capabilities, energy storage assets, and/or demand management technologies would be required to maintain

stability on the electric grid. This assessment would need to be a key feature of the energy simulation model.

The project team initially considered obtaining an existing energy supply and demand model to conduct the energy scenario analyses. The team was interested in a single-node dispatch model that could track hourly supply and demand of electricity on the Humboldt area grid. As shown in Table 3, two available energy simulation models were considered. Note that additional sources of energy analysis tools can be found on the National Renewable Energy Laboratories web site (http://www.nrel.gov/analysis/analysis_tools_policy.html) and on the Community for Energy, Environment and Development web site (http://www.energycommunity.org/default.asp?action=71).

The project team had some previous experience using the EnergyPLAN model and was leaning toward its use for the project. After some initial work with the model the team found that it was not possible to obtain documented source code for the model. This meant that the model needed to be operated essentially like a "black box." The modeling team would submit model inputs and get the resulting outputs without clearly understanding what had taken place within the model. This made the team uneasy. In addition, the team wanted the ability to add features to the model, but this was not possible with the "black box" approach.

The modeling team also considered using the HOMER® energy modeling software. This tool is commonly used to design and analyze hybrid energy systems that contain a mix of conventional and renewable electric generators. While the tool could potentially be used for regional energy planning, there were modeling features the team wanted that are not supported by the model, like modeling plug-in electric vehicles. In the end the team decided to build its own custom energy simulation model called the Regional Energy Planning Optimization (REPOP) Model.

Table 3: Energy simulation models considered for the project

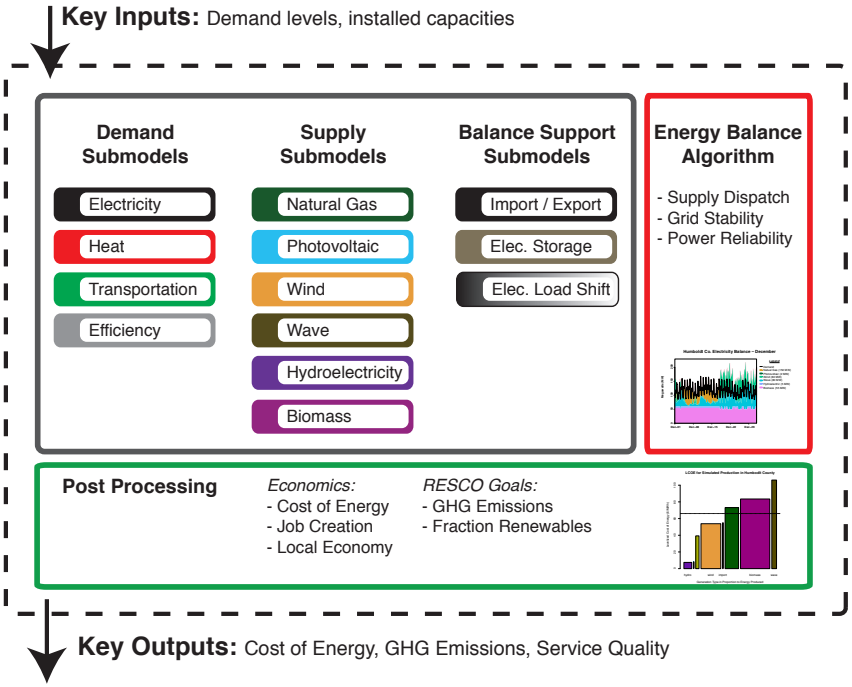
Energy simulation models considered	Source	Characteristics
EnergyPLAN	Sustainable Energy Planning Research Group, Aalborg University, Denmark http://energy.plan.aau.dk/	Deterministic input/output energy balance model, hourly time-step, aims to assist the design of national or regional energy planning strategies on the basis of technical and economic analyses that determine the consequences of implementing different energy systems and investments
HOMER® Model	HOMER Energy LLC http://homerenergy.com/index.html (originally developed at the National Renewable Energy Laboratory)	Micropower hourly optimization model, can potentially be used for regional planning
REPOP Model	Schatz Energy Research Center	Stochastic input/output energy balance model with optimization algorithm, hourly time-step, developed specifically for the Humboldt RESCO project

Source: Schatz Energy Research Center.

The REPOP Model includes an energy balance model and an optimization algorithm that can identify the best mix of resources. The model tracks Humboldt County's energy flows for the electricity, heating, and transportation (light duty vehicles only) sectors. The energy balance model is made up of a combination of submodels that characterize supply and demand for energy, an algorithm that dispatches supply to meet demand, and post processing algorithms that serve to summarize a model run. Figure 3 depicts how these algorithms work together to model energy production and consumption. A portfolio of generation capacities and demand levels is defined as input to the model. Outputs from the model summarize the resulting energy costs, greenhouse gas (GHG) emissions, economic impacts, and service quality associated with a given portfolio over an annual cycle.

Key characteristics of the REPOP model are as follows. Electricity supply and demand are modeled hourly, with demand for heat and transportation fuels (for example, gasoline, natural gas, propane, and wood for heating) assessed daily. Demand is forecasted ahead to the year 2030 based on population growth projections. Key data sources used to estimate the availability of energy supply resources and energy demands are listed below. The model includes a stochastic element to reflect the variability in supply and demand.

Figure 3: Regional Energy Planning Optimization (REPOP) Model



Source: Schatz Energy Research Center.

The model is capable of evaluating opportunities for fuel switching, where liquid or gaseous fossil fuels are replaced by electrical energy to supply heating and transportation energy demands. The model also considers energy efficiency and demand response opportunities. Electrical energy storage technologies can be modeled, and electricity reserve capacity requirements are accounted for using a persistence forecasting method.

The model is used to assess various energy supply portfolios. Key outputs include the cost and GHG emissions associated with a particular portfolio, as well as the percentage of local energy demand supplied by local renewable resources. The modelers used an optimization algorithm to identify optimal resource portfolios that minimize GHG emissions at a fixed cost. Table 4 shows the range of parameters explored with the REPOP model in the optimization exercise. Further details about the REPOP model can be found in the *Humboldt County Renewable Energy Secure Community: Resource and Technology Assessment Report* (Zoellick et al., 2012).

Table 4: Decision Variables Used in the REPOP Optimizations and their Corresponding Boundary Constraints

Decision Variable	Lower / Upper Limit of Installed Capacity (includes existing and new capacity)
Wind Capacity (MW)	0 / 250
Wave Capacity (MW)	0 / 100
Biomass Capacity (MW)	61 / 225
Hydropower Capacity (MW)	10.4 / 35
Solar PV Capacity (MW)	1.1 / 10
Import/Export Transmission Capacity (MW)	60 / 250
Storage Capacity (MW)	0 / 25
Efficiency Program Level (0 = Base incentive, 100 = Full measure cost incentive)	0 / 100
Electric Vehicle Penetration (% of registered vehicles)	0 / 38
Heat Pump Penetration (% of residential & commercial natural gas furnaces)	0 / 38
Demand Response (% of max potential or approximately 12% of peak load)	0 / 100

Source: Schatz Energy Research Center.

Based on the results of the REPOP model optimizations, three representative energy scenarios were developed: the base case, or ***business-as-usual***, the ***bold*** scenario, and the ***peak*** scenario. The ***bold*** and ***peak*** scenarios reflected estimated cost increases of 5 percent and 15 percent, respectively. The bold scenario included 124 MW of new local renewable generation capacity, while the peak scenario included 280 MW of new renewables. These three scenarios were featured in the Humboldt RESCO strategic plan.

Assessing electric grid impacts

Simulations using the REPOP model identified opportunities for substantial development of renewable energy projects on the Humboldt area electric grid. Before any new generators are added to the grid, however, interconnection studies will need to be performed to identify required transmission and distribution system upgrades. To develop a preliminary assessment of the need for infrastructure upgrades, the Humboldt RESCO study engaged the services of project partner and local investor-owned utility PG&E.

PG&E's Interconnected Grid Planning group conducted an interconnection feasibility study to evaluate the transmission impacts of a representative scenario for future renewable energy development in Humboldt County. The objectives of the study were to identify:

- Transmission system impacts caused solely by the addition of the proposed renewable energy development
- System reinforcements necessary to mitigate any adverse impacts of the proposed renewable energy development under various system conditions
- Facilities required for system reinforcements with a non-binding good faith estimate of cost responsibility

The study examined transmission facilities within PG&E's Humboldt and North Coast Areas. The study assumed a projected year 2030 winter peak electric loading condition of 223 MW and included nine proposed new generation facilities in Humboldt County with a total generation output of 253 MW, a scenario similar to the ***peak*** scenario mentioned above.

The interconnection study was performed to ensure that PG&E's transmission system remains in full compliance with North American Electric Reliability Corporation (NERC) reliability standards. Two power flow base cases were used in the analysis. These included a winter peak base case and an off-peak base case, representing extreme loading and extreme generation conditions, respectively. Additional analyses were not possible within the scope of the Humboldt RESCO study. Consequently, it is important to note that this was a preliminary analysis, and the results of this study do not provide any guarantees about the ability of the system to function properly during times, seasons, and situations not studied.

Data/information resources:

Tables 5 and 6 provide a listing of key data and information sources that were used to conduct the resource and technology assessment. Further information on the data and information sources that were used can be found in the *Humboldt County Renewable Energy Secure Community: Resource and Technology Assessment Report* (Zoellick et al., 2012).

Table 5: Electricity and Natural Gas Demand Data Sources

Data Type	Segregation	Time Scale	Duration	Source
Electricity Use (kWh)	Countywide	15-minute	2004-2009	PG&E, 2010
Electricity Use (kWh)	Resid/Comm/Industrial & Commercial Bldg Type	Monthly	2004-2008	CEC, 2010
Electric Customer Counts	Resid/Comm/Industrial & Commercial Bldg Type	Annual	2004-2008	CEC, 2010
Natural Gas Use (therms)	Resid/Comm/Industrial & Commercial Bldg Type	Monthly	2004-2008	CEC, 2010
Natural Gas Customer Counts	Resid/Comm/Industrial & Commercial Bldg Type	Annual	2004-2008	CEC, 2010

Source: Schatz Energy Research Center.

Table 6: Energy Resource Data Sources

Resource	Data Sources
Wind resource	NREL Western Wind Resources Dataset (NREL, 2010a) http://wind.nrel.gov/Web_nrel/
Wave resource	NOAA Buoy 46022 (NOAA, 2010) http://www.ndbc.noaa.gov/station_page.php?station=46022 *California Ocean Wave Energy Assessment* (California Energy Commission, 2003)
Solar resource	National Solar Radiation Database (NREL, 2010b) http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2010/
River hydro resource	Humboldt Bay Municipal Water District (HBMWD, 2010) Three Forks Water Power Project (Burgess, 2010) USGS Mad River flow data (USGS, 2010) http://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=11480410 Alderpoint precipitation data (Western Regional Climate Center, 2010) http://www.raws.dri.edu/cgi-bin/rawMAIN.pl?caCAPT *An Analysis of Small Hydroelectric Planning Strategies* (Oscar Larson & Associates, 1982)
Biomass power plant operation	DG Fairhaven Power (Marino, 2010)
Biomass resource	California Biomass Collaborative (Williams, R. 2008)
Energy efficiency	*California Energy Efficiency Potential Study,* (Itron, 2008)

Source: Schatz Energy Research Center.

Lessons learned:

- Few energy simulation modeling tools exist that can be used for local energy planning. The project team decided that development of a customized model better served its needs.
- Local renewable resources can be used to meet the majority of electricity needs and a large fraction of heating and transportation energy demand. This can result in a substantial reduction in GHG emissions and can be achieved at a modest cost increase.
- There are many possible resource and technology options to choose from, and a mixed portfolio of options is likely more advantageous than any technology in isolation. Aggressive implementation of cost-effective energy efficiency opportunities should be a near-term pursuit.
- The initial RESCO goal of meeting 75 percent or more of electric demand with local renewable resources may not be the best metric for measuring success. Instead, the

project team changed the focus to be on cost-effective options to decrease *overall* GHG emissions across the whole energy sector.

- Fuel switching to plug-in hybrid and battery-only electric vehicles in the transportation sector and to electric heat pumps in the heating sector has the potential to play a major role in realizing the RESCO vision. Fuel switching opportunities are critical to cost-effectively achieving large reductions in energy related GHG emissions. Without fuel switching, deep reductions in GHG emissions are infeasible.
- An interconnection feasibility study conducted by PG&E indicated that substantial upgrades to the local transmission and distribution system would be required to accommodate large-scale development of local renewable energy sources. The most cost-effective plan for these upgrades would likely involve an area-wide planning approach that simultaneously considers multiple projects. If instead a project-by-project approach is taken, a less optimal piecemeal solution is likely to result.
- Energy storage is not expected to play a significant role in the near- or even intermediate-term due to the load following capabilities of a local gas-fired power plant and 70 MW of available transmission capacity connecting the Humboldt area to the larger statewide electric grid.

Deliverables:

The project deliverables for Task 2 included the following reports.

Humboldt County as a Renewable Energy Secure Community: Resource and Technology Assessment Report (Zoellick, et al., 2012)

Humboldt County as a Renewable Energy Secure Community: Database of Local Renewable Energy Sources and Current/Projected Energy Demands (Sheppard, 2011).

5. Assessment of Resource Development, Financing, and Ownership Options (Task 3)

The section discusses the assessment of development, financing, and ownership options. Additional information on this topic is available in the *Humboldt RESCO Task 3 Memo: Renewable Energy Development, Ownership and Financing Options.*

Goals/objectives:

The goal of this task was to critically analyze different business and organizational structures, financing mechanisms, and ownership options that could be used effectively to develop the renewable energy portfolios identified in Task 2.

Actions:

There are many possible models for the development, financing, and ownership of renewable energy projects. Use of various models can affect (1) the community's ability to implement the RESCO vision, (2) the benefits accrued by the local community from local renewable energy projects and programs, and (3) the potential risks associated with project and program development. The project team identified and researched a set of models and assessed their potential to help implement the Humboldt RESCO vision.

The development, financing, and ownership options considered are listed below.

Development/Ownership Models

- Investor-owned utility
- Independent power producer
- Public power – Community Choice Aggregation (CCA) and municipal utilities
- Community renewable energy models and public/private partnerships

Financing Options for Renewable Energy Generation

- Equity financing
- Loan financing
- Bond financing
- Community renewable energy flip structures
- Grants, rebates, and tax credits
- Residential and small commercial financing

The information gathered in Task 3 helped inform the development of the RESCO strategic plan. In addition, a summary of the information gathered for Task 3 was included in the strategic plan appendices as supplemental information. This information will serve to help educate the local community about development, financing, and ownership options.

Data/information resources:

Key information resources used to assess the renewable energy development, financing, and ownership options are listed in Table 7. In addition, the *Regulatory and Policy Guide on Renewable Energy and Energy Efficiency for Humboldt County Local and Tribal Governments* (Schatz Energy Research Center, 2013a) that was developed for this project as part of Task 5 (Examine regulatory and political issues) provides additional information on these topics.

Lessons learned:

- Numerous models exist for the development, financing, and ownership of community renewable energy projects.
- Different models have different levels of opportunity and risk associated with them.

- Communities need assistance in understanding and assessing their options.
- Community Choice Aggregation (CCA) is a relatively new community energy model that is gaining interest among California communities.
- Municipalization is an alternative that communities continue to consider, but it involves substantially more upfront investment and effort, and therefore poses greater risk.
- A number of California counties and other jurisdictions have Property Assessed Clean Energy (PACE) programs or are developing them.

Deliverables:

Humboldt RESCO Task 3 Memo: Renewable Energy Development, Ownership, and Financing Options

Table 7: Information Sources for Development, Financing and Ownership Options

Information type	Information Sources
Community Renewable Energy	*A Comparative Analysis of Community Wind Power Development Options in Oregon* (Bolinger et al., 2004) *A Guide to Community Solar: Utility, Private and Non-Profit Development* (Coughlin, et al., 2010) Community-Based Renewable Energy Self-Generation Program (Environmental Entrepreneurs, 2012)
Community Choice Aggregation and Municipal Utilities	Local Government Commission CCA web page, http://www.lgc.org/cca/ U.S. Department of Energy CCA web page, http://apps3.eere.energy.gov/greenpower/markets/community_choice.shtml *Community Choice Aggregation* (Local Government Commission, 2006) *City of Davis Energy Assessment* (examines Community Choice Aggregation and municipalization) (Nixon Peabody LLP, 2012) *Municipal Utility Study, Technical Report* (Massachusetts Department of Energy Resources, 2010) *Boulder Municipal Utility Feasibility Study* (Robertson-Bryan, Inc., 2011)
Clean Energy Financing	*Clean Energy Financing Programs: A Decision Guide for States and Communities* (U.S. EPA State Clean Energy and Climate Program, 2011) *Financing Projects That Use Clean-Energy Technologies: An Overview of Barriers and Opportunities* (Goldman, et al., 2005) *Community Wind Financing, A Handbook by the Environmental Law & Policy Center* (Harper, et al., 2004) *Private Financing of Renewable Energy, A Guide For Policymakers* (Justice, S., 2009)
Property Assessed Clean Energy (PACE) Financing Programs	CaliforniaFIRST PACE finance program, https://californiafirst.org/overview Examples of Existing PACE programs in CA, Governor's Office of Planning and Research, http://www.opr.ca.gov/s_renewableenergy.php#E Alliance to Save Energy PACE web page, http://ase.org/resources/property-assessed-clean-energy-financing-pace *Guide to Energy Efficiency & Renewable Energy Financing Districts For Local Governments* (Renewable and Appropriate Energy Laboratory, University of California, Berkeley, 2009)

Source: Schatz Energy Research Center.

6. Economic Analysis (Task 4)

This section discusses the economic analysis, including an assessment of costs and economic impacts. Further detail is provided in the *Humboldt County as a Renewable Energy Secure Community: Economic Analysis Report* (Hackett et al. 2012).

Goals/objectives:

The goal of Task 4, Economic Analysis, was to determine the levelized cost of energy associated with the local renewable energy supply portfolios identified in Task 2. In addition, an assessment of the economic impacts, in terms of jobs and economic activity, was to be determined for the renewable energy supply portfolios. Cost and job estimates were then to be used in the optimization algorithm to identify optimal resource and technology solutions that maximize community benefits.

Actions:

The project team assessed the costs and economic impacts associated with a renewable energy development plan for Humboldt County. The team then used the results of the cost and impact analysis as inputs to the REPOP Model discussed in Section 4.

Cost Analysis

The cost analysis examined the construction, operation, and maintenance costs associated with each renewable energy category (biomass, wind, wave, small hydroelectric, and solar photovoltaic) as compared to the costs of natural gas-fired generation at the Humboldt Bay Generating Station, a natural gas-fired power plant that serves the Humboldt area. Additionally, the team estimated the costs of more aggressive energy efficiency programs and a transition from conventional heating and transportation technologies to heat pumps and electric vehicles.

Elements of the cost analysis included modeling and estimating the instant capital cost, levelized cost, and marginal cost of dispatch for each renewable energy resource, as well as for the existing gas-fired generation plant. The authors first drew cost estimates for natural gas-fired electricity generation, renewable electricity generation, energy efficiency, and heating and transportation fuels and technologies from the most current and authoritative literature. Based on the research team's knowledge of local conditions and through conducting extensive local interviews, they modified cost estimates to reflect unique conditions in Humboldt County.

Economic Impact Assessment

The team also assessed the creation of jobs and economic activity that could be directly or indirectly attributed to new renewable energy development. The analysts specified a set of renewable energy development scenarios based on output from the REPOP model and employed a suite of economic impact assessment models to estimate the local jobs, income, and economic output generated due to the construction and operation of proposed renewable energy and energy efficiency projects.

To evaluate economic development potential, the research team used highly specialized economic impact assessment models for each of the major renewable energy categories and for energy efficiency. For natural gas, wind, and solar photovoltaic generation, the research team customized available Jobs and Economic Development Impact (JEDI) models developed by the National Renewable Energy Laboratory (NREL, 2009). Models were unavailable, however, for biomass, wave, small hydroelectric, and energy efficiency. Consequently, the research team reverse engineered the available JEDI models and used that knowledge to develop their own impact assessment models for these technologies. By utilizing this full suite of models, the research team was able to estimate net economic impacts associated with renewable energy development in Humboldt County.

Economic Impact Assessment Approach

The original intent for the economic impact analyses conducted under RESCO was to use the IMPLAN regional economic impact assessment software created by the Minnesota IMPLAN Group. IMPLAN's input-output (I-O) tables, consisting of a matrix of over 500 industries, are based on data provided by the US Bureau of Economic Analysis. Currently, the US Bureau of Economic Analysis does not collect "make" and "use" data for renewable energy industries and therefore these industries are not reflected in IMPLAN software. Thus, in order to use IMPLAN for an economic impact assessment of renewable energy development, IMPLAN datasets need to be manipulated to accurately reflect the presence of the desired industries. This would involve collecting a multitude of cost data, including construction, equipment, and O&M costs, for each renewable energy technology under investigation. Originally, these data were to be collected by a student researcher through literature reviews and surveys. Although these data were not pursued, it is expected that the task would have required a significant time commitment on the part of the researcher.

Ultimately, the decision was made to forego the process outlined above and to instead utilize the Jobs and Economic Development Impact (JEDI) software suite developed by the National Renewable Energy Laboratory (NREL). Humboldt RESCO researchers were first made aware of JEDI software through a Technical Assistance Program Webinar on July 29, 2009, which is available for download (EERE, 2009).

The JEDI software suite is an emerging standardized platform for conducting economic impact assessments of renewable energy development projects. Each JEDI model is built on highly specific industry cost data collected by NREL researchers who have exceptional access to this information. In addition, NREL has included assumptions that allow the JEDI models to be driven by the amount of installed capacity (e.g. megawatts or million gallons per year), making the format user-friendly. After studying the JEDI models, SERC researchers believe that the valuable research embedded within the JEDI models coupled with its relative ease of use will make JEDI the preeminent software tool for conducting economic impact assessments of renewable energy development on a regional scale. Therefore, in order to make the RESCO research more relevant and replicable, the JEDI suite will be used exclusively when conducting economic impact assessments of renewable energy development.

Although JEDI is very simple to use on a state level impact assessment, in order to conduct a county level assessment JEDI models need to be customized using county level multipliers that reflect the aggregated industries impacted by JEDI. This feature is included in all JEDI models and county level multipliers can be purchased from the Minnesota IMPLAN Group. Relevant JEDI models were customized to assess economic impacts for the Humboldt RESCO project.

See Appendix C of *Humboldt County as a Renewable Energy Secure Community: Economic Analysis Report* (Hackett et al. 2012) for further discussion on the use of JEDI, development of JEDI-like input-output models, and use of IMPLAN multipliers.

Data/information resources:

The Humboldt RESCO economic analysis was based on current and authoritative literature. Table 8 lists some of the information and data sources that were used to estimate costs and economic impacts associated with renewable energy development in Humboldt County.

Table 8: Key Data Sources for Economic Analysis

Data type	Data Sources
Energy cost data	*Renewable Energy Cost of Generation Update* (O'Donnell et al., 2009) *Levelized Cost of Energy Analysis - Version 2.0* (Lazard Ltd., 2008) *Comparative Costs of California Central Station Electricity Generation Technologies* (Klein, 2010) *Comparative Costs of California Central Station Electricity Generation Technologies* (Klein and Rednam, 2007) *New Generation Cost Summary* (Energy and Environmental Economics, Inc., 2008)
Energy efficiency cost and savings data	*California Energy Efficiency Potential Study* (Itron, 2008) *Saving Energy Cost Effectively: A National Review of the Cost of Energy Saved Through Utility-Sector Energy Efficiency Programs* (American Council for an Energy Efficient Economy, 2009)
Job creation	*Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?* (Wei et al., 2010) *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* (Kammen et al., 2006) *Energy Efficiency, Innovation, and Job Creation in California* (Roland-Horst, D. 2008) *The Jobs and Economic Development Impact Model (JEDI): About JEDI and Frequently Asked Questions* (NREL, 2009) How to Estimate the Economic Impacts from Renewable Energy (EERE/DOE, 2009) Humboldt County IMPLAN multipliers (Minnesota IMPLAN Group, Inc.) http://implan.com/V4/index.php?option=com_content&view=article&id=780:implan-data-products&catid=157:data&Itemid=113

Source: Schatz Energy Research Center.

Lessons learned:

Cost analysis

- On a levelized cost basis, many energy efficiency measures are cheaper to implement than any available electricity generation option. Implementing cost-effective energy efficiency measures saves money while simultaneously reducing GHG emissions.
- While the instant capital cost of renewable energy power plants tends to be greater per unity of installed capacity than for conventional combined cycle natural gas power plants, marginal costs tend to be substantially less. This results in numerous renewable electricity generation options that are cost-competitive with conventional combined cycle natural gas power plants.

Economic impact analysis

- NREL's JEDI software suite is the preeminent software tool for conducting economic impact assessments of renewable energy development on a regional scale. JEDI models must be customized using county level multipliers for regional assessments. County level multipliers can be purchased from the Minnesota IMPLAN Group.
- Renewable energy power plants tend to create more jobs and economic output per megawatt of installed capacity than conventional combined cycle natural gas power plants.

Deliverables:

Humboldt County as a Renewable Energy Secure Community: Economic Analysis Report (Hackett et al. 2012).

7. Assessment of Regulatory and Political Issues (Task 5)

This section discusses the assessment of regulatory and political issues regarding renewable energy development in Humboldt County. Further information on these topics is provided in the two deliverables generated in fulfillment of this task. These include the *RePower Humboldt Task 5 Memo: Regulatory and Political Issues – Challenges to Implementing the RePower Humboldt Strategic Plan*, and the *Regulatory and Policy Guide on Renewable Energy and Energy Efficiency for Humboldt County Local and Tribal Governments*.

Goals/objectives:

The goal of this task was to examine the regulatory and political environment in which a renewable energy portfolio on a local micro-grid must operate and to identify regulatory barriers that might inhibit RESCO development and may require administrative or legislative action to resolve. In addition, a focus was placed on identifying how local and Tribal governments can play a role in fostering local sustainable energy development.

Actions:

The project team conducted research and gathered documents and information pertaining to the structure, operation and regulation of the electric power industry. The team reviewed and summarized this information to provide a context for the RESCO strategic planning process. This information helped inform the development of the RESCO strategic plan. In addition, the authors included summary information characterizing the energy industry, its structure and regulation, key players, and California State energy policy in the RESCO strategic plan document (*RePower Humboldt: A Strategic Plan for Renewable Energy Security and Prosperity*) and the *Regulatory and Policy Guide on Renewable Energy and Energy Efficiency for Humboldt County Local and Tribal Governments.*

The project team developed two project deliverables as a result of the Task 5 work. A regulatory and political issues memo identified key challenges to implementing the RESCO strategic plan vision and suggested strategies for overcoming those challenges. The project team also developed a regulatory and policy guide on renewable energy and energy efficiency for local and Tribal governments. The stated purpose of this guide is to provide local policy makers with information and guidance on how they can help the county meet its sustainable energy goals. The main question addressed in this guide is: "How can local and Tribal government officials play a role in Humboldt County's sustainable energy development?"

The regulatory and policy guide is action-oriented. It presents information categorized into fifteen different action areas, and for each area describes "The Opportunity" (background information and notes on the role local government can play), "The Local Angle" (what's already happening in Humboldt County, emphasizing unique local aspects), "Examples from Elsewhere" (brief case studies from outside the county), and "Resources" (where to get more information). It also includes a background section that provides useful information about the energy industry, state energy policy, and the local energy scene. The fifteen action areas are listed below:

1. Building organizational capacity
2. Energy efficiency and renewable energy
3. Green fleets / alternative fuel vehicles
4. Financial benefits of generating your own electricity
5. Funding opportunities
6. Energy purchase and price options and information on energy use
7. Renewable energy and energy efficiency incentives
8. Financing programs, bulk purchasing, and other financial interventions
9. Planning and regulation
10. Permitting
11. Providing a public forum
12. The climate change energy nexus
13. Planning and implementation of energy efficiency programs

14. Generation, distribution, and/or sale of electrical power
15. Education and outreach

Data/information resources:

Many information resources were utilized to conduct the Task 5 work, and references for many of these resources are documented in the regulatory and policy guide. A sampling of key information resources is presented in Table 9.

Table 9: Key Energy Policy, Planning and Regulatory Information Resources

Data type	Data Sources
Energy policy	Statewide Energy Efficiency Collaborative, http://www.lgc.org/SEEC/index.html Local Government Sustainable Energy Coalition, http://www.lgsec.org/ Local Government Commission, Energy Resources and Publications, http://www.lgc.org/freepub/energy/index.html The California Air Resources Board's Cool California website, http://www.coolcalifornia.org CA Energy Commission Local Government Assistance, http://www.energy.ca.gov/localgovernment/ American Council for an Energy Efficient Economy, Local Energy Efficiency Policy http://www.aceee.org/portal/local-policy Institute for Local Government, Energy Efficiency and Conservation http://www.ca-ilg.org/energy-efficiency-conservation *Renewable Energy Assistance Packet: A Compendium of Resources for Local Governments* (Local Government Commission, 2003) http://www.lgc.org/services/docs/spire/spire_reap_3rd_edition.pdf
Energy planning and permitting	California Energy Commission Planning and Permitting Resources for Renewable Energy Systems, http://www.energy.ca.gov/localgovernment/planning_resources/index.html *Energy Aware Facility Siting and Permitting Guide* (Phinney et al., 2011) http://www.energy.ca.gov/2010publications/CEC-600-2010-007/CEC-600-2010-007.pdf *Solar Energy Facility Permit Streamlining Guide* (California County Planning Directors Association, 2012) http://www.ccpda.org/solar

Source: Schatz Energy Research Center.

Lessons learned:

- Sustainable energy planning at the local government level, especially in California's rural counties, is a rather new phenomenon. A sufficient amount of capacity building needs to take place because many local governments need support in this new arena.

- A comprehensive state guide on sustainable energy planning for local governments is needed. This effort could build on key planning guides already produced by the Energy Commission, including the Energy Aware Planning Guide (California Energy Commission, 2011) and the Energy Aware Facility Siting and Permitting Guide (Phinney et al., 2011). These are tremendously useful resources. However, there are additional informational needs to be filled. To establish a meaningful context, a guide should provide substantial background information regarding the structure and operation of the energy industry (especially electricity, but also natural gas and transportation fuels). This could include information regarding key players, regulatory structure, and options for buying and selling energy. A guide should also discuss state energy policy initiatives and relate them to local government. In addition, key energy terminology and topics should be defined and discussed, including terms like net metering, distributed generation, renewable energy credits, feed-in tariffs, Community Choice Aggregation, and others. An understanding of this basic background information is necessary for local leaders to be effective in the areas of energy policy and planning. State sponsored workshops and/or trainings could be used to educate local leaders about the energy industry and sustainable energy planning, and to provide them with tools they can use to increase the energy sustainability of their communities.
- Local governments are challenged because they have limited staffing and budget resources, and taking on work in a new area such as local energy planning competes with other program areas for already strained resources.
- Planning, siting, permitting, and regulatory hurdles for renewable energy projects point to a need for proactive efforts that can help streamline the project development process, identify preferred sites, develop programmatic environmental reviews, and develop land use zones that are compatible with renewable energy development.
- Low natural gas prices and Renewable Portfolio Standard quotas being reached have depressed prices for renewable electricity. While these may be short-lived transient conditions, they currently pose challenges to project developers and owners/operators of both existing and new renewable energy projects.
- There is a lack of consumer choice allowing for purchase of renewable energy, especially from local projects.

Deliverables:

RePower Humboldt Task 5 Memo: Regulatory and Political Issues – Challenges to Implementing the RePower Humboldt Strategic Plan

Regulatory and Policy Guide on Renewable Energy and Energy Efficiency for Humboldt County Local and Tribal Governments, Schatz Energy Research Center, February 2013.

8. Stakeholder Engagement (Task 6)

The stakeholder engagement task (Task 6) is discussed below. Additional information on this task can be found in the *Humboldt RESCO Task 6 Memo: Stakeholder Analysis*.

Goals/objectives:

The goal of this task was to identify key stakeholders in Humboldt County who should be engaged in the RESCO planning process and to gather their input regarding preferred options, goals and issues with respect to RESCO development.

Actions:

The stakeholder engagement process consisted of a number of subtasks. First, the project team identified a broad list of stakeholder groups along with prospective representatives from each group. Next, the team contacted stakeholders and invited them to participate in the Humboldt RESCO project. The stakeholder engagement process included two key stakeholder meetings, a separate youth stakeholder meeting, and a web-based survey for those who couldn't attend the meetings. In addition, the team sent the draft RESCO strategic plan to each of the stakeholders for their review and input. In addition to these official stakeholder activities, there were a number of informal meetings and gatherings that occurred throughout the project, allowing for additional community input and generally informing the strategic planning process.

The project team specified eleven stakeholder categories (listed below) and recruited participants from each of these categories to participate in the stakeholder process. The team made a concerted effort to cast a wide net and recruit a broad cross section of the community.

- Business Community
- Economic Development/Financial Organizations
- Education/Policy Groups
- Energy Industry
- Environmental/Energy Groups
- Forestry and Fisheries Organizations
- Labor Groups
- Political Leaders
- Regulatory Bodies
- Tribes
- Youth

<u>Stakeholder Meetings</u>

Key activities at the first meeting were (1) the development of a vision statement for renewable energy development in Humboldt County, and (2) development and ranking of criteria for evaluating potential renewable energy projects.

Following the first stakeholder meeting, the team conducted a web-based survey to solicit input from those stakeholders who were not able to attend the meeting. The survey presented renewable energy project evaluation criteria, which had been developed by stakeholders at the first project meeting, and the survey asked participants to rank the criteria according to their importance. The authors then combined results of the web-based survey with the ranked results from the first meeting to arrive at the final ranked evaluation criteria.

Following the initial general stakeholder meeting, the team conducted a special youth stakeholder meeting and recruited youth from local area high schools to participate. Meeting organizers engaged the youth in developing a vision for Humboldt County's energy future, as well as a set of project evaluation criteria.

A final general stakeholder meeting was held. At this meeting, organizers presented stakeholders with a project update and a review of the work completed to date. Participants then broke into small groups to discuss seven different potential energy project categories. Each group brainstormed potential near-term projects; identified key players; considered strengths, weaknesses, opportunities, and threats; and identified near-term next steps and long-term goals and concerns.

Input gathered as a result of these stakeholder activities helped inform the development of the RePower Humboldt Strategic Plan.

Lessons learned:

- Key criteria to be considered for future energy projects include: environmental impacts, financial viability/affordability, local acceptance/participation/control, and economic impacts (jobs, economic stimulus).
- A distrust of large corporations can make securing outside capital more challenging and creates a preference for locally owned, community-based projects.
- There is a strong preference for local participation and control in energy planning and development.
- People would like the ability to purchase locally generated electricity.
- People want to see real, tangible benefits for their communities associated with proposed projects, especially if they perceive they are giving something up in the process.
- The community can benefit from education and outreach efforts that provide information about how much energy is consumed, where it comes from, what the alternatives are, and what the associated impacts are.
- Potential community concerns regarding local impacts of renewable energy projects creates a need for transparent processes that involve community stakeholders in planning and project development activities in a meaningful way.

- While people are concerned about broad environmental issues, they become much more personally involved when a project is located in their neighborhood and will impact their own local environmental quality.
- Offshore wind and wave energy: The public process surrounding a recently proposed wave project showed that the local fishing community is concerned about the impacts that offshore energy (wave power, wind power) might have on their industry. Possible environmental impacts were also raised during this process. However, there was also a lot of public support for the project.
- Onshore wind energy: While there were those in the community who voiced support for a recently proposed on-shore wind project, there was also a significant amount of opposition. Key concerns included potential impacts to local tourism, impacts to roads, construction impacts and disruption to town activities, potential impacts to the town water supply, impacts to birds and bats, and visual impacts.
- Biomass energy: Concerns have been voiced about the expansion of biomass power in Humboldt County. Some people are concerned about potential negative impacts to the local forest ecosystem and creating a situation where trees are being cut to feed a power plant (as opposed to capturing an otherwise unused waste stream). Concerns have also been voiced about the sustainability and carbon neutrality of biomass energy.
- Small hydro energy: It is anticipated that there will also be concerns about the development of small-scale, run-of-the-river hydroelectric projects and the impacts these projects could have on aquatic ecosystems. Although it is true that any approved project would need to meet stringent environmental criteria and overcome significant permitting and regulatory hurdles, there still may be concern about potential impacts.

Deliverables:

Humboldt RESCO Task 6 Memo: Stakeholder Analysis

9. Development of Strategic Plan (Task 7)

The culminating document for the Humboldt RESCO project is the strategic plan, called the RePower Humboldt Strategic Plan. The plan is available at: http://www.redwoodenergy.org/programs/repower.

Goals/objectives:

The goal of this task was to develop a strategic plan for securing Humboldt County's RESCO future. The strategic plan was to present an overview of Humboldt County's RESCO options and identify preferred options as determined in Tasks 2 through 6. The plan would include a roadmap for pursuing the preferred options and would identify the next steps that need to be taken, including pursuit of pilot scale projects to further the RESCO vision.

Actions:

The project team produced the RePower Humboldt Strategic Plan in a professional, user-friendly format that is intended to be accessible to the general population. It sets a context for Humboldt County's energy future, describes the strategic planning process, and presents the vision statement and community values developed by the Humboldt RESCO stakeholder group. The plan presents results of the resource and technology assessment and economic analysis, and three representative scenarios, ***business-as-usual, bold,*** and ***peak***, illustrate what is possible. Also provided is a set of long-term strategies and near-term next steps, as well as a preliminary evaluation plan. The plan summarizes near-term next steps in a tabular format that identifies responsible parties, a proposed implementation schedule, and potential resources to support the effort.

The project team publicly released a draft RePower Humboldt Strategic Plan in September of 2012. The team directly sent the plan to members of the Humboldt RESCO stakeholder group and asked stakeholders to review the document and provide feedback. In addition, the Redwood Coast Energy Authoritiy made the plan available on their website and hard copies were available for pick-up at their business office. The team implemented a publicity campaign that included a press release to local media outlets, a town hall meeting, interviews on local television and radio, a newspaper editorial, and presentations to local jurisdictions and community groups. The project team provided a six-week period for public comment. The authors then made changes to the draft plan based on the public comment received and prepared a final version. The final strategic plan included appendices that provided a record of the public comments that were received and a description of how they were addressed.

Data/information resources:

The team used data and information from all preceding project tasks in the preparation of the RePower Humboldt Strategic Plan.

Lessons learned:

The RePower Humboldt Strategic Plan includes a set of long-term implementation measures. They are listed below.

- Engage the community in the adoption and implementation of the RePower Humboldt vision and plan.
- Aggressively pursue cost-effective energy efficiency opportunities.
- Develop local renewable energy resources.
- Adopt plug-in electric vehicles.
- Adopt heat pumps for water and space heating.
- Develop distributed generation projects.
- Pursue cost-effective and sustainable means to access forest management residues for biomass energy applications.

- Work to develop Humboldt County as a center for wave energy and offshore wind energy research and demonstration.
- Work with PG&E to plan for long-term electric grid infrastructure upgrades.
- Work with regulatory agencies to assess and reduce permitting barriers to renewable energy project development.
- Create options for local development and ownership of renewable energy projects.
- Develop options for local consumers to purchase local renewable energy.
- Develop options to finance local renewable energy projects.
- Evaluate and adapt the RePower Humboldt Strategic Plan.

Deliverables:

RePower Humboldt: A Strategic Plan for Renewable Energy Security and Prosperity, Schatz Energy Research Center, February 2013.

10. Community Outreach (Task 8)

Goals/objectives:

The goal of this task was to develop a community outreach and education plan that would engage the community and secure broad community support for development of Humboldt County as a RESCO.

Actions:

Community outreach efforts included preparation of outreach materials, engagement in outreach activities, and development of a community outreach plan to move the RePower Humboldt vision forward.

The project team performed a large number of outreach activities as part of the Humboldt RESCO project, including public presentations, television appearances, radio talk show appearances, and articles and editorials for local news publications. In conjunction with the public release of the draft Repower Humboldt Strategic Plan the team held a town hall meeting to present the plan and solicit public input. The meeting featured a presentation of the strategic plan and a small group discussion session to stimulate dialog. In addition, the team created an electronic mailing list that serves to inform 80 community members about RePower Humboldt activities.

Outreach materials include the RePower Humboldt Strategic Plan (full document and executive summary excerpt), slide presentations for use in public meetings, and a RePower Humboldt web page (http://www.redwoodenergy.org/programs/repower).

The project team also prepared an outreach plan to guide additional education and outreach efforts. The outreach plan includes two main strategies to engage key stakeholders and reach out to the broader community.

1. Secure the support of local municipalities, agencies and community organizations.

Moving forward, the Humboldt RESCO project team will present the RePower Humboldt vision and Strategic Plan to local municipalities, agencies, and community organizations and will work to secure their endorsements or other expressions of support. In addition, the project team will identify specific actions these groups can take to support the Strategic Plan objectives. Groups to be engaged include, but are not limited to the following.

- City and county governments
- Local Native American Tribes
- Humboldt Bay Municipal Water District
- Humboldt Bay Harbor, Recreation and Conservation District
- North Coast Unified Air Quality Management District
- Redwood Region Economic Development Commission
- Humboldt County Farm Bureau
- Humboldt Waste Management Authority
- Northcoast Environmental Center

2. On-going education and outreach efforts.

The project team identified implementation of a RePower Humboldt education and outreach program as a near-term action item to pursue once endorsements from key constituencies have been secured. The program will include a coordinated education and outreach campaign that communicates the findings and recommendations of the RePower Humboldt Strategic Plan, solicits additional public input, works to build greater consensus for the plan, and mobilizes public action on the implementation strategies. Key aspects of the education and outreach program will include:

- Develop an increased online presence through the Redwood Coast Energy Authority web page.
- Research and document case studies that showcase local commercial and residential renewable energy and energy efficiency projects.
- Form working groups and/or a volunteer task force that can extend the reach of the RePower Humboldt project team.
- Host quarterly workshops to highlight key informational topics.

Deliverables:

RePower Humboldt Community Outreach Plan

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12. Appendix A – Contact Information

All documents associated with the Humboldt County RESCO project, also known as the RePower Humboldt project, can be accessed on the Redwood Coast Energy Authority's RePower Humboldt web page: http://www.redwoodenergy.org/programs/repower

Key contacts associated with the RePower Humboldt project include:

Matthew Marshall
Executive Director
Redwood Coast Energy Authority
707-269-1700
mmarshall@redwoodenergy.org

Jim Zoellick
Senior Research Engineer
Schatz Energy Research Center, Humboldt State University
707-826-4345
jimz@humboldt.edu

13. Appendix B – Scope of Work

California Energy Commission Grant Number PIR-08-034 supported the work performed for the Humboldt RESCO. The scope of work specified in the grant agreement is presented below.

PIR-08-034

WORK STATEMENT

TECHNICAL TASK LIST

Task #	CPR/PAC	Task Name
1		Administration
2	X (PAC)	Assess Resource and Technology Options
3		Examine Development Structure, Financing and Ownership Options
4		Conduct Economic Analysis
5	X (PAC)	Examine Regulatory and Political Issues
6		Conduct Stakeholder Analysis
7		Develop Strategic Plan and Identify Next Steps
8		Technology Transfer Activities
9		Production Readiness Plan

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	David Boyd – RCEA, Jim Zoellick - SERC	SERC	
2	Charles Chamberlin, Colin Sheppard, Jim Zoellick - SERC	SERC, PG&E	HTA, County of Humboldt, City of Eureka, City of Arcata, National Weather Service Eureka, HWMA, Shell WindEnergy, MSEI Fairhaven Power Plant
3	David Boyd - RCEA, Steve Hackett, Jim Zoellick - SERC	SERC, PG&E	HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA
4	Steve Hackett - HSU	SERC, PG&E	HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA
5	David Boyd - RCEA, Steve Hackett, Jim Zoellick - SERC	SERC, PG&E	HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA

6	David Boyd - RCEA, Jim Zoellick - SERC	SERC	PG&E, HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA, Shell WindEnergy, MSEI Fairhaven Power Plant
7	David Boyd - RCEA, Jim Zoellick - SERC	SERC	HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA
8	David Boyd - RCEA, Jim Zoellick - SERC	SERC	HTA, County of Humboldt, City of Eureka, City of Arcata, HWMA
9	David Boyd - RCEA, Jim Zoellick - SERC	SERC	

GLOSSARY
Specific terms and acronyms used throughout this scope of work are defined as follows:

Term/ Acronym	Definition
CPR	Critical Project Review
HSU	Humboldt State University
HTA	Humboldt Transit Authority
HWMA	Humboldt Waste Management Authority
IMPLAN	An economic impact assessment modeling tool.
MSEI	Marubeni Sustainable Energy, Inc.
PAC	Project Advisory Committee
PG&E	Pacific Gas and Electric Company
PIER	Public Interest Energy Research
RCEA	Redwood Coast Energy Authority
RD&D	Research, Development and Demonstration
RESCO	Renewable-based Energy Secure Community
SERC	Schatz Energy Research Center

Problem Statement:
If California is to meet its aggressive greenhouse gas reduction and renewable energy goals, select communities will need to become early adopters and set an example for other communities to follow. Humboldt County shows great potential to become a near-term renewable energy secure community (RESCO). Humboldt County already receives nearly half its electricity from local, biomass-fired power plants, and has a wealth of undeveloped renewable resources, including wind and wave resources. The Humboldt County Energy Element Appendices: Technical Report, prepared in October 2005 by the Schatz Energy Research Center at Humboldt State University, found that Humboldt County's renewable energy resources could meet all of the county's energy needs for electricity, transportation, and heating.

There are also strong commitments from the community to work to develop these resources and steps have been taken to that end. The County has developed an Energy Element as part of its General Plan Update, and two local cities and the County have joined the Cities for Climate Protection program and are pursuing greenhouse gas reduction activities. The Redwood Coast Energy Authority (RCEA), a joint powers authority, was formed in 2003 to develop and implement sustainable energy initiatives. What the community is lacking is a detailed assessment of its resources and a corresponding strategic plan for their orderly, capital efficient development. RCEA will create a plan for developing an integrated mix of renewable energy resources coupled with energy efficiency, demand management, and other grid-integration technologies that best meets the county's needs and best captures the environmental, economic, and social benefits for the County.

Currently the greatest barrier to Humboldt County's pursuit of RESCO status is a lack of strategic information. The County is geographically isolated and is essentially like an island in the electric grid. The normally available capacity of the transmission lines (approximately 70 MW) that connect Humboldt County to the larger grid is less than half of the County's peak electrical demand (168 MW in 2007 and 2008). For this reason, Humboldt County needs to be treated like a micro-grid; loads and resources must be well balanced. This makes Humboldt County a perfect candidate to become a RESCO. It also means that the local development of intermittent renewable energy resources must be done carefully and strategically. While the 2005 Technical Report made a gross assessment of Humboldt County's renewable energy resources, it did not examine their time varying nature or their potential effect on the local electric grid. The following types of strategic information must be obtained and utilized in order for Humboldt County to successfully pursue RESCO status:

Technological

- Assessment of time varying availability of renewable resources and their coincidence with local electrical demand,
- Assessment of grid integration technology options and how they could be applied (including smart grid technologies, energy storage, electric vehicles, and hydrogen production),
- Assessment of electric grid infrastructure and its capacity to support the development of new renewable energy resources.

Economic and Regulatory

- Assessment of which technology and resource options are cost-effective and feasible, and what mix is optimal,
- Assessment of what sort of phased development should be pursued,
- Assessment of what financing, development, and ownership options are both possible within the existing regulatory framework and economically feasible for the community, and
- Assessment of the priorities and agendas of key stakeholders with regard to renewable energy development.

Through this RESCO exploratory project RCEA will develop the necessary information and prepare a Renewable Energy Secure Community strategic plan for Humboldt County. The strategic planning model will be documented in a planning workbook and replicable by other California communities.

Goals of the Agreement:
The goal of this Agreement is to develop a strategic plan for Humboldt County to develop its local renewable energy resources in an effort to meet 75% to 100% of the local electricity demand as well as a significant fraction of heating and transportation energy needs. The plan will assess a full range of renewable resources and will identify an integrated mix that can be coupled with energy efficiency and demand management to best meet the county's needs and best capture associated environmental, economic, and social benefits. The plan will lay out a long-term development strategy and will identify the near-term next steps the County should take.

Objectives of the Agreement:
The objectives of this Agreement are to:

- Identify and assess various integrated mixes of renewable energy resources and technology options that will allow Humboldt County to meet most or all of its electricity needs and a large fraction of its heating and transportation energy needs using locally available renewable energy resources;
- Identify and assess renewable energy resources and technology options that are currently ready for commercial development, as well as those that offer promise for long-term development;
- Identify integrated renewable energy resource and technology options that will function acceptably on Humboldt County's local electricity grid;
- Identify possible development structures and financing and ownership options that could accelerate the development of local renewable energy resources and technology options;
- Conduct an economic analysis of these various resource and technology options and identify the most favorable solutions that optimize environmental, economic and societal benefits for the community;
- Identify potential regulatory and political hurdles that will need to be overcome to allow for comprehensive renewable resource development and propose possible solutions;
- Identify and engage key stakeholders and develop a plan to successfully cultivate community support;
- Compile this information into a succinct, action oriented strategic plan that reports the study's findings and lays out a clear path to move the community forward in developing its renewable energy resources; and
- Document the RESCO strategic planning model in a workbook that can be used by other communities seeking RESCO status.

Product Guidelines:
For complete product guidelines, refer to Section 5 in the Terms and Conditions.

TASK 1 ADMINISTRATION

Task 1.1 Attend Kick-off Meeting

The goal of this task is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a "Kick-Off" meeting with the Commission Project Manager, the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the Commission Project Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Project Manager will provide an agenda to all potential meeting participants.

  The administrative portion of the meeting shall include, but not be limited to, the following:
  - Discussion of the terms and conditions of the Agreement
  - Discussion of Critical Project Review (Task 1.2)
  - Match fund documentation (Task 1.6)
  - Permit documentation (Task 1.7)

  The technical portion of the meeting shall include, but not be limited to, the following:
  - The Commission Project Manager's expectations for accomplishing tasks described in the Scope of Work
  - An updated Schedule of Products
  - Discussion of Progress Reports (Task 1.4)
  - Discussion of Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
  - Discussion of the Final Report (Task 1.5)

  The Commission Project Manager shall designate the date and location of this meeting.

Recipient Products:

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

Commission Project Manager Product:

- Kick-Off Meeting Agenda

Task 1.2 Critical Project Review (CPR) Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Recipient. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Project Manager and as shown in the Technical Task List above. However, the Commission Project Manager may schedule additional CPRs as necessary, and any additional costs will be borne by the Recipient.

Participants include the Commission Project Manager and the Recipient and may include the Commission Grants Officer, the Public Interest Energy Research (PIER) Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Project Manager to provide support to the Energy Commission.

The Commission Project Manager shall:

- Determine the location, date, and time of each CPR meeting with the Recipient. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. Modifications to the Agreement may require a formal amendment (please see the Terms and Conditions). If the Commission Project Manager concludes that satisfactory progress is not being made, this conclusion will be referred to the Energy Commission's Research, Development and Demonstration (RD&D) Policy Committee for its concurrence.
- Provide the Recipient with a written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more product(s) that were included in the CPR.

The Recipient shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other products identified in this scope of work. The Recipient shall submit these

documents to the Commission Project Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Commission Project Manager Products:
- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

Recipient Products:
- CPR Report(s)
- Participate in CPR Meetings (Task 2 and 5)

Task 1.3 Final Meeting

The goal of this task is to closeout this Agreement.

The Recipient shall:
- Meet with Energy Commission staff to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

  This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the Commission Project Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Project Manager.

  The technical portion of the meeting shall present an assessment of the degree to which project and task goals and objectives were achieved, findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The Commission Project Manager will determine the appropriate meeting participants.

  The administrative portion of the meeting shall be a discussion with the Commission Project Manager and the Grants Officer about the following Agreement closeout items:
  - What to do with any equipment purchased with Energy Commission funds (Options).
  - Energy Commission's request for specific "generated" data (not already provided in Agreement products).
  - Need to document Recipient's disclosure of "subject inventions" developed under the Agreement.
  - "Surviving" Agreement provisions, such as repayment provisions and confidential Products.

- Final invoicing and release of retention.
- Prepare a schedule for completing the closeout activities for this Agreement.

Products:

- Written documentation of meeting agreements
- Schedule for completing closeout activities

Task 1.4 Monthly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

The Recipient shall:

- Prepare a Monthly Progress Report which summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Project Manager within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in the terms and conditions of this Agreement.

Products:

- Monthly Progress Reports

Task 1.5 Final Report

The goal of the Final Report is to assess the project's success in achieving its goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further RD&D projects and improvements to the PIER project management processes.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

The Recipient shall:

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the approved outline and the latest version of the PIER Final Report guidelines published on the Energy Commission's website at **http://www.energy.ca.gov/contracts/pier/contractors/index.html** at the time the Recipient begins performing this task, unless otherwise instructed in writing by the Commission Project Manager. Instead of the timeframe listed in the Product Guidelines located in Section 5 of the Terms and Conditions, the Commission Project Manager shall provide written comments on the Draft Final Report within fifteen (15) working days of receipt. The Final Report must be completed on or before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

Products:

- Draft Outline of the Final Report
- Final Outline of the Final Report
- Draft Final Report
- Final Report

Task 1.6 Identify and Obtain Matching Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the PIER budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Project Manager at least 2 working days prior to the kick-off meeting. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts,

then state such in the letter. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter a list of the match funds that identifies the:

  - Amount of each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
  - Amount of each in-kind contribution, a description, documented market or book value, and its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.

- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Project Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Project Manager within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR.

Products:

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)
- Letter that match funds were reduced (if applicable)

Task 1.7 Identify and Obtain Required Permits

The goal of this task is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track.

Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement. Although the PIER budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditures for which a permit is required.

The Recipient shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Project Manager at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies the:
    - Type of permit,
    - Name, address and telephone number of the permitting jurisdictions,
    - or lead agencies.
- The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule and the copies of the permits. The implications to the Agreement if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide the appropriate information on each permit and an updated schedule to the Commission Project Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Project Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Project Manager within 5 working days. Either of these events may trigger an additional CPR.

Products:

- Letter documenting the permits or stating that no permits are required
- A copy of each approved permit (if applicable)
- Updated list of permits as they change during the term of the Agreement (if applicable)
- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)

PROFESSIONAL ADVISORY COMMITTEE (PAC)

Task 1.8 Establish the PAC

The goal of this task is to create an advisory committee for this Agreement.

The PAC shall be composed of diverse professionals. The number can vary depending on potential interest and time availability. The Recipient's Project Manager and the Commission Project Manager shall act as co-chairs of the PAC. The exact composition

of the PAC may change as the need warrants. PAC members serve at the discretion of the Commission Project Manager.

The PAC may be composed of, but is not limited to, qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter.
- Members of the trades who will apply the results of the project (for example, designers, engineers, architects, contractors, and trade representatives).
- Public Interest Market Transformation Implementers.
- Product Developers relevant to project subject matter.
- U.S. Department of Energy Research Manager.
- Public Interest Environmental Groups.
- Utility Representatives.
- Members of the relevant technical society committees.

The purpose of the PAC is to:

- Provide guidance in research direction. The guidance may include scope of research; research methodologies; timing; coordination with other research. The guidance may be based on:
  - Technical area expertise.
  - Knowledge of market applications.
  - Links between the agreement work and other past, present or future research (both public and private sectors) they are aware of in a particular area.
- Review products. Provide specific suggestions and recommendations for needed adjustments, refinements, or enhancement of the products.
- Evaluate tangible benefits to California of this research and provide recommendations, as needed, to enhance tangible benefits.
- Provide recommendations regarding information dissemination, market pathways or commercialization strategies relevant to the research products.

The Recipient shall:

- Prepare a draft list of potential PAC members that includes name, company, physical and electronic address, and phone number and submit it to the Commission Project Manager at least 2 working days prior to the kick-off meeting. This list will be discussed at the kick-off meeting and a schedule for recruiting members and holding the first PAC meeting will be developed.
- Recruit PAC members and ensure that each individual understands the member obligations described above, as well as the meeting schedule outlined in Task 1.9.
- Prepare the final list of PAC members.
- Submit letters of acceptance or other comparable documentation of commitment for each PAC member.

Products:

- Draft List of PAC Members
- Final List of PAC Members
- Letters of acceptance, or other comparable documentation of commitment for each PAC Member

Task 1.9 Conduct PAC Meetings

The goal of this task is for the PAC to provide strategic guidance to this project by participating in regular meetings or teleconferences.

The Recipient shall:

- Discuss the PAC meeting schedule at the kick-off meeting. The number of face-to-face meetings and teleconferences and the location of PAC meetings shall be determined in consultation with the Commission Project Manager. This draft schedule shall be presented to the PAC members during recruiting and finalized at the first PAC meeting.
- Organize and lead PAC meetings in accordance with the schedule. Changes to the schedule must be pre-approved in writing by the Commission Project Manager.
- Prepare PAC meeting agenda(s) with back-up materials for agenda items.
- Prepare PAC meeting summaries, including recommended resolution of major PAC issues.

Products:

- Draft PAC Meeting Schedule
- Final PAC Meeting Schedule
- PAC Meeting Agenda(s) with Back-up Materials for Agenda Items
- Written PAC meeting summaries, including recommended resolution of major PAC issues

TECHNICAL TASKS

Unless otherwise provided in the individual Task, the Recipient shall prepare all products in accordance with the requirement in the Special Conditions.

TASK 2 ASSESS RESOURCE AND TECHNOLOGY OPTIONS

The goal of this task is to identify various integrated mixes of renewable energy resources and technology options that will allow Humboldt County to meet most or all of its electricity needs and a significant fraction of its heating and transportation energy needs using locally available renewable energy resources. This will include modeling a spectrum of resource mix options, assessing their impact on the local electrical grid, and identifying options that will function acceptably on the local grid. Both near-term and long-term options will be identified and considered.

The Recipient shall:

- Conduct a review of available literature and information regarding integration of renewable energy resources into the electrical grid. This will include a review of grid integration technologies such as smart grid, energy storage, and demand response technologies.
- Compile data on existing energy infrastructure. Investigate the potential to increase the efficiency of existing power production and transmission.
- Identify the major renewable energy resources available in the county and assess the readiness and availability of the associated technology options. These resources will include wind, biomass, wave, landfill gas, solar, small hydro, and biogas.
- Identify technologies that can facilitate integration of renewable energy technologies on the electrical grid and assess their commercial readiness and availability. This will include grid integration technologies such as smart grid, energy storage, and demand response technologies.
- Estimate the potential to lower energy consumption and demand using energy efficiency and conservation measures.
- Obtain required data and develop stochastic time series availability models of local renewable energy resources.
- Obtain energy demand data from PG&E and develop stochastic time series models of energy demand for Humboldt County. Assess the impact of energy efficiency, conservation and demand management technologies on the profile. Develop demand scenarios for 10, 20 and 30 years into the future.
- Using a single node model, simulate the time varying supply and demand characteristics for various renewable energy resource mix options and assess their impact on the local electrical grid.
- Examine the ability of energy storage, smart grid, demand response, and transportation fuel production technologies to allow for fuller development of renewable energy resources on the local electrical grid. This will include an assessment of plug-in hybrid and all electric vehicles, hydrogen fuel production, heat pumps with heat storage for space and water heating, and cold storage for refrigeration.
- Develop a set of local renewable energy supply portfolios that meet 75% to 100% of the local electricity demand as well as a large fraction of heating and transportation energy needs. Develop a staged implementation schedule to progressively increase the proportion of energy consumption met by local renewable resources.
- For 1 or 2 preferred scenarios identified in Task 4, work with PG&E to assess the ability of the local grid to handle new renewable energy generation sources in combination with demand reduction measures and storage/transportation options. This preliminary assessment will involve a steady-state power flow analysis and a spot transient stability analysis for a few key hours and will identify the need for major transmission system upgrades.

- Assess the greenhouse gas reduction and other environmental health and safety benefits associated with the energy mix options considered.
- Assess the load following and dispatchability benefits associated with various energy mix options.
- Conduct preliminary assessment of the potential for forest-based biofuels production and utilization. This will include a resource assessment, evaluation of technology status, and examination of how biofuels might integrate into the RESCO model for Humboldt County.
- Prepare Resource and Technology Assessment Report that summarizes Task 2.
- Participate in CPR Meeting
- Participate in PAC activities (See Task 1.9 for details)

Products:

- Database of Local Renewable Energy Resources (No Draft)
- Database of Current and Projected Energy Demands
- Resource and Technology Assessment Report – Draft and Final Versions
- PAC products (See Task 1.9)

TASK 3 EXAMINE DEVELOPMENT STRUCTURE, FINANCING AND OWNERSHIP OPTIONS

The goal of this task is to critically analyze different business and organizational structures, financing mechanisms, and ownership options that could be used to effectively develop the renewable energy portfolios identified in Task 2.

The Recipient shall:

- Research and critically evaluate alternative mechanisms for facilitating the development of the renewable energy portfolios identified in Task 2. This research will address:
  - An investor-owned utility development model,
  - Public-private partnerships,
  - Other possible development models, including collaborative partnership opportunities with our investor-owned utility (PG&E).
- Research and critically evaluate alternative approaches to financing the renewable energy portfolios identified in Task 2. This research will address:
  - Alternative means for raising financial capital, such as equity, bonds, bank loans, and other means,
  - Up-front sales of carbon credits and other lifecycle benefits and co-benefits.
- Research and critically evaluate alternative ownership structures that could be used for the renewable energy portfolios and related energy infrastructure identified in Task 2. As with the development mechanisms, this research will address:

  - An investor-owned utility ownership model,
  - Public-private partnerships,
  - Other possible ownership models.
- Document findings in a Development Structure, Financing and Ownership Options Memo. This memo will include a compilation of development structure, financing and ownership options as investigated above, and will include a critical analysis of alternatives therein.

Product:

- Development Structure, Financing and Ownership Options Memo (No Draft)

TASK 4 CONDUCT ECONOMIC ANALYSIS

The goal of this task is to conduct a life-cycle economic analysis of the various local renewable energy supply portfolios identified in Task 2 when paired with a development model as identified in Task 3. The analysis will identify the optimal resource and technology solutions that maximize benefits for the community.

The Recipient shall:

- Determine life-cycle costs associated with construction, operation, maintenance, and repair for renewable energy supply portfolios identified in Task 2.
- Create one or more economic impact assessment models applicable to the energy sector of the regional economy. These models will utilize the standard IMPLAN economic impact assessment software tool.
- Apply the above models to assess the economic impact of developing the renewable energy portfolios identified in Task 2. This impact assessment will measure direct job creation, income, and tax revenues, as well as indirect and induced multiplier effects as these direct effects ripple through the local economy.
- Analyze the economic development potential resulting from creating a renewable energy industry cluster in Humboldt County. This will include an evaluation of the potential for renewable energy to improve the local economy by reducing economic leakages associated with importing electricity and transportation and heating fuels from outside Humboldt County.
- Consider market and policy interactions that influence micro-grid energy prices and import/export interaction with the greater California grid.
- Assess the costs of achieving a given unit of carbon/climate change benefit as well as other quantifiable environmental benefits/impacts.
- Consider the avoided costs of new fossil power development and energy imports.
- Consider avoided or added costs of infrastructure upgrades (electrical transmission grid, natural gas pipeline).

- Conduct a cost-benefit analysis of using renewable electricity to generate hydrogen for use as a transportation fuel and to charge electric vehicles (plug-in hybrids or all-electric vehicles).
- Identify least-cost renewable energy supply options that meet community goals for renewable power development.
- Prepare Economic Analysis Report that summarizes Task 4.

Product:

- Economic Analysis Report – Draft and Final Versions

TASK 5 EXAMINE REGULATORY AND POLITICAL ISSUES

The goal of this task is to fully describe the regulatory and political environment in which a renewable energy portfolio on a local micro-grid must operate and to identify regulatory barriers that may inhibit RESCO development and may require administrative or legislative action to resolve.

The Recipient shall:

- Fully characterize the regulatory environment that governs the development and operation of electrical power generators and the flow of power on the electrical power grid. This will include:
  - A description of the regulatory agencies with authority over permitting and licensing of new energy generating facilities and a description of the permitting and licensing processes, and
  - A description of regulatory agencies with authority over power generation, transmission and pricing and a description of how these regulatory processes work.
- Identify critical regulatory barriers that may inhibit RESCO development.
- Identify specific administrative or legislative actions that could reduce RESCO development barriers.
- Identify RESCO development activities that require local policymaker action and conduct a political analysis that assesses the prospects and strategies for local success.
- Describe regulatory and political environment and potential RESCO development barriers, and proposed administrative or legislative actions in a Regulatory and Political Issues Memo.
- Develop an Energy Policy and Regulatory Guide for Local Government Officials that informs, empowers and inspires officials to further their community's RESCO vision.
- Participate in CPR Meeting
- Participate in PAC activities (see Task 1.9 details).

Products:

- Regulatory and Political Issues Memo (No Draft)
- Energy Policy and Regulatory Guide for Local Government Officials – Draft and Final Versions
- PAC Products (See Task 1.9)

TASK 6 CONDUCT STAKEHOLDER ANALYSIS

The goal of this task is to identify key stakeholders in the development of Humboldt County as a RESCO and to gather their input regarding preferred options, goals and issues regarding RESCO development.

The Recipient shall:

- Develop a list of key RESCO stakeholders (e.g., local governments, electric and gas utility company, transit authorities, HWMA, environmental organizations, business and community groups, Native American Tribes, etc.).
- Based on the results of Tasks 2 through 5, develop a set of RESCO options and an overall RESCO vision for Humboldt County that can be shared with stakeholders.
- Develop a multi-criteria decision support framework that utilizes weighted criteria to capture stakeholder values.
- Conduct stakeholder focus groups. Inform stakeholders about Humboldt County's RESCO opportunities and solicit their input regarding the strengths and weaknesses of various options.
- Analyze stakeholder's interests and assess their influence over RESCO development.
- Develop strategies for securing stakeholder support of RESCO development.
- Prepare Stakeholder Analysis Memo that summarizes Task 6.

Product:

- Stakeholder Analysis Memo (No Draft)

TASK 7 DEVELOP STRATEGIC PLAN AND IDENTIFY NEXT STEPS

The goal of this task is to develop a strategic plan for securing Humboldt County's RESCO future. The strategic plan will present an overview of Humboldt County's RESCO options and will identify preferred options as determined in Tasks 2 through 6. The plan will include a roadmap for pursuing the preferred options and will identify the next steps that need to be taken, including pursuit of pilot scale projects to further the RESCO vision.

The Recipient shall:

- Describe the Humboldt County RESCO strategic planning process and resulting vision.
- Develop an overview of Humboldt County's RESCO options and identify the preferred options.
- Identify near-term pilot scale projects that should be pursued to advance the RESCO vision.

- Develop a roadmap and timeline for pursuing preferred RESCO options.
  - Identify key tasks and milestones.
  - Identify measurable outcomes.
  - Identify the responsible party.
  - Identify possible funding sources and mechanisms.
- Identify key factors that could affect achievement of goals and objectives.
- Develop a framework and schedule for program evaluation.
- Present the RESCO strategic plan to the RCEA Board, County Board of Supervisors, and other interested parties and discuss next steps to further the RESCO vision.

Product:

- Humboldt County RESCO Strategic Plan – Draft and Final Versions

TASK 8 TECHNOLOGY TRANSFER ACTIVITIES

The goal of this task is to develop a community outreach and education plan that will engage the community and secure broad community support for development of Humboldt County as a RESCO.

The Recipient shall:

- Develop a community outreach plan to share Humboldt County's RESCO vision and engage the community.
- Develop plans to engage local municipalities in the RESCO plan and identify actions they can take to promote the plan.
- Develop plans for a media outreach campaign.
- Develop a PowerPoint presentation and brochure describing the Humboldt County RESCO strategic planning process and resulting strategic plan.
- Conduct a "town hall" type meeting to share the RESCO vision with the community.

Products:

- Community Outreach Plan (No Draft)
- RESCO PowerPoint Presentation
- RESCO Outreach Brochure

TASK 9 PRODUCTION READINESS PLAN

The goal of the plan is to develop a RESCO planning workbook that documents Humboldt County's RESCO strategic planning process. This workbook will allow other communities to learn from Humboldt County's experience and employ similar strategic planning methods in their pursuit of RESCO status.

The Recipient shall:

- Document the RESCO strategic planning process as it is developed and carried out.
- Develop a simple workbook that lays out Humboldt County's RESCO planning process. Briefly describe the key work tasks that were carried out as part of the project, identify key partners and stakeholders, identify key background information sources, and list data needed for the analyses.
- Include a list of key contacts that were involved with the Humboldt RESCO planning process.
- Prepare a draft and final RESCO Planning Workbook.

Product:

- RESCO Planning Workbook - Draft and Final Versions