2 EXECUTIVE SUMMARY

Rogue Valley Council of Governments (RVCOG) in collaboration with Geos Institute, Energy Trust of Oregon, City of Ashland, and Jackson Soil and Water Conservation District (JSWCD) contracted with Good Company to conduct a Renewable Energy Assessment (REA) for Jackson and Josephine counties. The purpose of the REA is to review existing renewable energy projects and assess the potential for new renewable energy generation development that can create jobs, increase local energy security, buffer local economies from energy price volatility, reduce fossil-fuel dependency, and reduce the associated greenhouse gas and local emissions. This assessment considers the following power generation resources:

- Energy efficiency
- Solar electric
- Wind
- Direct-fired biomass
- Landfill gas
- Anaerobic digestion
- Hydroelectric
- Geothermal

This study provides a foundation of knowledge for planning economic development strategies around renewable energy generation opportunities. The project sponsors (listed above) intend to convene work groups of local experts on the various technologies as well as those that have an interest in renewable energy development in Jackson and Josephine counties.

Approach and Deliverables

This study combines *existing, publically available research and data* with interviews of state experts, business people, government officials, and other stakeholders in Oregon and specifically, in Jackson and Josephine counties to assess local potential for renewable energy development opportunities.

The following criteria were used to assess each technology. The results are summarized in Figure ES-2.

- Energy type
- Existing resource capacity
- Resource potential
- Employment potential (for select resources)
- Likely technology for each resource
- Risks and challenges
- Benefits and opportunities
- Levelized cost
- Energy return on energy invested (EROEI)
- Carbon intensity

In addition to this report, the consultant team will prepare a separate, in-depth study on anaerobic digestion (AD), which will be available in early 2012. The AD study provides an inventory of the available AD feedstocks in southern Oregon and assesses potential utilization scenarios.

Market Context and Drivers

A number of overarching factors converge to impact the development of renewable energy development. Many of these factors are dynamic, but are critical drivers of renewable energy development.

- **Connection to the electrical grid** can be challenging for large-scale generation projects based on the available infrastructure, line capacity, required upgrades, and the cost of interconnection studies.
- **Financing instruments** exist for energy production and can be as simple as debt financing, but are often more complex and intertwined with incentives. **Incentives** are ever changing, but encourage renewable energy investments.
- **Policies and regulations** are being designed at all levels of government to reduce the carbon intensity of electricity generation and fuel production.
- **Prices of electricity** will rise over time, making renewable generation more economically viable as their manufacture scales up.

Findings

The high-level findings of the analysis are shown in Figures ES1 and ES2. Figure ES1 shows the annual quantity of electricity consumed in Jackson and Josephine counties (orange bar) set next to the existing (dark green) and potential (light green) of local renewable energy generation and resources. Existing generation capacity (dominated by hydropower) makes up the largest portion of generation, followed by the unrealized potential of the area's energy efficiency resource. In addition to being the area's largest untapped resource, energy efficiency will also produce the greatest number of jobs per unit of investment and distributes economic benefits most equitably across all segments of the public and private sectors as well as across socio-economic status.

A second tier of generation potential is represented by wind, solar, and biomass followed by a third tier represented by hydropower and anaerobic digestion. Two of the technologies assessed in this study, landfill gas and geothermal, were excluded due to lack of available resources for electricity generation.

The generation potentials shown in Figure ES-1 do not represent the maximum generation potential for each of the technologies; rather they represent an average or achievable portion of that maximum (see ES-2 for details). While this assessment highlights feasible projects and resources, it is important to keep in mind that each of these technologies has associated risks and opportunities. The findings of this study serve as a starting point for further studies by the renewable energy working groups being convened by RVCOG.

Figure ES-1: Existing electricity use in the study area compared to existing renewable generation and future potential.

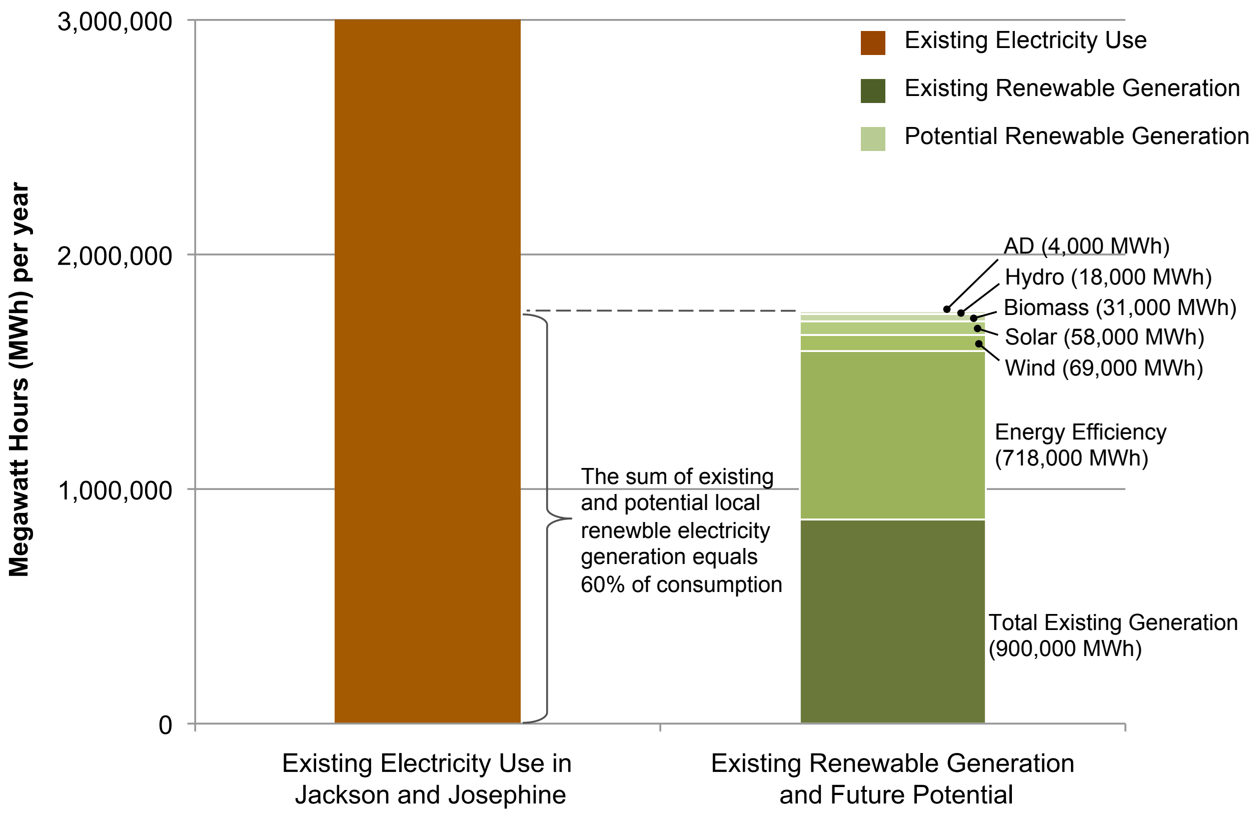

Figure ES-2 summarizes the findings of this study for each of the renewable technologies according to the applied assessment criteria. This figure is meant to provide a relative apples-to-apples comparison across the spectrum of technologies to provide the community with the information required to make an informed decision about which technologies to pursue.

The following points summarize the findings for each technology:

Energy Efficiency: The various technologies and practices that make up energy efficiency and conservation represent the greatest potential for the area over the next 20 years combined with the lowest levelized-cost and highest return on investment. There are few barriers to entry; a wide array of projects are possible for all economic sectors and the economic benefits associated with the savings are accessible to anyone who can change a light bulb. The primary risks are high first costs for certain types of projects, poor access to financing vehicles, and a lack of readily available, high-quality and understandable information to compare and contrast the cost/benefit of ownership for similar products.

Solar: Solar energy is abundant and small-scale distributed photovoltaic (PV) panels have few barriers to entry. The primary barrier is first cost, but recent trends and future projections show the costs of materials and labor are rapidly decreasing. As costs decrease, this technology will become a viable opportunity to a greater number of residents and businesses. Like energy efficiency, small-scale solar has the potential to distribute economic benefits more broadly than utility-scale projects. While the technical potential is near limitless, larger utility-scale systems pose greater challenges associated with land use, permitting, and electricity grid interconnection. Thermal energy generation is not the focus of this assessment it's important to note that solar water heating also represents a significant opportunity.

Wind: While this resource is limited to ridgelines in Jackson and Josephine counties, its potential is large compared to other technologies. The downside is that many of the ridgelines with the highest wind energy are undesirable due to lack of site access, disturbance to local view sheds, and lack of access to the electrical grid. One ridgeline was identified as promising in terms of potential resource, site access, and interconnection, but there may be significant challenges associated with land ownership, as the area is a mix of public and private lands. More study of this site will be required to determine final feasibility.

Biomass: Biomass is already a significant source of electricity in the Rogue Valley. Based on the additional available feedstock resource in the area, existing generation capacity could theoretically be expanded, but is constrained by high feedstock acquisition costs, availability, and wholesale price of electricity. While there is unused feedstock technically available in the area, a new biomass plant faces high feedstock acquisition cost, regulatory compliance, permitting, land use, and environmental challenges. A second option for biomass is building level boiler conversions to meet direct thermal loads. This option has fewer risks than would be faced by utility-scale electricity generation.

Hydroelectric: Hydroelectricity is by far the largest source of existing, renewable power in the area. While there is abundant kinetic energy available from moving water in the area, the access to this resource is heavily limited by habitat alteration regulations, and water rights. New large hydroelectric dams are unlikely at best. The greatest opportunity for this technology is incremental efficiency projects, such as adding electricity generation to existing flood control dams, water supply lines, or irrigation canals. A few projects are identified in this report, but the combined scale is relatively small.

Anaerobic Digestion: While the generation potential associated with this technology is relatively small, it represents an opportunity to make more efficient use of existing organic wastes (i.e., food waste, yard waste and manure) compared to a landfill gas collection system. This technology will be assessed in detail in a separate, but related study. This additional study consists of a feedstock inventory and evaluation of several potential scenarios to determine feasibility of a local anaerobic digester.

Geothermal: Geothermal is excluded from consideration due to its lack of available resources in Jackson and Josephine counties. Based on available data, the geothermal resources in Jackson and Josephine counties would not be effective for electricity generation. The research implies that there is no cause to fund further exploration of this technology. However, there is potential for distributed thermal applications (such as ground-source heat pumps or greenhouse use).

Landfill gas (LFG): LFG is excluded from consideration due to its lack of an available, cost-effective resource. The only active landfill in Jackson and Josephine counties is Dry Creek Landfill, which already has a gas collection system in place that generates electricity. The gas is also being evaluated for use as a vehicle fuel for Dry Creek Landfill's fleet. The biogas production from the other closed landfills in the area are unlikely to justify the capital cost associated with constructing a new gas collection system given the age of these landfills and the likelihood that most of their useful gas has already been released to the atmosphere.

Figure ES-2: Summary of renewable energy technologies, by feasibility criteria.

Category	Energy Efficiency	Solar	Wind	Biomass	Hydroelectric	Anaerobic Digestion	Geothermal	Landfill Gas
Energy Type	Baseload; Peak matched	Intermittent; Peak matched	Intermittent	Baseload or Dispatchable	Baseload or Dispatchable	Baseload	Baselaod	Baselaod
Existing Resource	8 MW (2002–2008 projects only)	2.1 MW	0 MW	32 MW	121 MW	0.7 MW	0.5 MWe (thermal energy)	3.2 MW
Additional Potential	64 – 100 aMW[2] (560,000 – 876,000 MWh / year)	35 MW[3] (58,000 MWh)	27 MW[4] (68,000 MWh)	5 – 14.5 MW[5] (30,000 – 96,000 MWh / year)	2.4 MW[6] (18,000 MWh / year)	0.5 MW[7] (4,000 MWh / year)	0 MW[8]	0 MW[9]
Risk	First costs; Lack of understandable, comparable information on benefits; Lack of financing vehicles	High first cost; Incentives uncertainty; Land use and utility interconnection (large-scale systems only)	Noise; Aesthetic issues; Land use and ownership; Development of remote areas; Utility interconnection; Raptor mortalities	Air emissions; Ash; Odor; Noise; Ability to source cost-effective feedstocks; Utility interconnection; Loss of soil nutrients; Potential for Habitat disturbance; Carbon-neutrality questioned	Water rights; disruption to water system (turbidity, temperature, habitat); Variable fuel source; Utility interconnection	Ability to cost-effectively source and separate feedstock; Air emissions; Odor; Permits	Lack of resource; Fluid disposal and risk of ground water contamination; Development of pristine areas; Water rights; Zoning; High exploration costs	Low resource potential; Air emissions; Utility interconnection: Permits
Benefit	Displaces need for generation and emissions; Cost savings for utility customers; Various financial incentives; 17 jobs per $1 million[1]	No air emissions; Carbon neutral during operation; Various incentives; Generates RECs; low cost of operation; 14 jobs per $1 million	No air emissions; Carbon neutral; Various financial incentives; Generates RECs; 3 jobs per $1 million	Displaces emissions from open burning; Reduces wildfire risks; Various financial incentives; supports existing industry, Currently generates RECs; 11 jobs per $1 million	Carbon neutral during operation; Low-impact hydro generates RECs; Various incentives	Generates soil nutrient products; More efficient gas capture compared to landfills; Generates RECs and Carbon Credits; Various incentives	No air emissions; Carbon neutral; Generates RECs; Various incentives	Reduced risk, odor and release of methane (a powerful greenhouse gas); Generates RECs and Carbon Credits
Levelized Cost ($/ MWh)	$0 - $106 (average <$35)	$90 - $154	$44 - $91	$65 - $151	Incremental: $10 - $98 Small and Micro: $57 - $136	$36 - $115	$42 - $69	$50 -$81
Energy Return	Not available	3 - 6	18 - 34	3 - 27	170 - 280	3 - 20	2 - 13	Not available
Carbon Intensity[2]	Not available	50 – 59 kg CO_2 / MWh	6 – 14 kg CO_2 / MWh	Not available	3 – 23 kg CO_2/ MWh	120 kg CO_2 / MWh	23 - 122 kg CO_2 / MWh	101 kg CO_2 / MWh

RECs = Renewable Energy Certificates

Note 1: Jobs are presented per $1 million dollars invested in each technology. This analysis was only performed for EE, solar, wind, and biomass. See Appendix A for details.

Note 2: For reference, the Northwest Power Pool (Oregon's regional electricity grid) average carbon intensity is 390 kg CO_2e / MWh.

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[2] These values represent the range of potential over the next 20 years. The point value used in Figure ES-1 represents the mid-point of this range.

[3] This value represents a scenario where 5% of total roof area suitable for solar installations has installations of solar PV panels (assuming current PV panel efficiency).

[4] This value represents the Shale City project described in the wind section of Chapter 6.

[5] This range is based on technically available feedstock estimates. The point value is based on lower end of this estimate and represents electricity generation from currently obtainable feedstock. This feedstock is not currently a cost effective electricity generation resource at $65 per bone dry ton, but future market conditions may make it viable.

[6] This value represents the potential of electricity generation added to Emigrant Dam and projects found to be feasible in Talent Irrigation district.

[7] This value represents the estimated electricity generation based on the most feasible feedstock sources (food processing, supermarkets, and schools).

[8] No electricity generation resources are available in the study area, but thermal resources are available.

[9] The existing biogas resource is already utilized at Dry Creek Landfill to generate electricity. No other cost-effective resources are available at the closed landfills in the area.