

Chapter 6 - Appendix B

Characterization Data – Renewable Resources¹

Resource Option	Renewable Resource	Operations Mode	Technology Description	Plant Output, MW	Heat Rate HHV, Btu/kWh	Assumed Fuel Type/ Source	Fuel Flexibility	Technology Maturity	Permitting, months	NTP to COD, months	Assumed Annual Capacity Factor, %	Forced Outage Rate, %
Regional Wind	Wind	Intermittent	Wind	1000	n/a	n/a	n/a	Mature	36 to 60	12	45%	n/a
Missouri Wind	Wind	Intermittent	Wind	700	n/a	n/a	n/a	Mature	36 to 60	12	40%	n/a
Solar	Solar PV	Intermittent	PV	13.2	n/a	n/a	n/a	Mature	12 to 18	15	19%	1%
Co-firing (St. Louis Region)	Biomass	Baseload	Existing Host	28.8	10,125	Wood	Yes	Mature	12 to 18	12	85%	8%
Poultry-litter Standalone (Monett Region)	Biomass	Baseload	Sub Critical	29.6	14,500	Wood/Litter	Yes	Mature	18 to 24	32	80%	10%
Wood-fired Standalone (Ellington Region)	Biomass	Baseload	Sub Critical	13.5	14,500	Wood	Yes	Mature	18 to 24	32	80%	10%
Mississippi L&D 21	Hydro	Baseload	Hydro	6	n/a	n/a	n/a	Mature	21 to 27	24	62%	3%
Mississippi L&D 22	Hydro	Baseload	Hydro	8	n/a	n/a	n/a	Mature	21 to 27	24	56%	3%
Mississippi L&D 24	Hydro	Baseload	Hydro	30	n/a	n/a	n/a	Mature	21 to 27	24	58%	3%
Mississippi L&D 25	Hydro	Baseload	Hydro	30	n/a	n/a	n/a	Mature	21 to 27	24	52%	3%
Mississippi L&D 26	Hydro	Baseload	Hydro	75	n/a	n/a	n/a	Mature	21 to 27	24	55%	3%
Clearwater	Hydro	Baseload	Hydro	5.3	n/a	n/a	n/a	Mature	21 to 27	24	40%	3%
Pomme De Terre	Hydro	Baseload	Hydro	4.6	n/a	n/a	n/a	Mature	21 to 27	24	60%	3%
IESI Champ (expansion)	LFG	Baseload	CT	3.7	12,250	LFG	No	Mature	12 to 18	15	90%	8%
Maple Hill	LFG	Baseload	RICE	4	13,750	LFG	No	Mature	12 to 18	15	90%	8%
IESI Timber Ridge	LFG	Baseload	RICE	3	13,750	LFG	No	Mature	12 to 18	15	90%	8%
Lemons East	LFG	Baseload	RICE	3	13,750	LFG	No	Mature	12 to 18	15	90%	8%
Eagle Ridge	LFG	Baseload	RICE	2	13,750	LFG	No	Mature	12 to 18	15	90%	8%
Missouri Pass	LFG	Baseload	RICE	2	13,750	LFG	No	Mature	12 to 18	15	90%	8%
Newton County 1	AD	Baseload	RICE	4.5	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Mercer County 1	AD	Baseload	RICE	3.9	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Putnam County 2	AD	Baseload	RICE	3.2	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Mercer County 2	AD	Baseload	RICE	3	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Putnam County 1	AD	Baseload	RICE	2.5	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Gentry County 1	AD	Baseload	RICE	2.1	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Gentry County 2	AD	Baseload	RICE	2	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Sullivan County 4	AD	Baseload	RICE	2	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Sullivan County 2	AD	Baseload	RICE	1.8	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Lewis County 1	AD	Baseload	RICE	1.7	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Vernon County 1	AD	Baseload	RICE	1.7	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Harrison County	AD	Baseload	RICE	1.6	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Sullivan County 3	AD	Baseload	RICE	1.6	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Lincoln County 1	AD	Baseload	RICE	1.4	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Mercer County 3	AD	Baseload	RICE	1.2	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%
Mercer County 4	AD	Baseload	RICE	1.1	12,000	Digester Gas	No	Mature	12 to 18	12	90%	8%

¹ 4 CSR 240-22.040(1)

Characterization Data – Renewable Resources²

Resource Option	Renewable Resource	Tax Life, years	Economic Life, years	Owner's Cost, %	EPC Capital Cost, \$1,000	EPC Capital, Cost \$/kW	Project Cost - Includes Owners Cost, Excluding AFUDC \$1,000	Total Project Cost- Includes Owners Cost, Excluding AFUDC, \$/kW
Regional Wind	Wind	5	20	5%	1,777,000	1,777	1,865,850	1,866
Missouri Wind	Wind	5	20	5%	1,239,000	1,770	1,300,950	1,859
Solar	Solar PV	5	20	8%	22,819	1,729	24,592	1,863
Co-firing (St. Louis Region) - Note 1	Biomass	7	20	26%	23,533	817	29,646	1,029
Poultry-litter Standalone (Monett Region)	Biomass	7	20	19%	173,236	5,853	206,061	6,962
Wood-fired Standalone (Ellington Region)	Biomass	7	20	19%	108,737	8,055	129,367	9,583
Mississippi L&D 21	Hydro	20	60	22%	26,010	4,335	31,709	5,285
Mississippi L&D 22	Hydro	20	60	22%	29,505	3,688	35,996	4,500
Mississippi L&D 24	Hydro	20	60	22%	182,269	3,645	93,690	4,739
Mississippi L&D 25	Hydro	20	60	22%	76,795	2,560	93,690	3,123
Mississippi L&D 26	Hydro	20	60	22%	191,988	2,560	234,225	3,123
Clearwater	Hydro	20	60	22%	18,336	3,460	22,385	4,224
Pomme De Terre	Hydro	20	60	22%	15,035	3,269	18,355	3,990
IESI Champ (expansion)	LFG	7	20	25%	0	3,730	17,237	4,659
Maple Hill	LFG	7	20	25%	14,602	3,651	18,253	4,563
IESI Timber Ridge	LFG	7	20	25%	11,923	3,974	14,899	4,966
Lemons East	LFG	7	20	25%	11,923	3,974	14,899	4,966
Eagle Ridge	LFG	7	20	25%	8,978	4,489	11,228	5,614
Missouri Pass	LFG	7	20	25%	8,978	4,489	11,228	5,614
Newton County 1	AD	7	15	26%	29,608	6,579	37,296	8,288
Mercer County 1	AD	7	15	26%	25,908	6,643	32,654	8,373
Putnam County 2	AD	7	15	26%	21,632	6,760	27,269	8,522
Mercer County 2	AD	7	15	26%	20,407	6,802	25,724	8,575
Putnam County 1	AD	7	15	26%	17,351	6,940	21,861	8,744
Gentry County 1	AD	7	15	26%	14,898	7,094	18,764	8,935
Gentry County 2	AD	7	15	26%	14,284	7,142	17,998	8,999
Sullivan County 4	AD	7	15	26%	14,284	7,142	17,998	8,999
Sullivan County 2	AD	7	15	26%	13,066	7,259	16,466	9,148
Lewis County 1	AD	7	15	26%	12,448	7,322	15,677	9,222
Vernon County 1	AD	7	15	26%	12,448	7,322	15,677	9,222
Harrison County	AD	7	15	26%	11,835	7,397	14,908	9,317
Sullivan County 3	AD	7	15	26%	11,835	7,397	14,908	9,317
Lincoln County 1	AD	7	15	26%	10,615	7,582	13,371	9,551
Mercer County 3	AD	7	15	26%	9,385	7,821	11,830	9,859
Mercer County 4	AD	7	15	0	8,772	7,975	11,055	10,050

1- Costs are shown as incremental

² 4 CSR 240-22.040(1); 4 CSR 240-22.040(2)

Characterization Data – Renewable Resources³

Resource Option	Renewable Resource	First Year Fixed O&M Cost, \$1,000/yr	First Year Fixed O&M Cost, \$/kW-yr	First Year Variable O&M Cost, \$1,000/yr	First Year Variable O&M Cost, \$/MWh	First Year Fuel Cost, \$/MBtu	NOx, lbm/MMBtu	SO ₂ , lbm/MMBtu	CO ₂ , lbm/MMBtu
Regional Wind	Wind	26,360	26	0	0	n/a	0.00	0	0
Missouri Wind	Wind	18,452	26	0	0	n/a	0.00	0	0
		0	0	0	0				
Solar	Solar PV	211	16	0	0	n/a	0.00	0	0
Co-firing (St. Louis Region) - Note 1	Biomass	1,467	51	0	0	3	0.10	<0.1	carbon neutral
Poultry-litter Standalone (Monett Region)	Biomass	5,026	170	2,642	13	3	0.10	<0.1	carbon neutral
Wood-fired Standalone (Ellington Region)	Biomass	4,398	326	1,602	17	3	0.10	<0.1	carbon neutral
Mississippi L&D 21	Hydro	148	25	0	0	n/a	0.00	0	0
Mississippi L&D 22	Hydro	197	25	0	0	n/a	0.00	0	0
Mississippi L&D 24	Hydro	740	25	0	0	n/a	0.00	0	0
Mississippi L&D 25	Hydro	740	25	0	0	n/a	0.00	0	0
Mississippi L&D 26	Hydro	1,849	25	0	0	n/a	0.00	0	0
Clearwater	Hydro	131	25	0	0	n/a	0.00	0	0
Pomme De Terre	Hydro	113	25	0	0	n/a	0.00	0	0
IESI Champ (expansion)	LFG	436	118	361	12	3	0.20	*	carbon neutral
Maple Hill	LFG	471	118	393	12	3	0.20	*	carbon neutral
IESI Timber Ridge	LFG	382	127	265	11	3	0.20	*	carbon neutral
Lemons East	LFG	382	127	265	11	3	0.20	*	carbon neutral
Eagle Ridge	LFG	382	191	202	13	3	0.20	*	carbon neutral
Missouri Pass	LFG	382	191	202	13	3	0.20	*	carbon neutral
Newton County 1	AD	4,632	1,029	0	0	n/a	0.20	*	carbon neutral
Mercer County 1	AD	4,097	1,051	0	0	n/a	0.20	*	carbon neutral
Putnam County 2	AD	3,396	1,061	0	0	n/a	0.20	*	carbon neutral
Mercer County 2	AD	3,184	1,061	0	0	n/a	0.20	*	carbon neutral
Putnam County 1	AD	2,680	1,072	0	0	n/a	0.20	*	carbon neutral
Gentry County 1	AD	2,295	1,093	0	0	n/a	0.20	*	carbon neutral
Gentry County 2	AD	2,186	1,093	0	0	n/a	0.20	*	carbon neutral
Sullivan County 4	AD	2,186	1,093	0	0	n/a	0.20	*	carbon neutral
Sullivan County 2	AD	1,987	1,104	0	0	n/a	0.20	*	carbon neutral
Lewis County 1	AD	1,894	1,114	0	0	n/a	0.20	*	carbon neutral
Vernon County 1	AD	1,894	1,114	0	0	n/a	0.20	*	carbon neutral
Harrison County	AD	1,800	1,125	0	0	n/a	0.20	*	carbon neutral
Sullivan County 3	AD	1,800	1,125	0	0	n/a	0.20	*	carbon neutral
Lincoln County 1	AD	1,605	1,146	0	0	n/a	0.20	*	carbon neutral
Mercer County 3	AD	1,401	1,167	0	0	n/a	0.20	*	carbon neutral
Mercer County 4	AD	1,296	1,178	0	0	n/a	0	*	carbon neutral

*SO₂ emissions are highly variable. Sulfur in bio-gas can range from 100 ppmvd to 12,000 ppmvd.

³ 4 CSR 240-22.040(1); 4 CSR 240-22.040(2)

Characterization Data – Renewable Resources⁴

Resource Option	Renewable Resource	First Year Fixed O&M Cost, \$1,000/yr	First Year Fixed O&M Cost, \$/kW-yr	First Year Variable O&M Cost, \$1,000/yr	First Year Variable O&M Cost, \$/MWh	First Year Fuel Cost, \$/MBtu	NOx, lbm/MMBtu	SO ₂ , lbm/MMBtu	CO ₂ , lbm/MMBtu
Regional Wind	Wind	26,360	26	0	0	n/a	0.00	0	0
Missouri Wind	Wind	18,452	26	0	0	n/a	0.00	0	0
Solar	Solar PV	211	16	0	0	n/a	0.00	0	0
Co-firing (St. Louis Region) - Note 1	Biomass	1,467	51	0	0	3	0.10	<0.1	carbon neutral
Poultry-litter Standalone (Monett Region)	Biomass	5,026	170	2,642	13	3	0.10	<0.1	carbon neutral
Wood-fired Standalone (Ellington Region)	Biomass	4,398	326	1,602	17	3	0.10	<0.1	carbon neutral
Mississippi L&D 21	Hydro	148	25	0	0	n/a	0.00	0	0
Mississippi L&D 22	Hydro	197	25	0	0	n/a	0.00	0	0
Mississippi L&D 24	Hydro	740	25	0	0	n/a	0.00	0	0
Mississippi L&D 25	Hydro	740	25	0	0	n/a	0.00	0	0
Mississippi L&D 26	Hydro	1,849	25	0	0	n/a	0.00	0	0
Clearwater	Hydro	131	25	0	0	n/a	0.00	0	0
Pomme De Terre	Hydro	113	25	0	0	n/a	0.00	0	0
IESI Champ (expansion)	LFG	436	118	361	12	3	0.20	*	carbon neutral
Maple Hill	LFG	471	118	393	12	3	0.20	*	carbon neutral
IESI Timber Ridge	LFG	382	127	265	11	3	0.20	*	carbon neutral
Lemons East	LFG	382	127	265	11	3	0.20	*	carbon neutral
Eagle Ridge	LFG	382	191	202	13	3	0.20	*	carbon neutral
Missouri Pass	LFG	382	191	202	13	3	0.20	*	carbon neutral
Newton County 1	AD	4,632	1,029	0	0	n/a	0.20	*	carbon neutral
Mercer County 1	AD	4,097	1,051	0	0	n/a	0.20	*	carbon neutral
Putnam County 2	AD	3,396	1,061	0	0	n/a	0.20	*	carbon neutral
Mercer County 2	AD	3,184	1,061	0	0	n/a	0.20	*	carbon neutral
Putnam County 1	AD	2,680	1,072	0	0	n/a	0.20	*	carbon neutral
Gentry County 1	AD	2,295	1,093	0	0	n/a	0.20	*	carbon neutral
Gentry County 2	AD	2,186	1,093	0	0	n/a	0.20	*	carbon neutral
Sullivan County 4	AD	2,186	1,093	0	0	n/a	0.20	*	carbon neutral
Sullivan County 2	AD	1,987	1,104	0	0	n/a	0.20	*	carbon neutral
Lewis County 1	AD	1,894	1,114	0	0	n/a	0.20	*	carbon neutral
Vernon County 1	AD	1,894	1,114	0	0	n/a	0.20	*	carbon neutral
Harrison County	AD	1,800	1,125	0	0	n/a	0.20	*	carbon neutral
Sullivan County 3	AD	1,800	1,125	0	0	n/a	0.20	*	carbon neutral
Lincoln County 1	AD	1,605	1,146	0	0	n/a	0.20	*	carbon neutral
Mercer County 3	AD	1,401	1,167	0	0	n/a	0.20	*	carbon neutral
Mercer County 4	AD	1,296	1,178	0	0	n/a	0	*	carbon neutral

1- Costs are shown as incremental

*SO₂ emissions are highly variable. Sulfur in bio-gas can range from 100 ppmvd to 12,000 ppmvd.

⁴ 4 CSR 240-22.040(2); 4 CSR 240-22.040(2)(A); 4 CSR 240-22.040(2)(C)1

The anaerobic digestion (AD) projects were excluded based on cost. Ameren Missouri will continue to consider these projects but they were not analyzed further in this IRP.⁵

Table 6.B.1 Potential Items Included in Owner's Costs

Potential Owner's Costs	
Project Development: Site selection study Land purchase/options/rezoning Transmission/gas pipeline rights of way Road modifications/upgrades Demolition (if applicable) Environmental permitting/offsets Public relations/community development Legal assistance Utility Interconnections: Natural gas service (if applicable) Gas system upgrades (if applicable) Electrical transmission Supply water Wastewater/sewer (if applicable) Spare Parts and Plant Equipment: Air quality control systems materials, supplies, and parts Acid gas treating materials, supplies and parts Combustion turbine and steam turbine materials, supplies, and parts HRSG materials, supplies, and parts Gasifier materials, supplies, and parts Balance-of-plant equipment materials, supplies and parts Rolling stock Plant furnishings and supplies Operating spares Owner's Project Management: Preparation of bid documents and selection of contractor(s) and suppliers Provision of project management Performance of engineering due diligence Provision of personnel for site construction Management	Plant Startup/Construction Support: Owner's site mobilization O&M staff training Supply of trained operators to support equipment testing and commissioning Initial test fluids and lubricants Initial inventory of chemicals/reagents Consumables Cost of fuel not recovered in power sales Auxiliary power purchase Construction all-risk insurance Acceptance testing Taxes/Advisory Fees/Legal: Taxes Market and environmental consultants Owner's legal expenses: • Power Purchase Agreement (PPA) • Interconnect agreements • Contracts--procurement & construction • Property transfer Owner's Contingency: Owner's uncertainty and costs pending final negotiation: • Unidentified project scope increases • Unidentified project requirements • Costs pending final agreement (e.g., interconnection contract costs) Financing: Development of financing sufficient to meet project obligations or obtaining alternate sources of funding Financial advisor, lender's legal, market analyst, and engineer Interest during construction Loan administration and commitment fees Debt service reserve fund Miscellaneous: All costs for above-mentioned Contractor-excluded items, if applicable

⁵ 4 CSR 240-22.040(2)(C)2

Compliance References

4 CSR 240-22.040(1)	1, 2, 3
4 CSR 240-22.040(2)	2, 3, 4
4 CSR 240-22.040(2)(A)	4
4 CSR 240-22.040(2)(C)1	4
4 CSR 240-22.040(2)(C)2	5