Appendix E—Modular Biomass Systems Available or in Pre-Commercial Development

A number of small development companies are working on modular biomass CHP systems. **Table E-1** compares the specifications and costs, as available, for five modular systems. The systems are all available in sizes of 250 kW or less. None of them could be categorized as being fully commercial.[78] Contact information for each of the companies that offers the systems follows.

CPC and Chiptec have demonstration projects at customer sites that have been supported by federal and state funding sources. Emery Energy is more active in larger gasification systems, but has expressed interest in commercializing small systems based on the pilot test facility operating at its research and manufacturing facility. Ormat is demonstrating its heat recovery technology at a larger scale (4 MW) using the heat available from combustion turbines operating on natural gas at a natural gas pipeline compression station. The system has not yet been integrated with a biomass combustion system in an operating facility. There are no identified demonstration installations for the Entropic Turbion system.

[78] The modular systems under development are identified here for informational purposes only. EPA has not verified the accuracy of the developers' claims nor is the inclusion of this information an endorsement.

Table E-1. Small Modular Biomass System Comparison

Company	Community Power Corporation	Chiptec Wood Energy Systems	Emery Energy Company	Ormat	Entropic Energy
Web site	www.gocpc.com	www.chiptec.com/	www.emeryenergy.com	www.ormat.com/	www.entropicenergy.com
Equipment Type	Downdraft gasifier, gas cleanup, mostly IC engine prime mover	Two-chamber gasification with hot gas combustion to produce steam	Small- to large-scale biomass gasification equipment and design	Direct combustion organic Rankine bottoming cycle	Direct combustion entropic cycle
Available Sizes	5 to 75 kW	0.4 to 50 MMBtu/hr gasifier/boilers	Small to large, custom design	100 to 5,000 kW	100 to 5,000 kW
Commercialization Status	Several field demonstrations in the United States and internationally, four sites in California	250 kW commercial demonstration CHP system installed in Vermont hospital	Large systems installed worldwide, modular system in pre-commercial stage	Demonstration of waste heat recovery for geothermal energy and gas turbines	Developmental projects in Canada
Applicable System	BioMax Series	250 kW was minimum economic size	75 kW CHP system designed but not built	Ormat Energy Converter	Biopower Turbion Series
Cost	$2,500 to $4,000/kW for equipment plus estimated $600 to $1,000/kW for fuel handling	Budgetary quote for 100 boiler horsepower gasifier/boiler (3,400 thousand Btu/hr): $215,000 (equipment only); steam turbine generator not included	$12,350/kW installed (~$925,000 total installed costs, not including fuel preparation)	$4,500 to $7,500/kW equipment cost	$3,000 to 5,000/kW equipment cost
Electric Output (kW)	50	250	75		250 kW
Thermal Output (Btu/kWh)	600	11,000	No information provided	17,400	16,500
Electric/Thermal Ratio	0.28	0.08	No information provided		
Electric Efficiency	16 to 22%	< ~15%	30% from fuel gas (~20% from biomass)	11%	13%
CHP Efficiency	55 to 75%	~60 to 70%	Data requested	67%	76%
Emissions	2003 California Air Resources Board-certified	C-Series has been BACT-approved	No information provided	No information provided	No information provided

Modular Biomass System Developers and Suppliers

Chiptec Wood Energy Systems

Equipment type: two-chamber gasification with hot gas combustion to produce steam, 0.4 to 50 MMBtu/hr gasifier/boilers

48 Helen Avenue
South Burlington, VT 05403

Telephone: (800) 244-4146
E-mail: BobBender@Chiptec.com
Web site: www.chiptec.com

Community Power Corporation

Equipment type: downdraft gasifier, gas cleanup, mostly IC engine prime mover, 5 to 75 kW

8110 Shaffer Parkway
Littleton, CO 80127

Telephone: (303) 933-3135
E-mail: rwalt@gocpc.com
Web site: www.gocpc.com

Emery Energy Company

Equipment type: small- to large-scale biomass gasification equipment and design

157 West Pierpoint Avenue
Salt Lake City, UT 84101

Telephone: (801) 364-8283
E-mail: bphillips@emeryenergy.com
Web site: www.emeryenergy.com

Entropic Energy

Equipment type: direct combustion entropic cycle, 100 to 5,000 kW

106-1656 Martin Drive, Suite 189
White Rock, BC, Canada
V4A 6E7

Telephone: (604) 538-3033
E-mail: porter@EntropicEnergy.com
Web site: http://entropicenergy.com

FlexEnergy

Equipment type: microturbines for burning very low Btu gases, applied to a portable wood gasifier

22922 Tiagua
Mission Viejo, CA 92692

Telephone: (949) 380-4899
E-mail: info@flexenergy.com
Web site: www.flexenergy.com

Ormat Technologies, Inc.

Equipment type: direct combustion organic Rankine bottoming cycle power systems for geothermal, waste heat, and biomass systems, 100 to 5,000 kW

6225 Neil Road
Reno, NV 89511

Telephone: (775) 356-9029
E-mail: ormat@ormat.com
Web site: www.ormat.com

Sunpower, Inc.

Equipment type: Stirling engines matched to biomass combustion, 0.5 to 10 kW

182 Mills Street
Athens, OH 45701

Telephone: (740) 594-2221
E-mail: info@sunpower.com
Web site: www.sunpower.com/index.php