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Assumptions to the Annual Energy Outlook 2006

Table 72. Overnight Capital Cost Characteristics for Renewable Energy Generating Technologies in Three Cases (2004$/kW)

Technology	Year	Reference	High Renewables[1]	Low Renewables
Geothermal[2]	2010	1,916	1,850	2,013
	2020	1,594	2,115	2,008
	2030	2,639	2,271	2,665
Hydroelectric[2,]	2010	1,381	1,339	1,398
	2020	1,377	1,310	1,423
	2030	1,341	1,192	1,437
Landfill Gas	2010	1,524	1,490	1,544
	2020	1,486	1,389	1,544
	2030	1,447	1,389	1,544
Photovoltaic[3]	2010	3,931	3,848	4,138
	2020	3,436	3,196	4,046
	2030	2,832	2,523	3,882
Solar Thermal[3]	2010	2,605	2,550	2,742
	2020	2,325	2,161	2,735
	2030	2,030	1,760	2,707
Biomass[4]	2010	1,763	1,673	1,780
	2020	1,653	1,467	1,704
	2030	1,458	1,261	1,558
Wind	2010	1,153	1,150	1,167
	2020	1,150	1,115	1,167
	2030	1,149	1,080	1,167

[1]Overnight capital cost (that is, excluding interest charges), plus contingency, learning, and technological optimism factors, excluding regional multipliers. A contingency allowance is defined by the American Association of Cost Engineers as the specific provision for unforeseeable elements of costs within a defined project scope. This is particularly important where previous experience has shown that unforeseeable events which will increase costs are likely to occur.

[2]Geothermal and Hydroelectric costs are specific for each site. The table entries represent the least cost unit available in the specified year in the Northwest Power Pool region. In the 2006 Renewables cases, costs vary as different sites continue to be developed.

[3]Costs decline slightly in the Low Renewable case for photovoltaic and solar thermal technologies as technological optimism is factored into initial costs (see pg. 72 in the chapter discussing the EMM). However, there is no learning-by-doing assumed once the optimism factor has been removed.

[4]Biomass plants share significant components with similar coal-fired plants, these components continue to decline in cost in the Low Renewables case, although biomass-specific components (especially fuel handling components) do not see cost declines beyond 2005.

Source: AEO2006 National Energy Modeling System runs AEO2006.D111905A, LOREN06.D120505A, and HIREN06.D120605A.

Table 73. Capacity Factors[1] for Renewable Energy Generating Technologies in Three Cases

Technology	Year	Reference	High Renewables	2006 Renewables
Geothermal[2]	2010	0.95	0.95	0.95
	2020	0.95	0.95	0.95
	2030	0.95	0.89	0.95
Hydrolectric[2]	2010	0.64	0.64	0.64
	2020	0.64	0.64	0.57
	2030	0.57	0.51	0.57
Landfill Gas	2010	0.90	0.90	0.90
	2020	0.90	0.90	0.90
	2030	0.90	0.90	0.90
Photovoltaic	2010	0.21	0.21	0.21
	2020	0.21	0.21	0.21
	2030	0.21	0.21	0.21
Solar Thermal	2010	0.31	0.31	0.31
	2020	0.31	0.31	0.31
	2030	0.31	0.31	0.31
Biomass	2010	0.83	0.83	0.83
	2020	0.83	0.83	0.83
	2030	0.83	0.83	0.83
Wind[3]	2010	0.44	0.46	0.37
	2020	0.45	0.46	0.37
	2030	0.41	0.43	0.37

[1]Capacity factor for units available to be built in specified year. Capacity factor represents maximum expected annual power output as a fraction of theoretical output if plant were operated at rated capacity for a full year.

[2]Geothermal and Hydroelectric capacity factors are specific for each site. The table entries represent the least-cost unit available in the specified year in the Northwest Power Pool region.

[3]Wind capacity factors are based on regional resource availability and generation characteristics. The table entries represent the least-cost resource available in the specified year in the Northwest Power Pool region.

Source: AEO2006 National Energy Modeling System runs: AEO2006.D111905A, LOREN06.D120505A, and HIREN06.D120605A.

Table 74. Maximum U.S. Biomass Resources, by Coal Demand Region and Type
(Trillion Btu)

Coal Demand Region	States	Agricultural Residue	Energy Crops	Forestry Residue	Urban Wood Waste/Mill Residue	Total
1. NE	CT, MA, ME, NH, RI, VT	1	29	131	15	176
2..YP	NY, PA, NJ	29	73	89	59	250
3. SA	WV, MD, DC, DE, VA, NC, SC	63	116	408	56	643
4. GF	GA, FL	57	66	246	47	416
5. OH	OH	71	119	27	17	234
6. EN	IN, IL, MI, WI	409	307	404	47	1,167
7. KT	KY, TN	27	210	92	30	359
8. AM	AL, MS	18	211	149	19	397
9. CW	MN, IA, ND, SD, NE, MO, KS	900	1,004	523	28	2,455
10. WS	TX, LA, OK, AR	191	473	247	57	968
11. MT	MT, WY, ID	70	56	229	25	380
12. CU	CO, UT, NV	6	0	23	7	36
13. ZN	AZ, NM	6	0	23	7	36
14. PC	AK, HI, WA, OR, CA	104	0	195	83	382
Total U.S.		1,952	2,664	2,786	497	7,899

Sources: Urban Wood Wastes/Mill Residues: Antares Group Inc., *Biomass Residue Supply Curves for the U.S (updated)*, prepared for the National Renewable Energy Laboratory, June 1999; Agricultural residues: James Easterly, "Biomass Suppy Curve Enhancement Regarding Agricultural Residues" prepared for EIA, September, 2004. All other biomass resources: Oak Ridge National Laboratory, personal communication with Marie Walsh, August 20, 1999.

Table 75. Post-2004 Supplemental Capacity Additions (Megawatts Nameplate Capacity)

Rationale	Biomass	Conventional Hydroelectric	Geothermal	Landfill Gas	Solar Photovoltaic[2]	Solar Thermal	Wind	Total
RenewablePortfolio Standards[1]	41.15	25.99[2]	258.00	49.28	75.50	94.15	4728.15	5272.22
Mandates	55.00	0.00	0.00	50.00	7.50	0.00	4001.70	4114.20
Goals	0.27	12.10	0.00	5.80	0.00	0.00	301.40	319.57
Commercial[3]	75.00	251.20	12.70	39.80	281.50	70.50	1266.39	1997.09
Total	171.40	289.20	270.0	144.88	364.50	164.65	1029.60	11702.93

[1]Electric power sector grid-connected builds, including (a) specifically identified projects, (b) EIA estimates for goals, mandates, and renewable portfolio standards, and (c) other builds assumed by EIA to be built for reasons other than least-cost electricity supply.

[2]In addition to values shown in the table for the electric power sector, EIA assumes another 748 megawatts of grid-connected distributed PV will be installed 2005-2030 in the end-use sectors, including both identified projects and programs and additional capacity assumed by EIA to be installed for reasons in addition to least-cost supply. Excludes off-grid PV.

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting.

Table 76. Planned U.S. Central Station Generating Capacity Using Renewable Resources for 2004 and Beyond[1]

Technology	Plant Identification	Program[2]	State	Net Summer Capability (Megawatts)	On-Line Years
Biomass					
	APS Biomass I	R	Arizona	3.0	2006
	Puente Hills Energy Recovery	R	Califonria	8.0	2005
	Buckeye Florida	C	Florida	25.0	2006
	Ware Cogeneration	R	Massachusetts	4.3	2006
	Worcester Energy	R	Maine	25.9	2005
	Fibrominn Biomass Power Plant	M	Minnesota	55.0	2007
	Schiller Biomass Conversion	C	New Hampshire	50.0	2006
	Blue Spruce Farm Anaerobic Digester	G	Vermont	0.3	2005
Landfill Gas (including mass-burn waste)	Los Reales LFG (Expansion)	R	Arizona	2.0	2006
	Lee County Solid Waste Energy	C	Florida	20.0	2007
	Owl Creek-Richmond Creek Road	C	Georgia	4.0	2005
	Dekalb County Landfill Gas	C	Georgia	3.2	2006
	New Paris Pike Landfill	C	Indiana	1.6	2005
	Pearl Hollow Landfill	C	Kentucky	2.4	2005
	Crapo Hill Landfill	R	Massachusetts	3.2	2005
	Glendale	R	Massachusettsi	1.2	2005
	Central Minn. Ethanol Corp.	G	Minnesota	1.0	2006
	Atlantic County Utilities Landfill	R	New Jersey	1.6	2005
	Brookside Dairy	R	Pennsylvania	0.1	2005
	IGENCO (Upton)	R	Pennsylvania	6.1	2005
	Lanchester	R	Pennsylvania	0.9	2005
	Pine Hurst Acres	R	Pennsylvania	0.1	2005
	Rolling Hills	R	Pennsylvania	2.0	2005
	Wanner's Pride	R	Pennsylvania	0.2	2005
	Harrisburg Facility	R	Pennsylvania	27.5	2006
	Lee County Landfill	C	South Carolina	7.6	2005, 2006
	Texas Mandate Landfill Gas	M	Texas	50.0	2006-2015
	Davis County	C	Utah	1.0	2005
	Coventry Landfill Gas	G	Vermont	4.8	2005
	Doubls S Dairy Digester	R	Wisconsin	0.4	2005
	Rodefield Landfill Gas	R	Wisconsin	4.0	2005
Geothermal					
	William R. Gould Geothermal	R	California	10.0	2005
	East Mesa Expansion	R	California	10.0	2006
	Raft River Phase I	C	Idaho	12.7	2006
	Desert Peak II, III	R	Nevada	26.0	2005, 2006
	Rye Patch	R	Nevada	12.0	2005

Table 76. Planned U.S. Central Station Generating Capacity Using Renewable Resources for 2004 and Beyond[1] (cont)

Technology	Plant Identification	Program[2]	State	Net Summer Capability (Megawatts)	On-Line Years
	Galena I, Omi7	R	Nevada	20.0	2006
	Salt Wells I	R	Nevada	10.0	2006
	Nevada RPS Geothermal	R	Nevada	170.0	2006-2015
Coventional Hydroelectric					
	South Fork	C	Alaska	2.0	2005
	Atka Hydro	C	Alaska	0.3	2006
	Indian River Hydro 1	C	Alaska	0.1	2007
	Goat Rock	C	Alabama	5.4	2005
	El Dorado Project 184	R	California	22.0	2005
	Tungstar	R	California	1.0	2005
	Buford	C	Georgia	7.2	2005
	Puueo	G	Hawaii	3.1	2005
	Four Mile Hydropower Project	C	Michigan	0.2	2005
	Lower St. Anthony Falls	G	Minnesota	9.0	2008
	Abiquiu Dam	R	New Mexico	3.0	2007
	Wanapum	C	Washington	235.2	2006
	Swift Creek Power	C	Washington	0.8	2005
Central Station Photovoltaics(PV)	Saguaro	R	Arizona	1.0	2005
	Springerville Expansion	R	Arizona	4.0	2005-2010
	Arizona RPS Solar PV	R	Arizona	2.0	2007
	Arizona Commercial Solar PV	C	Arizona	58.5	2008-2030
	California RPS Solar PV	R	California	38.0	2007-2017
	California Commercial Solar PV	C	California	76.0	2018-2030
	Brocton Brightfields	R	Massachusetts	0.5	2005
	Nevada RPS Solar PV	R	Nevada	30.0	2007-2015
	Nevada Commercial Solar PV	C	Nevada	67.5	2016-2030
	Southern Great Plains Commercial Solar PV[3]	C	Southern Great Plains	51.0	2007-2030
	Texas Mandate Solar PV	M	Texas	7.5	2007-2015
	Texas Commercial Solar PV	C	Texas	28.5	2016-2030
Solar Thermal					
	Arizona Solar Trough	R	Arizona	1.0	2005
	Arizona RPS Solar Thermal	R	Arizona	1.0	2007
	Arizona Commercial Solar Thermal	C	Arizona	23.0	2008-2030
	California RPS Solar Thermal	R	California	13.5	2007-2017
	California Commercial Solar Thermal	C	California	19.5	2018-2030
	New Mexico Dish Stirling	R	New Mexico	0.2	2005
	Eldorado Solar Thermal	R	Nevada	70.0	2007
	Nevada RPS Solar Thermal	R	Nevada	36.5	2007-2030

Table 76. Planned U.S. Central Station Generating Capacity Using Renewable Resources for 2004 and Beyond[1] (Cont.)

Technology	Plant Identification	Program[2]	State	Net Summer Capability (Megawatts)	On-Line Years
Wind	AVEC Wind Phase 1A, 1B	C	Alaska	0.9	2005, 2006
	Coram Energy LLC	R	California	9.0	2005
	Kumeyaay Wind	R	California	50.0	2005
	Shiloh Wind	R	California	150.0	2005
	Windridge, LLC	R	California	40.0	2005
	California RPS Wind	R	California	2930.0	2006, 2007
	Solano Wind	R	California	2.5	2006
	Tehachapi Wind Resource I, II	R	California	8.4	2006, 2007
	Spring Canyon	R	Colorado	60.0	2005
	Hawaii Remewable Dev. Wind Farm	G	Hawaii	10.6	2005
	Kaheawa Pastures	G	Hawaii	30.0	2006
	Century	C	Iowa	185.0	2005
	Intrepid expansion	C	Iowa	15.0	2005
	Fossil Gulch	C	Idaho	10.5	2005
	Wolverine Creek	C	Idaho	64.5	2005
	Adam and Eve Wind	G	Illinois	5.0	2005
	Cresent Ridge	G	Illinois	54.5	2005
	Illinois Electric Cooperative	G	Illinois	1.7	2005
	Sustainable Energy Foundation (FPC Services)	G	Illinois	1.7	2005
	Elk River Wind	C	Kansas	150.0	2005
	Sherman Co Comm Wind Part I	C	Kansas	3.0	2005
	IBEW Local 103 Adv Training Ctr	R	Massachusetts	0.1	2005
	Massachusetts Marittime Academy Bussard Bay	R	Massachusetts	0.7	2006
	Seven Turbines: Breezy, Bucks, Salty Dog, et al.	M	Minnesota	8.8	2005
	Fairmont	M	Minnesota	1.7	2005
	Palmer WindII	M	Minnesota	1.7	2005
	South Generation	M	Minnesota	1.7	2005
	St. Olaf College Wind	M	Minnesota	1.7	2005
	Trimont Area Wind Farm	M	Minnesota	100.5	2005
	U. Minn West Central Research	M	Minnesota	1.7	2005
	Minnesota Mandate Wind	M	Minnesota	184.0	2006, 2007
	Texas RPS 2006	M	Texas	155.0	2006
	Texas RPS 2007	M	Texas	155.0	2007
	Texas RPS 2008	M	Texas	154.0	2008
	Texas RPS 2009	M	Texas	154.0	2009
	Minnesota Small Wind	M	Minnesota	85.0	2006-2010
	Judith Gap	R	Montana	135.0	2005
	Velva North Dakota Wind	C	Noth Dakota	12.0	2005
	Wilton	C	North Dakota	49.5	2005

Table 76. Planned U.S. Central Station Generating Capacity Using Renewable Resources for 2004 and Beyond[1] (Cont.)

Technology	Plant Identification	Program[2]	State	Net Summer Capability (Megawatts)	On-Line Years
	Ainsworth Wind	C	Nebraska	60.0	2005
	New England Wind[3]	C	New England	663.0	2006, 2007
	Atlantic City Wind Farm	R	New Jersey	7.5	2005
	(Elida) San Juan Mesa	R	New Mexico	120.0	2005
	Caprock Wind Farm	R	New Mexico	20.0	2005
	Nevada RPS Wind	R	Nevada	508.0	2006-2015
	Maple Ridge Wind Farm	G	New York	198.0	2005
	OhioConsent Decree Wind - Phase I, II	C	Ohio	23.0	2007-2009
	Blue Canyon Windpower	C	Oklahoma	151.0	2005
	Weatherford Wind Energy Ctr	C	Oklahoma	147.0	2005
	Klondike Wind Power	C	Oregon	75.0	2005
	Bear Creek	R	Pennsylvania	24.0	2005
	Southeastern US Wind[3]	C	Southeast	166.0	2006, 2007
	Buffalo Gap Wind Farm	M	Texas	120.6	2005
	Calahan Divide Wind Energy Center	M	Texas	114.0	2005
	Cottonwood Creek Wind	M	Texas	135.0	2005
	Horse Hollow Wind Energy Center	M	Texas	220.5	2005
	Suzlon	M	Texas	30.0	2005
	Sweetwater Wind 2 LLC	M	Texas	92.0	2005
	Texas Mandate Wind	M	Texas	2903.0	2006-2015
	Hopkins Ridge Wind	C	Washington	150.0	2005
	FE Warren AFB	C	Wyoming	1.3	2005
	J. Bar 9 Ranch Wind	C	Wyoming	0.0	2005
	Medicine Bow	C	Wyoming	2.8	2005

[1]includes reported information and EIA estimates for goals, mandates, renewable portfolio standards (RPS), and California Assembly Bill 1890 required renewables.

[2]"R" (RPS) represents state renewable portfolio standards; "M" (Mandate) identifies other forms of identified state legal requirements; "C" (Commercial) identifies other new capacity, including "green marketing" efforts and other voluntary programs and plans. Publicly available information does not always specify whether a project is mandated or a commercial build. Commercial building may or may not be used to satisify State requirements if eligible.

[3]Regional estimates developed by EIA.

Note: Publicly available information does not always specify whether a project is required, commercial, or other voluntary build; EIA characterizes unspecified projects as "commercial".

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting, based on publicly available information about specific projects, state renewable portfolio standards, mandates, goals, and commercial and other plans.