

Table 1 ▷ Construction costs, operating costs and efficiencies of new coal-fired power plants

	2015			2030		
	Construction cost	O&M costs	Efficiency	Construction cost	O&M costs	Efficiency
	(\$ per kW)	(\$ per kW)	(net, LHV)	(\$ per kW)	(\$ per kW)	(net, LHV)
Subcritical						
United States	2300	46	37%	2300	46	37%
Canada	1700	34	37%	1700	34	37%
Mexico	1200	24	28%	1200	24	28%
Europe	1700	34	37%	1700	34	37%
Japan	2150	43	37%	2150	43	37%
Korea	1550	31	37%	1530	31	37%
Australia	1600	32	37%	1600	32	37%
Russia	1550	31	38%	1550	31	38%
China	850	17	34%	1000	20	34%
India	1200	24	36%	1200	24	36%
Indonesia	1200	24	38%	1200	24	38%
Other Asia	1200	24	38%	1200	24	38%
Brazil	1200	24	38%	1200	24	38%
Other Latin America	1200	24	38%	1200	24	38%
Africa	1200	24	35%	1200	24	35%
Middle East	1550	31	38%	1550	31	38%
Supercritical						
United States	2700	54	41%	2700	54	41%
Canada	2000	40	41%	2000	40	41%
Mexico	1400	28	42%	1400	28	42%
Europe	2000	40	41%	2000	40	41%
Japan	2500	50	41%	2500	50	41%
Korea	1800	36	41%	1800	36	41%
Australia	1900	38	41%	1900	38	41%
Russia	1800	36	42%	1800	36	42%
China	1000	20	38%	1200	24	38%
India	1400	28	40%	1400	28	40%
Indonesia	1400	28	42%	1400	28	42%
Other Asia	1400	28	42%	1400	28	42%
Brazil	1400	28	42%	1400	28	42%
Other Latin America	1400	28	42%	1400	28	42%
Africa	1400	28	39%	1400	28	39%
Middle East	1800	36	42%	1800	36	42%
Ultrasupercritical						
United States	3100	62	47%	3100	62	49%
Canada	2300	46	47%	2300	46	49%
Mexico	1600	32	48%	1600	48	50%

Europe	2300	46	47%	2300	46	49%
Japan	2900	58	47%	2900	58	49%
Korea	2050	41	47%	2050	41	49%
Australia	2200	44	47%	2200	44	49%
China	1150	23	44%	1400	28	49%
India	1600	32	46%	1600	32	49%
Indonesia	1600	32	48%	1600	32	50%
Other Asia	1600	32	48%	1600	32	50%
Brazil	1600	32	48%	1600	32	50%
Other Latin America	1600	32	48%	1600	32	50%
Africa	1600	32	45%	1600	32	47%
Middle East	2050	41	48%	2050	41	50%
IGCC						
United States	3150	94	48%	2850	85	50%
Canada	2800	84	48%	2750	76	50%
Mexico	2800	84	48%	2750	76	50%
Europe	2800	84	48%	2750	76	50%
Japan	3000	89	48%	2700	80	50%
Korea	2800	84	48%	2550	76	50%
Australia	2800	84	48%	2550	76	50%
Russia	2800	84	48%	2750	76	50%
China	2550	77	45%	2300	69	47%
India	2550	77	46%	2300	69	48%
Indonesia	2550	77	48%	2300	69	50%
Other Asia	2550	77	48%	2300	69	50%
Brazil	2550	77	48%	2300	69	50%
Other Latin America	2550	77	48%	2300	69	50%
Africa	2550	77	45%	2300	69	47%
Middle East	2800	84	48%	2550	76	50%

Table 2 ▷ Construction costs, operating costs and efficiencies of new gas-fired power plants

	2015			2030		
	Construction cost	O&M costs	Efficiency	Construction cost	O&M costs	Efficiency
	(\$ per kW)	(\$ per kW)	(net, LHV)	(\$ per kW)	(\$ per kW)	(net, LHV)
CCGT						
United States	1000	15	58%	1000	15	60%
Canada	1000	15	58%	1000	15	60%
Mexico	750	11	56%	750	11	59%
Europe	1000	15	58%	1000	15	60%
Japan	1000	15	56%	1000	15	58%
Korea	1000	15	56%	1000	15	58%
Australia	1000	15	58%	1000	15	60%
Russia	850	13	56%	850	13	59%
China	750	11	56%	750	11	59%
India	750	11	54%	750	11	57%
Indonesia	750	11	56%	750	11	59%
Other Asia	750	11	56%	750	11	59%
Brazil	750	11	56%	750	11	59%
Other Latin America	750	11	56%	750	11	59%
Africa	750	11	56%	750	11	59%
Middle East	850	13	58%	850	13	60%
Gas turbine (large)						
United States	600	9	37%	600	9	39%
Canada	600	9	37%	600	9	39%
Mexico	450	7	35%	450	7	38%
Europe	600	9	37%	600	9	39%
Japan	600	9	37%	600	9	39%
Korea	600	9	37%	600	9	39%
Australia	600	9	37%	600	9	39%
Russia	500	8	35%	500	8	38%
China	450	7	35%	450	7	38%
India	450	7	35%	450	7	38%
Indonesia	450	7	35%	450	7	38%
Other Asia	450	7	35%	450	7	38%
Brazil	450	7	35%	450	7	38%
Other Latin America	450	7	35%	450	7	38%
Africa	450	7	35%	450	7	38%
Middle East	500	8	37%	500	8	39%
Gas turbine (small)						
United States	1000	40	33%	1000	40	35%
Canada	1000	40	33%	1000	40	35%

Mexico	750	30	33%	750	30	35%
Europe	1000	40	33%	1000	40	35%
Japan	1000	40	33%	1000	40	35%
Korea	1000	40	33%	1000	40	35%
Australia	1000	40	33%	1000	40	35%
Russia	850	34	33%	850	34	35%
China	750	30	33%	750	30	35%
India	750	30	33%	750	30	35%
Indonesia	750	30	33%	750	30	35%
Other Asia	750	30	33%	750	30	35%
Brazil	750	30	33%	750	30	35%
Other Latin America	750	30	33%	750	30	35%
Africa	750	30	33%	750	30	35%
Middle East	850	34	33%	850	34	35%
Fuel cell						
United States	5000	200	44%	2500	100	58%
Canada	5000	200	44%	2500	100	58%
Mexico	5000	200	44%	2500	100	58%
Europe	5000	200	44%	2500	100	58%
Japan	5000	200	44%	2500	100	58%
Korea	5000	200	44%	2500	100	58%
Australia	5000	200	44%	2500	100	58%
Russia	5000	200	44%	2500	100	58%
China	5000	200	44%	2500	100	58%
India	5000	200	44%	2500	100	58%
Indonesia	5000	200	44%	2500	100	58%
Other Asia	5000	200	44%	2500	100	58%
Brazil	5000	200	44%	2500	100	58%
Other Latin America	5000	200	44%	2500	100	58%
Africa	5000	200	44%	2500	100	58%
Middle East	5000	200	44%	2500	100	58%

Table 3 ▷ Construction costs, operating costs and efficiencies of new gas-fired CHP power plants

	2015			2030		
	Construction cost	O&M costs	Efficiency	Construction cost	O&M costs	Efficiency
	(\$ per kW)	(\$ per kW)	(net, LHV)	(\$ per kW)	(\$ per kW)	(net, LHV)
Small						
United States	1400	42	75%	1400	42	75%
Canada	1400	42	75%	1400	42	75%
Mexico	1050	32	75%	1050	32	75%
Europe	1400	42	75%	1400	42	75%
Japan	1400	42	75%	1400	42	75%
Korea	1400	42	75%	1400	42	75%
Australia	1400	42	75%	1400	42	75%
Russia	1200	36	75%	1200	36	75%
China	1050	32	75%	1050	32	75%
India	1050	32	75%	1050	32	75%
Indonesia	1050	32	75%	1050	32	75%
Other Asia	1050	32	75%	1050	32	75%
Brazil	1050	32	75%	1050	32	75%
Other Latin America	1050	32	75%	1050	32	75%
Africa	1050	32	75%	1050	32	75%
Middle East	1200	36	75%	1200	36	75%
Large						
United States	1200	48	75%	1200	48	75%
Canada	1200	48	75%	1200	48	75%
Mexico	900	36	75%	900	36	75%
Europe	1200	48	75%	1200	48	75%
Japan	1200	48	75%	1200	48	75%
Korea	1200	48	75%	1200	48	75%
Australia	1200	48	75%	1200	48	75%
Russia	1000	41	75%	1000	41	75%
China	900	36	75%	900	36	75%
India	900	36	75%	900	36	75%
Indonesia	900	36	75%	900	36	75%
Other Asia	900	36	75%	900	36	75%
Brazil	900	36	75%	900	36	75%
Other Latin America	900	36	75%	900	36	75%
Africa	900	36	75%	900	36	75%
Middle East	1000	41	75%	1000	41	75%

Table 4 ▷ Construction costs, operating costs and efficiencies of new nuclear power plants

	2015		2030	
	Construction cost	O&M costs	Construction cost	O&M costs
	(\$ per kW)	(\$ per kW)	(\$ per kW)	(\$ per kW)
United States	5500	165	5500	165
Canada	3400	102	3400	102
Mexico	3200	96	3200	96
Europe	3600	108	3600	108
Japan	3600	108	3600	108
Korea	3200	96	3200	96
Australia	3600	108	3600	108
Russia	3200	96	3200	96
China	3000	90	3000	90
India	3200	96	3200	96
Indonesia	3200	96	3200	96
Other Asia	3200	96	3200	96
Brazil	3200	96	3200	96
Other Latin America	3200	96	3200	96
Africa	3200	96	3200	96
Middle East	3200	96	3200	96

Table 5 ▷ Construction costs, operating costs and efficiencies of new biomass power plants

	2015				2030			
	Construction cost	O&M costs	Efficiency	Capacity factor	Construction cost	O&M costs	Efficiency	Capacity factor
	(\$ per kW)	(\$ per kW)	(net, LHV)*	(%)	(\$ per kW)	(\$ per kW)	(net, LHV)*	(%)
Small to medium-scale CHP								
United States	3400	101	28%	47%	3150	95	29%	47%
Canada	3050	91	28%	43%	2850	86	29%	43%
Mexico	3050	91	28%	43%	2850	86	29%	43%
Europe	3150	95	28%	44%	3000	89	29%	44%
Japan	3250	98	28%	43%	3100	92	29%	43%
Korea	3200	96	28%	43%	3000	90	29%	43%
Australia	3300	99	28%	43%	3050	91	29%	43%
Russia	3100	93	28%	43%	3950	89	29%	43%
China	2950	89	28%	43%	2800	84	29%	43%
India	2900	87	28%	43%	2750	82	29%	43%
Indonesia	2900	88	28%	43%	2750	82	29%	43%
Other Asia	2900	88	28%	43%	2750	82	29%	43%
Brazil	3000	90	28%	43%	2800	84	29%	43%
Other Latin America	3000	89	28%	43%	2800	83	29%	43%
Africa	2950	88	28%	43%	2750	82	29%	43%
Middle East	3000	90	28%	43%	2800	84	29%	43%
Biogas digestion								
United States	2900	87	31%	63%	2700	87	32%	63%
Canada	2600	78	31%	63%	2450	74	32%	63%
Mexico	2600	78	31%	63%	2450	74	32%	63%
Europe	2700	81	31%	63%	2550	81	32%	63%
Japan	2800	84	31%	63%	2650	84	32%	63%
Korea	2750	82	31%	63%	2600	82	32%	63%
Australia	2850	85	31%	63%	2600	85	32%	63%
Russia	2650	80	31%	63%	2550	76	32%	63%
China	2550	77	31%	63%	2400	77	32%	63%
India	2500	75	31%	63%	2350	75	32%	63%
Indonesia	2500	75	31%	63%	2350	70	32%	63%
Other Asia	2500	75	31%	63%	2350	70	32%	63%
Brazil	2550	77	31%	63%	2400	72	32%	63%
Other Latin America	2550	77	31%	63%	2400	72	32%	63%
Africa	2550	76	31%	63%	2350	71	32%	63%
Middle East	2600	77	31%	63%	2400	73	32%	63%
Waste incineration								

United States	7500	225	12%	82%	7000	210	13%	82%
Canada	6750	202	12%	74%	6350	190	13%	74%
Mexico	6750	202	12%	74%	6350	190	13%	74%
Europe	7000	210	12%	70%	6600	198	13%	70%
Japan	7250	218	12%	74%	6800	204	13%	74%
Korea	7100	213	12%	74%	6650	199	13%	74%
Australia	7500	225	12%	74%	7000	210	13%	74%
Russia	6900	207	12%	74%	6550	197	13%	74%
China	6600	197	12%	74%	6200	186	13%	74%
India	6450	194	12%	74%	6050	182	13%	74%
Indonesia	6450	194	12%	74%	6050	181	13%	74%
Other Asia	6500	195	12%	74%	6050	181	13%	74%
Brazil	6650	199	12%	74%	6200	186	13%	74%
Other Latin America	6600	198	12%	74%	6150	185	13%	74%
Africa	6500	196	12%	74%	6100	182	13%	74%
Middle East	7300	219	12%	74%	6800	204	13%	74%
Cofiring								
United States	700	97	38%	83%	650	90	39%	83%
Canada	600	87	40%	65%	600	82	42%	65%
Mexico	600	87	39%	61%	600	82	41%	61%
Europe	650	90	34%	46%	600	85	35%	46%
Japan	650	94	43%	54%	650	88	44%	54%
Korea	650	92	36%	59%	600	86	37%	59%
Australia	650	94	34%	58%	600	87	35%	58%
Russia	650	89	24%	51%	600	85	25%	51%
China	600	85	33%	58%	550	80	34%	58%
India	600	83	27%	59%	550	78	28%	59%
Indonesia	600	84	36%	56%	600	78	37%	56%
Other Asia	600	84	35%	56%	550	78	36%	56%
Brazil	600	86	29%	40%	550	80	30%	40%
Other Latin America	600	85	32%	57%	550	80	33%	57%
Africa	600	84	40%	52%	550	79	41%	52%
Middle East	600	82	40%	58%	550	77	41%	58%

Table 6 ▷ Construction costs, operating costs and efficiencies of new non-biomass renewables power plants

	2015			2030		
	Construction cost	O&M costs	Capacity factor	Construction cost	O&M costs	Capacity factor
	(\$ per kW)	(\$ per kW)	(%)	(\$ per kW)	(\$ per kW)	(%)
Hydro - Large scale						
United States	2600	65	43%	2550	64	43%
Canada	2500	63	57%	2450	62	57%
Mexico	2150	53	33%	2150	54	33%
Europe	2300	58	33%	2350	59	33%
Japan	2450	61	45%	2450	61	45%
Korea	2400	59	29%	2400	60	29%
Australia	2450	62	36%	2400	60	36%
Russia	2250	56	44%	2300	58	44%
China	2050	52	38%	2100	53	38%
India	2000	50	35%	2000	50	35%
Indonesia	2000	50	27%	2000	50	27%
Other Asia	2000	50	33%	2000	50	33%
Brazil	2100	52	53%	2100	52	52%
Other Latin America	2050	52	54%	2050	52	54%
Africa	1950	49	45%	1950	49	45%
Middle East	2100	53	25%	2150	54	26%
Hydro - Small scale						
United States	3650	80	43%	3600	79	43%
Canada	3500	77	57%	3450	76	57%
Mexico	3000	66	33%	3050	67	33%
Europe	3250	71	33%	3300	72	33%
Japan	3400	75	45%	3400	75	45%
Korea	3350	73	29%	3350	74	29%
Australia	3450	76	36%	3350	74	36%
Russia	3150	69	44%	3250	72	44%
China	2900	64	38%	3000	66	38%
India	2800	62	35%	2850	62	35%
Indonesia	2800	62	27%	2800	62	27%
Other Asia	2800	62	33%	2800	62	33%
Brazil	2950	65	53%	2950	64	52%
Other Latin America	2900	64	54%	2900	64	54%
Africa	2750	61	45%	2750	60	45%
Middle East	3000	66	25%	3000	66	26%
Wind onshore						
United States	1800	42	31%	1750	39	32%

Canada	1800	41	29%	1650	38	30%
Mexico	1700	39	32%	1550	36	33%
Europe	1750	40	25%	1600	37	25%
Japan	1750	41	28%	1650	38	25%
Korea	1750	40	28%	1600	37	25%
Australia	1800	41	29%	1600	37	32%
Russia	1700	39	32%	1600	37	33%
China	1650	38	25%	1550	36	26%
India	1650	38	27%	1550	35	28%
Indonesia	1650	38	31%	1550	35	33%
Other Asia	1650	38	32%	1550	35	32%
Brazil	1650	38	32%	1550	36	34%
Other Latin America	1650	38	31%	1550	35	33%
Africa	1650	38	31%	1500	35	33%
Middle East	1700	38	31%	1550	35	33%
Wind offshore						
United States	2650	93	44%	2700	94	45%
Canada	2650	92	44%	2650	93	45%
Mexico	2500	87	45%	2500	88	46%
Europe	2550	90	44%	2600	91	46%
Japan	2600	91	44%	2650	92	45%
Korea	2550	90	44%	2600	91	45%
Australia	2600	91	44%	2600	92	45%
Russia	2500	88	43%	2550	90	43%
China	2450	86	44%	2500	88	45%
India	2450	85	43%	2450	86	43%
Indonesia	2450	85	43%	2450	86	43%
Other Asia	2450	85	43%	2450	86	43%
Brazil	2450	86	43%	2500	87	43%
Other Latin America	2450	86	43%	2500	87	44%
Africa	2400	85	43%	2450	85	43%
Middle East	2500	87	43%	2500	88	43%
Solar PV						
United States	3900	25	17%	2750	18	17%
Canada	3800	25	11%	2650	17	11%
Mexico	3600	23	20%	2500	16	20%
Europe	3600	23	13%	2550	17	13%
Japan	4000	26	15%	2850	18	14%
Korea	3650	24	15%	2550	17	15%
Australia	3850	25	20%	2700	17	20%
Russia	3900	25	13%	2950	19	13%
China	3600	23	20%	2450	16	20%
India	3400	22	20%	2400	16	20%

Indonesia	3500	23	20%	2400	16	19%
Other Asia	3400	22	20%	2350	15	20%
Brazil	3650	24	20%	2500	16	19%
Other Latin America	3600	23	20%	2500	16	20%
Africa	3400	22	21%	2350	15	20%
Middle East	3600	23	21%	2500	16	20%
Solar thermal						
United States	3100	109	31%	2350	82	32%
Canada	3250	114	15%	2550	89	16%
Mexico	2900	101	35%	2200	77	38%
Europe	2950	104	27%	2300	80	26%
Japan	3200	111	26%	2500	88	26%
Korea	3050	107	24%	2350	83	25%
Australia	3050	107	36%	2250	78	38%
Russia	3000	105	35%	2400	83	35%
China	2800	99	35%	2150	75	38%
India	2750	96	36%	2050	72	39%
Indonesia	2750	96	36%	2050	72	38%
Other Asia	2750	96	33%	2050	72	35%
Brazil	2850	99	36%	2150	75	38%
Other Latin America	2800	99	36%	2150	74	38%
Africa	2700	95	36%	2000	71	40%
Middle East	2850	100	34%	2100	73	40%
Geothermal						
United States	3850	201	79%	3650	190	82%
Canada	3700	193	78%	3500	182	80%
Mexico	3450	180	73%	3300	173	76%
Europe	3600	187	83%	3450	179	85%
Japan	3750	194	71%	3550	185	74%
Korea	3600	188	79%	3450	179	81%
Australia	3750	195	79%	3500	183	80%
Russia	3500	183	79%	3400	177	80%
China	3400	176	79%	3250	169	81%
India	3300	173	79%	3150	165	81%
Indonesia	3350	174	74%	3200	165	77%
Other Asia	3350	174	77%	3150	165	79%
Brazil	3400	177	79%	3200	168	81%
Other Latin America	3400	177	77%	3200	167	80%
Africa	3300	172	76%	3150	163	77%
Middle East	3400	178	79%	3250	170	81%
Tidal and Wave						
United States	4350	148	42%	3250	111	45%
Canada	4350	147	42%	3250	110	45%

Mexico	4200	142	42%	3200	109	45%
Europe	4250	144	41%	3250	110	44%
Japan	4300	146	43%	3300	112	45%
Korea	4300	146	42%	3300	113	43%
Australia	4300	147	43%	3300	112	45%
Russia	4200	144	42%	3300	112	45%
China	4150	141	43%	3200	109	45%
India	4100	140	43%	3150	107	45%
Indonesia	4150	140	42%	3150	107	45%
Other Asia	4150	140	42%	3150	107	45%
Brazil	4150	142	42%	3200	108	45%
Other Latin America	4150	141	42%	3150	108	45%
Africa	4100	140	42%	3150	106	45%
Middle East	4200	142	42%	3200	109	45%

Table 7 ▷ Assumed learning rates for renewable energy technologies

	2006 to 2010	2011 to 2020	2021 to 2030
Biomass			
Small to medium- scale CHP	5%	5%	5%
Biogas digestion	5%	5%	5%
Waste incineration	5%	5%	5%
Cofiring	5%	5%	5%
Geothermal	5%	5%	5%
Hydro - Large scale	1%	1%	1%
Hydro - Small scale	1%	1%	1%
Solar PV	17.5%	15%	10%
Solar thermal	13%	10%	7.5%
Tidal and Wave	15%	12.5%	10%
Wind onshore	0%	6.5%	5%
Wind offshore	0%	20%*	15%*

Table 8 ▷ Additional construction costs, operating costs and efficiencies of new carbon dioxide capture and storage (CCS) power plants

	Additional construction cost				Efficiency loss					Additional O&M cost (% of plant w/o CCS)
	(\$ per kW)				(%)					
	Current	2030			Current	2030				
		RS	550 hybrid	450 hybrid	RS	550 Policy Scenario	450 Policy Scenario			
Coal steam (ultrasupercritical)	800	600	600	550	12	12	12	12	7	100%
IGCC	650	600	600	500	12	12	12	12	6	30%
CCGT	500	400	400	350	8	8	8	8	7	50%
Capture rate	90%	90%	90%	90%	90%	90%	90%	90%	90%	

Notes to the tables

All costs are reported in year 2007 US dollars.

Construction costs include owner's costs but exclude interest during construction.

Plant efficiency is net (sent out basis), LHV (lower heating value). The difference between lower and higher heating value, based on IEA conventions, is 5% for coal and 10% for gas.

The IEA assumes an average thermal efficiency of 33% for nuclear power plants.

Regional efficiencies of coal-fired power plants have been adjusted to take into account cooling conditions, coal quality and the use of flue gas desulphurisation (FGD) and NOx control.

The costs and capacity factors of renewable energy technologies are for the Reference Scenario.

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