LAZARD

LAZARD

LEVELIZED COST OF ENERGY ANALYSIS - VERSION 2.0

JUNE 2008

Introduction

This analysis will address the following topics:

- Comparative "levelized cost of energy" for various technologies on a \$/MWh basis, including sensitivities, as relevant, for:
 - Fuel costs
 - Illustrative carbon emission costs
 - U.S. federal tax subsidies
 - Anticipated capital costs, over time
- Comparison of assumed capital costs on a \$/kW basis for various generation technologies
- Decomposition of the levelized costs of energy for various generation technologies by capital costs, fixed operations & maintenance expense, variable operations & maintenance expense, and fuel costs, as relevant
- Considerations regarding the applicability of various generation resources, taking into account factors such as location requirements/constraints, dispatch characteristics, land and water requirements and contingencies such as carbon pricing
- Summary assumptions for the various generation technologies examined
- Summary of Lazard's approach to comparing the levelized cost of energy for various conventional and Alternative Energy generation technologies, including identification of key potential sensitivities not addressed in the scope of this presentation

Levelized Cost of Energy Comparison

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies under some scenarios, even before factoring in environmental and other externalities (e.g., RECs, potential carbon emission costs, transmission costs) as well as the fast-increasing construction and fuel costs affecting conventional generation technologies

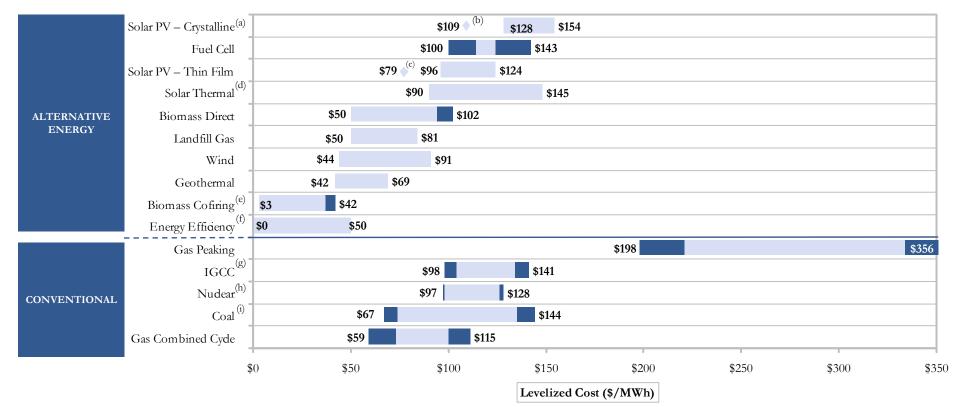
	Solar PV – Crystalline ^(a)			\$109 (b)	\$128 \$154				
	Fuel Cell			\$115	\$125				
	Solar PV – Thin Film		\$79 (^(c) \$9	6	\$124				
	Solar Thermal ^(d)		\$90		\$145				
ALTERNATIVE	Biomass Direct	\$50		\$94					
ENERGY	Landfill Gas	\$50	\$81						
	Wind	\$44		\$91					
	Geothermal (e)	\$42	\$69						
	Biomass Cofiring (f)	\$3 \$37							
	Energy Efficiency	\$0	\$50						
	Gas Peaking _(g)					\$221			\$334
	IGCC		\$	104	\$134				
CONVENTIONAL	Nudear ^(h)		\$	98	\$126				
	Coal ⁽¹⁾		\$74		\$135				
	Gas Combined Cyde		\$73	\$100					
	\$	\$0 \$50)	\$100	\$15 0	\$200	\$25 0	\$300	\$350
					Levelized C	ost (\$/MWh)			

Source: Lazard estimates.

- Note: Reflects production tax credit, investment tax credit, and accelerated asset depreciation as applicable. Assumes 2008 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life, 40% tax rate, and 5-20 year tax life. Assumes coal price of \$2.50 per MMBtu and natural gas price of \$8.00 per MMBtu.
- (a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
- (b) Represents a leading solar crystalline company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$5.00 per watt. Company guidance for 2012 total system cost of \$4.00 per watt would imply a levelized cost of energy of \$90 per MWh.
- (c) Represents the leading thin-film company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$2.75 per watt. Company guidance for 2012 total system cost of \$2.00 per watt would imply a levelized cost of energy of \$62 per MWh.
- (d) Low end represents solar tower. High end represents solar trough.
- (e) Represents retrofit cost of coal plant.
- (f) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.
- (g) High end incorporates 90% carbon capture and compression.
- 2 | LAZARD (h)
 - b) Does not reflect potential economic impact of federal loan guarantees or other subsidies.
 b) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

Levelized Cost of Energy Comparison – Sensitivity to Fuel Prices

Variations in fuel prices can materially affect the levelized cost of energy for conventional generation technologies, but direct comparisons against "competing" Alternative Energy generation technologies must take into account issues such as dispatch characteristics (e.g., baseload and/or dispatchable intermediate load vs. peaking or intermittent technologies)



Source: Lazard estimates.

3 LAZARD

- Note: Darkened areas in horizontal bars represent low end and high end levelized cost of energy corresponding with ±25% fuel price fluctuations.
- (a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
- (b) Represents a leading solar crystalline company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$5.00 per watt. Company guidance for 2012 total system cost of \$4.00 per watt would imply a levelized cost of energy of \$90 per MWh.
- (c) Represents the leading thin-film company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$2.75 per watt. Company guidance for 2012 total system cost of \$2.00 per watt would imply a levelized cost of energy of \$62 per MWh.
- (d) Low end represents solar tower. High end represents solar trough.
- (e) Represents retrofit cost of coal plant.
- (f) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.

(g) High end incorporates 90% carbon capture and compression.

- (h) Does not reflect potential economic impact of federal loan guarantees or other subsidies.
- (i) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

Levelized Cost of Energy – Sensitivity to Carbon Emission Costs

Conventional generation technologies are subject to uncertainty regarding the potential for future carbon emission costs, which would not affect Alternative Energy generation technologies except positively through credit positions or otherwise (n.b., these potential positive benefits are not reflected below)

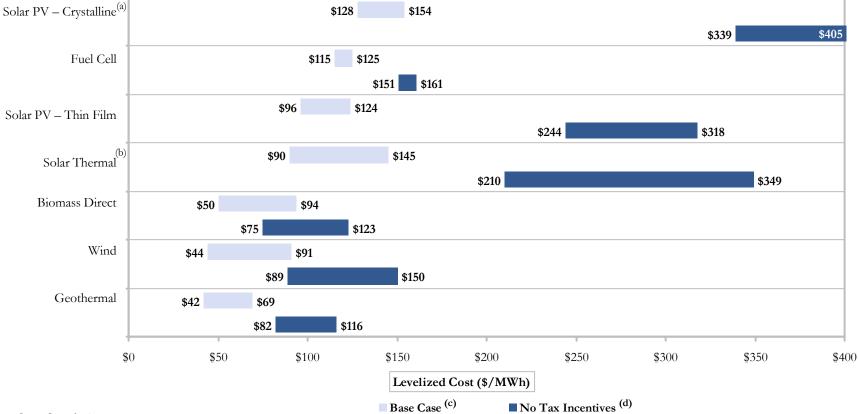
	Solar PV – Crystalline ^(a)			\$109	(b) \$	128 \$1	54			
	Fuel Cell			\$1	15	\$139				
	Solar PV – Thin Film		\$79	(^{c)} \$96	\$12	24				
	Solar Thermal ^(d)			\$90		\$145				
ALTERNATIVE ENERGY	Biomass Direct	\$50		\$94						
	Land fill Gas	\$50		\$81						
	Wind	\$44		\$91						
	Geothermal	\$42	\$	69						
	Biomass Cofiring ^(e)	\$3 \$37								
	Energy Efficiency ^(f)	\$0	\$50							
	Gas Peaking						\$221			\$352
	IGCC ^(g)			\$104	\$132	\$134				
	Nudear ^(h)			\$98	\$1	26				
CONVENTIONAL	Coal ⁽ⁱ⁾		\$74	\$102 🔷		\$135				
	Gas Combined Cyde		\$73	\$100	\$112		Base Case	\$30/ton CO2		
	\$	i0 \$!	60	\$100		\$150 Leveliz	\$200 ed Cost (\$/MWh)	\$250	\$300	\$35

Source: Lazard estimates.

- (a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
- (b) Represents a leading solar crystalline company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$5.00 per watt. Company guidance for 2012 total system cost of \$4.00 per watt would imply a levelized cost of energy of \$90 per MWh.
- (c) Represents the leading thin-film company's targeted implied levelized cost of energy in 2010, assuming a total system cost of \$2.75 per watt. Company guidance for 2012 total system cost of \$2.00 per watt would imply a levelized cost of energy of \$62 per MWh.
- (d) Low end represents solar tower. High end represents solar trough.
- (e) Represents retrofit cost of coal plant.
- (f) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.
- (g) High end of light horizontal bar incorporates 90% carbon capture and compression and no carbon emission cost. Diamond represents no carbon capture and compression, and a carbon emission cost of \$30 per ton.
- (h) Does not reflect potential economic impact of federal loan guarantees or other subsidies.
-) Based on advanced supercritical pulverized coal. Diamond represents no carbon capture and compression, and a carbon emission cost of \$30 per ton.

Levelized Cost of Energy - Sensitivity to U.S. Federal Tax Incentives

U.S. federal tax subsidies remain an important component of the economics of Alternative Energy generation technologies (and government incentives are important in all regions), notwithstanding high prevailing fossil fuel prices; future cost reductions in technologies such as fuel cells, solar PV and solar thermal have the potential to enable these technologies to approach "grid parity" without tax subsidies (albeit such observation does not take into account issues such as dispatch characteristics or other factors)



Source: Lazard estimates.

Note: Assumes 2008 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life and 40% tax rate. Assumes coal price of \$2.50 per MMBtu and natural gas price of \$8.00 per MMBtu.

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.

(b) Low end represents solar tower. High end represents solar trough.

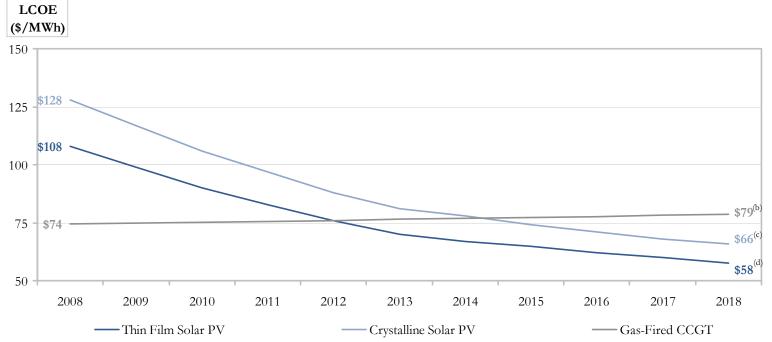
(c) Reflects production tax credit, investment tax credit, and accelerated asset depreciation as applicable.

(d) Illustrates levelized cost of energy in the absence of U.S. federal tax incentives such as investment tax credits, production tax credits and assuming 20-year tax life.

Levelized Cost of Energy – Sensitivity to Capital Costs^(a)

An important finding in respect of Solar PV technologies is the potential for significant cost reductions over time as manufacturing scale along the entire production value chain increases; by contrast, conventional generation technologies are experiencing capital cost inflation (as well as fuel cost inflation), driven by high levels of global demand for conventional generation equipment, where potentially cost-reducing manufacturing improvements for these mature technologies are largely incremental in nature

This assessment, however, does not take into account the intermittent nature of Solar PV as compared with the dispatchable nature of conventional generation; the key finding in this regard is that Solar PV technologies will play an increasingly *complementary* role in generation portfolios



Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit, and accelerated asset depreciation as applicable. Assumes 2008 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life, 40% tax rate, and 5-20 year tax life. Assumes coal price of \$2.50 per MMBtu and natural gas price of \$8.00 per MMBtu.

(a) Assumes capital costs for thin film and crystalline Solar PV decline by 10% annually through 2012 and 5% annually thereafter; assumes capital costs for gas-fired CCGT increase by 2.5% annually and gas prices constant at \$8.00 per MMBtu.

(b) Assumes 85% capacity factor.

(c) Assumes 26% capacity factor based on single-axis tracking.

(d) Assumes 23% capacity factor.

Capital Cost Comparison

While capital costs for a number of Alternative Energy generation technologies (e.g., solar PV, solar thermal) are currently in excess of conventional generation technologies (e.g., gas, coal, nuclear), declining costs for many Alternative Energy generation technologies, coupled with rising construction and fuel costs for conventional generation technologies, are working to close formerly wide gaps in electricity costs. This assessment, however, does not take into account issues such as dispatch characteristics, capacity factors, fuel and other costs needed to compare generation technologies

	Solar PV – Crystalline ^(a)					\$5,0	000 (b)	\$5,500 \$6,000)		
	Fuel Cell					\$3,800					
	Solar PV – Thin Film			\$2,75	50 🔶 ^(c) \$3,500	\$4,000					
	Solar Thermal ^(d)					\$4,500		\$	6,300		
ALTERNATIVE ENERGY	Biomass Direct			\$2,7	750	\$3,500					
	Landfill Gas		\$1,500	\$2,000)						
	Wind		\$1,900		\$2,500						
	Geothermal				\$3,000	\$4,000					
	Biomass Cofiring ^(e)	\$50 \$50	0								
	Gas Peaking	\$650	\$1,500)							
	$\mathrm{IGCC}^{(\mathrm{f})}$				\$3	,750	\$5,05	0			
CONVENTIONAL	Coal ^(g)			\$2,550)		\$	5,350			
CONVENTIONAL	Nudear						\$5,	750		\$7,550	
	Gas Combined Cyde	\$900	\$1,100								
	\$	0	\$1,000 \$2	2,000	\$3,000	\$4,000	\$5,000	\$6,000	\$7,000	\$8,000	\$9,000
						Capital Cos					

Source: Lazard estimates.

7 LAZARD

(a) Low end represents single-axis tracking crystalline. High end represents fixed installation.

(b) Based on a leading solar crystalline company's guidance of 2010 total system cost of \$5.00 per watt. Company guidance for 2012 total system cost is \$4.00 per watt.

(c) Based on the leading thin-film company's guidance of 2010 total system cost of \$2.75 per watt; company guidance for 2012 total system cost is \$2.00 per watt.

(d) Low end represents solar trough. High end represents solar tower.

(e) Represents retrofit cost of coal plant.

(f) High end incorporates 90% carbon capture and compression.

(g) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

Levelized Cost of Energy Components - Low End

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies; a key factor regarding the long-term competitiveness of currently more expensive Alternative Energy technologies is the ability of technological development and increased production volumes to materially lower the capital costs of certain Alternative Energy technologies, and their levelized cost of energy, over time (e.g., as is anticipated with solar PV technologies)

	Solar PV – Crystalline ^(a)		\$117		\$11 \$12	8		
	Fuel Cell	\$34	\$20 \$11	\$50	\$115			
	Solar PV – Thin Film			\$84 \$12 \$96				
	Solar Thermal ^(b)		\$69	\$21 \$90				
ALTERNATIVE ENERGY	Biomass Direct	\$27	\$12 \$11 \$50					
	Landfill Gas	\$13 \$17	7 \$20 <mark>\$50</mark>					
	Wind	\$31	\$13 \$44					
	Geothermal	\$17	\$25 \$42					
	Biomass Cofiring ^(c)	\$ <mark>2</mark> \$3						
	Gas Peaking		\$98	\$8	\$28		\$87	\$221
	IGCC ^(d)		\$71	\$4\$7\$22 <mark>\$1</mark>	04			
CONVENTIONAL	Coal ^(e)	\$4	7 \$3\$2 \$22	\$74				
	Nuclear ^(f)		\$91	\$ <mark>2\$5</mark> \$98				
	Gas Combined Cycle	\$14 \$ <mark>1</mark> \$4	\$54	\$73				
	\$	50	\$50	\$100		\$150	\$200	\$250
				Leveliz	ed Cost (\$/	MWh)		
	Source: La	ızard estimates.	Capital Co	st 🗖 Fixed O&M	Variable O	&M ∎ Fuel Cos	t	
o -	co (a) Lo (b) Lo (c) Re	st, 20-year econo ow end represent ow end represent presents retrofit	n tax credit, investment tax omic life, 40% tax rate, and ts single-axis tracking crystz ts solar tower. High end rep t cost of coal plant. arbon capture and compres	5-20 year tax life. Assumes alline. High end represents presents solar trough.	coal price of \$2	50 per MMBtu and nat		

(f) Does not reflect potential economic impact of federal loan guarantees or other subsidies.

Levelized Cost of Energy Components - High End

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies; a key factor regarding the long-term competitiveness of currently more expensive Alternative Energy technologies is the ability of technological development and increased production volumes to materially lower the capital costs of certain Alternative Energy technologies, and their levelized cost of energy, over time (e.g., as is anticipated with solar PV technologies)

	Solar PV – Crystalline ^(a)		\$140		\$14 \$154				
	Fuel Cell	\$36	\$20 \$11	\$58	\$125				
ALTERNATIVE ENERGY	Solar PV – Thin Film		\$110	\$14	\$124				
	Solar Thermal ^(b)		\$116		\$29 \$145				
	Biomass Direct	\$42	\$12 \$11 \$	\$29 \$94					
	Landfill Gas	\$23 \$1	\$41	\$81					
	Wind	5	\$71	\$20 \$91					
	Geothermal	\$39	\$30 <mark>\$</mark> 6	9					
	Biomass Cofiring ^(c)	\$14 \$3 \$20	\$37						
	Gas Peaking			\$217			\$31 \$5	\$81	\$334
	IGCC ^(d)		\$97	<mark>\$4</mark> \$7 \$2	6 \$134				
CONVENTIONAL	Coal ^(e)		\$95	\$4\$6 \$30	\$135				
	Nudear ^(f)		\$119	\$2 <mark></mark> \$	5 \$126				
	Gas Combined Cyde	\$38	\$2 \$2 \$58	\$100					
	\$	0	\$50	\$100	\$150	\$2 00	\$25	0 \$30	00 \$
						ost (\$/MWh)	п		

Capital Cost Fixed O&M Variable O&M Fuel Cost

Source: Lazard estimates.

- Note: Reflects production tax credit, investment tax credit, and accelerated asset depreciation as applicable. Assumes 2008 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life, 40% tax rate, and 5-20 year tax life. Assumes coal price of \$2.50 per MMBtu and natural gas price of \$8.00 per MMBtu.
- (a) Low end represents single-axis tracking crystalline. High end represents fixed installation.
- (b) Low end represents solar tower. High end represents solar trough.
- (c) Represents retrofit cost of coal plant.
- 9 **T A Z A R D** (e) (d) Incorporates 90% carbon capture and compression. Based on advanced supercritical pulverized coal. Inc
 - (e) Based on advanced supercritical pulverized coal. Incorporates 90% carbon capture and compression.
 - (f) Does not reflect potential economic impact of federal loan guarantees or other subsidies.

Energy Resources: Matrix of Applications

While the levelized cost of energy for Alternative Energy generation technologies is becoming increasingly competitive with conventional generation technologies, direct comparisons must take into account issues such as location (e.g., central station vs. customer-located), dispatch characteristics (e.g., baseload and/or dispatchable intermediate load vs. peaking or intermittent technologies), and contingencies such as carbon pricing

					LOCATION		DISPATCH				
		LEVELIZED COST OF ENERGY	CARBON NEUTRAL/ REC POTENTIAL	STATE OF TECHNOLOGY	CUSTOMER LOCATED	CENTRAL STATION	GEOGRAPHY	INTERMITTENT	PEAKING	LOAD- FOLLOWING	BASE-LOAD
	FUEL CELL	\$115-125	? (a)	Emerging/ Commercial	✓		Universal	-			\checkmark
	SOLAR PV	\$96-154	\checkmark	Newly Commercial	✓	\checkmark	Universal	\checkmark	\checkmark		
ALTERNATIVE ENERGY	SOLAR THERMAL	\$90-145	\checkmark	Emerging		\checkmark	Southwest	\checkmark	\checkmark	\checkmark	
	BIOMASS DIRECT	\$50-94	\checkmark	Mature		\checkmark	Universal			\checkmark	\checkmark
	WIND	\$44-91	\checkmark	Mature		\checkmark	Varies	\checkmark			
	GEOTHERMAL	\$42-69	\checkmark	Commercial/ Evolving		\checkmark	Varies				\checkmark
	LANDFILL GAS	\$50-81	\checkmark	Mature		\checkmark	Varies				\checkmark
	GAS PEAKING	\$221-334	×	Mature	✓	\checkmark	Universal		\checkmark		
	IGCC	\$104-134	x ^(b)	Emerging ^(c)		\checkmark	Co-located or rural				\checkmark
CONVENTIONAL	GAS COMBINED CYCLE	\$73-100	×	Mature	✓	\checkmark	Universal			\checkmark	\checkmark
	COAL	\$74-135	x ^(b)	Mature ^(c)		\checkmark	Co-located or rural				\checkmark
	NUCLEAR	\$98-126	\checkmark	Mature/ Emerging		\checkmark	Co-located or rural				\checkmark

Source: Lazard estimates.

(a) Qualification for RPS requirements varies by location.

(b) Could be considered carbon neutral technology, assuming carbon capture and compression.

(c) Carbon capture and compression technologies are in emerging stage.

Levelized Cost of Energy – Key Assumptions

		Sola	r PV	Solar Thermal			
	Units	Thin Film Utility	Crystalline Utility ^(b)	Trough-No Storage ^(c)	Tower ^(d)		
Net Facility Output	MW	10	10	200	100		
EPC Cost	\$/kW	\$3,500 - \$4,000	\$6,000 - \$5,500	\$4,500 - \$5,800	\$5,000 - \$6,300		
Owner's Cost	\$/kW	included	included	included	included		
Total Capital Cost ^(a)	\$/kW	\$3,500 - \$4,000	\$6,000 - \$5,500	\$4,500 - \$5,800	\$5,000 - \$6,300		
Fixed O&M	\$/kW-yr	\$25. 00	\$25.00	\$66. 00	\$70.00		
Variable O&M	\$/MWh	—		—			
Heat Rate	Btu/kWh	—		—	_		
Capacity Factor	%	23% - 20%	26% - 20%	29% - 26%	35% - 38%		
Fuel Price	\$/MMBtu	—	—	—			
Construction Time	Months	12	12	24	24		
Facility Life	Years	20	20	20	20		
CO ₂ Equivalent Emissions	Tons/MWh	—		—	—		
Investment Tax Credit	%	30%	30%	30%	30%		
Production Tax Credit	\$/MWh	—		—	—		
Levelized Cost of Energy	\$/MWh	\$96 - \$124	\$128 - \$154	\$108 - \$145	\$90 - \$116		

Source: Lazard estimates.

Note: Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices, 40% tax rate, financing with 60% debt at 7% interest rate and 40% equity at 12% cost.

Includes capitalized interest costs during construction. (a)

(b) Left side represents single-axis tracking crystalline; right side represents fixed installation.

(c) (d) Left side represents wet-cooled; right side represents dry-cooled.

11 LAZARD

Represents a range of solar thermal tower estimates.

Levelized Cost of Energy – Key Assumptions (cont'd)

Gas Combined											
	Units	IGCC ^(b)	Cycle	Gas Peaking ^(c)	Coal ^(d)	Nuclear ^(e)	Fuel Cell ^(f)				
Net Facility Output	MW	580	550	150	600	1,100	2.3				
EPC Cost	\$/kW	\$2,500 - \$3,375	\$700 - \$875	\$500 - \$1,150	\$1,825 - \$3,825	\$3,750 - \$5,250	\$3,000				
Owner's Cost	\$/kW	\$1,250 - \$1,700	\$200 - \$225	\$150 - \$350	\$725 - \$1,525	\$2,000 - \$2,300	\$800				
Total Capital Cost ^(a)	\$/kW	\$3,750 - \$5,075	\$900 - \$1,100	\$650 - \$1,500	\$2,55 0 - \$5,35 0	\$5,750 - \$7,550	\$3,800				
Fixed O&M	\$/kW-yr	\$26.40 - \$28.20	\$5.50 - \$6.20	\$6.80 - \$27.00	\$20.40 - \$31.60	\$12.8 0	\$169.00				
Variable O&M	\$/MWh	\$6.80	\$2.00 - \$3.50	\$28.00 - \$4.70	\$2.00 - \$5.60	\$11.00	\$11.00				
Heat Rate	Btu/kWh	8,800 - 10,520	6,800 - 7,220	10,880 - 10,200	8,870 - 11,900	10,450	6,240 - 7,260				
Capacity Factor	%	80%	85% - 40%	10%	85%	90%	95%				
Fuel Price	\$/MMBtu	\$2.5 0	\$8.00	\$8.00	\$2.5 0	\$0.50	\$8.00				
Construction Time	Months	57 - 63	36	25	60 - 66	69	3				
Facility Life	Years	20	20	20	20	20	20				
CO ₂ Equivalent Emissions	Tons/MWh	0.93 - 0.11	0.40 - 0.42	0.40 - 0.42	0.94 - 0.13		0.36 - 0.42				
Investment Tax Credit	%	—	—		—		30%				
Production Tax Credit	\$/MWh	—	—	—	—						
Levelized Cost of Energy	\$/MWh	\$104 - \$134	\$73 - \$1 00	\$221 - \$334	\$74 - \$135	\$98 - \$126	\$115 - \$125				

Source: Lazard estimates.

Note: Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices, 40% tax rate, financing with 60% debt at 7% interest rate and 40% equity at 12% cost.

- (a) Includes capitalized interest costs during construction.
- (b) High end incorporates 90% carbon capture and compression.
- (c) Low end represents assumptions regarding GE 7FA. High end represents assumptions regarding GE LM6000PC.
- (d) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.
- (e) Does not reflect potential economic impact of federal loan guarantees or other subsidies.

12 LAZARD

(f) Low end incorporates illustrative economic and efficiency benefits of combined heat and power ("CHP") applications.

	Units	Biomass Direct	Wind	Geothermal	Landfill Gas	Biomass Cofiring ^(b)
Net Facility Output	MW	35	100	30	5	2% - 20% ^(c)
EPC Cost	\$/kW	\$2,750 - \$3,500	\$1,900 - \$2,500	\$3,000 - \$4,000	\$1,500 - \$2,000	\$50 - \$500
Owner's Cost	\$/kW	included	included	included	included	included
Total Capital Cost ^(a)	\$/kW	\$2,750 - \$3,500	\$1,900 - \$2,500	\$3,000 - \$4,000	\$1,500 - \$2,000	\$50 - \$500
Fixed O&M	\$/kW-yr	\$83.00	\$40.00 - \$50.00			\$10.00 - \$20.00
Variable O&M	\$/MWh	\$11.00		\$25.00 - \$30.00	\$17.00	
Heat Rate	Btu/kWh	14,500			13,500	10,000
Capacity Factor	%	80%	36% - 28%	80% - 70%	80%	80%
Fuel Price	\$/MMBtu	\$0.00 - \$2.00			\$1.50 - \$3.00	\$0.00 - \$2.00
Construction Time	Months	36	12	36	12	12
Facility Life	Years	20	20	20	20	20
CO ₂ Equivalent Emissions	Tons/MWh	—				
Investment Tax Credit	%	—				
Production Tax Credit	\$/MWh	\$10	\$2 0	\$2 0	\$10	
Levelized Cost of Energy	\$/MWh	\$50 - \$94	\$44 - \$91	\$42 - \$6 9	\$5 0 - \$ 81	\$3 - \$37

Levelized Cost of Energy – Key Assumptions (cont'd)

Source: Lazard estimates.

Note: Assumes 2.5% annual escalation for production tax credit, O&M costs and fuel prices, 40% tax rate, financing with 60% debt at 7% interest rate and 40% equity at 12% cost.

Includes capitalized interest costs during construction. (a)

13 | LAZARD (c)Represents retrofit cost of host coal plant.

Additional output to a coal facility.

Summary Considerations

Lazard has conducted this study comparing the levelized cost of energy for various conventional and Alternative Energy generation technologies in order to understand which Alternative Energy generation technologies may be cost-competitive with conventional generation technologies, either now or in the future, and under various operating assumptions, as well as to understand which technologies are best suited for various applications based on locational requirements, dispatch characteristics and other factors. We find that Alternative Energy technologies are complementary to conventional generation technologies, and believe that their use will be increasingly prevalent for a variety of reasons, including government subsidies, RPS requirements, and continuously improving economics as underlying technologies improve and production volumes increase.

In this study, Lazard's approach was to determine the levelized cost of energy, on a \$/MWh basis, that would provide an after-tax IRR to equity holders equal to an assumed cost of equity capital. Certain assumptions (e.g., required debt and equity returns, capital structure, and economic life) were identical for all technologies, in order to isolate the effects of key differentiated inputs such as investment costs, capacity factors, operating costs, fuel costs (where relevant) and U.S. federal tax incentives on the levelized cost of energy. These inputs were developed with a leading consulting and engineering firm to the Power & Energy Industry, augmented with Lazard's commercial knowledge where relevant.

Lazard has not manipulated capital costs or capital structure for various technologies, as the goal of the study was to compare the current state of various generation technologies, rather than the benefits of financial engineering. The results contained in this study would be altered by different assumptions regarding capital structure (e.g., increased use of leverage) or capital costs (e.g., a willingness to accept lower returns than those assumed herein).

Key sensitivities examined included fuel costs and illustrative carbon emission costs. Other factors would also have a potentially significant effect on the results contained herein, but have not been examined in the scope of this current analysis. These additional factors, among others, could include scale benefits or detriments, the value of Renewable Energy Credits ("RECs") or carbon emissions offsets, the impact of transmission costs, and the economic life of the various assets examined.