

NLH 2013 Amended General Rate Application

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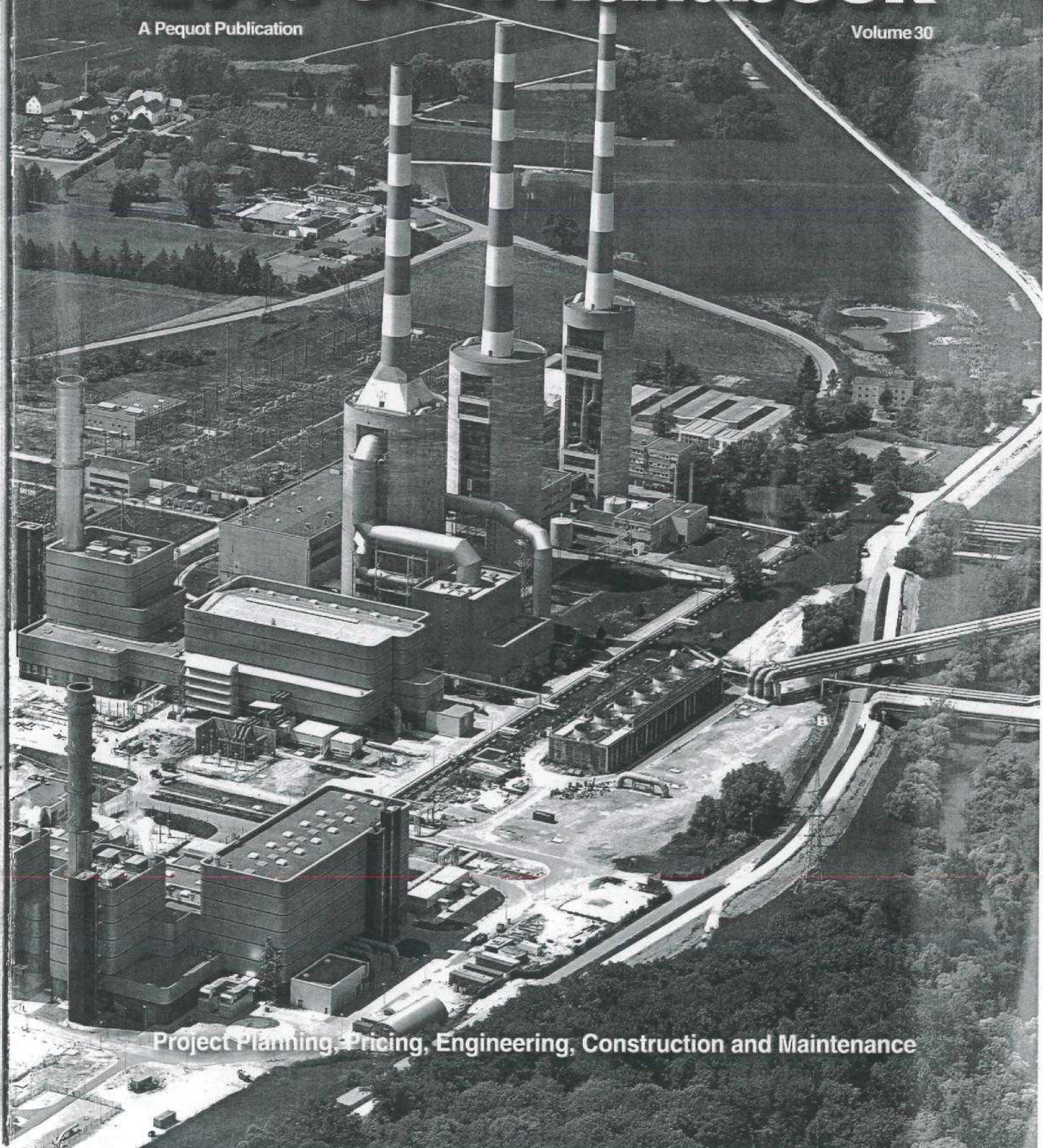
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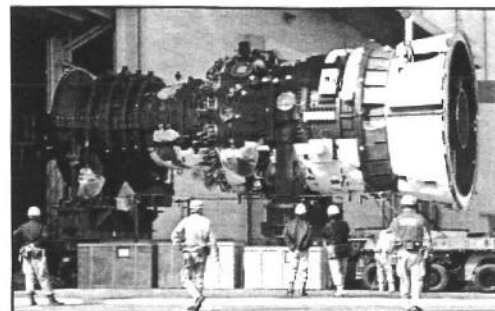
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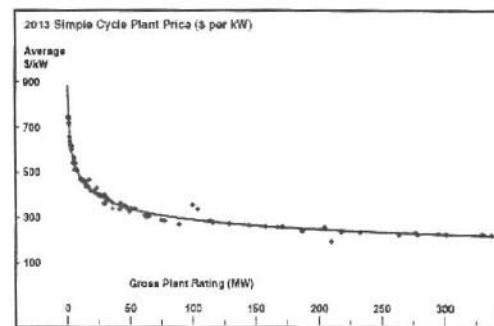
- 192 Volume 43 (2012)
- 195 Volume 42 (2011)
- 198 Volume 41 (2010)

On the Cover. Siemens 1x1 SCC5-8000H plant (in front of chimneys) rated at 570MW and 60% efficiency has a 35MW per min ramp rate.



Engineering and Design

In response to changing industry needs, OEMs are designing for higher power densities and efficiencies, lower emissions, extended maintenance intervals and lower part-load operating range, page 00



Budget Plant Pricing

GTW budget prices are intended as benchmarks for standard bare bones plants built around a minimum equipment scope of supply for an operational plant with existing onsite access to fuel, water and the grid, page 00



Orders and Installations

Gas turbine power plant projects on order or installed during 2011 and 2012 worldwide sorted by region and country listing buyer and site, operational application, plant rating, OEM gas turbine model and type fuel, page 00



2013 Simple Cycle Plant Prices

Estimated equipment-only budget prices for standard single-fuel gas turbine plant without options

Standard packages

Equipment-only budget prices for packaged turbine gensets and simple cycle power plants are FOB factory in US dollars for a single-unit purchase. They do not include engineering, construction or owner project costs.

We are talking standard power plant packages equipped with basic systems and controls required of an operational installation without bells and whistles, options or customized changes.

Scope of equipment can be likened to a standard automobile equipped with wheels, transmission, brakes and steering but without cruise control, navigation system or moon roof.

Scope of supply

Basic scope of supply for an operational simple cycle power plant typically includes gas turbine, electric generator, dry low NOx combustion (standard for new generation designs),

and auxiliary mechanical and electrical systems:

- **Gas turbine.** Skid-mounted single-fuel gas turbine engine, starting motor, reduction gear (if any), lube oil and hydraulic oil systems, compressor water wash system, fuel forwarding/control valve system, turbine cooling system (if any) and interconnecting piping. (Note: mechanical equipment will often be supplied in a separately packaged and enclosed skid.

- **Generator.** Common standard is air-cooled generator. Hydrogen cooling or totally enclosed air-water cooling (TEWAC) for larger units are usually supplied as options. Generator exciter is typically included in a standard packaged plant.

- **DLN combustion.** Increasingly, advanced gas turbine models include dry low NOx combustion in the basic scope of supply.

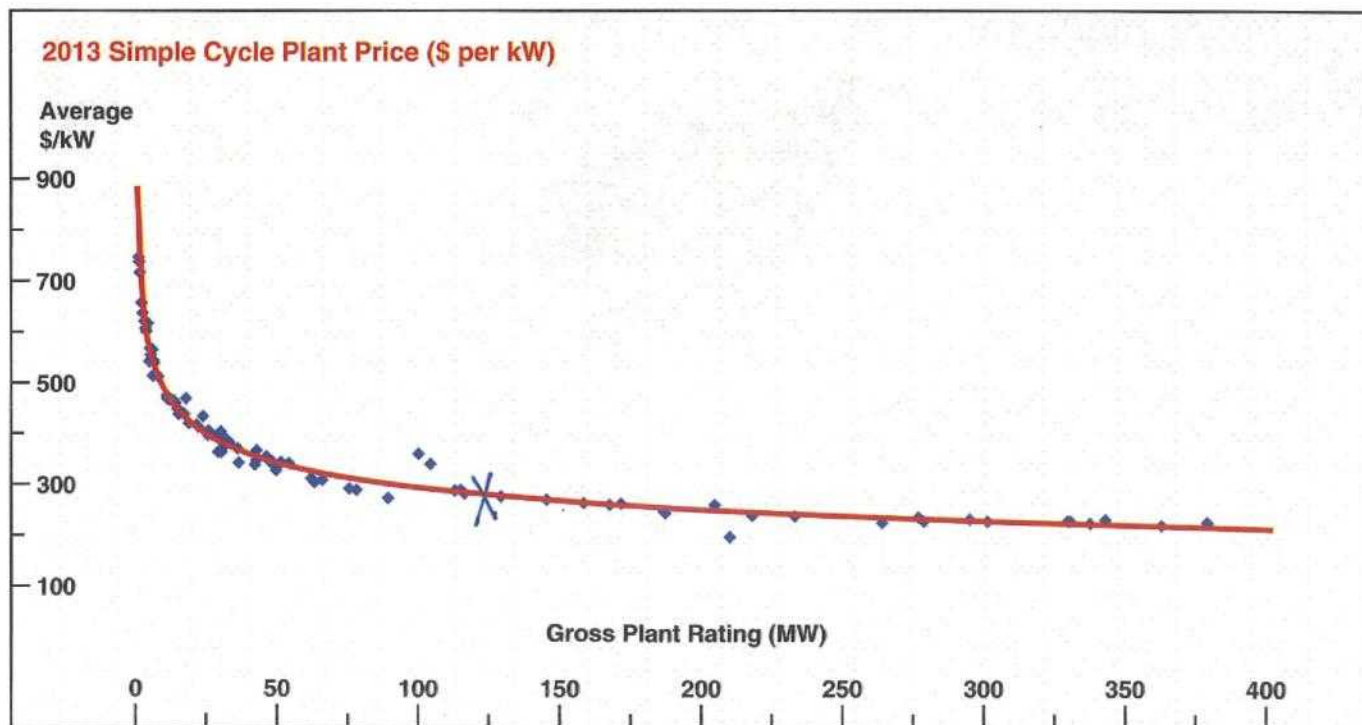
- **Balance of plant.** Standard auxiliaries include air intake filter, ducting and silencer, exhaust ducting and stack (short) with silencer, vibration monitoring and digital control system.

Packaged gensets include acoustic enclosures with ventilation and fire protection systems for outdoor installation. Electrical auxiliaries typically include batteries, motor control center, voltage regulator and surge protection.

Auxiliary transformers needed to condition power supply for plant motors (starting, lube oil pump and cooling fans) are usually optional. Other OEM options might include liquid fuel or dual-fuel (gas and liquid) system, inlet air chilling, isolated phase bus, gas compression, etc.

Power ratings

Industry practice is to reference plant pricing to ISO base load output rating on natural gas fuel at 59°F ambient temperature and sea level site condi-



tions (ie. 0 ft. elevation) and 60% relative humidity.

For purposes of standardization, unit ratings are listed without inlet and exhaust losses, and without water or steam injection for NOx reduction or power augmentation, unless otherwise specified. Typical inlet and exhaust pressure drops combined can reduce power output by about 1.5 percent and increase heat rate by about 0.5 percent.

Nominally quoted prices are for OEM specified design ratings with power output measured across the generator terminals so as to include generator efficiency and any reduction gearing losses.

Specific project bid prices are usually quoted by OEMs with guarantees on net power and heat rate at site specific conditions (ambient temperature, elevation and relative humidity, as well as fuel composition). Quoted performance would include inlet and exhaust losses.

Bid quotes

Actual performance quoted and guaranteed by the gas turbine OEM will be for "new and clean" equipment condition with no allowance made for inevitable degradation in performance with usage.

Conservative OEMs tend to bid with some margin, i.e. with slightly higher heat rate and lower power output to allow for normal variations in manufacturing tolerances and test uncertainties.

Typically, with performance guarantees, there is a margin of 0.5 to 1% points on efficiency and power ratings which is why slightly better performance may initially be realized in actual service.

Several factors that enter into a given project price quote include number of units ordered (there are quantity discounts), scope of equipment supply, site specifics, duty cycle, geographic location and local market share position.

Changes in currency valuations may also play a significant role in quotation depending on which countries (i.e. currencies) are involved in the gas turbine manufacture, purchase, and installation.

Gas turbine gensets specially designed for onshore oil and gas pipeline operation typically are priced around 10% higher than industrial or utility power plants due to increased cost of special packaging and safety requirements for such applications

Offshore platform packages have an additional price premium. They

require specialized mounts and housing, marine-resistant coatings and materials, and ultra efficient intake filter systems to handle salt-water laden air.

Scoping studies

This reference section of the GTW Handbook is useful for a preliminary assessment and evaluation of gas turbine equipment prices within a plus or minus 10% range of accuracy for the defined equipment scope.

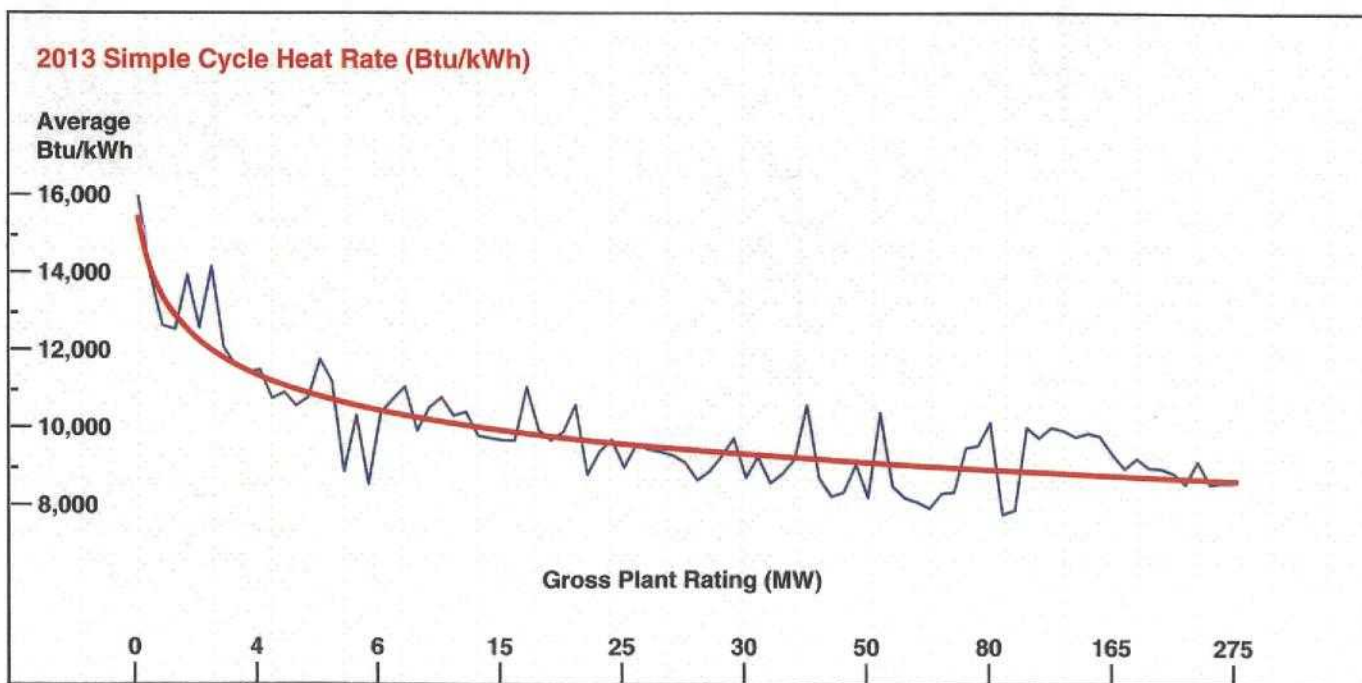
For project budget planning, mind that profit and cost of engineering and construction services for installation can add 60 to 100% to total plant cost.

In general, prices are considerably higher in \$/kW for small gas turbines in the "under 20 MW size range" than for larger units.

Above 20MW on up to around 150MW, the \$/kW price falls off considerably as economies of scale allow OEMs to reduce the manufacturing costs of larger machines.

Beyond that, the \$/kW curve for units bigger than 150MW more or less remains flat regardless of size.

In reality, the higher cost of materials and manufacturing for the larger more advanced (high firing temperature) units effectively negates any economies of scale that might otherwise have been realized. ■



Simple Cycle Plant Prices

Estimated equipment-only budget prices for basic power plant FOB factory in fixed 2013 dollars

Gas Turbine Model	ISO Base Load	Heat Rate Btu/kWh	Efficiency	Budget Plant Price	\$ per kW
C200	200 kW	10,300 Btu	33.1%	\$220,000	\$1,111
VPS1	504 kW	16,378 Btu	20.8%	\$460,000	\$906
M1A-13D	1,485 kW	14,238 Btu	24.0%	\$1,140,000	\$765
M7A-17D	1,685 kW	12,841 Btu	26.6%	\$1,270,000	\$756
OP16-3B (DLE)	1,910 kW	12,732 Btu	26.8%	\$1,400,000	\$735
OGT2500	2,670 kW	12,780 Btu	26.7%	\$1,810,000	\$678
M1T-13D	2,930 kW	14,444 Btu	23.6%	\$1,920,000	\$656
Centaur 40	3,515 kW	12,240 Btu	27.9%	\$2,250,000	\$640
CX501-KB5	3,897 kW	11,747 Btu	29.0%	\$2,440,000	\$626
GT10	4,130 kW	11,582 Btu	29.5%	\$2,560,000	\$620
Centaur 50	4,600 kW	11,630 Btu	29.3%	\$2,930,000	\$636
501-KB7S	5,245 kW	10,848 Btu	31.5%	\$2,940,000	\$561
SGT-100	5,400 kW	11,008 Btu	31.0%	\$3,170,000	\$587
GT13	5,600 kW	10,646 Btu	32.0%	\$3,280,000	\$585
Taurus 60	5,670 kW	10,860 Btu	31.5%	\$3,250,000	\$574
MF-61	5,925 kW	11,910 Btu	28.6%	\$3,350,000	\$566
OGT6000	6,200 kW	11,299 Btu	30.2%	\$3,510,000	\$565
Taurus 65	6,300 kW	10,375 Btu	32.9%	\$3,530,000	\$561
501-KH5	6,447 kW	8509 Btu	40.1%	\$3,400,000	\$533
GT6	6,630 kW	10,450 Btu	32.7%	\$3,740,000	\$563
SGT-200	6,750 kW	10,824 Btu	31.5%	\$3,770,000	\$558
CX300	7,900 kW	11,158 Btu	30.6%	\$4,220,000	\$534
Taurus 70	7,965 kW	9955 Btu	34.0%	\$4,270,000	\$536
GE10-1	11,250 kW	10,867 Btu	31.4%	\$5,540,000	\$493
Mars 100	11,430 kW	10,365 Btu	32.9%	\$5,580,000	\$488
GTU-12PG-2	12,300 kW	10,469 Btu	32.6%	\$5,970,000	\$485
SGT-400	12,900 kW	9817 Btu	34.8%	\$6,260,000	\$485
PGT16	13,720 kW	9758 Btu	35.0%	\$6,630,000	\$484
SGT-400	14,400 kW	9700 Btu	35.2%	\$6,900,000	\$479
Titan 130	15,000 kW	9695 Btu	35.2%	\$7,020,000	\$468

SC Prices

Gas Turbine Model	ISO Base Load	Heat Rate Btu/kWh	Efficiency	Budget Plant Price	\$ per kW
LM1800E	18,100 kW	9930 Btu	34.4%	\$8,210,000	\$454
SGT-500	19,100 kW	10,664 Btu	32.0%	\$7,800,000	\$408
Titan 250	21,745 kW	8775 Btu	40.0%	\$8,820,000	\$405
PGT25	22,417 kW	9401 Btu	36.3%	\$9,010,000	\$402
LM2500PE	24,049 kW	9717 Btu	35.1%	\$10,130,000	\$421
SwiftPac 25	25,455 kW	8960 Btu	38.1%	\$10,010,000	\$393
UGT 25000	25,680 kW	9590 Btu	35.6%	\$9,940,000	\$387
MobilePac	26,140 kW	9453 Btu	36.1%	\$10,310,000	\$394
RB211-G62 DLE	27,216 kW	9387 Btu	36.4%	\$10,530,000	\$387
LM2500PK	29,316 kW	9287 Btu	36.7%	\$10,440,000	\$356
RB211-GT62 DLE	29,845 kW	9089 Btu	37.5%	\$11,380,000	\$381
PGT25+	30,226 kW	8610 Btu	39.6%	\$11,890,000	\$393
LM2500PR	30,464 kW	8854 Btu	38.5%	\$10,850,000	\$356
SwiftPac 30	30,850 kW	9260 Btu	36.8%	\$11,500,000	\$373
MS5002E	31,100 kW	9748 Btu	35.0%	\$11,710,000	\$377
RB211-GT61 DLE	32,130 kW	8681 Btu	39.3%	\$12,190,000	\$379
SGT-700	32,214 kW	9255 Btu	36.9%	\$11,950,000	\$371
PGT25+G4	33,057 kW	8530 Btu	40.0%	\$12,330,000	\$373
SGT-750	35,930 kW	8787 Btu	38.8%	\$13,030,000	\$363
LM2500+ RC	36,333 kW	9184 Btu	37.2%	\$12,230,000	\$337
MS6001B	42,100 kW	10,644 Btu	32.1%	\$14,020,000	\$333
RB211-H63 WLE	42,473 kW	8679 Btu	39.3%	\$14,460,000	\$340
LM6000PF	42,732 kW	8173 Btu	41.7%	\$15,340,000	\$359
LM6000PC Sprint	46,200 kW	8286 Btu	41.2%	\$16,070,000	\$348
SGT-800	47,500 kW	9058 Btu	37.7%	\$16,040,000	\$338
LM6000PF Sprint	48,092 kW	8151 Btu	41.9%	\$16,280,000	\$339
SGT-900	49,500 kW	10,450 Btu	32.7%	\$15,970,000	\$323
LM6000PC Sprint	50,526 kW	8458 Btu	40.3%	\$16,820,000	\$333
LM6000PG	51,204 kW	8142 Btu	41.9%	\$17,290,000	\$338
Trent 60 DLE	54,020 kW	8031 Btu	42.5%	\$18,140,000	\$336
Trent 60 DLE ISI	61,842 kW	7867 Btu	43.4%	\$19,040,000	\$308
Trent 60 WLE	62,920 kW	8268 Btu	41.3%	\$18,900,000	\$300
Trent 60 WLE ISI	65,632 kW	8304 Btu	41.1%	\$20,020,000	\$305
AE64.3A	75,000 kW	9505 Btu	35.9%	\$21,690,000	\$289
6F 3-series	77,577 kW	9574 Btu	35.6%	\$22,220,000	\$286
7E 3-series	88,718 kW	10,192 Btu	33.5%	\$24,090,000	\$272
LMS100PB	99,400 kW	7695 Btu	44.3%	\$38,400,000	\$386
LMS100PA	103,500 kW	7815 Btu	43.7%	\$39,300,000	\$380
SGT6-2000E	112,000 kW	10,066 Btu	33.9%	\$31,870,000	\$285

Gas Turbine Model	ISO Base Load	Heat Rate Btu/kWh	Efficiency	Budget Plant Price	\$ per kW
M501DA	113,950 kW	9780 Btu	34.9%	\$32,530,000	\$286
GT11N2	115,400 kW	10,065 Btu	33.9%	\$32,200,000	\$279
9E 3-series	128,183 kW	9980 Btu	34.2%	\$35,050,000	\$273
M701DA	144,090 kW	9810 Btu	34.8%	\$38,590,000	\$268
V94.2	157,000 kW	9920 Btu	34.4%	\$41,170,000	\$262
SGT5-2000E	166,000 kW	9834 Btu	34.7%	\$43,070,000	\$259
AE94.2K	170,000 kW	9348 Btu	36.5%	\$44,430,000	\$261
7F 3-series	184,906 kW	8953 Btu	38.1%	\$45,740,000	\$247
M501F3	185,400 kW	9230 Btu	37.0%	\$45,350,000	\$245
GT13E2	202,700 kW	8980 Btu	38.0%	\$52,590,000	\$259
SGT6-5000F	232,000 kW	8953 Btu	38.1%	\$44,930,000	\$216
7F 5-series	215,769 kW	8830 Btu	38.6%	\$51,770,000	\$240
GT24	230,700 kW	8531 Btu	40.0%	\$55,140,000	\$239
SGT6-5000F	232,000 kW	8794 Btu	38.8%	\$49,420,000	\$213
9F 3-series	261,284 kW	9146 Btu	37.3%	\$59,290,000	\$227
SGT6-8000H	274,000 kW	8530 Btu	40.0%	\$64,980,000	\$237
M501GAC	276,000 kW	8574 Btu	39.8%	\$63,400,000	\$230
SGT5-4000F	292,000 kW	8567 Btu	39.8%	\$68,160,000	\$233
9F 5-series	298,174 kW	8855 Btu	38.5%	\$68,490,000	\$230
GT26	326,000 kW	8467 Btu	40.3%	\$74,890,000	\$230
M501J	327,000 kW	8325 Btu	41.0%	\$75,120,000	\$230
M701G2	334,000 kW	8630 Btu	39.5%	\$75,480,000	\$226
9F 7-series	339,366 kW	8526 Btu	40.0%	\$78,900,000	\$233
M701F5	359,000 kW	8530 Btu	40.0%	\$79,790,000	\$222
SGT5-8000H	375,000 kW	8530 Btu	40.0%	\$85,440,000	\$228
M701J	470,000 kW	8325 Btu	41.0%	\$99,220,000	\$211