# Assumptions and Input Data for Localized, Levelized Cost of Peaking Units

**Design of Units:**

| Item | Base | Options | Comments |
|---|---|---|---|
| Technology | LM6000PC-Sprint<br><br>7EA | LMS100<br><br>7FA | LM6000 (50,512 kW) and 7EA (85,970 kW) best peaking duty selections.<br><br>The LM6000 combustion turbine generators were introduced for commercial applications in 1992 and have an excellent reputation in the power generation industry for efficiency and reliability. The LM6000 is the first industrial combustion turbine with simple-cycle efficiency in excess of 40%. All of the 2001 PowerNow! LM6000 gas turbines installed by NYPA and installed for LIPA in their Fast Track Summer 2002 Project incorporate Sprint technology.<br><br>7EA combustion turbine unit has been on the market since 1976 with over 750 units in service. The 7EA fleet has accumulated tens of millions of service hours and is recognized for high reliability and availability in both simple cycle and combined cycle operation.<br><br>The LMS 100 currently has only one machine operating.<br><br>The 7FA (171,700 kW) is more suited for base-load and combined cycle applications. Note the maximum NY gas turbine size, out of 169 simple cycle gas turbines, is 81,100 kW (re: Existing Generating Facilities As Of April 1, 2005; NYISO Planning Data and Reference Documents) |
| Fuel | Primary – Natural Gas<br><br>Secondary – No. 2 Fuel Oil | Natural Gas Only<br><br>Or<br><br>Fuel Oil Only | Dual fuel capability provides more flexibility. Increased capital expenditure is a disadvantage for dual fuel capability.<br><br>Note out of the 169 NY simple cycle gas turbines 60 are dual fuel, 32 natural gas only, 68 fuel oil only, and 9 kerosene only. |
| Inlet Air Conditioning | Evaporative Cooler | None | Evaporative cooler provides 3 – 4 MW of additional power output during high ambient temperature conditions, which is typical peaking unit operating time. |
| Natural Gas Compressors | None | New Compressors | Assumed natural gas pressure at supply point meets OEM minimum pressure requirements (675 psig for LM6000 and 290 psig for 7EA). |
| Natural Gas Treatment | Fuel Gas Heater | Media Filtration, | Fuel gas heater to provided minimum of 50°F (28°C) of superheat to compensate for temperature reduction due to pressure drop across the gas fuel control valves. |

| Item | Base | Options | Comments |
|---|---|---|---|
| | | Inertial Separation, Coalescing | Assumed natural gas is pipeline quality and additional treatment is not required. |
| Switchyard | Existing | New | Assumed existing switchyard can be utilized. |
| Transmission Voltage | 345 kV | 138 kV | Assumed 345 kV transmission voltage. |
| Foundation | Mat | Piling | Assumed mat foundation is sufficient. |
| Emission Controls | SCR, CO Catalyst | Emission Reduction Credits | Selective catalytic reduction and oxidation catalysts to control NOx and CO emissions. |
| Ancillary Services | TMNSR for LM6000<br><br>TMOR for 7EA | No Ancillary Service | LM6000 unit allows it to achieve full load operation within 10 minutes. The selective catalytic reduction system takes around 15-35 minutes, depending on ambient temperature, to become operational. Assuming the air permit conditions incorporate provisions to accommodate potential short-term exceedances of applicable emission standards during start-up, the LM6000 can provide Ten-Minute Non-Spinning Reserve (TMNSR) in the NYISO ancillary services market.<br><br>The 7EA is an industrial frame unit that requires approximately thirty minutes to achieve full load, enabling it to provide Thirty-Minute Operating Reserve (TMOR). |
| Performance | | | LM6000 performance calculated with GE Application for Packaged Power Solutions (APPS) software Version 3.5.0<br><br>7EA performance calculated with GE Gas Turbine Performance Simulation Version 3.5.1<br><br>Performance will be calculated for each at ISO, Average, and Summer Maximum Average conditions.<br><br>Maximum of three sites. |
| Degradation | | | Degradation based on GE data. |

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**Cost Estimate of Peaking Unit Designs at Three Locations:**

Labor:

1) Quantities: Internally generated, based on S&L data, plant design, and/or cost estimating staff experience
2) Labor Rates: R.S. Means "Labor Rates for the Construction Industry 2007"
   a) Issue: Labor rates are published for NYC, Long Island City, and nine other cities: Albany, Binghamton, Buffalo, Elmira, Rochester, Schenectady, Syracuse, Utica, and Yonkers; which of these should be used or averaged for the ROS rate?
3) Labor Productivity: Aspen Technology "Aspen Richardson Cost Factors" labor productivity factors
   a) Issue: Labor productivity rates are published for NYC and Syracuse; will Syracuse suffice for ROS? Should the labor rate for ROS be for Syracuse to match the labor productivity rate?
4) Cost to Attract Labor: $50/day, ranging from $25 to $150
   a) Ideally, this is based on a survey performed at the beginning of the project, which assesses the demand and supply of each labor category
   b) Generally, will be a function of economic activity—for example, if construction for the World Trade Center site is very active in the 2008-11 time period, a higher value may be justified

Materials:

1) Quantities: Internally generated, based on S&L data, plant design, and/or cost estimating staff experience
2) Cost: Source will be chosen depending on type of material, date of pricing, availability of data, and other factors.
   a) Potential sources include R.S. Means "Construction Cost Data," Aspen Technology "Aspen Richardson Cost Factors," internal S&L project data (if not client confidential), vendor data, or available publications.
3) Material cost will be assumed to be the same at all three locations.
   a) Means publishes data for locational differences, but is specific to building construction.
   b) Most materials will likely come from the same sources rather than locally, so locational differences should not be significant

Equipment:

1) Two approaches will used for major equipment (in terms of cost):
   a) Obtain vendor quotes:
      i) Generally can be obtained as a courtesy from vendors
      ii) Not as rigorous or defensible as a firm bid supplied for a specific set of specs in an RFP process where the vendor puts itself at risk if the bid is accepted.
   b) Translate equipment costs from an actual project to each site:
      i) For equipment costs, project does not have to be in the same geographic region.
      ii) Confidentiality agreements with clients may eliminate ability to use this approach
      iii) Specs tend to be tailored to the project and the owner—hard to generalize costs from specific bids.
   c) S&L will attempt to obtain both vendor quotes and translate specific project data to each site.
2) Best available internal S&L or external data will be used for BOP

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Contracting Scheme

1) Choose EPC over Multiple Lump Sum
   a) Construction management and owner's cost will vary with contracting scheme
2) Contingency costs are typically the owner's preference
   a) Typically based on Monte Carlo simulation of construction scenarios
   b) Simple and combined cycle tend to be lower than other technologies
   c) Assume 8%, ranging from 3% to 10%

**Financial Analysis to Determine Levelized Cost at Each Location:**

| Economic Parameter Inputs | Likely Value | Mimimum | Maximum | Source |
|---|---|---|---|---|
| | | | | |
| Equity Fraction | 0.5000 | 0.4000 | 0.5500 | (1) |
| Debt Fraction | 0.5000 | 0.6000 | 0.4500 | (1) |
| Return on Equity (nominal) | 12.00% | 10.00% | 14.00% | (2) |
| Cost of Debt (nominal) | 6.50% | 5.00% | 8.00% | (3) |
| Return on Equity (real) | 9.06% | 7.42% | 10.68% | (4) |
| Cost of Debt (real) | 3.70% | 2.54% | 4.85% | (4) |
| | | | | |
| Federal Tax Rate | 35.00% | 35.00% | 35.00% | |
| State Tax Rate | 7.50% | 7.50% | 7.50% | NY state corporate tax rate (flat rate). |
| Composite Tax Rate | 39.88% | 39.88% | 39.88% | (5) |
| | | | | |
| Weighted Average Cost of Capital (WACC, nominal) | | | | |
| Before-Tax | 9.25% | 7.00% | 11.30% | Calculated from above data. |
| After-Tax (Discount Rate) | 7.95% | 5.80% | 9.86% | Calculated from above data. |
| Weighted Average Cost of Capital (WACC, real) | | | | |
| Before-Tax | 6.38% | 4.49% | 8.06% | (4) |
| After-Tax (Discount Rate) | 5.64% | 3.88% | 7.19% | (4) |
| | | | | |

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|---|---|---|---|---|
| Property Tax Rate | 1.70% | 1.00% | 2.50% | Percent of initial capital cost.<br>Value escalates each year with inflation. |
| Insurance Rate | 0.30% | 0.00% | 0.50% | Percent of initial capital cost.<br>Value escalates each year with inflation. |
| Depreciation Schedule | 15- year MACRS | 15- year MACRS | 15- year MACRS | Federal tax code schedule<br>for a simple cycle combustion turbine. |
| Debt Repayment Period (years) | 20 | 30 | 15 | (6) |
| Equity Recovery Period (years) | 20 | 30 | 15 | (6) |
| Levelization Period (years) | 20 | 30 | 15 | (6) |
| Inflation | 2.70% | 2.40% | 3.00% | |
| Levelized Fixed Charge Rate (nominal) | 15.61% | 10.22% | 20.97% | Calculated from above data and applied to the all-in capital cost<br>(directs, indirects, IDC, and working capital and inventories). |
| Levelized Fixed Charge Rate (real) | 12.52% | 7.86% | 17.25% | (4) |
| | | | | |
| **Indirect Capital Cost Components** | 11.00% | 5.00% | 15.00% | Percent of direct capital costs |
| Owner' Development Costs | | | | |
| Oversight | | | | |
| Legal Fees | | | | |
| Financing Fees | | | | |
| Startup and Testing | | | | |
| Training | | | | |
| | | | | |
| Construction Duration (months) | 24 | 20 | 30 | |
| Interest During Construction (IDC) | 18.50% | 11.67% | 28.25% | Before-tax WACC applied to mid-point of construction duration<br>as a percent of direct plus indirect capital costs. |
| Working Capital and Inventories | 2.00% | 1.50% | 2.50% | Percent of direct capital costs |
| | | | | |
| **Fixed O&M Components** | | | | Included in the capacity charges. |
| Site Operating Labor | | | | |
| Site Maintenance Labor | | | | |
| Materials and Supplies - Routine | | | | |
| LTSA Fixed Fees | | | | |
| Administrative and General | | | | |
| | | | | |

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|---|---|---|---|---|
| **Variable O&M Components** | | | | Included in the energy charges. |
| LTSA Variable Fees / Major Maintenance | | | | |
| Catalyst Replacement and Disposal | | | | |
| Consumables | | | | |
| Water | | | | |
| | | | | |
| **Notes:** | | | | |
| 1. Based on a financially healthy merchant generator with a BBB credit rating. Consistent with S&P classification of merchant generation as "Business Position 8" under its ratings criteria with a mid-BBB rating target debt ratio of 47.5%. | | | | |
| 2. Based on capital asset pricing model (CAPM). Risk-free rate is 4.73% using the 20-year treasury yield. Equity risk premium is 7.10%, which is the Long Horizon Equity Risk Premium from 1926 to 2005 (Source: Ibbotson Associates, *Stocks, Bonds, Bills and Inflation 2006 Yearbook*). Beta is 1.0 for a merchant generator with a BBB credit rating and 50% equity, which is consistent with observed equity betas for existing merchant generators. (Observed betas are slightly higher, attributable to higher leverage). | | | | |
| 3. Consistent with yields on corporate bonds rated Baa by Moody's (6.2% as of 12/13/06). Source: Federal Reserve Statistical Release (http://www.federalreserve.gov/releases/h15/update/) | | | | |
| 4. Real rates are derived by removing inflation from the cost of debt and equity. | | | | |
| 5. Federal Tax Rate + State Tax Rate - (Federal Tax Rate x State Tax Rate), to account for deductibility of state taxes from federal taxable income. New York City would be subject to an additional city income tax of 8.85%. | | | | |
| 6. Maximum unit life results in a "minimum" levelized fixed charge rate, and vice versa. | | | | |