Evaluation of Fuel Cost Savings for Optimal Loading of The Generating Units of Bangladesh Power System

by

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Abstract

Bangladesh Power System (BPS) does not use optimization technique to schedule its generating units. This results in higher production cost. Moreover, the hydro potential of Kaptai is not utilized properly to generate electricity. This thesis evaluates the production cost of BPS considering appropriate generation scheduling and exhaustive use of hydro potential.

This thesis uses dynamic programming (DP) method for the generation scheduling. It neglects the transmission loss. A multi-state model of Kaptai hydro plant is developed using the historical data of water head of Kaptai reservoir and forced outage rate (FOR) of the units of the plant. The input output characteristics of the units of BPS are not readily available. These characteristics are developed by collecting data from different power stations. The startup and shutdown cost of the generating units are also collected.

This thesis evaluates production cost of BPS for four cases. First case considers only the thermal power generating units optimally scheduled using DP and hydro units are scheduled as peak shaving unit. All the thermal generating units of BPS are optimally scheduled and the hydro unit is scheduled as energy limited (EL) unit in the second case. In both cases, first and second, the duration of study is considered to be 2006. The production cost savings is calculated by comparing the actual energy production cost of 2006. In the third case the production cost of 2006 is evaluated using segmentation method, which considers merit order loading based on average incremental cost of the units and neglecting startup and shutdown cost. The results are compared with those obtained by optimal scheduling of the units by DP method without considering startup and shutdown costs. The fourth case evaluates the energy generation cost of BPS for a period from 2007 to 2025 using DP optimal scheduling approach. The savings in production cost is evaluated by comparing with that obtained using merit order loading.

List of Symbols and Abbreviations

BPDB	= Bangladesh Power Development Board
BPS	= Bangladesh Power System
IPP	= Independent Power Producer
PGCB	= Power Grid Company of Bangladesh
CFT	= Cubic Feet
MCFT	= Million Cubic Feet
MW	= Mega Watt
MWh	= Mega Watt hour
kWh	= kilo Watt hour
FOR	= Forced Outage Rate
AIC	= Average Incremental Cost
FO	= Furnace Oil
HSD	= High Speed Diesel
SKO	= Super Speed Kerosene Oil
BTU	= British Thermal Unit
PDF	= Probability Density Function
LDC	= Load Dispatch Centre
SCGT	= Simple Cycle Gas Turbine
FGD	= Fuel Gas Desulfurization
CC	= Combined Cycle
CT	= Combustion Turbine
ST	= Steam Turbine
RPCL	= Rural Power Company Limited
KPCL	= Khulna Power company Limited
CDC	= " CDC Globeleq" A British power generation company
WMPL	= West Mont Power Limited
λ	= 'Lambda' A Greek letter is called Lagrangian multiplier in economic dispatch solution.

λ_i	= Incremental fuel cost of i[th] unit
λ_S	= System Lambda for economic dispatch
P_{gi}	= Power generation of i[th] unit
F	= Fuel cost
Tk	= Taka
P_{gT}	= Total economic dispatch by the committed units.
DP	= Dynamic Programming
PL	= Priority List
EL	= Energy Limited
RV	= Random Variable
X_i	= i[th] Combination of the Units
P_{max}	= Maximum generation capacity of a unit
P_{min}	= Minimum generation capacity of a unit
H	= Water head
H_{max}, H_{min}	= Minimum and maximum value of water head, respectively
PDF	= Probability Density Function
$f_H(h)$	= PDF of water head
C_e	= Equivalent capacity generation
$f_{C_e}(c_e)$	= PDF of equivalent capacity generation
C	= Capacity output
$f_C(c)$	= PDF of capacity output
C_g	= Available capacity of hydro generating unit
$f_{C_g}(c_g)$	= PDF of available capacity of a hydro generating unit
C_o	= Capacity on outage
$f_{C_o}(c_o)$	= PDF of capacity on outage of hydro generating unit
Acre-ft	= Water volume measuring unit (1 acre-ft =43560 cubic feet)
TL	= Total hourly generation in Megawatt
HLCONV	= Hydro generation in MW as conventional peak shaving unit

TLCONV = Hourly load allocation for economic dispatch of thermal Units with conventional hydro generation

HLOPT = Possible hourly hydro generation in Megawatt as an EL unit.

TLOPT = Dispatchable load among the thermal units considering hydro unit as an EL unit.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

In case of electrical power system, the 'Optimal loading' of the generating units indicates the most economic combination of the units with economic dispatch compared to other feasible unit combinations to meet the daily load cycle. So, optimal loading causes the minimum fuel consumption by the units with the fulfillment of system demand.

The main objective of power system utilities is to earn maximum profit by supplying electrical energy to the consumer with minimum cost and desired level of reliability. Therefore, utility planners always try to optimize the energy production cost by minimizing the power interruption cost. For any specified load condition, economic dispatch determines the power output of each plant (and each generating unit within the plant), which minimize the overall cost of fuel required to serve the load.

In the economic dispatch process, the scheduling of a hydro generating unit is important. It is economical to use all of the available energy associated with a hydroelectric unit for its virtually nonexistent fuel cost. Owing to this advantage electric utilities put emphasis on the simulation of hydro unit, especially energy limited (EL) hydro unit. An EL unit is one whose sources of energy supply are not abundant. The main constraints of energy limitations are reservoir size, rainfall, and the stream flow. According to the recent survey report the average inflow of water per year in Kaptai reservoir is a significant amount. However, the amount of water head is not sufficient to operate 230 MW hydro plant throughout the year.

1.2 Critical review

Throughout the last few decades a lot of research works have been carried out in the field of power system optimization. A review of some previous works is described below.

A comprehensive analysis for economic loading of the generating units is presented in [1], [2], [3]. The authors of these books also developed the mathematical model of economic load dispatch on the basis of equal incremental fuel cost criteria. For optimal scheduling of the units, the dynamic programming method is rigorously discussed and a recursive approach is developed in [3], [4]. A production cost analysis with a mathematical model for average incremental cost is presented in [5].

Ahsan, Q. and Bhuiyan, M. R. [6] presented a methodology for the probabilistic simulation of the EL unit incorporating the randomness in the water head. The methodology utilizes the concept of the multi-state model of a generating unit to present an EL unit with the randomness in the availability of hydro energy. This paper emphasis on the hydro unit simulation but not discuss about the economic operation of the thermal power station

Ahsan, Q. [7] has given an analysis for evaluating the power interruption cost for residential and industrial sector. Ahsan, Q. and Das, A. C. [8] evaluated the loss of the consumers due to the electrical power interruption and compares with the electric bill. They have shown that, the per unit energy interruption cost is much higher than the per unit energy consumption cost but they have not shown any guide line for the calculation of energy generation cost.

A methodology for long term electrical load forecasting is developed on the basis of probabilistic approach in [9], [10].

A straightforward and computationally efficient method of unit commitment on the basis of priority ranking of the units is developed in [11], [12]. Here, the priority ranking of loading order is prepared using the relative operating cost of the generating units at their maximum efficiency point. Priority ranking method gives the solution with lower possible time but the generation cost is higher.

Li, S., Shahidehpour, S. M., and Wang, C., [13] presented a heuristic approach for the short term unit commitment problem. In their approach firstly they have divided the generating units' capacities into three categories, base load units, medium load units and peak load units, and then establishes a rough 24-hour generation schedule. For the medium load adjustment priority list method of unit commitment is utilized. This method of unit commitment is a heuristic method and causes higher cost of energy generation.

Maifeld, T.T. and Sheble, G.B. [14] proposed a new unit commitment method on the basis of genetic algorithm. Genetic algorithm (GA) unit commitment is analogous to genetic of living beings. They have shown that, the genetic algorithm technique gives the better simulation result compared to the Lagrange relaxation method of unit commitment but the GA method is so much heuristic and consume large amount of time.

Schenk, K.F., Misra, R.B, Vassos, S., and Wen, W. [15] described a new method of calculating loss of load probability, expected energy generation, and production cost for each type of unit in an electric utility. The method consists of obtaining the frequency distribution of equivalent loads by convolving the generating units in an economic merit order of loading. The entire evaluation process is performed without considering startup and shutdown cost. Without transition cost the production cost evaluation does not give the actual cost.

Senjyu, T., Shumabukuro, K., Uezato, K. and Funabashi, T. [16] introduced a new unit commitment solution, adapting extended priority list (EPL) method. The EPL method consists of two steps. The first step produces some initial unit commitment schedule by priority list (PL) method. In the second step, the unit schedule is modified using the problem specific heuristics to fulfill the operational constraints. In this evaluation process priority list is prepared according to the average running cost at the rated capacity of the unit and it does not give the global minimum production cost for all the stage of load level.

Chowdhury, A K M. D. H. [17] presented a thesis work for the optimization of power generation of Bangladesh Power System. He has shown a mathematical modeling of hydro thermal power system combining the Lagrangian method with the Khun-Tucker's condition. Priority list method is implemented in this thesis for unit commitment. The priority list is prepared according to the average production cost at the rated capacity of the units. In this thesis it is difficult to obtain the minimum production cost, because the priority base unit commitment does not guarantee the global minimum cost.

In all of the research works on unit commitment, mentioned above, the scheduling of generating units has not been performed considering all the feasible combination of units. Rather, a combination set of units is considered to satisfy the load at each stage according to a priority list. The priority list method of unit scheduling results in higher cost of energy generation. In this case, the scheduling of generating units considering all the feasible combinations at each stage of load level can give the lower cost of energy generation, and it can be implemented if dynamic programming based unit commitment technique is used.

1.3 Objective of the Thesis

This thesis has the following three objectives:

1. Evaluation of energy generation cost of Bangladesh Power System (BPS) using optimum scheduling technique (dynamic programming) of generating units.
2. Comparison of energy generation cost of BPS obtained from optimum scheduling technique with the actual one.
3. Investigation into the impacts of EL operation of hydro unit of BPS and comparison of the results with the peak shaving operation of that unit.

1.4 Organization of Thesis

There are five chapters in this thesis. A brief description of all the chapters is presented sequentially.

The introductory Chapter 1 consists of introduction, literature review, objective of the thesis and thesis organization. The introduction of this chapter briefly clarifies the term optimal loading of the generating units and gives a description about the impacts of the optimal use of hydro resource. A review of some previous study relating to this thesis work is presented in literature review portion. This chapter also discusses about the objective of the thesis and gives a brief idea about all the chapters of this thesis work.

Chapter 2 gives a comprehensive analysis for electrical energy generation from thermal and hydro units. This chapter discusses about the input output characteristic, cost components and economic operation of thermal units and presented a technique of hydro unit simulation. Among the various methods of unit commitment, some most commonly used methods are discussed in brief in this Chapter and also established a mathematical model for dynamic programming method of unit commitment.

Chapter 3 elaborately discusses about the situation of BPS. The system load pattern is clearly depicted by load curves. The generating unit characteristic of BPS is given along with the fuel type and forced outage rate and the real picture of hydro generation is also clearly revealed in this chapter. The load management scheme of the regulatory body of BPS is described and a long-term future plan for the power system operation to meet the increasing load demand is also included in this chapter.

Chapter 4 describes the mathematical model of the thermal units, evaluation technique of average incremental cost, and PDF model of hydro unit for the appropriate hydro electric generation of BPS. This chapter also presents the simulation result of this thesis work with the impacts of optimal scheduling of the generating units and optimal use of hydro resource of BPS.

Chapter 5 concludes the thesis work. This chapter also provides the recommendation for future study in connection with this thesis work.

CHAPTER 2 : ECONOMIC OPERATION OF GENERATING UNIT

2.1 Introduction

For supplying the electrical energy to the consumers with a minimum cost, the economic operation of generating units can plays a vital rule in case of power system operation.. Different types of factors are involved in economic operation of generating units, such as; input output characteristic, startup and shutdown time and cost, Loading limit of the generating units, and some other practical constraints. Considering all the factors, the power system engineers distribute the load among the generating units so that the overall production cost is minimum.

2.2 Power generating unit characteristic

To determine the economic loading of a thermal unit, the variable operating cost of the unit must be expressed in terms of the power output. Fuel cost is the principal factor in case of thermal power station. In defining the unit characteristics, gross input versus net output is considered. The net output of the plant is the electrical power output available to the utility system and gross input to the plant represents the total input which is measured in terms of Taka per hour or liter per hour for liquid fuel or cubic feet (CFT) per hour for gas or any other units. The characteristic of a thermal unit is shown in Figure 2.1. The figure indicates that the input output curve is a smooth convex curve. The essential data required to form an input output curve are obtained from the design calculation or heat rate test of a unit. In Figure 2.1 'H' and 'F' represents per hour heat energy and fuel cost respectively. Each generating unit has a maximum and minimum loading limit that is denoted by P_{max} and P_{min} respectively in the figure.

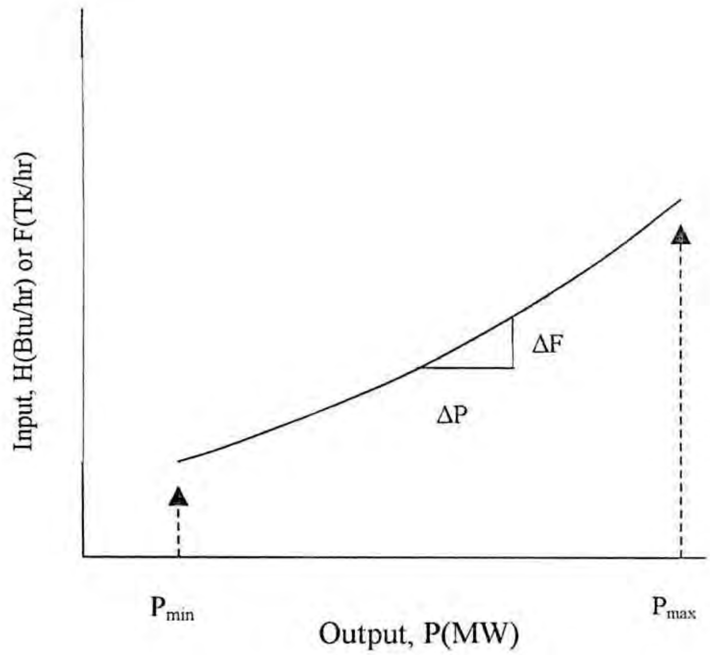


Figure 2.1: Typical input output curve of a thermal unit

The incremental heat rate characteristic is the slope of the input output characteristic curve. For economic loading the incremental heat rate characteristic of the units are usually utilized. This characteristic is converted to an incremental fuel cost characteristic by multiplying the incremental heat rate with the equivalent fuel cost.

The data obtained from the heat rate tests may be fitted by a polynomial curve. Usually quadratic equation is chosen for input output characteristic. If the input versus output characteristic is a quadratic smooth convex function the incremental heat rate curve is to be straight line. This incremental heat rate characteristic is monotonically increasing as a function of the power output of the unit.

2.3 Cost components of generating units

Various types of cost are involved in electrical energy generation. These costs are generally classified into two categories; fixed cost and variable cost. The fixed cost is not directly related to the energy generation. The example of fixed cost is the salary of regular employees. The variable cost is directly related to the energy generation such as fuel cost and cost of energy consumption by the feed water pump, auxiliary motors and drives. This chapter presents the discussion of variable cost. This cost has three components; such as production, startup, and shutdown costs.

Production Cost:

In a gas turbine generator heat is used to raise the temperature of the compressed air and this heated compressed air drives the gas turbine. In case of a steam turbine unit heat is required to produce steam. Usually, heat is produced by burning gas, coal, FO, HSD, SKO in BPS. The cost of fuel consumed by a unit during the period of supplying load is considered as production cost. This cost is directly proportional to the electrical energy output of the unit and is govern by the input output characteristic equation. The input output (I/O) curve can be obtained from the basic heat rate (HR) curve by multiplying every y-axis value (Btu/MWh or Taka/MWh) by its corresponding x-axis value (MW). Finally differentiating the I/O curve, the incremental heat rate (IHR) curve is obtained [5]. For a unit i it can be written as

$$I/O_i = L_i * HR_i(L_i) \text{ Btu/hour or Taka/hour} \quad \ldots \quad (2.1)$$

Here, 'L' is the load in MW

$$IHR_i(L_i) = \frac{d\, I/O_i}{dL_i} \quad \ldots \quad (2.2)$$

In the special case when the HR curve is assumed to be constant, $HR_i(L_i) = HR_i$, then

$$IHR_i(L_i) = HR_i \frac{dL_i}{dL_i} = HR_i \quad \ldots \quad (2.3)$$

This special case is important because in some economic studies the assumption of constant $HR_i(L_i)$ is used to facilitate computing the incremental fuel cost. Equation 2.3 shows that the incremental cost is constant for the average value of heat rate characteristic of a thermal unit, and this incremental cost is treated as average incremental cost (AIC). For example, the average value of heat rate data for CDC Meghnaghat(450MW) power station of BPS is 647.28 Taka/MWh .Therefore, the AIC for that unit is also 647.28 Taka/MWh and the hourly production cost of any load level of that unit can be calculated using the Equation 2.1. Consider that, the unit is loaded with 300MW for 4 hours then the per hour production cost is 647.28*300 Taka and the total energy generation cost is 647.28*300*4 Taka.

In most of the cases the input output quadratic equation is used to evaluate the production cost of a thermal unit.

Startup Cost:

The load of the system varies from hour to hour and the generating units are brought into operation when the system demand is increased. When a thermal generating unit is started, it takes some time to be synchronized to the grid bus. The time required from starting to synchronization is called startup time. Obviously the unit consumes some amount fuel during that time. The fuel cost during the startup time is known as startup cost. The startup time and cost vary from one unit to other. The steam turbine unit has a large startup time and cost and those of the gas turbine unit are lower. In case of steam turbine unit, the production of saturated steam from the water is the main reason for the larger startup time and cost. Two types of techniques are used to start steam turbine; hot and cold. For the hot start approach the boiler is kept in warm up condition and takes lower starting time. In the cold start approach, the boiler is allowed to get cooled and it takes larger time to be startup. A 210MW steam unit takes usually 10-11 hours and 2-3 hours for cold and hot start, respectively. In case of a 100MW gas turbine unit, 10-12 minutes is required to be started.

Shutdown Cost:

When a generating unit is bought into a schedule shutdown condition, it consumes fuel even after the isolation from the bus. The cost of fuel during shutdown time of a unit is called shutdown cost. In case of schedule shutdown of a steam turbine unit, a sufficient amount of heat energy is given to the boiler to maintain the working temperature and pressure so that the unit can be brought into startup condition within a short time. In case of a gas turbine unit; the fuel supply is not made cutoff instantly when it is isolated from the bus. The fuel supply is continued for a small amount of time, which is one third of the startup time and this is done only for the better operation of the equipment.

2.4 Economic operation of thermal units

The economic dispatch problem can be divided into two sub problems; one is economic allocation of system load on the generating units i.e. economic loading and other is economic scheduling of the units. To choose the best combination of generating units at the different load levels which can give the global minimum production cost is treated as economic scheduling. As the total load of a power system varies throughout the day, coordinated control of power plants output is necessary to ensure the generation for load balance so that the system become more economic.

2.4.1 Economic loading

For economic distribution of load among the generating units within a plant, the units must be operated at the same incremental fuel cost. If the transmission loss is neglected for the convenience of calculation, all the units of a power system can be virtually considered in one location. The incremental fuel cost can be determined by the slope of the input output curve [4]. For the mathematical expression of economic dispatch, here considered

f_i = Input to the unit 'i' in Taka per hour (Tk/h)

P_{gi} = Electrical Output of the unit 'i' in Megawatt (MW)

If the input output characteristic equation of the unit 'i' is quadratic, then it can be written

$$f_i = \frac{a_i}{2} P_{gi}^{\ 2} + b_i P_{gi} + c_i \quad \text{Tk / h} \qquad \ldots \qquad (2.4)$$

The incremental fuel cost of unit 'i' is obtained from the derivative of f_i with respect to P_{gi} that is $\frac{df_i}{dP_{gi}}$ and it is denoted by λ_i as follows

$$\lambda_i = \frac{df_i}{dP_{gi}} = a_i P_{gi} + b_i \ \text{Tk / MWh} \qquad \ldots \qquad (2.5)$$

Where a_i, b_i and c_i are the coefficient of the equation for the unit i but these coefficient are varies from unit to unit. By definition, the incremental fuel cost is the additional amount of fuel cost in Taka per hour to increase the output by one MW.

If n number of total units are existing in a system; each unit has the different incremental fuel cost which are considered as λ_1, λ_2, λ_3,.................. λ_n. For the economic loading, all the units must be operated in the same incremental fuel cost which is called system lambda i.e. λ_S. Mathematically it can be written as follows

$$\lambda_S = \lambda_1 = \lambda_2 = \lambda_3 = \ldots\ldots\ldots\ldots = \lambda_n$$

Therefore, for a two unit system

$$\lambda_1 = \frac{df_1}{dP_{g1}} = a_1 P_{g1} + b_1 \qquad \ldots \qquad (2.6)$$

$$\lambda_2 = \frac{df_2}{dP_{g2}} = a_2 P_{g2} + b_2 \qquad \ldots \qquad (2.7)$$

For economic load distribution $\lambda_1 = \lambda_2 = \lambda_S$ so, form the equation (2.6) and (2.7) it can be written as follows

$$a_1 P_{g1} + b_1 = a_2 P_{g2} + b_2 = \lambda_S \qquad \ldots \qquad (2.8)$$

Here the load distribution is

$P_{g1} = \frac{\lambda_S - b_1}{a_1}$ and $P_{g2} = \frac{\lambda_S - b_2}{a_2}$ when the total system load is $(P_{g1} + P_{g2})$

The solution for the λ_S can be find in following way

$$P_{g1} + P_{g2} = \frac{\lambda_S - b_1}{a_1} + \frac{\lambda_S - b_2}{a_2}$$

$$P_{g1} + P_{g2} = \frac{\lambda_S}{a_1} - \frac{b_1}{a_1} + \frac{\lambda_S}{a_2} - \frac{b_2}{a_2}$$

$$P_{g1} + P_{g2} = \lambda_S\left(\frac{1}{a_1} + \frac{1}{a_2}\right) - \left(\frac{b_1}{a_1} + \frac{b_2}{a_2}\right)$$

$$\lambda_S\left(\frac{1}{a_1} + \frac{1}{a_2}\right) = (P_{g1} + P_{g2}) + \left(\frac{b_1}{a_1} + \frac{b_2}{a_2}\right)$$

$$\lambda_S\left(\sum_{i=1}^{2}\frac{1}{a_i}\right) = (P_{g1} + P_{g2}) + \left(\sum_{i=1}^{2}\frac{b_i}{a_i}\right)$$

$$\lambda_S = \left(\sum_{i=1}^{2}\frac{1}{a_i}\right)^{-1}(P_{g1} + P_{g2}) + \left(\sum_{i=1}^{2}\frac{1}{a_i}\right)^{-1}\left(\sum_{i=1}^{2}\frac{b_i}{a_i}\right) \quad \ldots \quad (2.9)$$

The Equation 2.9 is the solution for λ_S (system lambda) when the system consists of two units. Therefore, for the n number of units the Equation 2.9 can be written again in the following way

$$\lambda_S = \left(\sum_{i=1}^{n}\frac{1}{a_i}\right)^{-1}\left(\sum_{i=1}^{n}P_{gi}\right) + \left(\sum_{i=1}^{n}\frac{1}{a_i}\right)^{-1}\left(\sum_{i=1}^{n}\frac{b_i}{a_i}\right)$$

$$\lambda_S = a_T P_{gT} + b_T \quad \ldots \quad (2.10)$$

Where

$$a_T = \left(\sum_{i=1}^{n}\frac{1}{a_i}\right)^{-1}$$

$$b_T = a_T\left(\sum_{i=1}^{n}\frac{b_i}{a_i}\right)$$

$$P_{gT} = \sum_{i=1}^{n}P_{gi}$$

Here P_{gT} is the total output of the generating system. The individual output of each unit is calculated by the following generalized formula from the Equation 2.8

$$P_{gi} = \frac{\lambda_S - b_i}{a_i} \quad \ldots \quad (2.11)$$

For the economic load distribution among the units, one thing is strictly mandatory that the unit must be operated within their maximum and minimum limit range. If maximum and minimum loads are specified for each unit, some units may be unable to operate at the same incremental fuel cost as the other units. Suppose that, this occurs for the unit 5 (n = 5) and the calculated value of P_{g5} violates the specified limit (either P_{max} or P_{min}) of the unit, then discard the calculated outputs of all five units and set the operating value of P_{g5} equal to the violated limit of unit 5. Hence, recalculate the value of the coefficients a_T and b_T for the rest of the four units and set the effective economic dispatch value of P_{gT} equal to the total plant load minus the violated limit value of P_{g5}. The resulting value of λ then govern the economic dispatch of units 1, 2, 3 and 4 when the actual plant output is to be increased or decreased, so long as unit 5 remains as the only unit at limit.

2.4.2 Economic scheduling

For the power system optimization, economic scheduling of the generating units is an important function. The load of the power system varies from hour to hour throughout the day and reaches a peak value and it is also different from one day to another. It is not economical to run all the units through the day. To meet the demand level for the different hours of a day, some units are to be brought into startup condition and some are put into shutdown condition. Among all the units a particular number of generating units i.e. a set of generating units must be chosen before the economic dispatch, for which the over all generating cost is minimum for a particular load level. When the load level is changed for the successive hours, the optimal set of the generating units is also changed due to startup and shutdown of the units. The transition cost (Startup and shutdown cost) is also an important factor for choosing the most economic set of the generating units for the different stage of load level. For instance, suppose a system has 4 generating units (unit-1, unit-2, unit-3, unit-4) each of 100MW with different input output characteristic. If the system demand is 300MW there is a number of unit combination or sets of the units shown below, which can meet the demand.

Set (1)-1,2,3; Set(2)-1,2,4 ; Set(3)-1,2,3,4 ; Set(4)-1,3,4 ; Set(5)-2,3,4

Here, 1,2,3,4 are the unit numbers.

Among these five sets of the unit combination, one set can provide the least amount of production cost due to the variation in incremental fuel cost of the units. Suppose, Set (2) gives the lowest production cost in this stage of load level but this combination may not gives the global minimum cost for considering all the stages of load level. Such as, if the next load level is 350 MW then only the unit combination Set (3) is applicable to meet the demand. The startup costs 2500, 2000, 2800, 3200 Taka, and the shutdown cost 1000, 750, 1150, 1250 Taka, are considered for the units 1, 2, 3, 4 respectively. The Table 2.1 gives the clear information of this typical system with two-stage load level.

Table 2.1
A typical scheduling of the units for 2-stage load level

Stage-1 (300MW)		Stage-2 (350 MW)		Startup unit and cost from stage-1 to stage-2	Shutdown unit and cost	Total cumulative cost (Tk)
Unit combination	Considered Production cost for the combination (Tk)	Unit combination	Considered Production cost for the combination (Tk)			
Set (1) 1,2,3	241500	Set (3) 1,2,3,4	280000	Unit 4 from set 1 3200Tk	Nil, 0Tk	524700
Set (2) 1,2,4	240900			Unit 3 from set 2 2800Tk	Nil, 0Tk	523700
Set (3) 1,2,3,4	242600			Nil, 0 Tk	Nil, 0Tk	522600
Set (4) 1,3,4	242200			Unit 2, from set 4 2000Tk	Nil, 0Tk	524200
Set (5) 2,3,4	241300			Unit - 1, from set 5 2500Tk	Nil, 0Tk	523800

It is observed from the table that the combination set (2) gives the lowest production cost within the stage-1 alone but not give the minimum cumulative cost after considering both the stages. Because of transition cost variation the global minimum cost 522600Tk is possible when the combination set (3) is considered for the economic dispatch at the stage-1. From the Table 2.1 it is clear that the choosing of generating unit combination at each stage of load level must be perform after the final stage calculation following the global minimum cost path.

2.5 Simulation technique of hydro unit

The hydro unit simulation is different from the thermal unit simulation. In case of thermal units the equal incremental fuel cost criteria is used for economic load distribution among the generating units. But the hydro unit has zero fuel cost. For this reason, the power system engineers always give the first priority to load the hydro unit. The energy generation from hydro unit is not only depends on generator availability but also depends on the availability of water head. Therefore, for a loading of hydro unit two things are essentially needed, one is appropriate conversion factor of water head into energy generation and other is appropriate hydro generating unit model.

The source of energy supply of hydro generating unit is not abundant. For this reason, to evaluate actual energy output the hydro unit is treated as an energy limited (EL) unit. The energy limited unit is one whose input energy supply is less than the energy required to operate that unit at its rated capacity. Energy limited operation of a hydro unit ensures the maximum use of potential energy of water head associated with that unit.

Suppose, a hydro generating unit has a rated capacity 100MW with forced outage rate 0.04. For a short term unit commitment the unit is considered 100% reliable. Hence, the energy generation from that unit is depends on the magnitude of water head for that time. If the conversion factor shows that the water head can give the generation by an amount of 70MW. Now, the 70MW generation from that unit for that time is treated as energy limited operation of that hydro unit.

Incase of long term unit commitment an appropriate hydro generation model is needed for the appropriate use hydro resource. To develop such a model the forced outage rate of hydro generating units and probability density function of water head are essentially needed. The technique for the development of appropriate hydro generation model [6] is presented below

The first step of this technique is to develop a PDF of water head, $f_H(h)$, by sampling the historical or the forecasted water head of the reservoir /stream flow. The variation of water head is random and discrete in nature. Therefore, the PDF of water head may be expressed in terms of delta function as,

$$f_H(h) = \sum_i f_H(h)\delta(H - h_i) \quad \ldots \quad (2.12)$$

The next step of this technique is to translate $f_H(h)$ into the PDF of equivalent electrical capacity generation $f_{C_e}(c_e)$ by converting water head into equivalent electrical capacity using appropriate conversion factor. Note that if the magnitude of water head falls below a certain lower value it may not be convertible to an equivalent capacity for the limitation of the turbine. Also because of the constraint of an already installed generating unit capacity all the available water resource may not be convertible when the head exceeds a certain upper limit. But for all other values of water head, each impulse of water head corresponds to a particular impulse of equivalent electrical capacity. That is,

$$f_{C_e}(c_{e_j}) = f_H(h_i) \quad \text{For } h_{\min} < H < h_{\max} \quad \ldots \quad (2.13)$$

$$f_{C_e}(c_e = 0.0) = \sum_{h_i \le h_{\min}} f_H(h_i) \quad \ldots \quad (2.14)$$

$$f_{C_e}(c_e = c_{e_{\max}}) = \sum_{h_i \ge h_{\max}} f_H(h_i) \quad \ldots \quad (2.15)$$

In Equations (2.14) and (2.15) the subscript 'min' and 'max' represent the minimum and maximum values of the corresponding random variable (R.V).

In reality a generating unit is not 100% reliable. To incorporate the FOR of a unit the PDF of equivalent electrical capacity $f_{C_e}(c_e)$ is convolved with the PDF of generating unit capacity $f_{C_g}(c_g)$ resulting the PDF of capacity output C from hydro resource. That is,

$$C = \min(C_g, C_e) \quad \ldots \quad (2.16)$$

$$f_C(c) = f_{C_e}(c_e) * f_{C_g}(c_g) \quad \ldots \quad (2.17)$$

Thus obtained $f_C(c)$ is treated as the PDF of the output capacity of EL hydro unit. This technique simulates the output capacity as a multi-state unit in the first stage of the loading order as the incremental cost of the unit is zero

2.6 Unit commitment

The total energy demand in an electrical power system does not remain the same for all the time throughout the day. Generally, the system demand is higher during the day time when the industrial loads are high and in early evening when lights are on. Lower demand occurs during the early morning. Therefore, it is necessary for the utility to decide in advance which generators will be started and when those will be connect to the network. It is also necessary to decide the sequence in which the operating units should be shutdown. The computational procedure for making such decisions is called unit commitment. Basically to "commit" a generating unit means that to "turn it on", bring the unit up to speed, synchronize it to the system and connect it to the bus bar to deliver the power.

2.6.1 Evaluation technique of unit commitment

Many constraints can be placed on the unit commitment problem. The constraints vary from unit to unit and power system to power system. To evaluate the unit commitment problem following constraints are to be considered.

SPINNING RESERVE:

Spinning reserve is the total amount of generation capacity available from all the synchronized units on the system minus the present load and losses being supplied. Spinning must be carried so that the loss of one or more units does not cause abrupt drop in system reliability. If one unit is lost, there must be ample reserve on the other units to make up the loss for a specified time period. How much amount of spinning reserve is to be kept, that is decided by the electric utility system.

THERMAL UNIT CONSTRAINTS:

Minimum up time: Once the unit is turned on, it should not be turn off immediately.

Minimum down time: Once the unit is turned off, there is a minimum time before it can be turned on.

Crew constraints: If a plant contains two or more units, due to less number of crewmembers all the units might not be possible to run at a time.

A certain amount of energy must be expended to bring the unit into online condition, because this energy does not result in any megawatt generation from the unit. Finally, the capacity limits of thermal units may change frequently due to maintenance or unscheduled outage of various equipments in the plant. This must also be taken into account in unit commitment.

The unit commitment problem can be very difficult. The main problem is to decide which set of the units is the most economic with highest reliability at different load levels. If the transmission loss is disregarded, the total plant output P_{gT} is equal to the system load demand.

The unit commitment procedure searches the most economic feasible combination of generating units to serve the forecasted load of the system at each stage of the load cycle. To do this, various methods have been developed. The most commonly used techniques for the solution of the unit commitment problems are as follows.

(i) Priority list method
(ii) Genetic based algorithm
(iii) Dynamic programming
(iv) Lagrange relaxation method
(v) Segmentation Method

The priority list method (PL) is the simplest type of unit commitment method where the units are committed according to a predetermined priority based loading order [13], [14], [15]. The priority list can be obtained from the average production cost of each unit. This method is very fast but highly heuristic and gives schedule of the units with relatively higher operating cost. The genetic algorithm (GA) is a general purpose search technique based on principles inspired from the genetic and evaluation mechanism observed in natural systems and populations of living beings. The feature of the GA is to search retaining candidate for the solution [16]. This method is also a heuristic method and gives better result than PL method but it takes so much time.

The dynamic programming (DP) is one of the techniques of power system optimization, which gives the most economic result. In DP method several combination of the units are evaluated for each hour or each stage of load level with intent to find predecessor path which results in the lowest cumulative cost through that hour. Consequently, each evaluated combination has only one predecessor path and all other possible predecessors path to that state is to be discarded as being sub-economic [3], [4].

For a large power system with many generating units the DP method is not suitable due to time consumption. In this case the Lagrange Relaxation (LR) method is advantageous. This method solves the unit commitment problem by "relaxing" or temporarily ignoring the coupling constraints and solving the problem as if they did not exist. The LR method concentrates on finding an appropriate coordination technique for generating feasible primal solution, while minimizing the duality gap [3].

The segmentation method is one of the methods of production cost calculation where the generating unit capacity is divided into two or more segments presented in Figure 2.2. The number of segments depends on the highest common factor of the generating units that means the segment size is equal to the highest common factor.

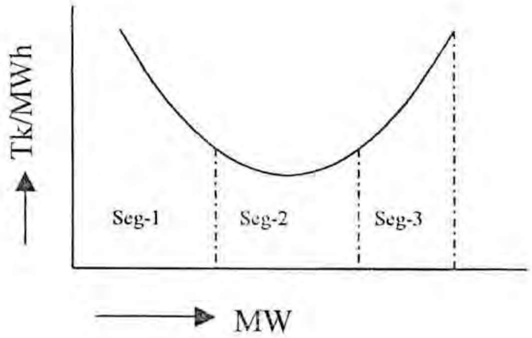


Figure 2.2: Typical heat rate curve with segmenting the capacity

For the economic operation of the generating units the average incremental cost (AIC) of all the segments for all the units is evaluated and a merit list is prepared for the segments according to AIC. The units are loaded according to the merit order of the segments.

2.6.2 Mathematical formulation of dynamic programming

The unit commitment problem for the power system optimization is a multistage or dynamic cost-minimizing problem. This dynamic nature of the unit commitment problem complicates its solution. Suppose that 10 units are available for scheduling within any one-hour interval, theoretically a total of $2^{10}-1=1023$ combinations can be listed. If it is possible to link each prospective combination of any one hour to each prospective combination of the next hour of the day, the total number of combinations becomes $(1023)^{24}=1.726*10^{72}$, which is enormously large and unrealistic to handle. Fortunately, however, the multistage decision process of the unit commitment problem can be dimensionally reduced by practical constraints of system operations and by a search procedure based on the following observation:

(i) The daily schedule has N discrete time intervals or stages, the durations of which are not necessarily equal. Stage 1 precedes stage 2, and so on to the final stage.

(ii) A decision must be made for each stage k regarding feasible combination of units to operate during that stage. This is the sub problem of the stage k.

(iii) To solve for the N decision, N sub problems are solved sequentially in such a way that the combined best decision for the N sub problems yield the best overall solution for the original problem.

Therefore, if a system has 4 generating units, theoretically15 combinations are possible which are as follows:

Table 2.2
Possible unit combinations of a typical 4-unit system for each load level

unit	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
1	1	1	1	1	0	0	1	0	1	1	0	1	0	0	0
2	1	1	1	0	1	1	0	0	1	0	1	0	1	0	0
3	1	1	0	1	1	0	0	1	0	1	1	0	0	1	0
4	1	0	1	1	1	1	1	1	0	0	0	0	0	0	1

Where x_i denotes the combination 'i' of the four units. Of course, not all combinations are feasible because of the constraints imposed by the load level and other practical operating requirements of the system. To assist the mathematical formulation of unit commitment problem, considered

$$x_i(k) = \text{Combination } x_i \text{ of interval or stage } k \qquad \ldots \qquad (2.18)$$

And then $x_j(k-1)$ represents the combination x_j of the interval $(k-1)$. If k equals to 1 and i equals to 9 in the four unit example mention in the Table 2.2, the combination $x_9(1)$ means that only units 1 and 2 are on-line during the first time interval.

The production cost incurred in supplying power over any interval of the daily load cycle depends on which combination of units is on-line during that interval. For a given combination x_i the minimum production cost P_i equal to the sum of the economic dispatch costs of the individual units. Accordingly

$$P_i(k) = \text{Minimum production cost of combination } x_i(k) \quad \ldots \quad (2.19)$$

And then $P_j(k-1)$ is the minimum production cost of combination $x_j(k-1)$. Minimum production cost is obtained by economic loading of the units, which is discussed in this chapter in article 2.4.1. Besides the production cost the transition cost must be taken into account. Transition cost is varied with the changing from one combination of units to another combination. The transition cost is consists of two types cost which are start-up cost and shutdown cost and expressed as follow

$$T_{ij}(k) = \text{Cost of transition from combination } x_j(k-1) \text{ to the Combination } x_i(k) \text{ between the intervals } k-1 \text{ and } k \quad \ldots \quad (2.20)$$

From the Equation 2.20 it is clear that, the status of the units in interval k affects the cost of transition to the interval $k+1$ and so on. Therefore, the transition cost links the scheduling decision of any one interval to the scheduling decisions of all other intervals of the load cycle. Accordingly, the problem of minimizing costs at one stage is tied to the combinations of units chosen for all other stages.

The cost $f_{ij}(k)$ associated with any stage k has two components given by

$$f_{ij}(k) = P_i(k) + T_{ij}(k) \quad \ldots \quad (2.21)$$

The Equation 2.21 gives the production cost incurred by the combination x_i during interval k plus the transition cost from the combination x_j of the previous interval. For the ease of explanation, it is assume that the system demand levels at the beginning and end of the day are the same. Because of this, when $k=1$, the transition cost $T_{ij}(1)$ becomes zero. Note that the cost $f_{ij}(k)$ is tied by $T_{ij}(k)$ to the decision of the previous stage. If the first two intervals of load cycle is consider then the cost function is

$$F_{i'}(2) = \min_{\{x_j(1)\}} \{P_{i'}(2) + T_{i'j}(2) + F_j(1)\} \quad \ldots \quad (2.22)$$

Where $F_{i^*}(2)$ is the minimum cumulative cost for the first two stages. The asterisk notation of Equation 2.22 means that the search for the minimum cost decision is made over all the feasible combinations x_j at stage 1.

Similarly, minimum cumulative cost of the initial three stages of the study period is given by

$$F_{i^*}(3) = \min_{\{x_j(2)\}} \{P_{i^*}(3) + T_{i^*j}(3) + F_j(2)\} \quad \ldots \quad (2.23)$$

Where, the search is now made among the feasible combination x_j of stage 2. The minimum cost searching procedure for the first three stages is graphically presented in Figure 2.3.

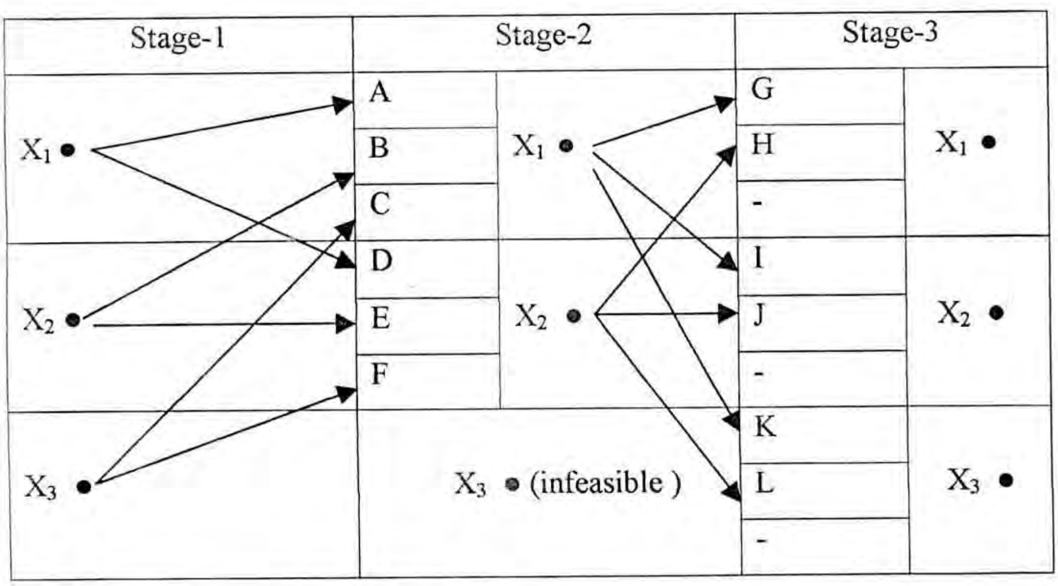


Figure 2.3: Minimum cost search procedure

In the above figure the feasible combination x_1 x_2 x_3 for stage-1 x_1 x_2 for stage-2 and x_1 x_2 x_3 for stage-3 are considered. In case of stage-2, each combination has only one production cost but three cumulative cost which are A, B, C and D, E, F for the combination x_1 and x_2 respectively. This is because; each combination of stage-2 is directly related to all the combinations of stage-1. The cost A is equal to the production cost of combination $x_1(2)$ plus transition cost from the combination $x_1(1)$ to $x_1(2)$ plus the production of combination $x_1(1)$. In this way all the values B, C, D, E, F are calculated by using Equation 2.22. Stage-3 has three feasible combinations, each have two cumulative costs, which are G, H at the combination $x_1(3)$, I, J at the combination $x_2(3)$ and K, L at the combination $x_3(3)$. These pair of cumulative cost of each combination are comes from two combinations of the previous stage which are $x_1(2)$ and $x_2(2)$. Although, there are three cumulative costs associated with each of the combination at stage-2 but only the minimum one for each combination is considered for the calculation of the stage-3. The cost L is equal to the production cost of the combination $x_3(3)$ plus transition cost from the combination $x_2(2)$ to $x_3(3)$ plus the minimum value among D, E and F. This way the values of G, H, I, J, K can be calculated by using Equation 2.23. Hence the cumulative minimum fuel cost $F_{i^*}(3)$ at stage-3 is the cost, which is the minimum among the costs G, H, I, J, k, L.

In continuation with the above logic, a recursive formula can be written for the minimum cumulative cost at the stage k, where k ranges from 1 to N. as follow

$$F_{i^*}(k) = \min_{\{x_j(k-1)\}} \{P_{i^*}(k) + T_{i^*j}(k) + F_j(k-1)\} \qquad \ldots \qquad (2.24)$$

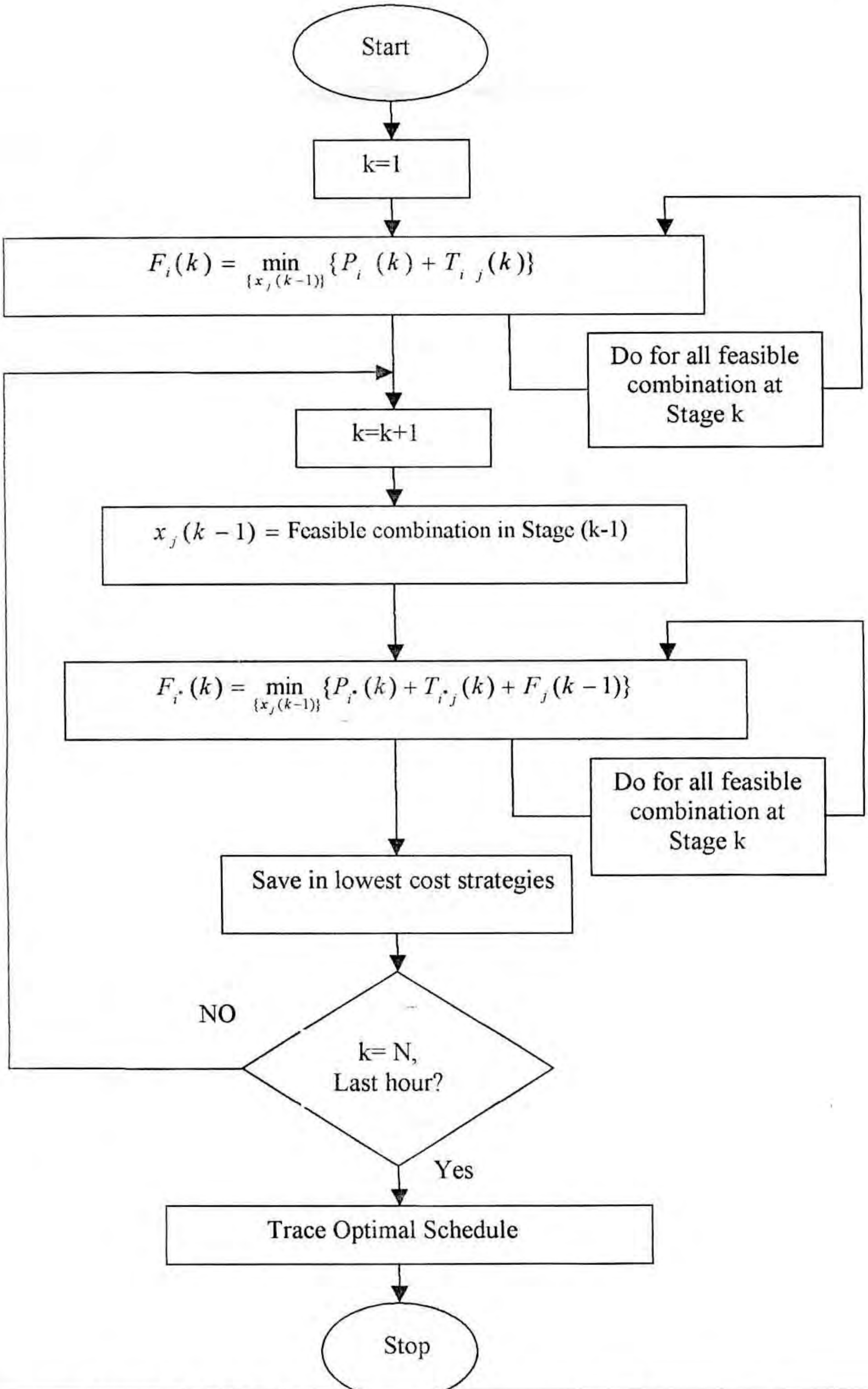


Figure 2.4: Flow chart of Dynamic Programming unit commitment

CHAPTER 3: OVERVIEW OF BANGLADESH POWER SYSTEM

3.1 Introduction

Two organizations; Bangladesh Power Development Board (BPDB) and Independent Power Producer (IPP) generate electricity in BPS. There is another private limited company named Power grid Company of Bangladesh (PGCB) is responsible for transmission and distribution of electrical energy of BPS. PGCB also operates the load dispatch centre (LDC) of BPS. All the data concerned with the system load and generating unit is collected from the Daily generation log of LDC.

3.2 Load

The base load of BPS varies from 1800MW to 2900MW and the maximum load varies from 3200MW to 4200MW depending on the seasons. The average duration of peak hour is 4 hours and it occurs at the evening period from 18.00 to 22.00. The daily load factor varies from 70% to 80%. The available generation capacity of BPS is not always sufficient to meet the peak demand, but it is sufficient to meet the base load and mid level load.

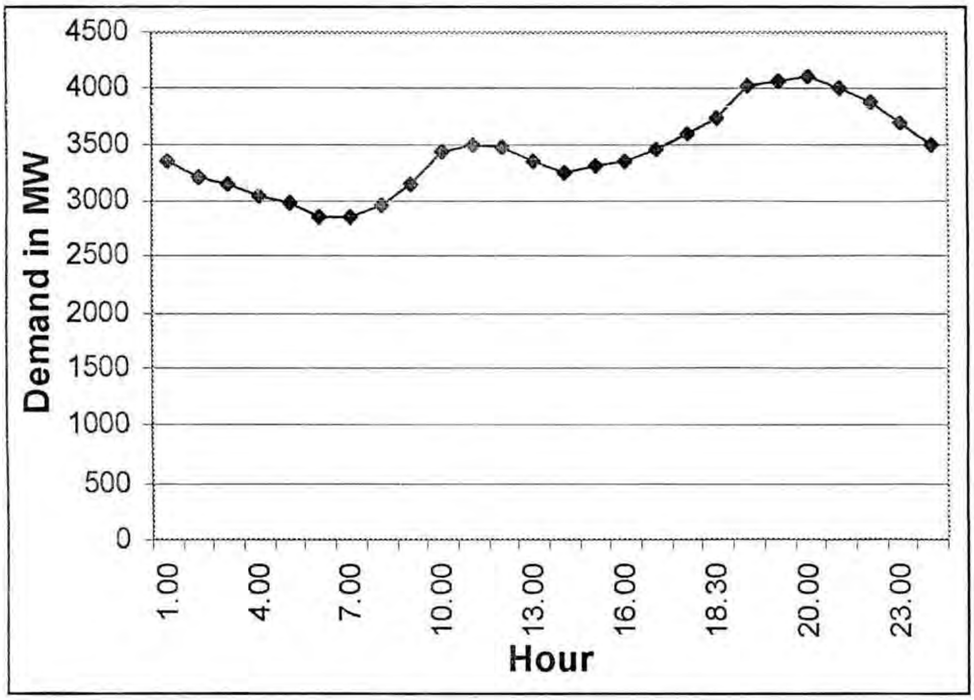


Figure 3.1: Daily load curve of a typical summer day of 2006

Figure 3.1 shows the load curve of a typical summer day. It shows that the minimum load occurs during the morning period from 6 .00 am to 8.00 am and peak load occurs from 19.00 pm to 22.00 pm. The curve also reveals that the minimum load of the system is about 2900 MW and maximum load is greater than 4000 MW. A difference of 1200MW occurs between the maximum and minimum load in summer season.

Figure 3.2 shows hourly load demand of a typical winter day. It is observed from this figure that the minimum load occurs during 3.00am to 5.00am and it is about 2100 MW. The peak load occurs during 18.00 pm to 21.00 pm and it is about 3300 MW. The difference between maximum and minimum load is also about 1200 MW in winter season, which is similar to that of summer season. It is clear from the figures that the minimum and peak demands of the summer season are 38% greater than those of the winter season.

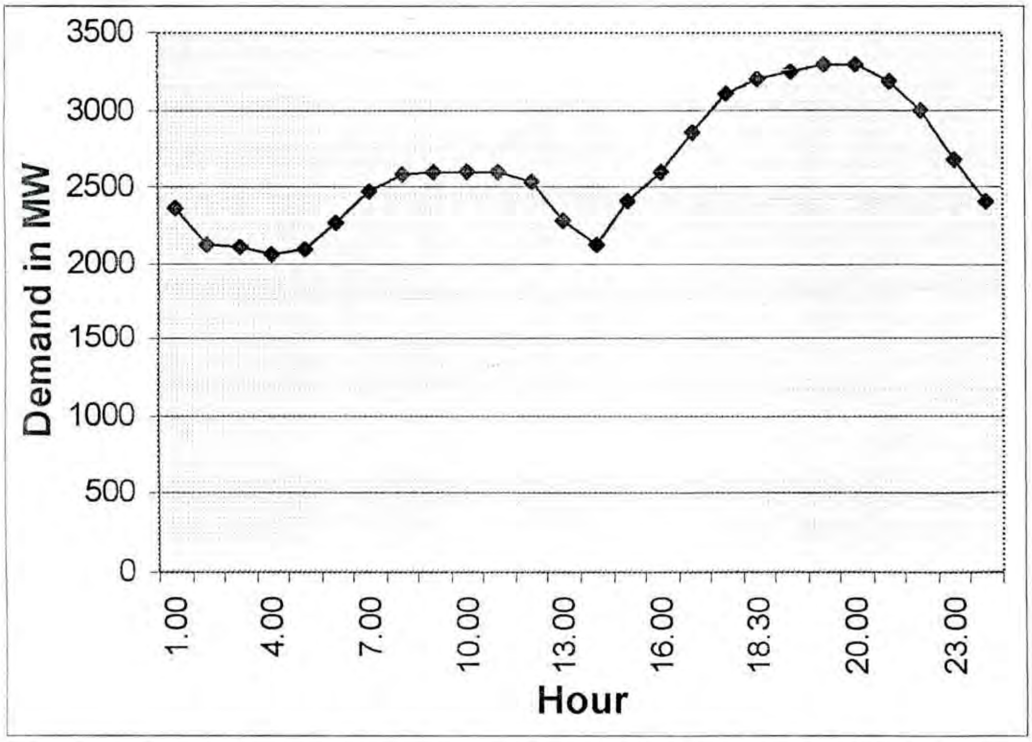


Figure 3.2: Daily load curve of a typical winter day of 2006

3.3 Daily energy demand of a summer and a winter week

The energy consumption of a BPS varies from season to season. Moreover, the loads in different days of a week are not same. Figures 3.3 and 3.4 show the energy demand of BPS for a typical summer and winter week, respectively. The customer's energy consumption in summer season is a bit higher than that of winter season. This is because; the ambient temperature in summer season is higher. Moreover, the summer season is the time for cultivation and a large amount electrical energy is used for irrigation .The two figures also reveal that the total energy demand in Friday is lower compare to other days of the week, because Friday is the weekly holiday. All the government offices, Universities, schools and industries are closed on Friday.

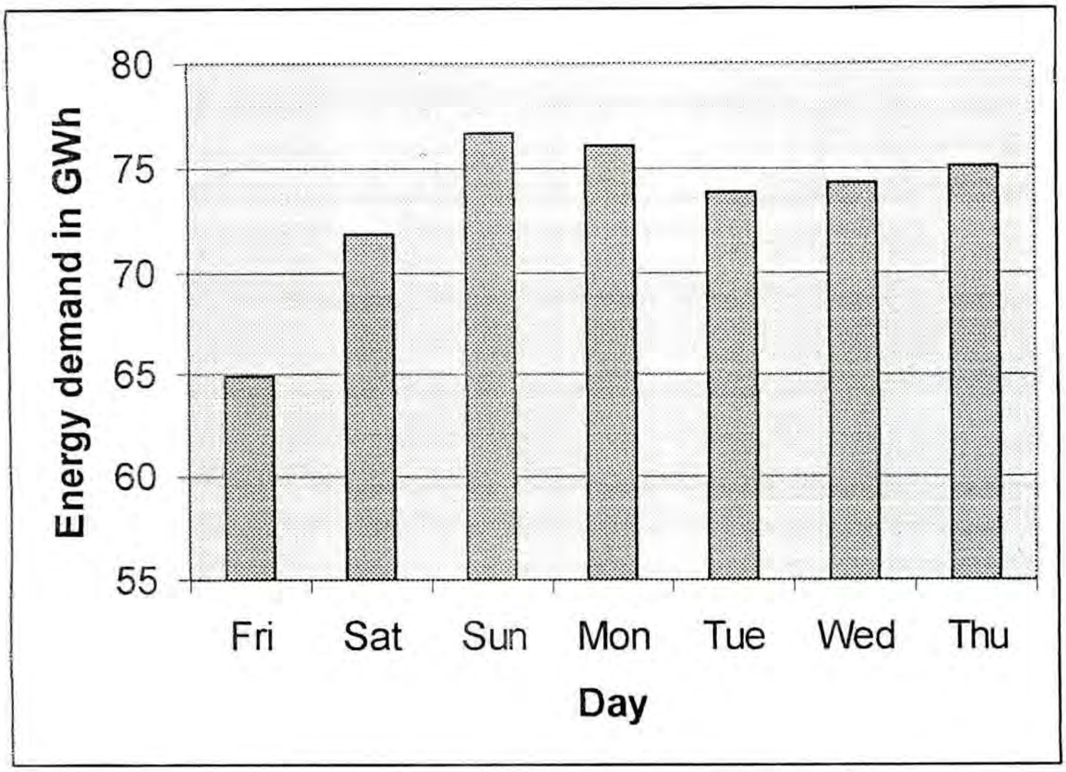


Figure 3.3: Daily energy demand of a typical summer week

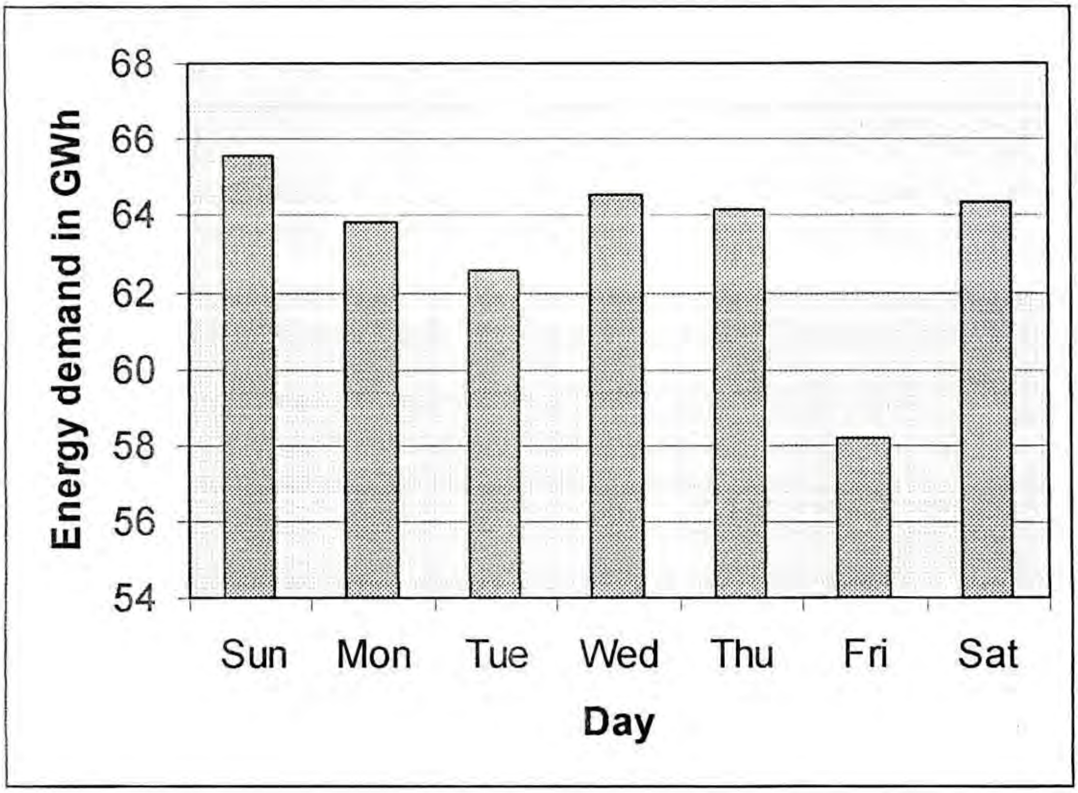


Figure 3.4: Daily energy demand of a typical winter week

3.4 Generating units

The maximum number of generating units of BPS is under the BPDB. The install capacity and the generating capacity of the units of BPDB in 2006 are 3983 MW and 3369 MW respectively. A minimum number of units are belong to private organization whose installed capacity and generation capacity are 1262 MW and 1262 MW respectively. Among all the units of BPS one is hydro unit that is situated in Rangamati at kaptai and others are thermal units situated at different places throughout the country. Among the thermal units steam turbine units occupy most of the generating capacity.

3.4.1 Capacity, Fuel, and FOR

The generating units of BPS are of different capacities ranging from 2 MW to 235 MW and maximum numbers of units are small and medium size. Table 3.1 presents the information regarding unit capacity, fuel type and FOR.

Table 3.1:
List of the existing generating units of BPS in 2006

No.	Name of Power Stations/ Units Under BPDB	FOR	Installed Capacity (MW)	Present Generating Capacity(MW)	Fuel
1	Kaptai Hydro (2*40, 3*50)	0.0000014	230	230	Hydro
2	Siddhirganj Steam-(1* 210)	0.16	210	210	Gas
3	Siddhirganj Steam- (1*50)	0.113	50	32	Gas
4	Tongi gas turbine-(1*109)	0.07	109	109	Gas
5	Ghorasal steam-1&2 (2*55)	0.185	110	80	Gas
6	Ghorasal steam-3 (1*210)	0.095	210	190	Gas
7	Ghorasal steam-4 (1*210)	0.019	210	200	Gas
8	Ghorasal steam-5 (1*210)	0.08	210	200	Gas
9	Ghorasal steam-6 (1*210)	0.08	210	200	Gas
10	Ashuganj steam- 1&2 (2*64)	0.116	128	128	Gas
11	Ashuganj steam-3 (1*150)	0.013	150	150	Gas
12	Ashuganj steam-4(1*150)	0.014	150	150	Gas
13	Ashuganj steam-5(1*150)	0.014	150	0	Gas
14	Ashuganj GT-1,2 (2*56)	0.321	112	80	Gas
15	Ashuganj CCPP Steam(1*30)	0.15	30	20	Gas
16	Haripur GT (3*33.33)	0.30	100	0	Gas
17	Raozan steam –1 (1*210)	0.197	210	180	Gas
18	Raozan steam-2 (1*210)	0.197	210	210	Gas
19	shikalbaha steam (1*60)	0.117	60	50	Gas
20	Shikalbaha BMPP (2*28)	0.6	56	10	Gas
21	Shahjibajar GT (1-7)(3*12, 4*15)	0.15	96	34	Gas
22	Shahjibajar GT (8-9)(2*35)	0.1	70	60	Gas
23	Sylhet GT(1*21)	0.122	21	21	Gas
24	Fenchuganj Comb. cycle(3*30)	0.04	90	90	Gas
25	Baghabari GT-1 (1*77)	0.101	77	77	Gas
26	Baghabari GT-2 (1*100)	0.04	100	100	Gas
27	Barapukuria Steam-1,2 (2*125)	0.1	250	250	Coal
28	Khulna Steam (1*110)	0.301	110	90	FO
29	Khulna Steam (1*60)	0.402	60	50	FO

To be continue

Continued Table 3.1

No.	Name of Power Stations/ Units	FOR	Installed Capacity (MW)	Present Generating Capacity(MW)	Fuel
	Under BPDB				
30	Khulna BMPP (2*28)	0.5	56	32	SKO
31	Sayedpur GT (1*20)	0.045	20	20	HSD
32	Barisal GT(2*20)	0.2	40	32	HSD
33	Rangpur GT(1*20)	0.119	20	20	HSD
34	Bheramara GT(3*20)	0.5	60	56	HSD
35	Combined Diesel (3+3+2)	0.3	8	8	Diesel
	Total for BPDB		**3983**	**3369**	
	Under Private Sector				
36	CDC Meghnaghat GT 1,2 (2*150) Steam (1*150)	0.07	450	450	Gas
37	CDC Haripur GT(1*235), Steam (1*125)	0.07	360	360	Gas
38	Haripur Barge(1-8)	0.11	110	110	Gas
39	RPCL Mymensing GT (4*35.57)	0.07	142	142	Gas
40	WMPL Baghabari-1,2(2*45)	0.07	90	90	Gas
41	KPCL (Tiger) Khulna(1-19)	0.07	110	110	FO
	Total for Private Sector		**1262**	**1262**	
	Grand total for BPS		**5245**	**4631**	

The generation capacity of Ashuganj steam-5 and Haripur GT are shown as zero, because those were in out of service throughout the year due to maintenance and overhauling. Form Table 3.1 it is observed that major amount of power is generated from natural gas which is 86 % of the total generation. A small amount of units are utilizing high speed diesel (HSD), furnace oil (FO), and super speed kerosene oil (SKO). The average running cost of the units of BPS varies from unit to unit and ranges from 678 Tk/MWh to 11847 Tk/MWh .

3.4.2 Characteristic of the units

Input output characteristic of a unit relates between fuel input and electrical energy output. The input output data of some of the units of BPS are collected directly from the power station. These are mentioned in Table 3.2.

Table 3.2
Input output data of the units of BPS

Name of the units	Generation (MW)	Fuel Consumption /MWh
Tongi Gas Turbine Ratedcapacity(109MW) (Natural Gas Fuel)	109	298.76 m^3
	81.75	318.05 m^3
	54.5	359.47 m^3
Bara Pukuria 2-unit, each 125 MW, (Coal)	125	0.325 ton
	100	0.329 ton
	62.5	0.346 ton
CDC Meghna Ghat(450 MW) (Natural Gas Fuel)	450	212.7 m^3
	405	216.01 m^3
	360	219.7 m^3
	315	223.39 m^3
	270	232.2 m^3
CDC Haripur (360 MW) (Natural Gas Fuel)	360	198.88 m^3
	324	200.53 m^3
	288	203.05 m^3
	252	207.88 m^3
	216	216.63 m^3
Baghabari 100 MW (Natural Gas Fuel)	89	364 m^3
	85	358 m^3
	84	355 m^3
	82	352 m^3
RPCL Unit-1 (Natural Gas Fuel)	35.57	369.33 m^3
	28.4	383.94 m^3
	21.3	419.38 m^3
	14.2	504.22 m^3
RPCL Unit-2 (Natural Gas Fuel)	35.57	345.97 m^3
	28.4	359.64 m^3
	21.3	392.86m^3
	14.2	472.32m^3
RPCL Unit-3 (Natural Gas Fuel)	35.57	349.34 m^3
	28.4	363.13 m^3
	21.3	396.67 m^3
	14.2	476.9m^3
RPCL Unit-4 (Natural Gas Fuel)	35.57	354.93 m^3
	28.4	368.97 m^3
	21.3	403.05m^3
	14.2	484.58 m^3

Although BPS has 99 units, not all the units are listed in the table, because the input output data of the units are not readily available.

Startup Cost Data:

The startup cost of some generating units of BPS is given in Table 3.3. These data are collected directly from the generating plant.

Table 3.3
Startup cost of some units of BPS

Name of the unit	Fuel consumption during startup	Start up cost in Taka
Tongi Gas Turbine 109 MW	700m^3 Natural gas	1830
RPCL (4 unit each of 35.57MW) gas turbine	210m^3 Natural gas for each unit	550 (For each unit)
Barapukuria- steam (2 unit each of 125MW)	9000 liter FO for each unit	108000 (For each unit)
Ghorasal Steam -6	38230m^3 Natural gas	100000

The data of Table 3.3 are used for evaluating the startup cost for the rest of the units. For example, the total capacity of RPCL plant is 142MW and its startup cost is 2200 Taka. CDC Meghnaghat has two gas turbine units of 150MW each. Using linear relationship the startup cost is evaluated as 4500 Taka for those two units. In Table 3.4 the startup costs of all the existing units of BPS are presented considering the hot start technology to steam units.

Table 3.4
Startup cost of the units of BPS

Name of plant / unit	Plant Capacity (MW)	Unit type	Type of fuel	Startup cost (Tk)
CDC Haripur GT	360	Gas turbine	Gas	4000
CDC Meghnaghat	450	Gas turbine	Gas	4500
NEPC(1-8)	110	Gas turbine	Gas	1900
siddhirganj 210MW	210	Stem turbine	Gas	100000
Tongi gas turbine	109	Gas turbine	Gas	1830
RPCL-1,2,3,4	140	Gas turbine	Gas	2200
Ghorasal steam-5 &6	400	Stem turbine	Gas	200000
Ashuganj steam-3&4	300	Stem turbine	Gas	140000
Ghorasal steam 3 & 4	390	Stem turbine	Gas	190000

To be continue

Name of plant / unit	Plant Capacity (MW)	Unit type	Type of fuel	Startup cost (Tk)
Ashuganj steam- 1&2	128	Stem turbine	Gas	60000
Raozan steam-1&2	390	Stem turbine	Gas	190000
Fenchuganj GT	90	Gas turbine	Gas	1000
Ashuganj GT	100	Gas turbine	Gas	1400
Shahjibajar GT –(1-9)	104	Gas turbine	Gas	1800
Ghorasal steam-1&2	80	Stem turbine	Gas	38000
shikalbaha steam	50	Stem turbine	Gas	23000
Sylhet GT	21	Gas turbine	Gas	350
siddhirganj 50MW	32	Stem turbine	Gas	20000
WMPL-1,2	90	Gas turbine	Gas	1500
Baghabari 71MW GT	77	Gas turbine	Gas	1400
Baghabari 100MW GT	100	Gas turbine	Gas	1800
Barapukuria 1 & 2	250	Stem turbine	Coal	216000
KPCL(1-19)	110	Gas turbine	FO	6000
Khulna 60 MW	50	Stem turbine	FO	112000
Khulna 110MW	90	Stem turbine	FO	200000
Khulna Burge	32	Gas turbine	SKO	3500
SaidpurGT	20	Gas turbine	HSD	2800
Barisal GT1&2	32	Gas turbine	HSD	5300
Rangpur GT	20	Gas turbine	HSD	2800
Bheramara GT-1,2,3	56	Gas turbine	HSD	8500

Shutdown Cost Data:

The collected data for shutdown cost of some units of BPS is presented in Table 3.5

Table 3.5
Shutdown cost of some units of BPS

Name of unit	Fuel consumption during shutdown	Shutdown cost in Taka
Tongi Gas Turbine(109MW)	295m^3 Natural gas	770
RPCL (4 unit each of 35.57MW)	96 m^3 Natural gas for each unit	250 (For each unit)
Barapukuria (2 unit each of 125MW)	4500 liter FO for each unit	54000 (For each unit)
Ghorasal Steam -6 (200MW)	16990 m^3 Natural gas	44500

Using the data of Table 3.5 shutdown costs are evaluated for all other units of BPS. In this case, the ratio of the rated capacity is considered as the ratio of shutdown cost of the units. Table 3.6 gives the shutdown cost of all the existing units of BPS.

Table 3.6
Shutdown cost of the units of BPS

Name of plant / unit	Plant Capacity (MW)	Unit type	Type of Fuel	Shutdown cost (Tk)
CDC Haripur GT	360	Gas turbine	Gas	1700
CDC Meghnaghat GT	450	Gas turbine	Gas	2000
NEPC(1-8)	110	Gas turbine	Gas	800
Siddhirganj 210MW	210	Stem turbine	Gas	45000
Tongi gas turbine	109	Gas turbine	Gas	770
RPCL-1,2,3,4	140	Gas turbine	Gas	1000
Ghorasal steam-5 &6	400	Stem turbine	Gas	90000
Ashuganj steam-3&4	300	Stem turbine	Gas	70000
Ghorasal steam 3 & 4	390	Stem turbine	Gas	85000
Ashuganj steam- 1&2	128	Stem turbine	Gas	27000
Raozan steam-1&2	390	Stem turbine	Gas	85000
Fenchuganj GT	90	Gas turbine	Gas	500
Ashuganj GT	100	Gas turbine	Gas	650
Shahjibajar GT – (1-9)	104	Gas turbine	Gas	770
Ghorasal steam-1&2	80	Stem turbine	Gas	17000
shikalbaha steam	50	Stem turbine	Gas	10500
Sylhet GT	21	Gas turbine	Gas	175
siddhirganj 50 MW	32	Stem turbine	Gas	8000
WMPL-1,2(90)	90	Gas turbine	Gas	700
Baghabari 71MW GT(77)	77	Gas turbine	Gas	650
Baghabari 100MW GT	100	Gas turbine	Gas	750
Barapukuria 1 & 2	250	Stem turbine	Coal	108000
KPCL(1-19)(110)	110	Gas turbine	FO	2600
Khulna 60 MW(50)	50	Stem turbine	FO	52000
Khulna 110MW(90)	90	Stem turbine	FO	95000
Khulna Burge	32	Gas turbine	SKO	1500
SaidpurGT	20	Gas turbine	HSD	1400
Barisal GT1&2(32)	32	Gas turbine	HSD	2400
Rangpur GT(20)	20	Gas turbine	HSD	1400
Bheramara GT-1,2,3(56)	56	Gas turbine	HSD	4100

It may be noted that, for evaluating the startup and shutdown cost the rated capacity ratio is used only for the same type of fuel and the same type of turbine. In case of different fuel types with same type of turbine, the average running cost ratio is considered for finding the startup and shutdown cost. For example, Sylhet-GT and Saidpur-GT both are gas turbine units with the same rated capacity. But the fuel is different and the average running cost of Saidpur-GT is eight times greater than that of Sylhet-GT. Therefore, the startup and shut down cost of Saidpur-GT is considered to be eight times greater than that of Sylhet-GT.

Fuel price is considered as 2.61 Taka/m3 for Natural gas and 25.31, 25.48, and 12.00 Taka/Liter for HSD, SKO and FO, respectively.

Data for Hydro Generating Unit:

Bangladesh Power System has only one hydroelectric power station located at Kaptai. The installed capacity of the plant is 230 MW and an average annual generation is 776.62 GWh [10]. The rated capacity of the reservoir at Kaptai is 5.25 million acre-ft with a maximum water head of 109 feet (from mean sea level).

Kaptai hydro electric power station has five generating units, two of them are 40 MW and rest of the three units are 50 MW each. Each unit has different force outage rate. The PDF of the generating units of Kaptai power station is mentioned in Figure 3.5.

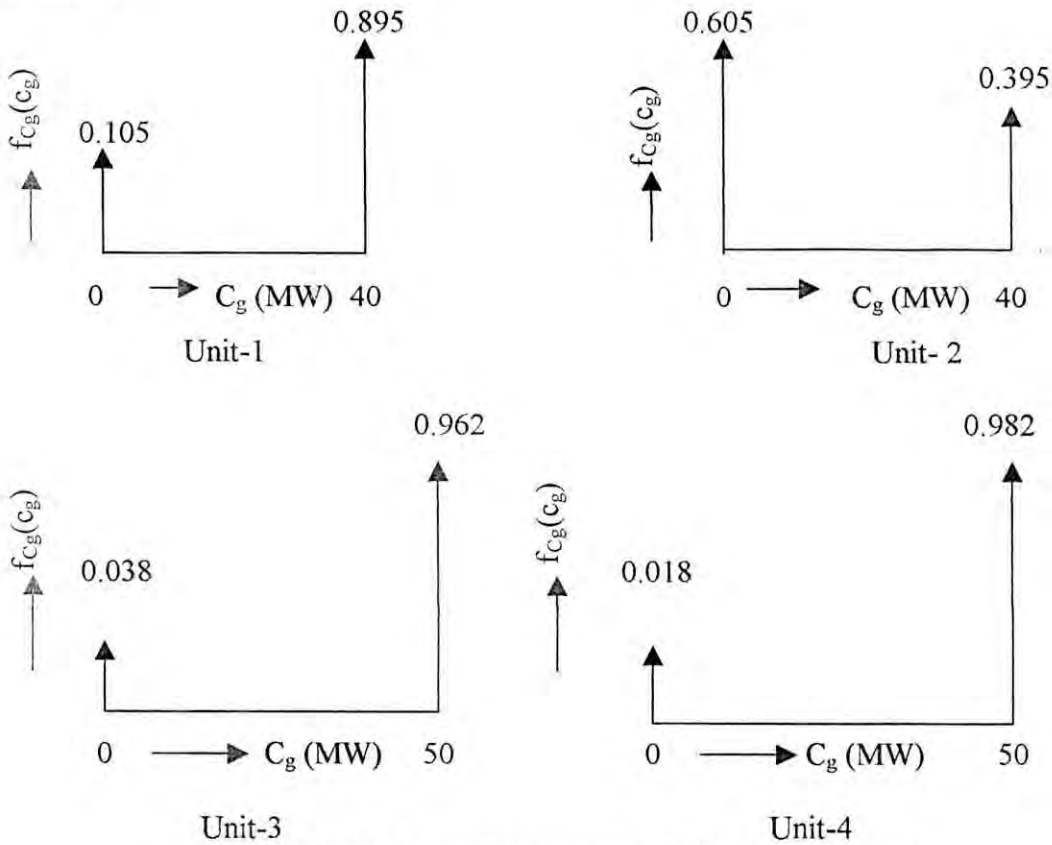


Figure 3.5: PDF of available capacity of Kaptai hydro units

To be continue

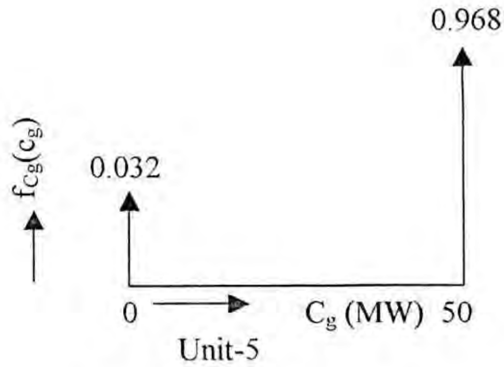


Figure 3.5(Continued): PDF of available capacity of Kaptai hydro units

The water level of Kaptai reservoir varies from season to season throughout the year. The monthly average water head of the reservoir is presented in Figure 3.6.

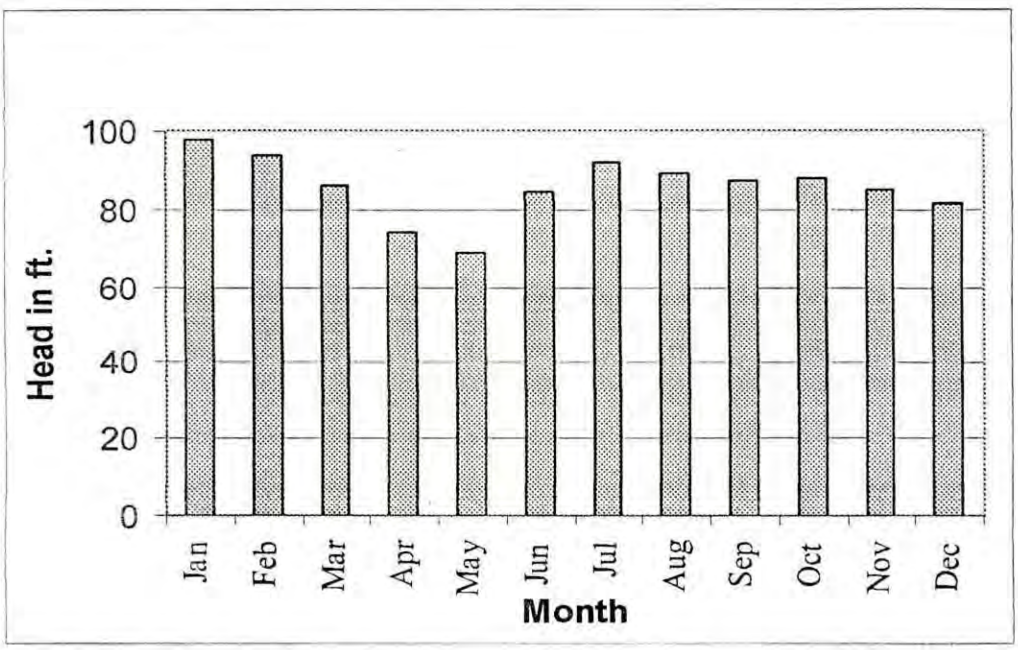


Figure 3.6: Monthly average water head of Kaptai reservoir in 2006

The figure shows that, during the dry season from March to May, water level is decreased. This is because; in this season the amount stream flow is lower and the rain fall in the catchment area is minimum. On the other hand, during the rainy season from July to October the water level is increased. In the figure it is seen that the maximum average water head occurred in the month of January due to the higher stream flow of that year. Depending upon the variation of water head the monthly average energy generation is varied. Although the maximum reservoir head is 109 feet but that level of water head was not found in 2006.

The minimum generation level of water head of Kaptai reservoir is 66 feet. If the water level goes below this level the electrical output of the plant is zero. A mathematical model is developed for the conversion of water head into Megawatt generation given in Equation 3.1. This mathematical model is established using the historical data of water head and corresponding energy generation.

$$y = 7.5 * x - 490 \quad \ldots \quad (3.1)$$

In Equation 3.1 'y' is in Megawatt and 'x' is the water head in feet.

Because of its zero fuel cost the hydro units are scheduled such that the hydro resource is fully utilized. Due to forced outages and the conventional scheduling of hydro units for peak shaving, the hydro resource of Kaptai is not completely exploited. Table 3.7 shows the monthly average water head and hydro energy generation of BPS for 2006.

Table 3.7
Energy generated and possible generation from Kaptai hydro resource during 2006

Month	Average water head in feet	Actual energy generated by hydro plant (GWh)	Possible energy generation(GWh)	Equivalent capacity generation from the water head(GWh)
January	97.46	36.92	96.72	180.03
February	93.69	55.10	87.36	142.50
March	86.10	67.90	92.91	116.18
April	73.95	32.53	47.49	47.49
May	69.01	20.07	20.58	20.58
June	84.40	78.24	103.15	103.15
July	91.85	130.56	148.13	148.28
August	88.89	95.48	130.8	131.60
September	87.15	82.40	105.54	118.18
October	87.73	66.66	104.16	125.32
November	85.18	31.52	99.90	107.17
December	81.52	14.86	90.29	90.29
	Total	**712.24**	**1129.77**	**1330.78**

This table also presents the possible monthly energy generation. The possible energy generation is evaluated considering actual on and off status of the hydro generating units, as the unit-1, unit- 4 and unit-5 of Kaptai power station remained in shutdown for 30%, 70% and 50% time of 2006 respectively. The table shows that only 53.52% of the available hydro resource at Kaptai reservoir is utilized in 2006. The equivalent capacity generation is evaluated just from the water head considering appropriate conversion factor and the generating unit constraints (FOR, capacity limit) are not considered here.

According to the conversion factor it is seen that, 96 feet head is required to run the unit at 230 MW loading throughout the day. Due to the unavailability of sufficient water head for the maximum period of a year the Kaptai hydro unit is operated as peak shaving unit and rest of the time of the day it is operated at lower generation capacity. The peak shaving unit is one which is operated only during the peak load hours of a day. The peak shaving approach of operation of Kaptai hydro unit causes the lower available generation compared to the possible generation.

3.5 Generation and load management Scheme

The BPS is divided into two regions, Eastern and Western. There is a tie line between eastern and western grid. Maximum number of units is situated in the Eastern region due to the availability of natural gas. Electrical power can be transfer from Eastern to Western grid by an amount of maximum 300MW. Though the present generation capacity of the units of BPS is a bit higher than the peak demand of the system but practically there is always a deficit in generation compared to the peak demand. The lower capacity is caused by the unavailability of some units. A large number of units are old. This generation deficit is maximum during summer season.

The BPS is forced to curtail electric demand during the peak hours; usually in the evening of the day, throughout the year and most of the hours of the day in the summer. When the demand is higher than the generation then BPS sheds the load through direct load management. Figure 3.7 and 3.8 presents load reduction at different hours of a typical summer and winter days, respectively.

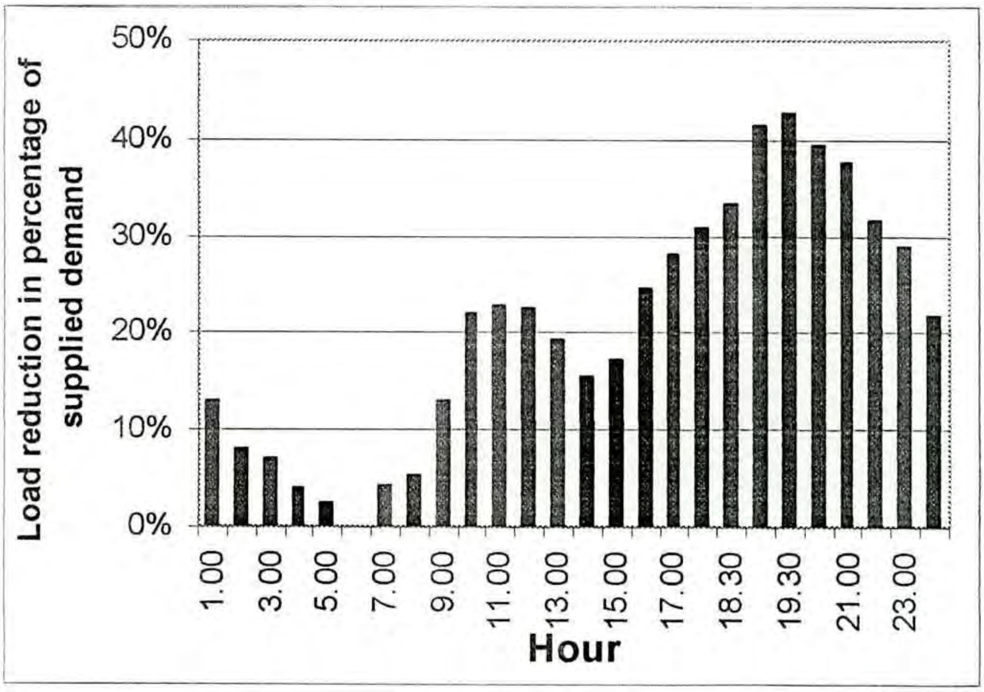


Figure 3.7: Hourly load reduction of a summer day of 2006

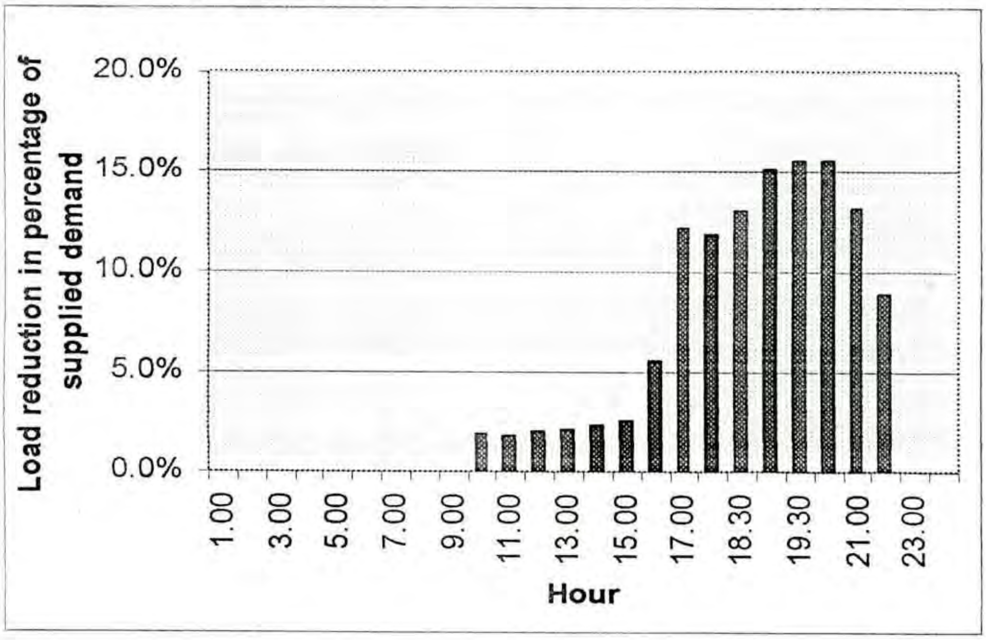


Figure 3.8: Hourly load reduction of a winter day of 2006

These two figures reveal that, it is required to curtail the load throughout the day except one or two hours in the morning during the summer season and load is mainly reduced in the evening hours during the winter season. Maximum load reductions during summer and winter are, respectively, 43% and 16% of the supplied demand.

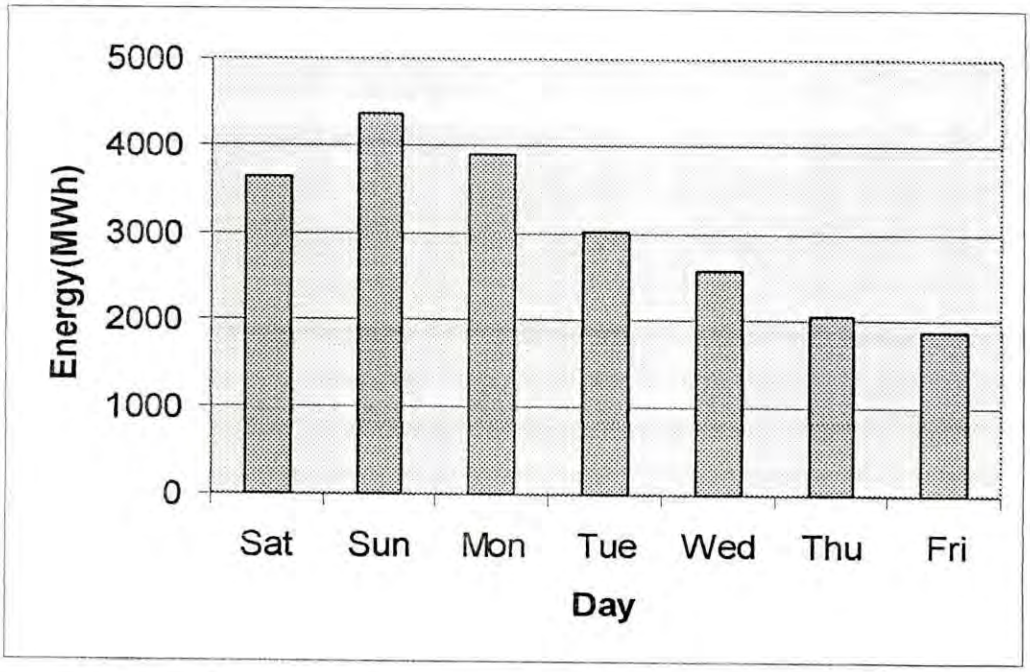


Figure 3.9: Daily unserved energy of a typical week of summer

The daily unserved energy of a summer week is presented in Figure 3.9. The load reduction on Friday is minimum compared to other days of the week. Most of the government offices are closed on Saturday and the institution with two-day weekend uses Thursday or Saturday as a second day weekly holiday. The figure shows that the daily maximum unserved energy is 4387 MWh, which is 7% of the supplied electrical energy.

The deficit in percent of available generation for the decade from 1997 to 2006 is depicted in Figure 3.10 [7]. The deficit varies from 14.47% to 43.67% of the maximum available generation for the respective years.

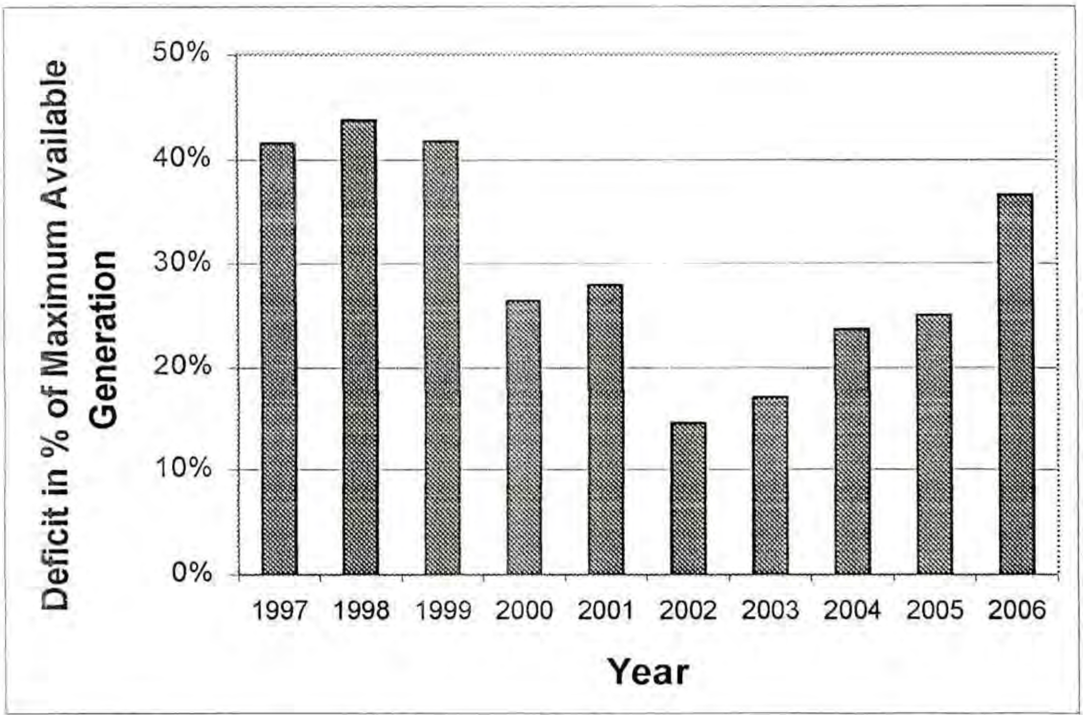


Figure 3.10: Generation deficit during the decade from1997 to 2006

3.6 Future plan

The BPS has a long-term master plan for 2005 to 2025. During this planning horizon many units will be added to the BPS. One is hydro unit of 100 MW is expected to be installed in the year 2009. The forecasted annual peak load of the period is given in Table 3.8 [9], [10]. In 19 years, during 2007-2025, 277% increase of peak load is observed from the forecasted data. Table 3.8 also presents the installed capacity obtained from the long-term generation expansion plan of BPS. The proposed installed capacity at the end of the planning period is 187% of the peak.

Table 3.8
Forecasted peak load and proposed future generation capacity

Year	Installed capacity (MW)	Annual Peak (MW)	Year	Installed capacity (MW)	Annual Peak (MW)
2007	5466.28	4288.3	2017	13684.28	7913.13
2008	6447.28	4582.34	2018	14684.28	8359.27
2009	7901.28	4891.59	2019	15634.2	8820.62

To be continue

Year	Installed capacity (MW)	Annual Peak (MW)	Year	Installed capacity (MW)	Annual Peak (MW)
2010	8251.28	5216.04	2020	17034.28	9297.18
2011	8851.28	5555.71	2021	17834.28	9788.95
2012	9671.28	5910.59	2022	19046.28	10295.9
2013	10194.28	6280.68	2023	20532.28	10818.1
2014	11094.28	6665.98	2024	21962.28	11355.5
2015	12034.28	7066.49	2025	22254.56	11908.1
2016	12934.28	7482.2	-	-	-

The generating units, those are planned to be installed in the BPS for the next nineteen years are presented in the Table 3.9 along with the unit type and total generation capacity of each year. All the data related to the future plan of BPS is collected from the web sit of Power Cell. Power Cell is a research body of Bangladesh government in electrical energy sector.

Table 3.9
Yearly generating unit addition from 2007-2025

Name of the units	**FOR**	**Capacity in MW**	**Unit Type**
For the year 2007			
Baghabari Barge Mtd Com	0.06	130	CC
Sidhiganj Com-1	0.07	119	CT
Sidhiganj Com-2	0.07	119	CT
Sidhiganj Com-3	0.07	119	CT
Sylhet Com	0.06	99	CT
Chandpur Com	0..06	99	CC
	Total	685	
For the year 2008			
Meghnaghat Com	0.0700	450	CC
Haripur	0.0600	150	CC
Shikalbaha	0.0600	150	CT
Bogra	0.0600	150	CT
Bhola	0.0600	150	CC
Fenchuganj Com	0.0600	88	CC
	Total	1138	
For the year 2009			
Karnafuli Hydro HY2 Com		100	Hydro
Shirajganj Com	0.0600	450	CC

To be continue

Name of the units	FOR	Capacity in MW	Unit Type
Meghnaghat	0.0600	450	CC
Sidhirganj Com	0.0800	197	ST
Khulna ST #2 Com	0.0800	197	ST
Khulna	0.0600	100	CT
	Total	1494	
For the year 2010			
Shikalbaha	0.0600	450	CC
	Total	450	
For the year 2011			
Meghnaghat	0.0600	450	CC
Sylhet	0.0700	150	CT
	Total	600	
For the year 2012			
Sirajganj	0.0600	450	CC
Bheramara	0.0600	450	CC
	Total	900	
For the year 2013			
Madanhat	0.0600	450	CC
Haripur	0.0700	150	CT
	Total	600	
For the year 2014			
Aminbazar	0.0600	450	CC
Madanhat	0.0600	450	CC
	Total	900	
For the year 2015			
Sidhirganj	0.0600	450	CC
Khulna	0.0600	450	CC
Shahjibazar	0.0700	150	CT
	Total	1050	
For the year 2016			
Aminbazar	0.0600	450	CC
Rajshahi	0.0600	450	CC
	Total	900	
For the year 2017			
Ashuganj	0.0700	150	CT
Aminbazar	0.0700	150	CT
Sylhet	0.0700	150	CT
Mymensingh	0.0700	150	CT
Madanhat	0.0700	150	CT
	Total	750	
For the year 2018			
Meghnaghat New site	0.0600	700	CC
Madanhat	0.0700	150	CT
Saidpur	0.0700	150	CT

To be continue

Name of the units	FOR	Capacity in MW	Unit Type
	Total	1000	
For the year 2019			
Mawa	0.0600	700	CC
Fenchuganj	0.0700	150	CT
Feni	0.0700	150	CT
	Total	1000	
For the year 2020			
Meghnaghat New site	0.0600	700	CC
Madanhat	0.0600	700	CC
	Total	1400	
For the year 2021			
Aminbazar	0.0700	150	CT
Mawa	0.0600	700	CC
Baghabari	0.0700	150	CT
Barisal	0.0700	150	CT
	Total	1150	
For the year 2022			
Mawa	0.0600	700	CC
Madanhat	0.0600	700	CC
	Total	1400	
For the year 2023			
Mawa	0.0600	700	CC
Khulna New	0.0600	700	CC
Khulna New	0.0700	150	CT
	Total	1550	
For the year 2024			
Ghorasal	0.0600	700	CC
Khulna New	0.0600	700	CC
	Total	1400	
For the year 2025			
Ashuganj	0.0600	700	CC
Fenchuganj	0.0700	150	CT
Baghabari	0.0700	150	CT
Rangpur	0.0700	150	CT
Bheramara	0.0700	150	CT
	Total	1300	
Grand total for capacity addition		19667	

In Table 3.9 all the units are gas-fired unit except one 100MW hydro unit. Table 3.10 presents the characteristics of the generating units for the long term generation expansion plan and Table 3.11 give the list of the generating units of BPS which will be retired from 2007 to 2025.

Table 3.10
Unit characteristics for the future plan

Unit Type	Net Unit Capacity	Plant Life in Years	Net Heat Rates kCAL/kWH			FOR (%)
			At 100% Power	At 75% Power	At 50% Power	
Steam(coal) With FGD	300	60	2173	2217	2287	8
Steam(coal) With FGD	500	60	2154	2198	2268	8
CC(Natural gas)	300	36	1720	1856	2023	6
CC(Natural gas)	450	36	1686	1819	1984	6
CC(Natural gas)	700	36	1564	1688	1840	6
SCGT(Natural gas)	100	24	2687	2986	3161	4
SCGT(Natural gas)	150	24	2605	2894	3064	4
Steam(Natural gas)	300	60	2127	2171	2239	6
Steam(Natural gas)	500	60	2109	2152	2220	6
Nuclear (light water reactor)	500	60	2598	2651	2735	8
Diesel(Diesel fuel)	10	24	2900	3050	3200	15

Table 3.11
Generating units retirement from 2007-2025

Name of the units	FOR	Capacity in MW	Fuel
For the year 2007			
Sidhirganj steam	0.10	28	Gas
Shahjibazar GT 1	0.15	10	Gas
	Total	38	
For the year 2008			
Ashuganj Steam	0.07	60	Gas
Sylhet GT	0.08	19	Gas
Bheramara GT-3	0.06	18	HSD
Saidpur GT	0.08	20	HSD
Rangpur GT	0.08	20	HSD
	Total	137	
For the year 2009			
Khulna Steam	0.06	50	FO
Barisal GT -1,2	0.08	32	HSD
	Total	82	

To be continue

Name of the units	FOR	Capacity in MW	Fuel
For the year 2010			
Ashuganj CC	0.15	60	Gas
Ashuganj GT	0.15	40	Gas
	Total	100	
For the year 2012			
Ghorasal steam-1	0.10	40	Gas
Ghorasal steam -2	0.10	40	Gas
	Total	80	
For the year 2013			
Baghabari GT	0.04	71	Gas
	Total	71	
For the year 2015			
Haripur Barge/NEPC	0.07	22	Gas
KPCL	0.07	22	FO
	Total	44	
For the year 2019			
Shikalbaha Steam	0.10	50	Gas
Khulna Steam	0.10	90	FO
	Total	140	
For the year 2021			
Ashuganj Steam -3	0.04	150	Gas
Ghorasal Steam -3	0.08	200	Gas
	Total	350	
For the year 2022			
Fenchuganj CC	0.06	90	Gas
Baghabari	0.04	100	Gas
	Total	190	
For the year 2023			
Ashuganj Steam -4	0.04	150	Gas
Shahjibazar GT-8	0.10	35	Gas
	Total	185	
For the year 2024			
Ghorasal Steam-4	0.08	200	Gas
	Total	200	
Grand total for capacity retirement		1767	

Comparing the Tables 3.9 and 3.11 it is observed that the capacity addition is higher than the capacity retirement in each year. After the planning period capacity addition is 19667 MW where the capacity retirement is 1767 MW. The net increment in generation capacity during 2007-2025 is 17900 MW.

CHAPTER 4: SIMULATION RESULTS AND DISCUSSION

4.1 Introduction

The dynamic programming optimization technique is applied to BPS. The technique is applied for 2006 and the results are compared with the collected data of BPS. The DP optimization technique is also applied to evaluate the energy production cost for a planning horizon from 2007 to 2025. In this case, forecasted data of [10] and generation expansion model of Power System Master Plan of BPS are considered. The evaluation is done considering hydro unit as peak shaving unit and also as an EL unit.

4.2 Formation of Quadratic equation and AIC of thermal units

For the economic scheduling, the input output curve of all the units is required. The input output data of only some numbers of the units of BPS is obtained from the station. These are given in Table 3.2 of Chapter -3. The input output characteristic of rest of the units is prepared from the generation and fuel consumption data of different days of the units obtained from the LDC (load dispatch centre) of PGCB . Assuming the same output throughout the day, the output power and the corresponding input are determined. For example, it is observed from the recorded data of LDC of a year that unit # 3 of Ashuganj power station consumed 25.11, 29.71 and 36.98 MCFT (Million Cubic Feet) gas in a day for 100, 120 and 150 MW loading, respectively. Therefore, the input are 1.046(25.11/24), 1.24(29.71/24) and 1.54(36.98/24) MCFT gas per hour for the output of 100, 120 and 150MW respectively. Similarly, the input output data for all the units are determined. From the input output data the characteristic curves are developed and the mathematical model for each curve is also developed. The mathematical model of each generating unit is given in Table 4.1. This table also presents the average incremental cost (AIC) of the units in the third column.

Table 4.1
Mathematical model of input output characteristic of the units of BPS

Name of the units	**(Taka/hour)**	**AIC**(Taka/MWh)
Shikalbaha steam	$y = 4.4x^2 + 710x + 1100$	888.48
Raozan steam –1	$y = 1x^2 + 600x + 4600$	761.76
Raozan steam-2	$y = 0.75x^2 + 620x + 12000$	837.36
Ashuganj steam- 1&2	$y = 0.67x^2 + 690x + 5900$	848.16
Ashuganj steam-3	$y = 0.73x^2 + 550x + 15000$	815.04
Ashuganj steam-4	$y = 0.75x^2 + 600x + 9500$	794.16
Ashuganj GT-1,2	$y = 0.82x^2 + 880x + 3900$	1011.60
Ghorasal steam-1&2	$y = 3.4x^2 + 740x + 3400$	995.04
Ghorasal steam-3	$y = 0.73x^2 + 620x + 13000$	845.28
Ghorasal steam-4	$y = 0.65x + 580x + 10000$	763.92
Ghorasal steam-5	$y = 0.7x^2 + 520x + 21000$	825.84
Ghorasal steam-6	$y = 0.62x^2 + 490x + 25000$	828.72
Tongi gas turbine	$y = 0.27x^2 + 580x + 19000$	980.64
Siddhirganj Steam 50MW	$y = 8.8x^2 + 620x + 1700$	897.12
Siddhirganj Steam 210MW	$y = 0.59x^2 + 400x + 40000$	885.60
CDC Meghnaghat GT-1, 2	$y = 0.072x^2 + 430x + 42000$	647.28
Hariput Barge /NEPC(1-8)	$y = 0.53x^2 + 410x + 16000$	765.36
CDC Haripur GT	$y = 0.35x^2 + 250x + 52000$	618.48
Shahjibajar GT(1-7)	$y = 10x^2 + 2000x + 2300$	2416.32
Shahjibajar GT (8-9)	$y = 2x^2 + 730x + 4100$	954.00
Fenchuganj GT-1, 2	$y = 6.4x^2 + 340x + 1800$	732.24
Sylhet GT	$y = 6.7x^2 + 730x + 7100$	1478.88
RPCL(1)	$y = 5.2x^2 + 470x + 11000$	1283.76
RPCL(2)	$y = 4.9x^2 + 440x + 10000$	1183.68
RPCL(3)	$y = 4.9x^2 + 450x + 10000$	1193.76
RPCL(4)	$y = 5.2x^2 + 450x + 11000$	1263.6
Khulna steam 110MW	$y = 14x^2 + 1700x + 36000$	3277.44
Khulna steam 60 MW	$y = 16x^2 + 1900x + 47000$	4368.96
KPCL(1-19)	$y = 14x^2 + 970x + 70000$	3284.68
Barisal GT1&2	$y = 35x^2 + 7500x + 63000$	11648.16
Bheramara GT-1,2,3	$y = 55x^2 + 7400x + 20000$	10002.96
Baghabari 71MW GT(77)	$y = 3.5x^2 + 610x + 3300$	856.80
Baghabari 100MW GT	$y = 5.4x^2 + 380x + 7900$	871.20
WMPL-1,2	$y = 2.1x^2 + 530x + 1500$	678.24
Rangpur GT	$y = 76x^2 + 7200x + 31000$	11119.68
Barapukuria -1,2	$y = 0.31x^2 + 1200x + 33000$	1525.68
Khulna Burge 1 & 2	$y = 81x^2 + 1800x + 77000$	7536.96

To be continue

Continued Table 4.1

Name of the units	**(Taka/hour)**	**AIC**(Taka/MWh)
Saidpur GT	$y = 82x^2 + 2200x + 90000$	11847.60

In this table 'y' is in taka per hour and 'x' in Megawatt. To determine the co efficient of 'x' the fuel price set by the government in 2006 is considered. To determine the AIC, first the heat rate curve is developed from the input output characteristic curve. An average value of heat rate is determined by considering the heat rates of different load levels and then using this average heat rate AIC of a unit is determined.

For the calculation of economic dispatch using DP optimization technique the input output characteristic of the generating units of Table 4.1 are considered as continuous characteristics.

4.3 Formation of PDF model of Kaptai hydro power generation

For the proper utilization of hydro resource of Kaptai reservoir an appropriate hydro generation model of the hydro power station is required. To develop such a model the PDF model of water head is firstly needed. The probability density function of water head of Kaptai reservoir is developed from the historical data of water head and presented in Figure 4.1.

From the PDF of water head of Kaptai reservoir the equivalent capacity generation model is developed by translating the random variable (R.V) of Figure 4.1 into generating capacity using appropriate conversion factor presented in article 3.4.2 of Chapter 3. The multi-state model of equivalent capacity generation is given in Figure 4.2. Note that in this model the probability value of water head impulse directly maps to the impulse of generating capacity.

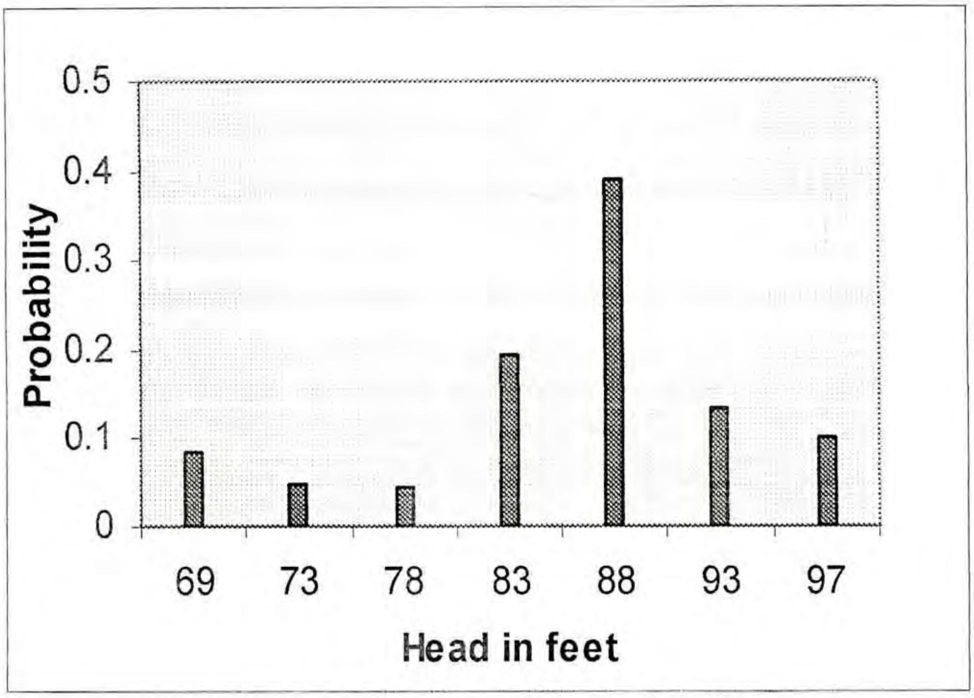


Figure 4.1: PDF of water head of Kaptai reservoir

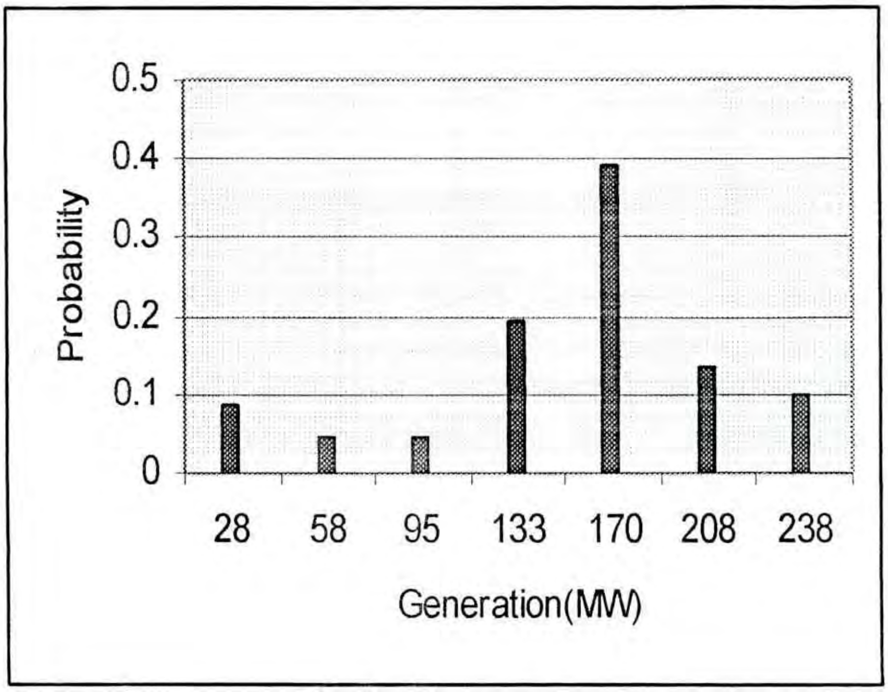


Figure 4.2: PDF of equivalent capacity generation from Kaptai reservoir.

Now it is required to develop a combined PDF capacity model of whole power station. To develop a combined PDF model, the individual units model presented in article 3.4.2 of Chapter 3 are convolved to each other, such that, unit -1 convolve with unit-2 then with unit-3 and so on. The combined PDF of available capacity of Kaptai hydro power station is shown in Figure 4.3.

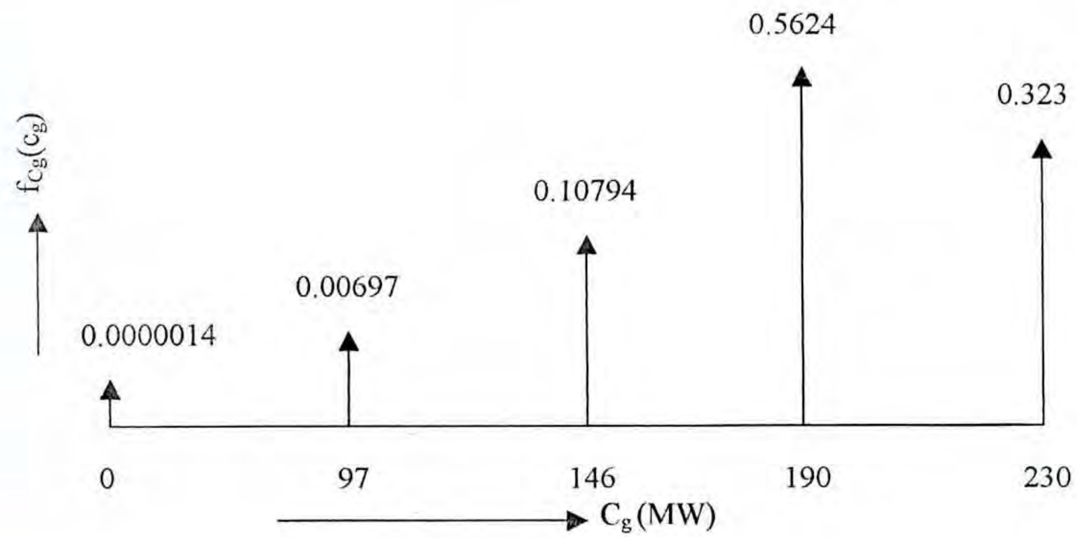


Figure 4.3: PDF of available capacity of Kaptai Power station

After the convolution of all the units' 12 impulses is obtained and for the simplicity of calculation only five impulses is considered that shown in the figure.

To develop a multistate model of Kaptai hydro power station of capacity output the PDF of available capacity is convolved with PDF of equivalent capacity generation from the water head. Figure 4.4 shows the multi state model of energy limited Kaptai hydro power station. This figure depicts the probability density function of capacity output where the magnitude of each impulse indicates the probability of corresponding MW generation. Though the equivalent capacity generation by water head has an impulse of 238 MW but the maximum unit capacity of the entire hydro power station is 230 MW, so the multi-state model will never get any impulse of higher than cumulative maximum capacity. Similarly Figure 4.5 gives the multi-state model of Kaptai hydro power station with PDF of capacity on outage.

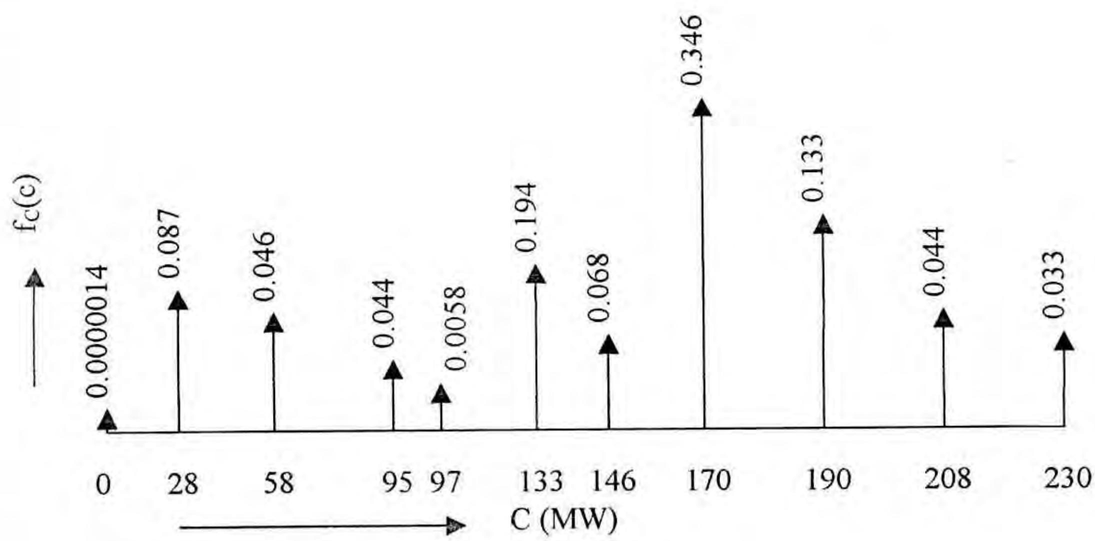


Figure 4.4: PDF of capacity output of Kaptai hydro power station

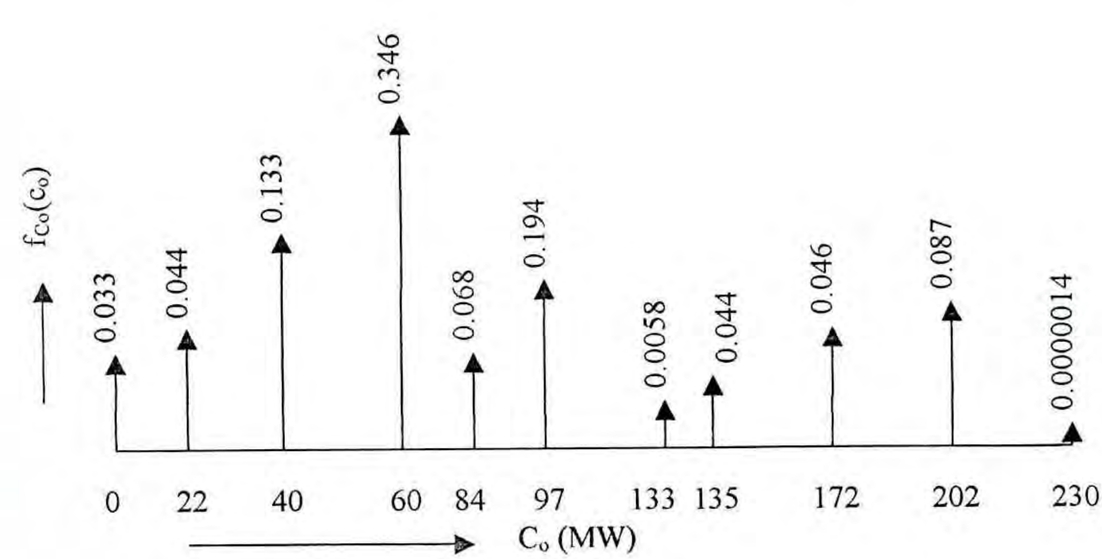


Figure 4.5: PDF of capacity on outage of Kaptai hydro power station

The PDF model (multi-state model) of Kaptai hydro power generation is used in this thesis for the calculation of energy generation and cost in merit order loading of segmentation method.

4.4 Impacts of the optimal scheduling of units on production cost

For a loading the generating units, the dispatch engineers of BPS does not follow any standard economic scheduling technique rather the units are loaded randomly. However, the operators maintain the schedule for the units that are loaded during the peak hours. This results in excessive amount of production cost.

The production cost of BPS for 2006 is evaluated by using dynamic programming (DP) approach. The hourly generation of 2006 is used, given in appendix 'B'. To reduce computational time the following considerations are applied in the evaluation.

(i) Same type of units with same rated capacity within the same station are considered as one equivalent unit and combined equivalent input output characteristic equation is used.

(ii) Eight stages of scheduling in a day are considered; each stage consists of three hours.

(iii) The small units with high production cost are considered to be scheduled during peak hours.

(iv) Some large units whose production cost is lower are considered as must run units.

The evaluation process is divided into four cases, which are clearly discussed below.

Case-1

In this case, the actual hourly generation of BPS of 2006 is considered as the load and hydro unit is treated as conventional peak shaving one. This essentially means that the hydro unit is not incorporated into economic scheduling and load allocation for thermal units in this evaluation process is the difference of total generation and actual hydro generation.

If,

TL = Total hourly generation in Megawatt

HLCONV= Hydro generation in MW as conventional peak shaving unit

TLCONV= TL-HLCONV.

Where, TLCONV= Hourly load allocation for economic dispatch of thermal units.

In the case-1 the evaluated production cost is compared with actual cost of BPS of 2006, which is given in Table 4.2.

Table 4.2
Comparison of actual production cost of 2006 with the evaluated one

Month	Cost in Million Take				
	Evaluated production cost by DP method with transition cost (considering all the units with FOR) 1	Evaluated production cost by DP method with transition cost (considering actual ON and OFF status of the units) 2	Actual cost incurred by BPS 3	Savings	
				3-2	3-1
Jan	1169.73	1182.19	1794.75	612.56	625.02
Feb	1217.63	1235.19	1901.03	665.84	683.40
Mar	1497.01	1515.28	2263.37	748.09	766.37
Apr	1477.65	1492.96	2062.11	569.15	584.47
May	1440.72	1468.01	2021.02	553.01	580.30
Jun	1509.01	1535.44	1998.45	463.01	489.44
Jul	1505.82	1530.89	1891.90	361.01	386.08
Aug	1531.28	1582.49	1950.36	367.87	419.08
Sep	1409.49	1473.77	1903.75	429.98	494.26
Oct	1359.25	1431.15	1894.60	463.45	535.35
Nov	1219.86	1276.82	1631.25	354.43	411.38
Dec	1207.45	1265.86	1702.19	436.33	494.74
Total	16544.88	16990.14	23014.77	6024.63	6469.89

The evaluated energy generation cost considering all the units with forced outage rate is presented in column 1 and column 2 presents the energy generation cost considering actual online and offline status of the generating units in each day throughout the year. The table also presents the monthly savings as well as annual savings. The implementation of DP optimization technique causes 28.11 % savings when all the units are considered with FOR and 26.18% savings considering actual on and off status of the units over the actual cost of production of 2006.

Case-2

This case considers the hydro unit as energy limited one. The hourly load allocation for thermal units in this evaluation process is the difference of actual hourly generation and possible hydro generation in that hour for the year 2006.

If,

TL = Total hourly generation in Megawatt

HLOPT = Possible hourly hydro generation in Megawatt as an EL unit.

TLOPT= TL-HLOPT

Where, TLOPT = Dispatchable load among the thermal units considering hydro unit as an EL unit.

The comparison of production cost is shown in Table 4.3 for the year 2006. The table shows that the optimal scheduling of the units of BPS results in 30.23 % fuel cost savings considering all the units with FOR and 27.53% savings considering actual on and off status of the units over the actual cost of production.

Table 4.3
Production cost comparison of 2006 with EL hydro

Month	Cost in Million Take				
	Evaluated production cost by DP method with transition cost (considering all the units with FOR) 1	Evaluated production cost by DP method with transition cost (considering actual ON and OFF status of the units) 2	Actual cost incurred by BPS 3	Savings	
				3-2	3-1
Jan	1065.74	1137.89	1794.75	656.86	729.01
Feb	1148.22	1212.65	1901.03	688.38	752.81
Mar	1456.85	1492.93	2263.37	770.44	806.53
Apr	1463.40	1485.28	2062.11	576.83	598.72
May	1438.47	1480.21	2021.02	540.81	582.55
Jun	1487.44	1517.64	1998.45	480.81	511.01
Jul	1491.16	1519.02	1891.90	372.88	400.74
Aug	1500.63	1548.69	1950.36	401.67	449.73
Sep	1384.32	1452.60	1903.75	451.15	519.43
Oct	1312.83	1401.49	1894.60	493.11	581.77
Nov	1160.08	1223.96	1631.25	407.29	471.17
Dec	1147.12	1207.18	1702.19	495.01	555.07
Total	16056.25	16679.60	23014.77	6335.17	6958.53

Comparing Tables 4.2 and 4.3 it is observed that, the EL simulation of hydro unit increases the savings by 488.64 Million Taka when all the units are considered with FOR and by 310.54 Million Taka for considering actual on off status of the units over the conventional peak shaving approach of loading of the hydro unit, which are 2.12 % and 1.35 % of the actual production cost of 2006 respectively.

Note that, to show a comparison with the actual cost of production the actual on and off status of the generating units of BPS for 2006 is considered in thesis but for the evaluation of energy generation cost for future generation planning it is not possible to know the actual on and of status of the units and in this case all the existing generating units are considered with their forced outage rate.

Case-3

This case compares the energy production costs obtained using dynamic programming method and merit order loading method. In merit order loading approach the segmentation method is applied [18]. In this case, merit order loading is based on the average incremental cost (AIC) of the segments of units which is discussed in article 2.6.1 of chapter 2. In both the cases all the generating units are considered with FOR and the transition cost is neglected. The evaluated production cost obtained from both the methods is compared with the actual cost of BPS, which is presented in Table 4.4. Incase of EL operation of Kaptai hydro plant the total evaluated hydro electric generation during 2006 is 1280 GWh . In this case all the hydro units are considered with FOR and the probability density function of water head of Kaptai reservoir is also considered. The table shows that the dynamic programming unit commitment method gives higher production cost savings compared to the merit order loading approach.

Table 4.4
Cost comparison between DP method and merit order loading for 2006

Month	Cost in Million Taka				
	Actual cost incurred by BPS 1	DP scheduling With EL Simulation Without transition cost 2	Merit order loading of segmentation method with EL simulation without transition cost 3	Savings	
				1-2	1-3
Jan	1794.75	1057.99	1224.68	736.76	570.07
Feb	1901.03	1145.49	1299.17	755.54	601.85
Mar	2263.37	1456.06	1602.51	807.32	660.86
Apr	2062.11	1462.40	1553.82	599.71	508.29
May	2021.02	1436.67	1509.35	584.35	511.66
Jun	1998.45	1485.99	1639.47	512.46	358.97
Jul	1891.90	1490.17	1677.49	401.73	214.41
Aug	1950.36	1500.04	1670.02	450.32	280.34
Sep	1903.75	1383.28	1529.27	520.47	374.48
Oct	1894.60	1311.60	1453.97	583.00	440.63
Nov	1631.25	1157.32	1275.05	473.93	356.19
Dec	1702.19	1144.37	1245.83	557.82	456.36
Total	23014.77	16031.36	17680.64	6,983.41	5,334.13

Case-4

This case deals with the production cost analysis for the period 2007 to 2025. In this case, the forecasted hourly load is considered. The addition and retirements of the generating units throughout the planning horizon is mentioned in Tables 3.9 and 3.11, respectively, of chapter 3. Table 4.5 compares the evaluated production cost with the different unit commitment approach. The evaluated production cost with dynamic programming is given in column 1 and column 2 gives the production cost with the same method without considering the startup and shutdown cost.

Table 4.5
Production cost evaluation from 2007 - 2025

Year	Cost in Million Taka			
	DP scheduling with EL simulation with transition cost 1	DP scheduling with EL simulation without transition cost 2	Merit order loading of segmentation method with EL simulation without transition cost 3	Savings (3-2)
2007	18120.45	18071.90	19870.34	1798.44
2008	18369.16	18347.76	20350.62	2002.86
2009	16886.26	16842.03	19536.02	2693.99
2010	17516.85	17446.29	20471.73	3025.44
2011	18284.40	18182.94	21515.83	3332.90
2012	18591.85	18516.48	22137.40	3620.91
2013	19634.20	19573.71	23454.92	3881.21
2014	20398.04	20373.93	24626.15	4252.23
2015	21635.73	21631.01	26008.58	4377.58
2016	22852.12	22844.80	27530.24	4685.44
2017	24275.78	24269.45	29251.60	4982.15
2018	25409.29	25402.08	30575.12	5173.04
2019	26599.71	26592.13	31971.75	5379.62
2020	27653.28	27646.72	33058.31	5411.59
2021	28951.78	28944.46	34595.38	5650.92
2022	30116.16	30109.83	35836.60	5726.77
2023	31353.87	31347.94	37161.93	5813.99
2024	32711.49	32705.83	38635.30	5929.46
2025	34196.77	34189.97	40478.50	6288.53
Total	453557.20	453039.24	537066.32	84027.08

In this evaluation process the average hourly load of a week is considered as hourly load of an equivalent day. This means that, 52 weeks of a year is treated as 52 equivalent day and six discrete load levels each consists of four hours in a day is also considered for the reduction of computational time. The column 3 presents the production cost obtained from the merit order loading of segmentation method. The table also shows that the dynamic programming method gives lower production cost compared to the priority base unit commitment and the saving is shown in the right end column of the table.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The loading of the generating units of BPS is usually not scheduled based on the optimization technique. This causes the higher generation cost. It is possible to implement optimization technique for BPS and this will have a significant impact on the reduction of generation cost.

It is clearly observed from the analysis that the optimal scheduling of the generating units through dynamic programming approach causes a significant amount of fuel cost savings of BPS. Moreover, dynamic programming method of unit scheduling provides better simulation result compared to the merit order loading approach. The production cost evaluation using dynamic programming method results in 30.23 % savings considering all the units with FOR and 27.53% savings considering actual on and off status of the units over the actual generation cost of BPS for 2006. A 9.33 % savings is observed in DP scheduling technique in comparison with the cost of merit order loading of the units of BPS for the same year. An analysis of BPS for 2007 to 2025 with dynamic programming method gives a fuel cost savings of 84027.08 Million Taka compared to the cost evaluated by merit order loading approach.

As the hydro generating unit at Kaptai is used as a peak shaving unit, therefore, the operation of this unit as an EL unit can reduce the energy generation cost and can increase the total energy generation of BPS. The result of the analysis shows that the EL operation of Kaptai hydro unit will give a fuel cost savings of 488.63 Million Taka and an increase in generation by 568 GWh over the peak shaving operation of that unit in a year.

5.2 Suggestion for further research

Priority list method of unit commitment does not give optimal solution. For this reason, dynamic programming method is used in this thesis for unit commitment. However, dynamic programming method is a time consuming method. For the reduction of solution time eight discrete time intervals in a day is considered. In case of hydroelectric generation, the impact of the exhaustive use of hydro energy is investigated. Further work in connection of this study may be

(i) Solution of the economic scheduling problem of BPS with more accurate heat rate data for all the generating units.

(ii) Evaluation of production cost using dynamic programming technique considering the transmission loss and the hourly loads i.e. 24 discrete equal time intervals in a day.

(iii) Development of the model of hydro power plants using the instantaneous head and reserve of the Kaptai reservoir.

(iv) Hydro generation analysis for the Kaptai hydroelectric power station if pumped storage scheme is considered.

REFERENCES:

[1] Stevention, W. D. Jr. "Elements of Power System Analysis" McGraw-Hill Book company, New York, 1996.

[2] Nagrath, I. J., Kothari, D. P. " Modern Power System Analysis" Tata McGraw-Hill Publishing Company Limited, New Delhi, 1985.

[3] Wood, A.J. and Wollenbery, B.F. "Power Generation Operation and Control" New York ; wiley,1996.

[4] Stevention, W. D. Jr., Grainger, J. J. "Power System Analysis" McGraw-Hill, New York, 1994.

[5] Sullivan, R.L. " Power System Planning" McGraw-Hill Int. Book company.

[6] Ahsan, Q. and Bhuiyan, M. R. 'New Approach for Simulating an Energy Limited Hydro Unit,' IEE Proceedings, vol. 137, pt.6, Nos.5, pp. 359-363, 1990

[7] Ahsan, Q. 'Evaluation of Power Interruption Cost for Residential and Industrial Sectors', Journal of Energy & Environment, 3(2004), pp. 119-131.

[8] Ahsan, Q. and Das, A. C. "Cost of Electric Service Interruption: Awareness among Consumers and Utilities", ICECE 2006, 19-21 December, Dhaka, pp. 128-131, 2006.

[9] Moin, U. 'Development of a Methodology for Long Term Hourly Electrical Load Forecasting and Assessment of Gas Requirement', M. Sc. Engineering Thesis, Department of EEE, BUET, Dhaka, 2003.

[10] Ahsan, Q. and Moin, U. Lt. Col. "A probabilistic Approach of Electrical Energy Forecasting", Proceedings of 2005,IEEE Instrumentation and Measurement Technology conference, Ottawa, Canada, 17-19 May, 2005

[11] Chowdhury, N., and Bilinton, R., " Unit Commitment in Interconnected Generating System Using a Probabilistic Technique", IEEE Transaction on Power Pystem, Vol.5, No.4, November 1990.

[12] Shoults, R. R., Chang, S. k., Helmick, S., and Grady, M. W. " A Practical Approach to Unit Commitment, Economic Dispatch and Savings Allocation for Multiple-area Pool Operation with Import/Export Constraints", IEEE Transaction on Power Apparatus and System, Vol.PAS-99,No.2 March/April 1980.

[13] Li, S. , Shahidehpour, S. M., and Wang, C., "Promoting the Application of Expert Systems in Short Term Unit Commitment", IEEE Transaction on Applied Superconductivity, Vol.3, No.1, March 1993.

[14] Maifeld, T.T. and Sheble, G.B. " Genetic Based Unit Commitment Algorithm" IEEE Transaction on Power System, Vol. 11, No.3,August 1986.

[15] Schenk, K.F., Misra, R.B, Vassos, S., and Wen, W. " A New Method for the Evaluation of Expected Energy Generation and Loss of Load Probability" ", IEEE Transaction on Power Apparatus and System, Vol.PAS-103, No.2 February1984.

[16] Senjyu, T., Shumabukuro, K., Uezato, K. and Funabashi, T. " A Fast Technique for Unit commitment Problem by Extended Priority List" IEEE Transaction on Power System, Vol. 18, No.2, May 2003.

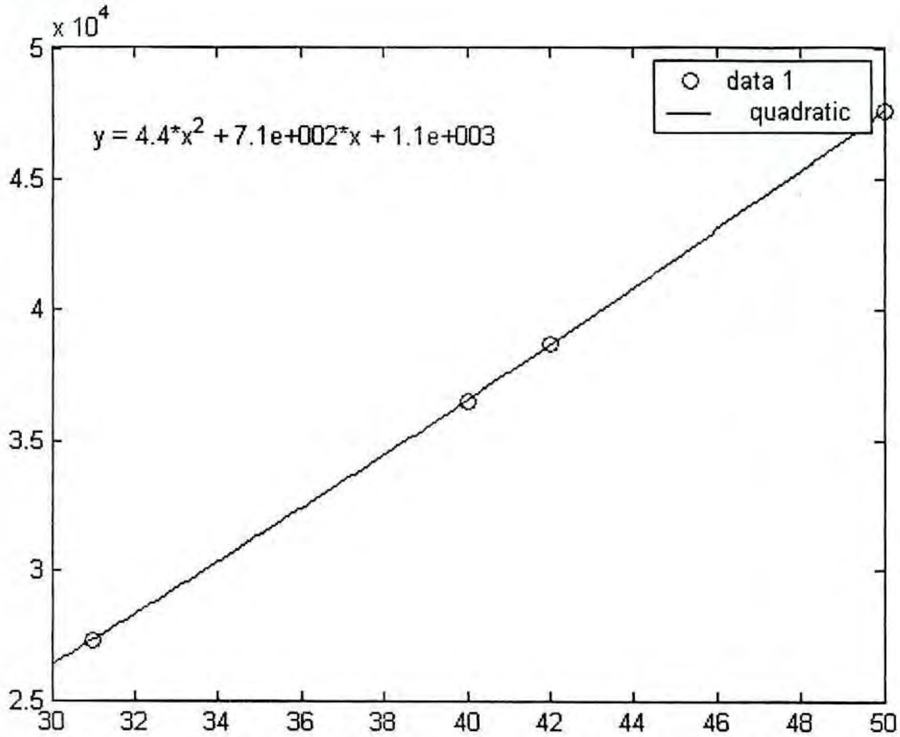
[17] Chowdhury, A K M. D. H., "Solution of the Economic Dispatch Problem of Hydro-Thermal Power System" M.Sc. Engg. Thesis (EEE), Bangladesh University of Engineering and Technology, Dhaka, 1988.

[18] Ahsan, Q. and Mohammad Tawhidul Alam, "Electrical Power Crisis in Bangladesh: Impacts of the Optimal Use of Energy Limited Hydro Unit on the System Reliability and Production Cost" Proceedings of 2007, IEEE Electrical Power Conference, Montreal, Canada, 25-26 October, 2007.

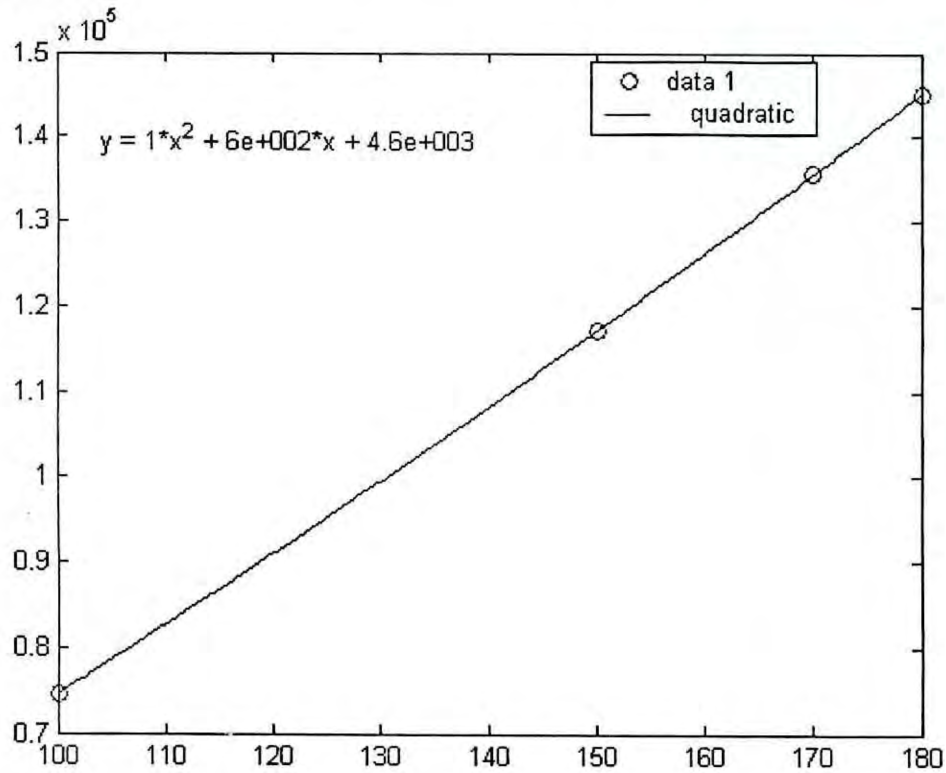
APPENDIX:

A: Input output curves of the units of BPS

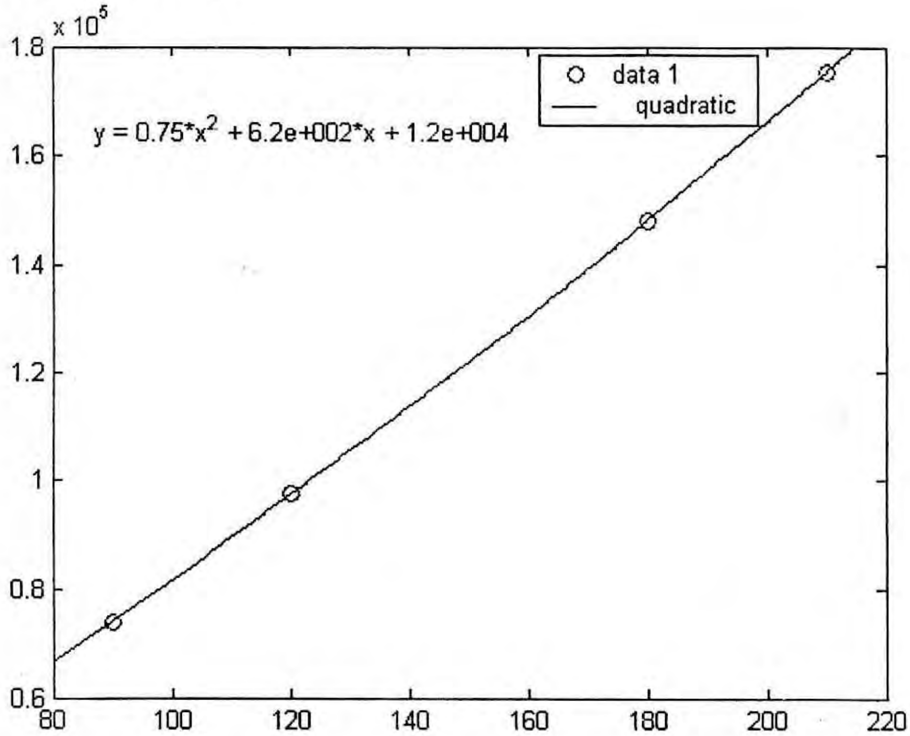
Shikalbaha Steam- 50



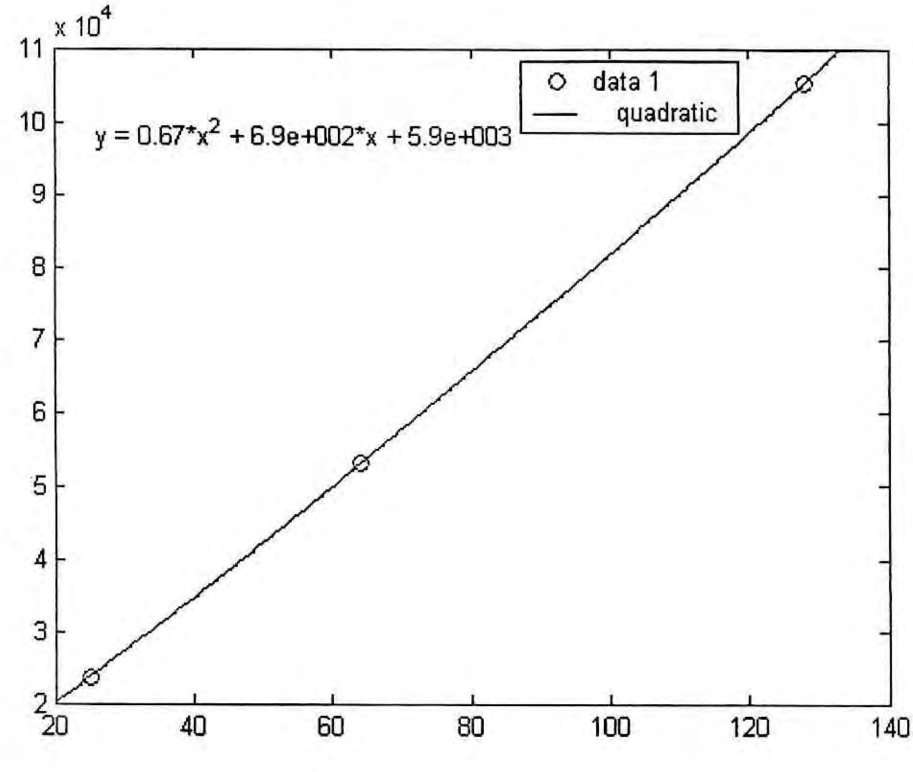
Raozan Steam- 1



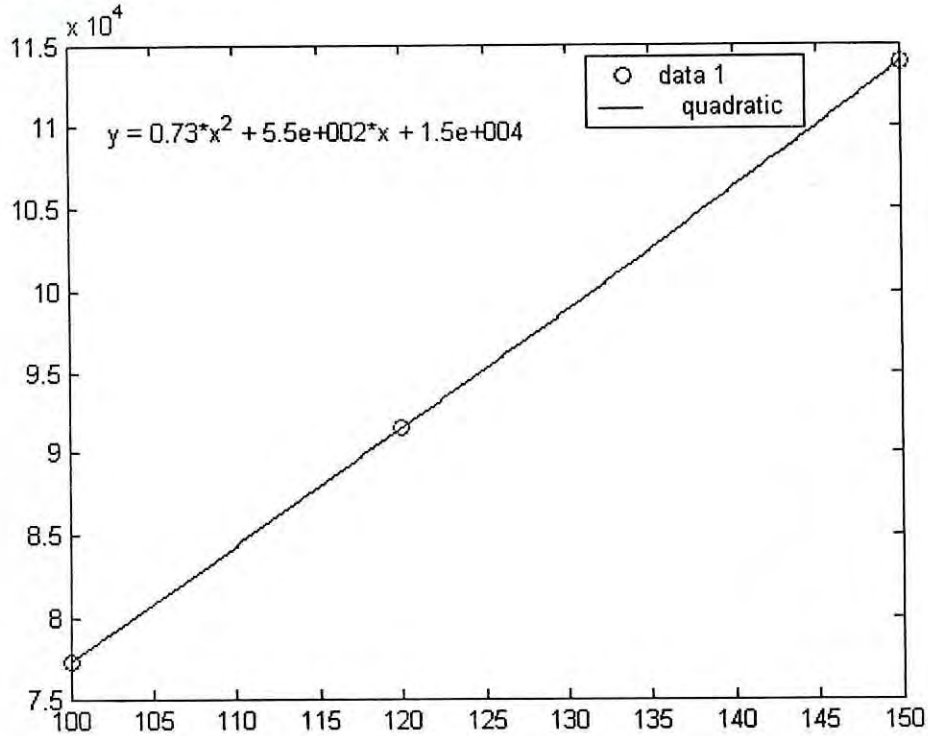
Raozan Steam- 2



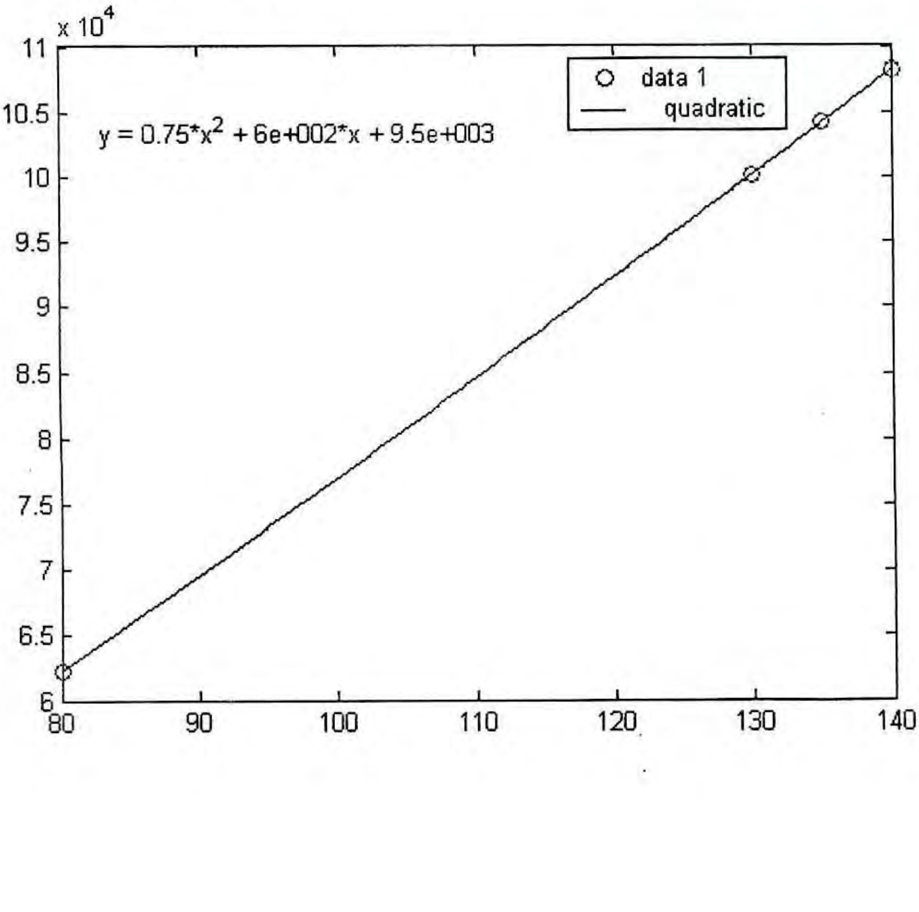
Ashuganj Steam- 1&2



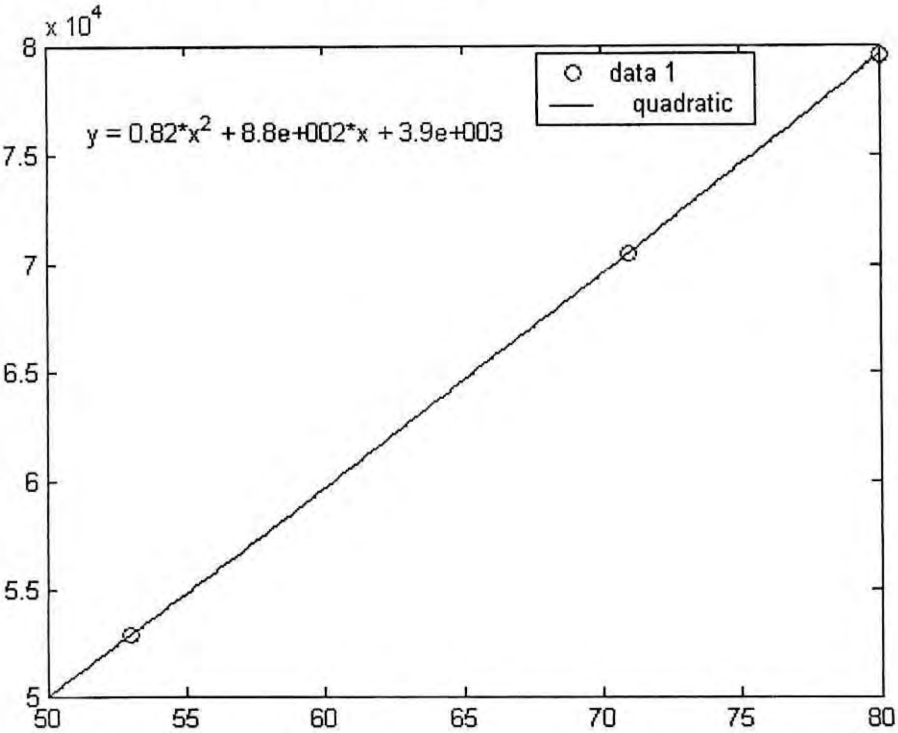
Ashuganj Steam- 3



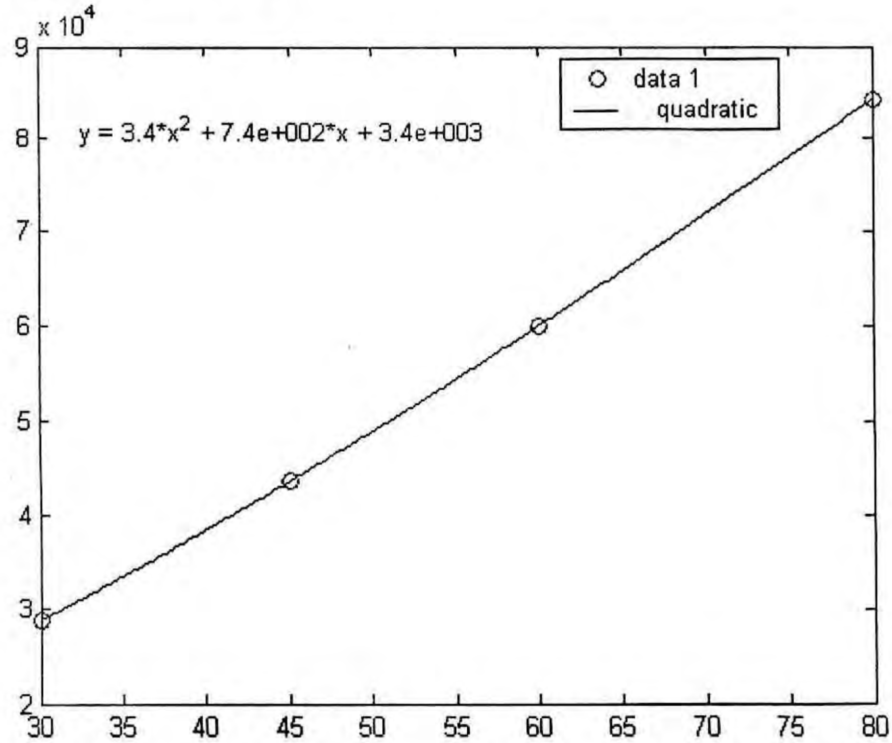
Ashuganj Steam- 4



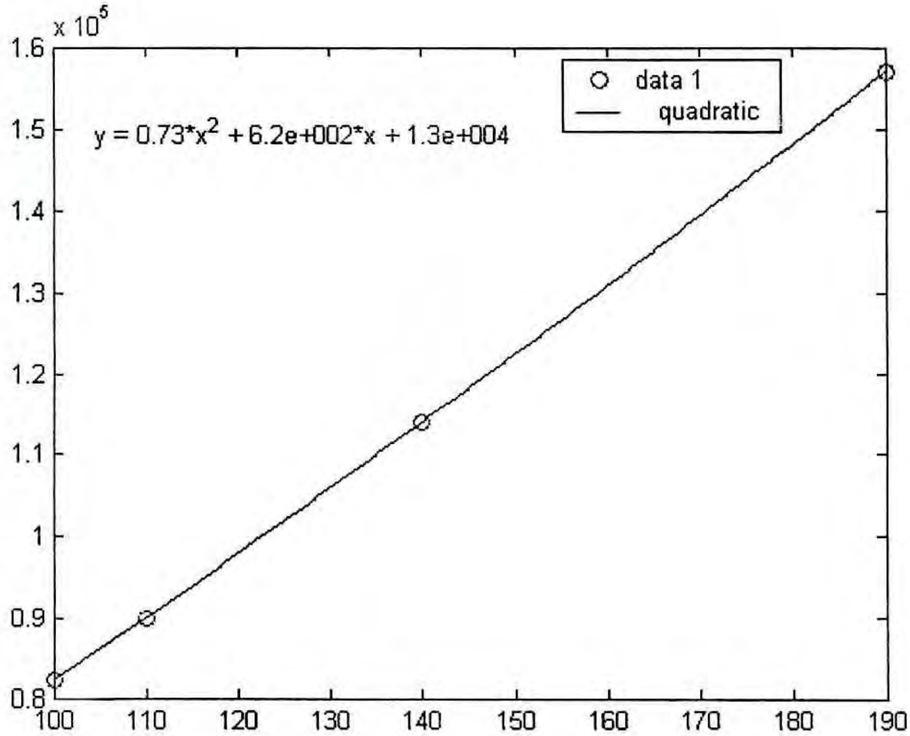
Ashuganj GT-1&2 with Steam unit



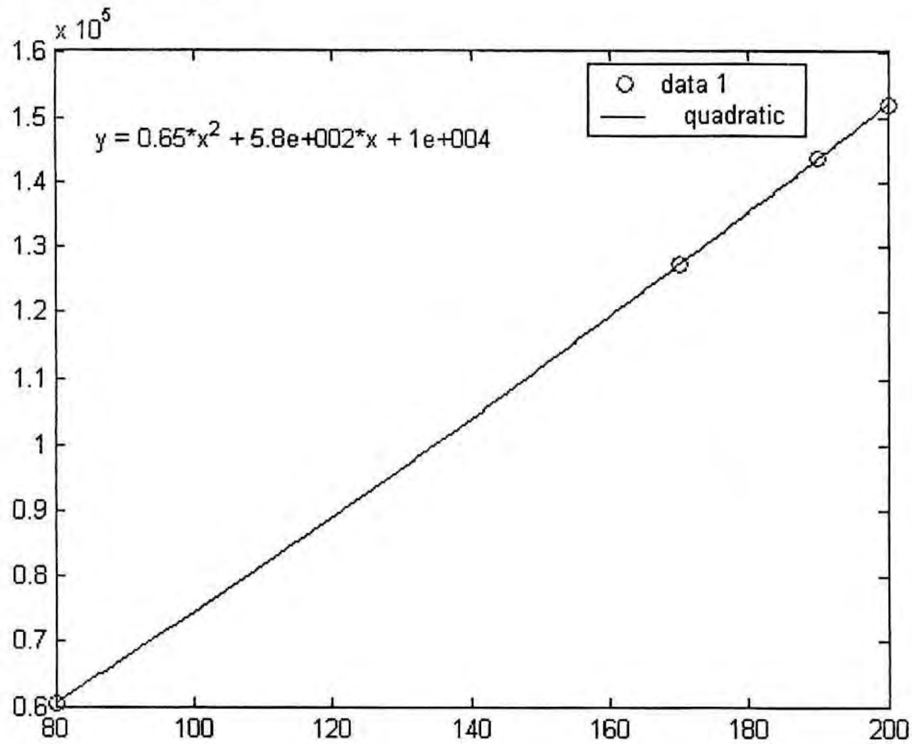
Ghorasal Steam-1&2



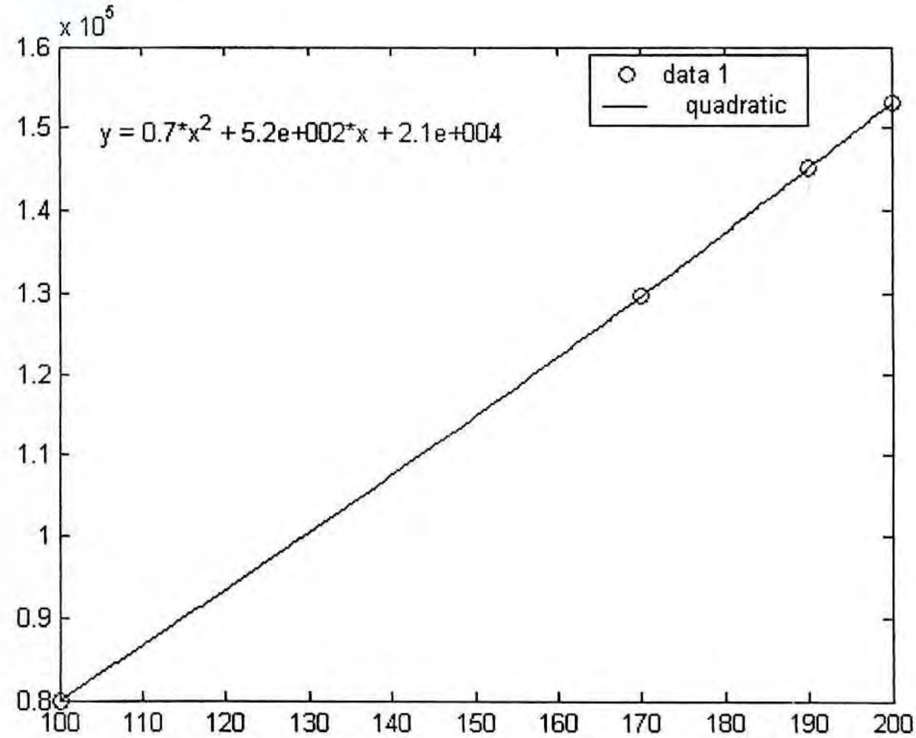
Ghorasal Steam- 3



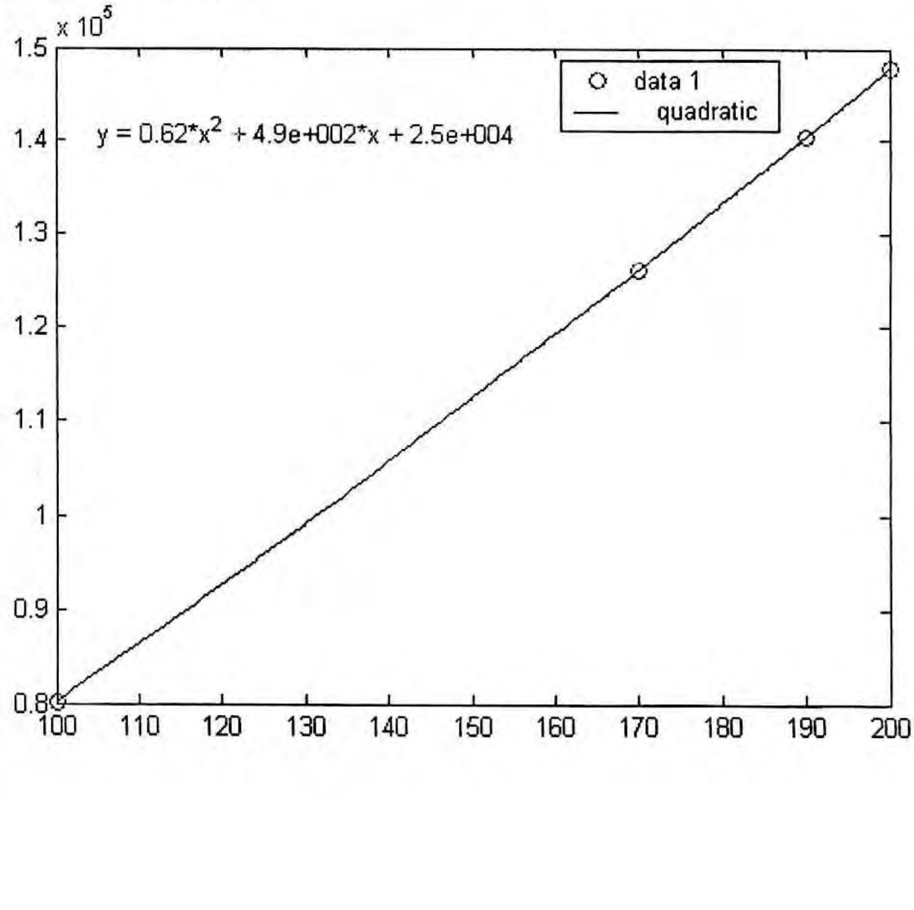
Ghorasal Steam- 4



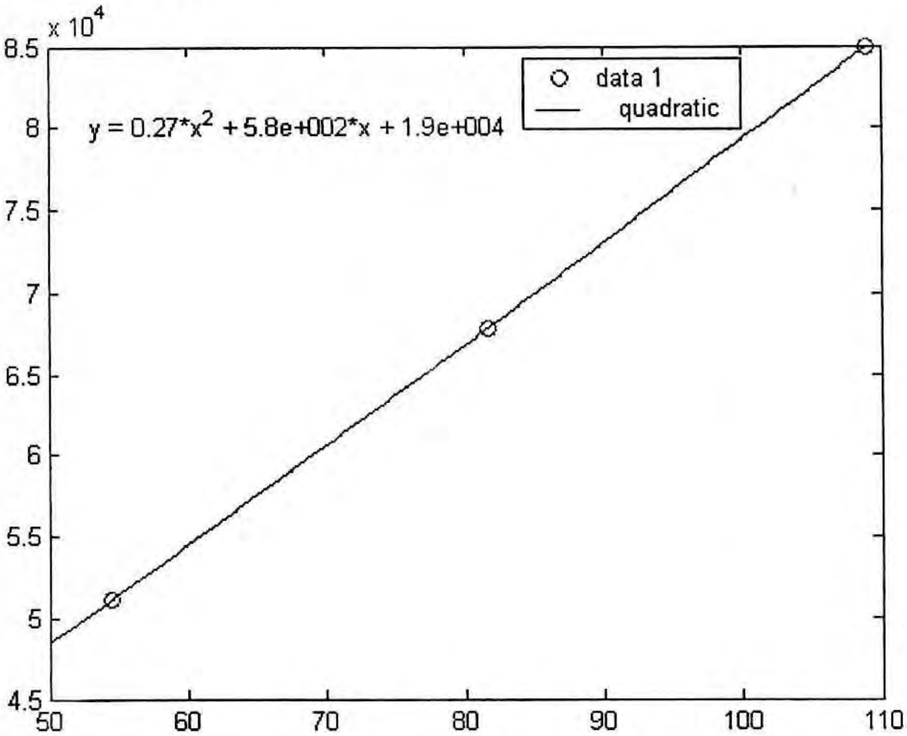
Ghorasal Steam- 5



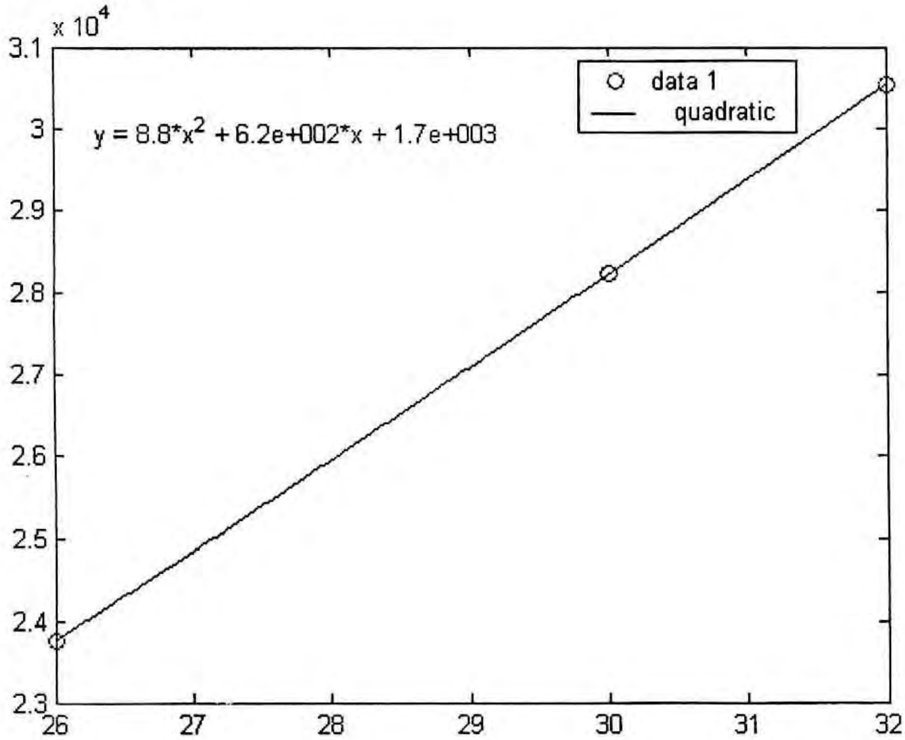
Ghorasal Steam- 6



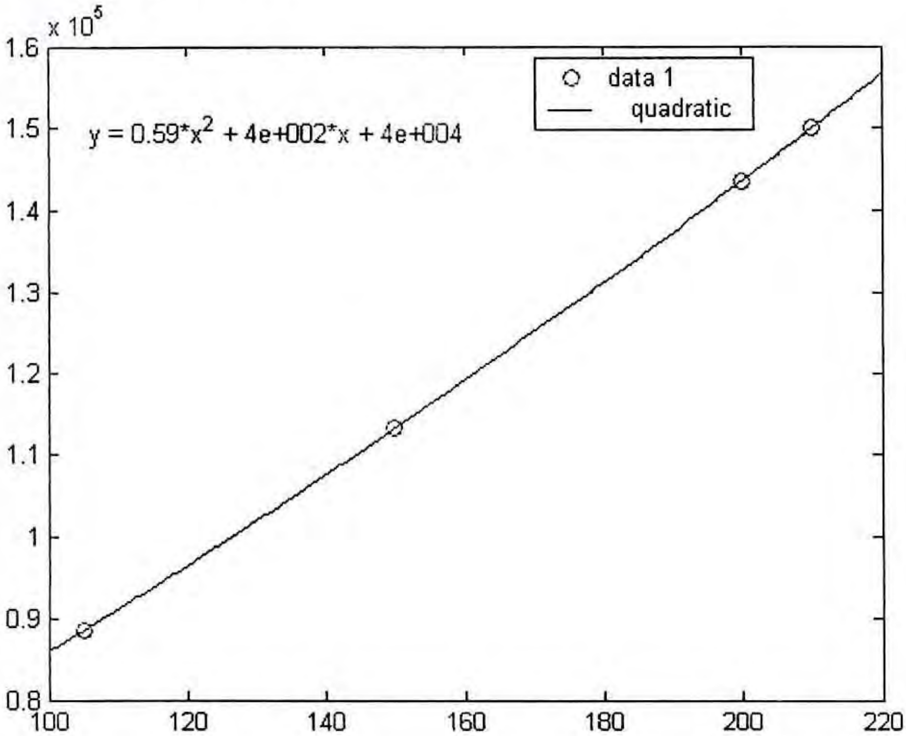
Tongi gas turbine



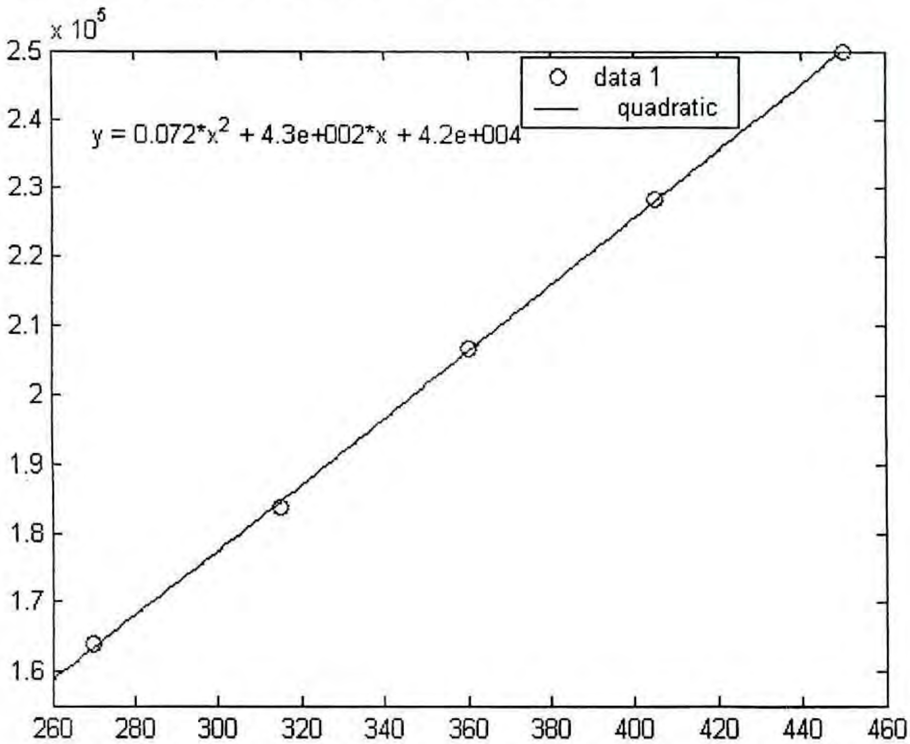
Siddhirganj 50 MW



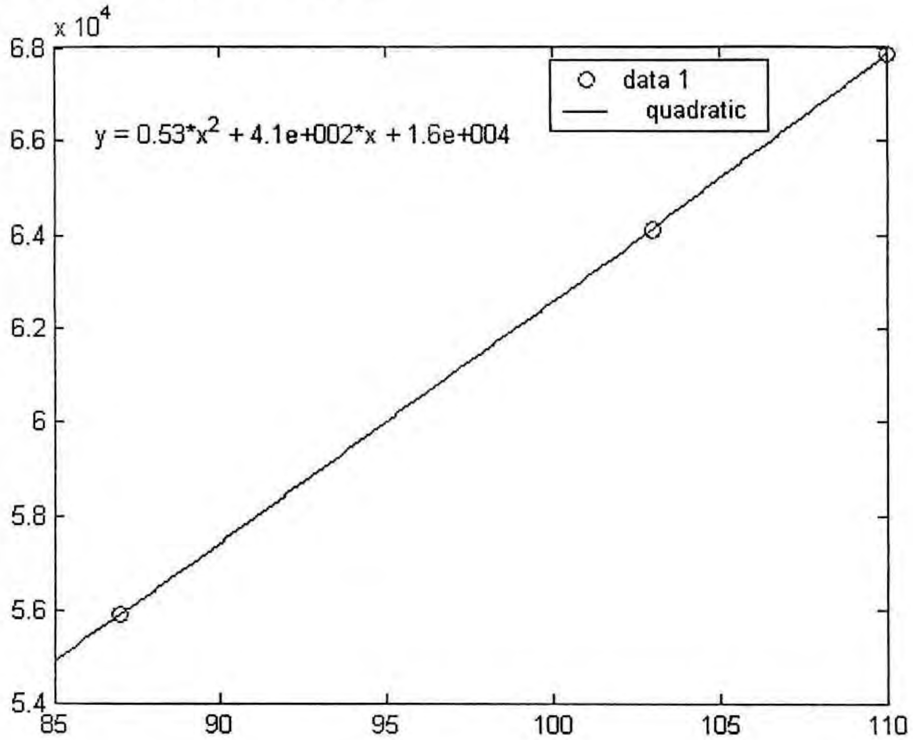
Siddhirganj 210 MW



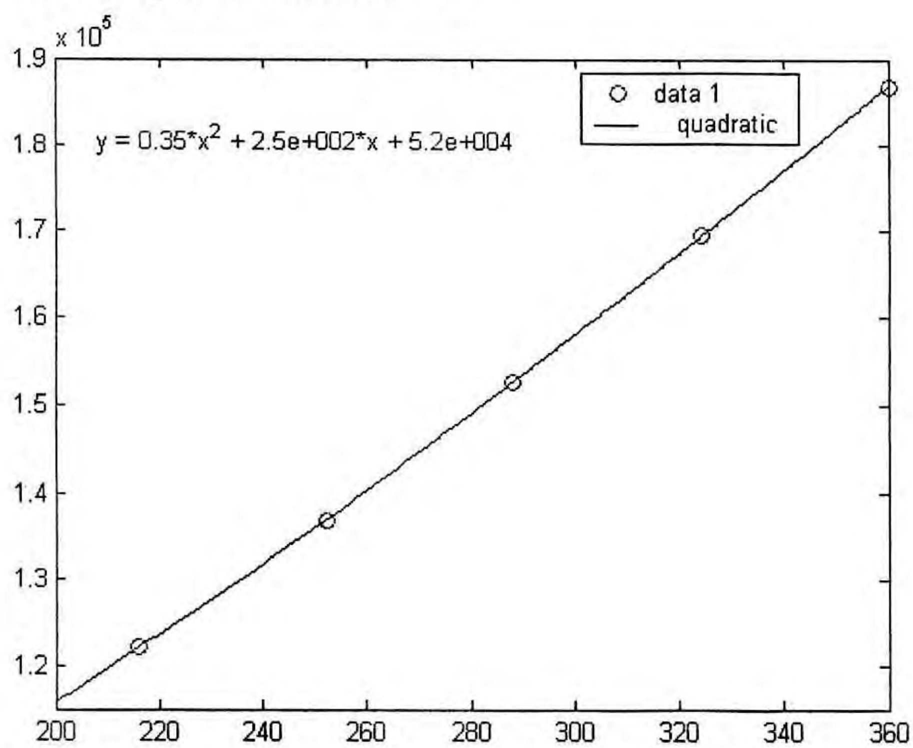
CDC Meghnaghat GT-1,2 With Steam unit



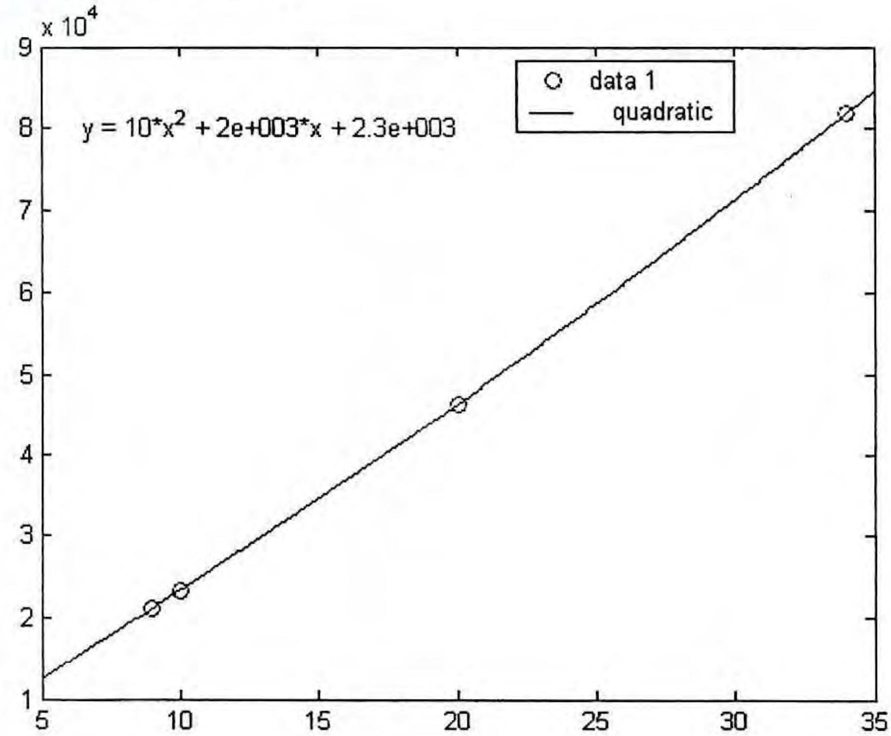
Haripur Barge/NEPC (1-8)



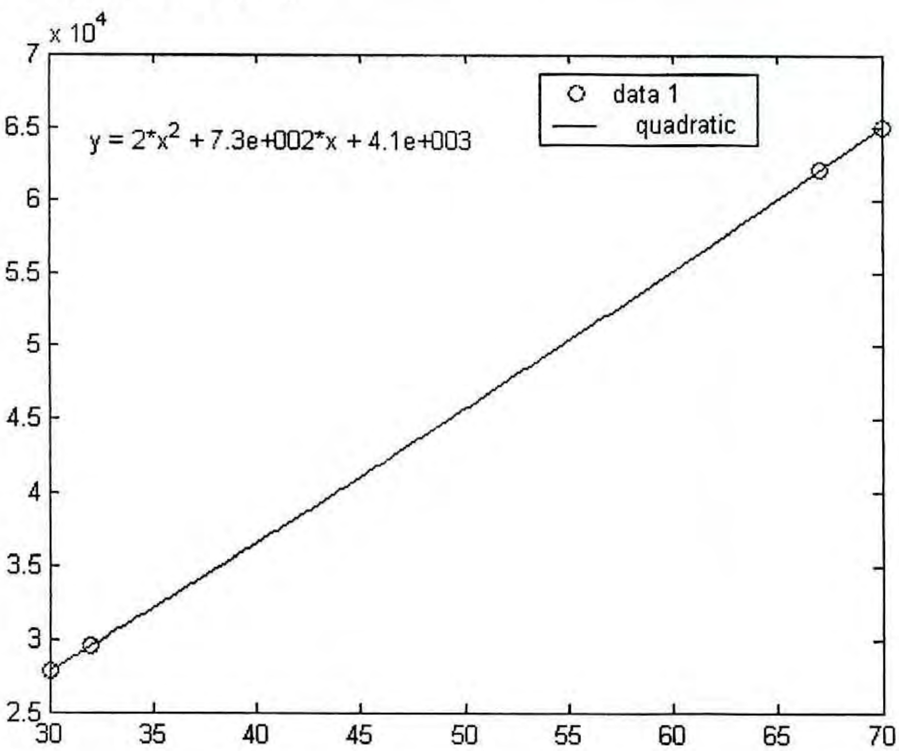
CDC-Haripur GT with steam unit



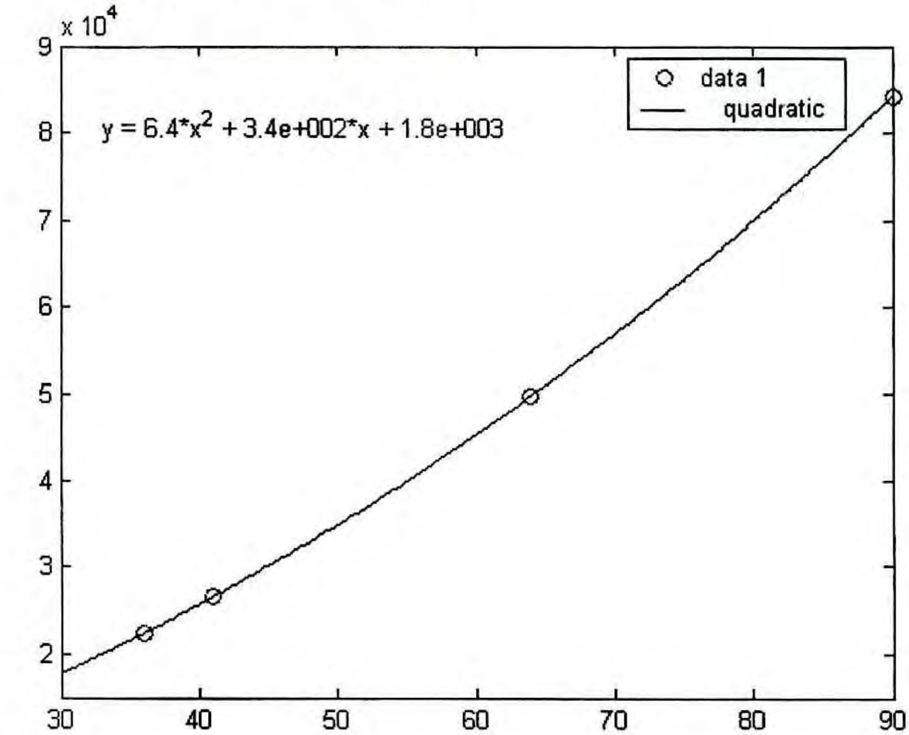
Shahjibazar GT-(1-7)



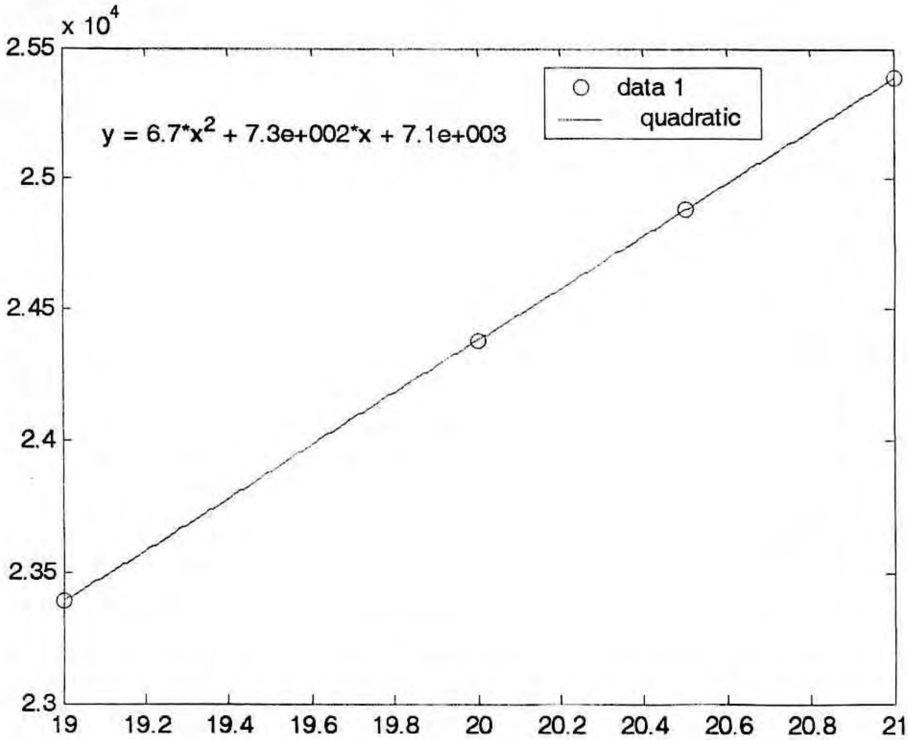
ShahjibazarGT-(8-9)



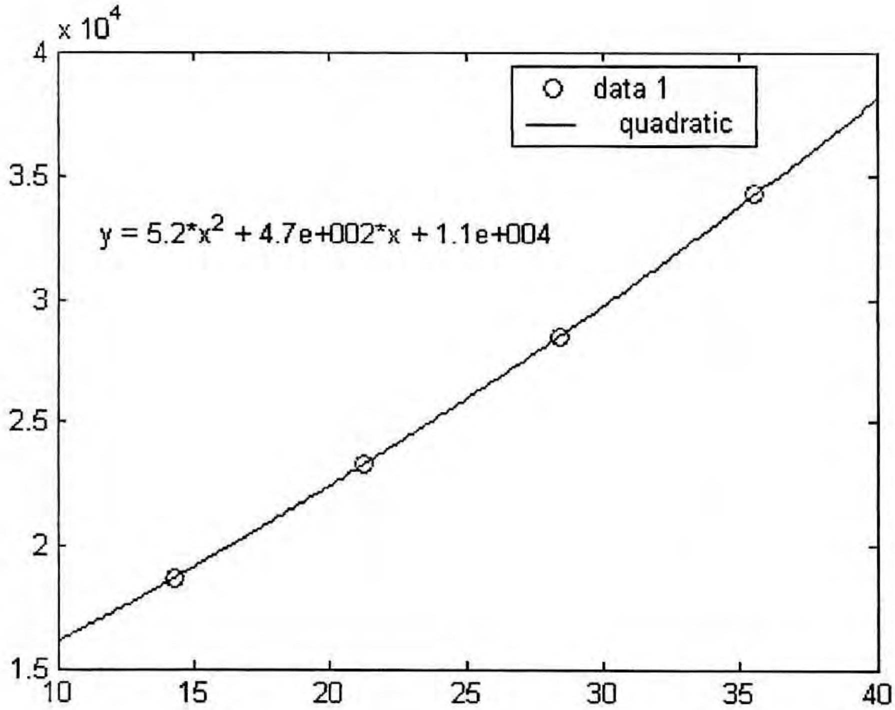
Fenchuganj GT-1&2 with Steam unit



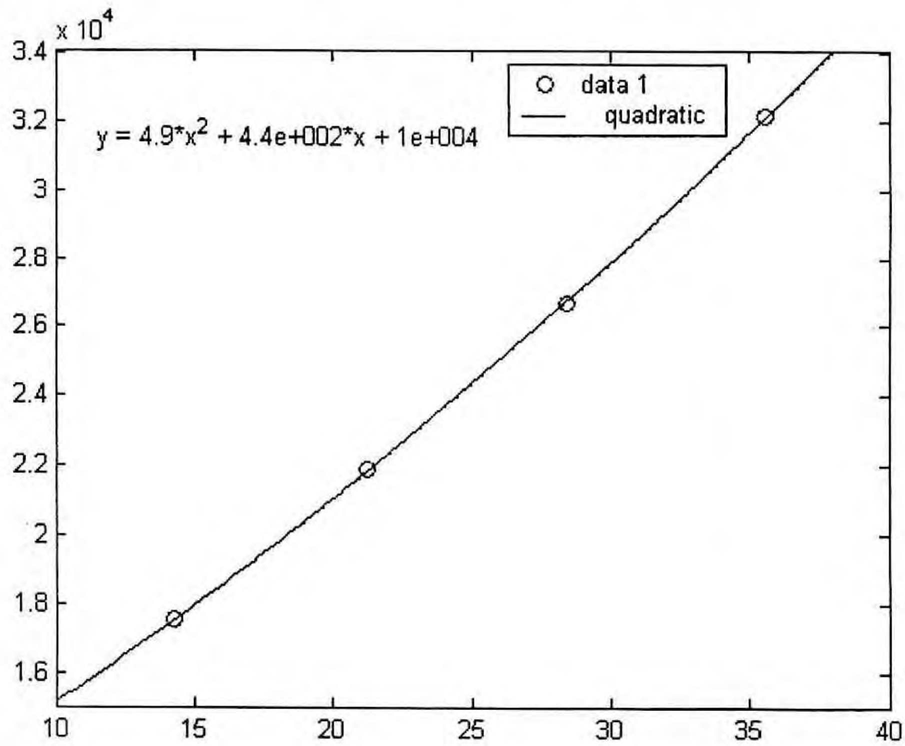
Sylhet GT



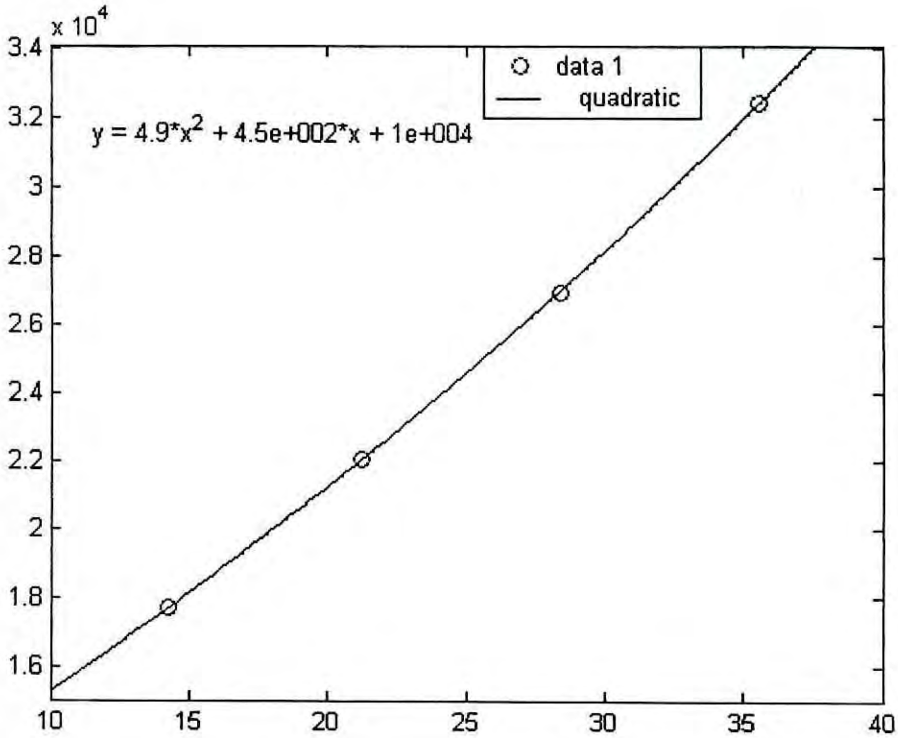
RPCL-1


x 10^4
4
3.5
3
2.5
2
1.5
10
15
20
25
30
35
40
data 1
quadratic
y = 5.2*x^2 + 4.7e+002*x + 1.1e+004

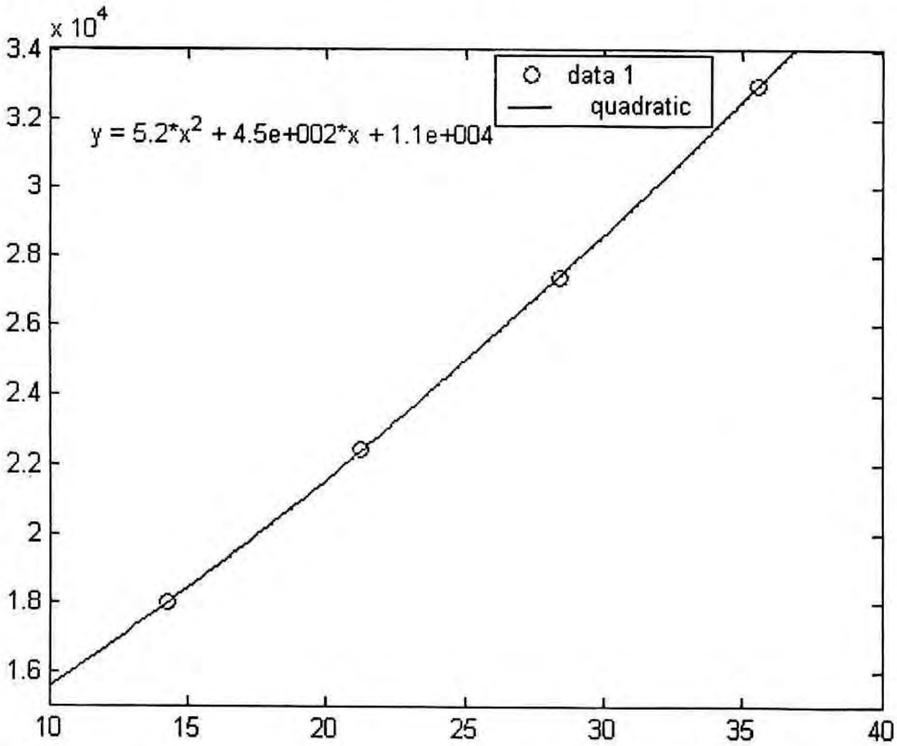
RPCL-2


x 10^4
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
10
15
20
25
30
35
40
data 1
quadratic
y = 4.9*x^2 + 4.4e+002*x + 1e+004

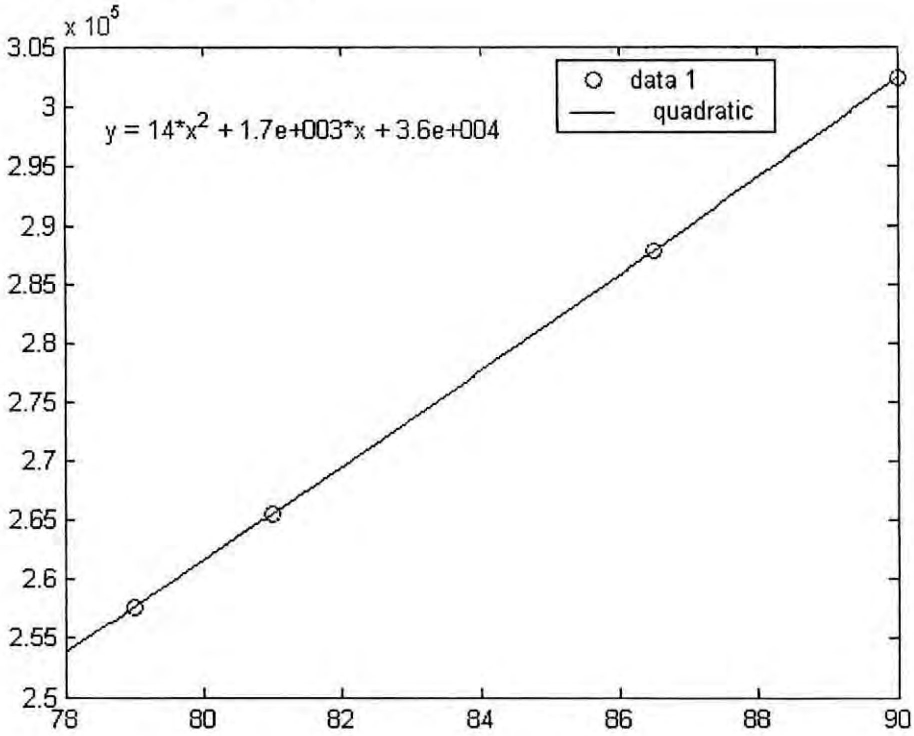
RPCL-3


x 10^4
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
data 1
quadratic
y = 4.9*x2 + 4.5e+002*x + 1e+004
10
15
20
25
30
35
40

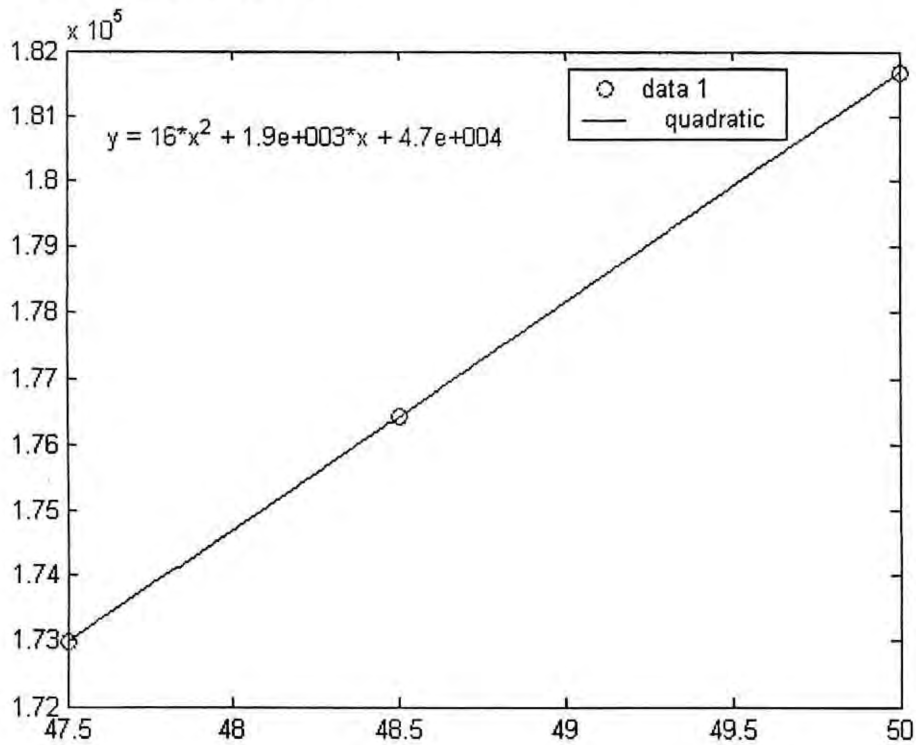
RPCL-4


x 10^4
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
data 1
quadratic
y = 5.2*x2 + 4.5e+002*x + 1.1e+004
10
15
20
25
30
35
40

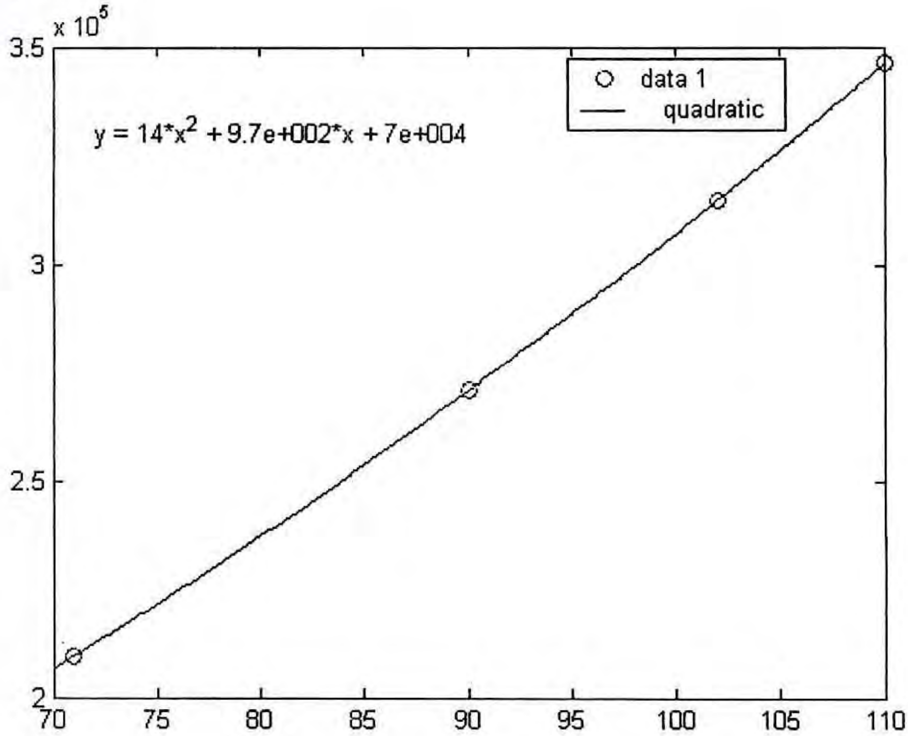
Khulna Steam 110 MW



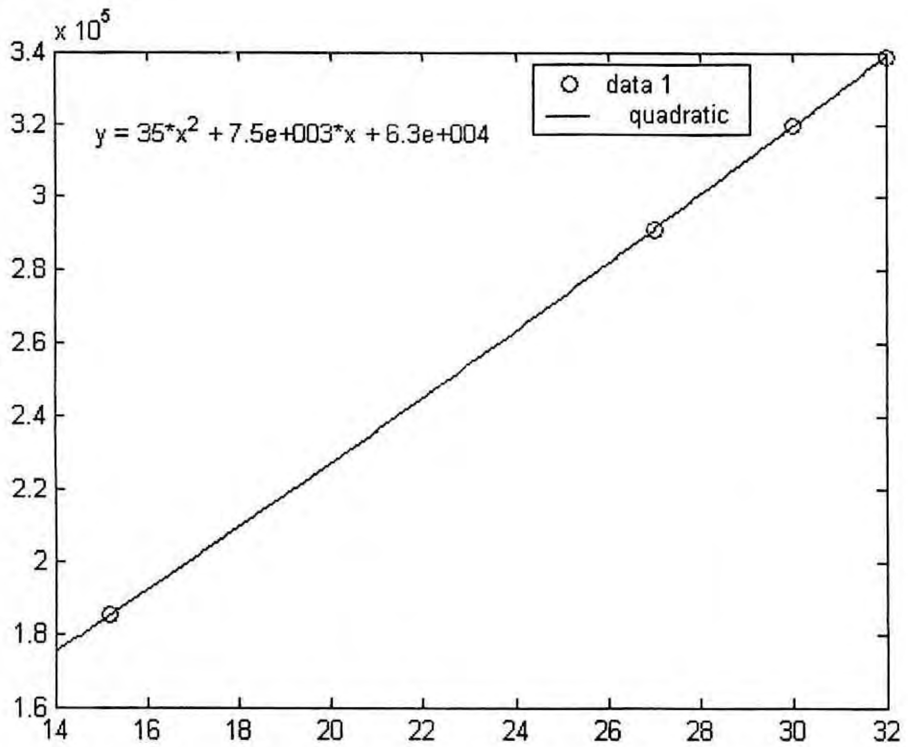
Khulna Steam 60 MW



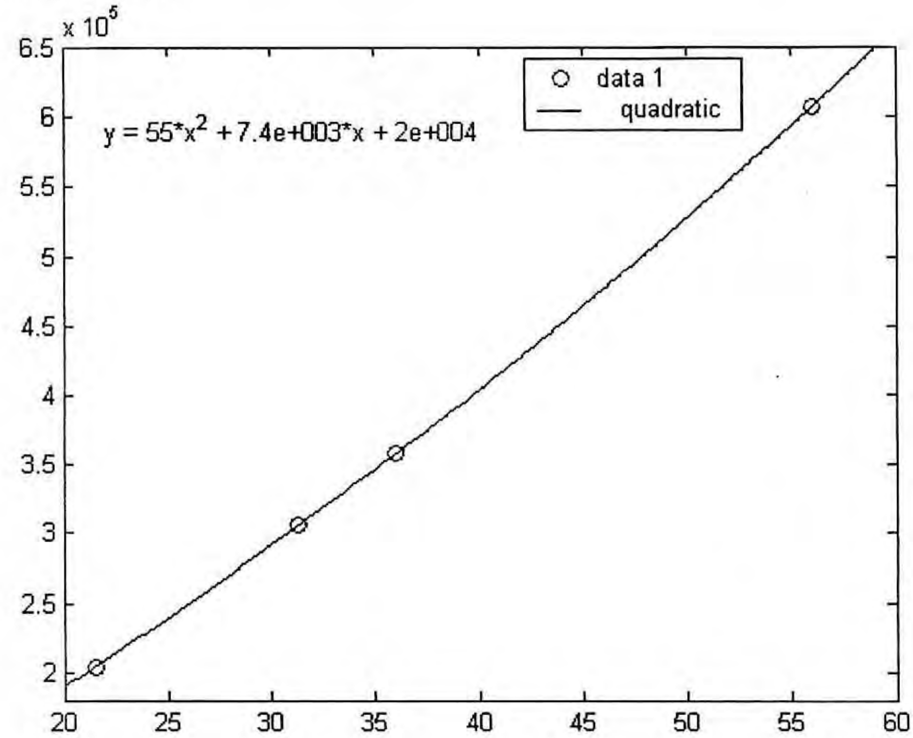
KPCL (1-19)



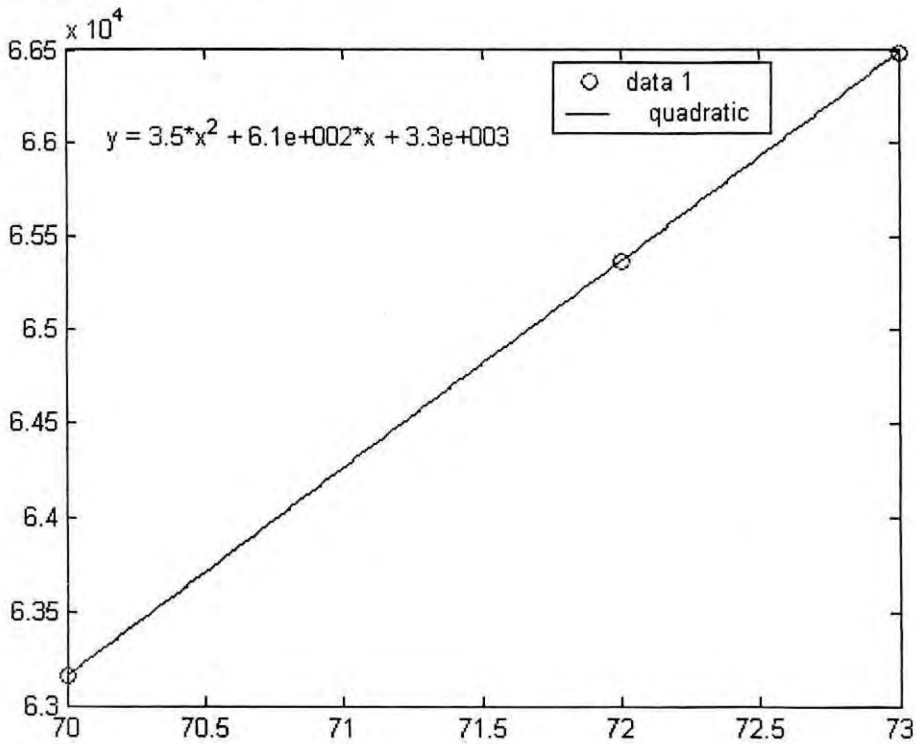
Barisal GT- 1&2



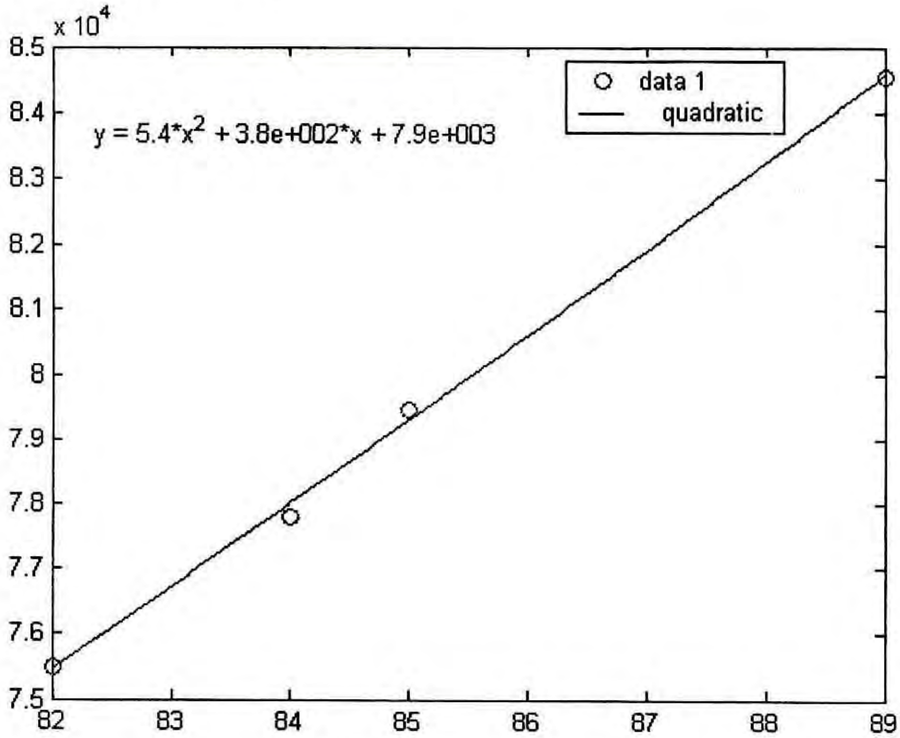
Bheramara GT-1,2&3



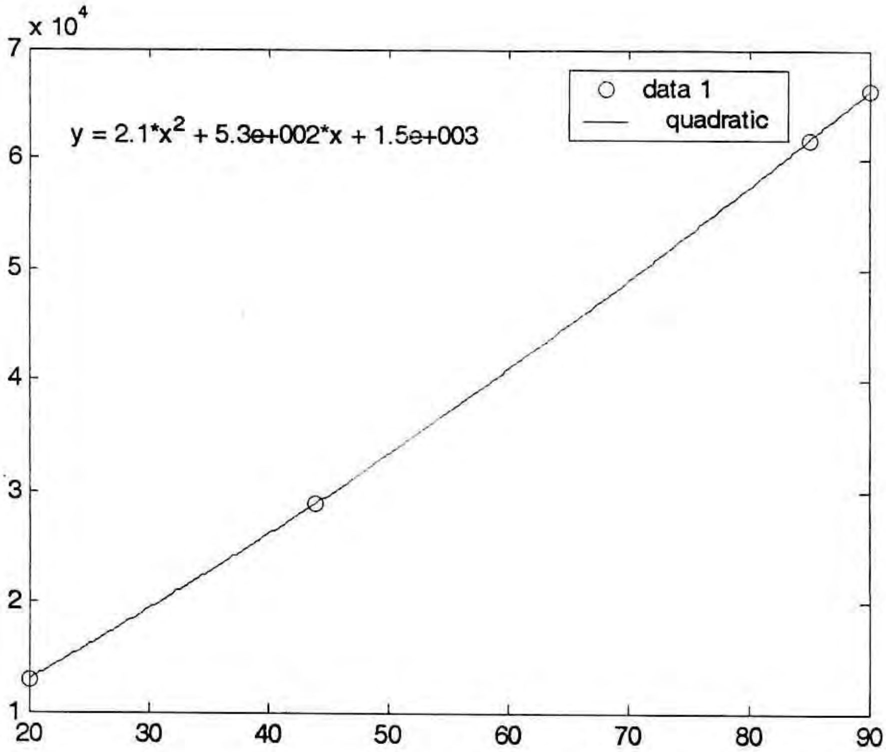
Baghabari 71 MW



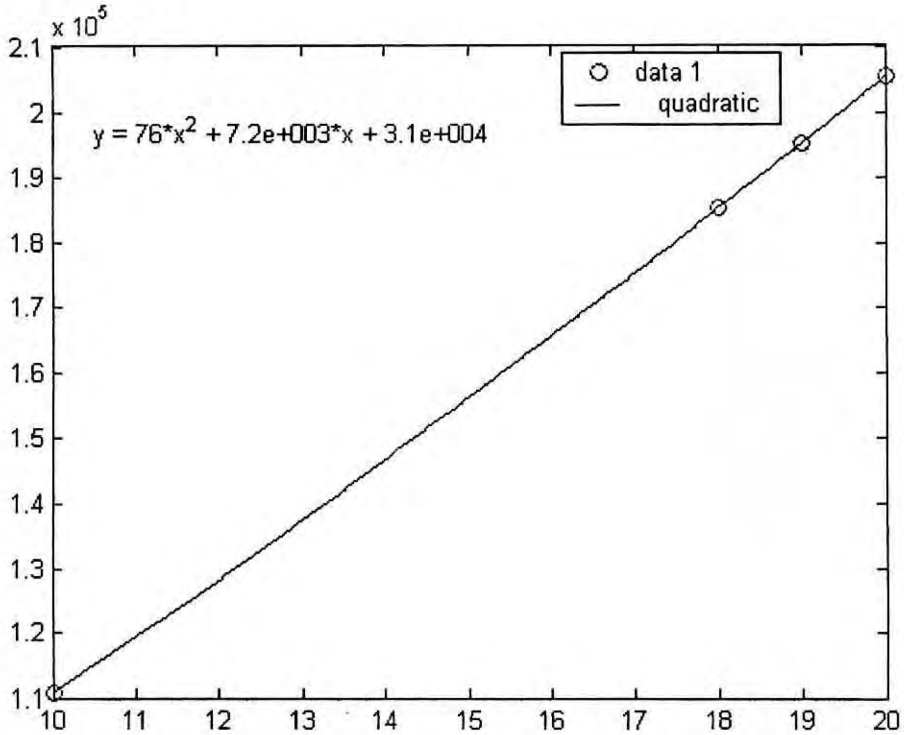
Baghabari 100 MW



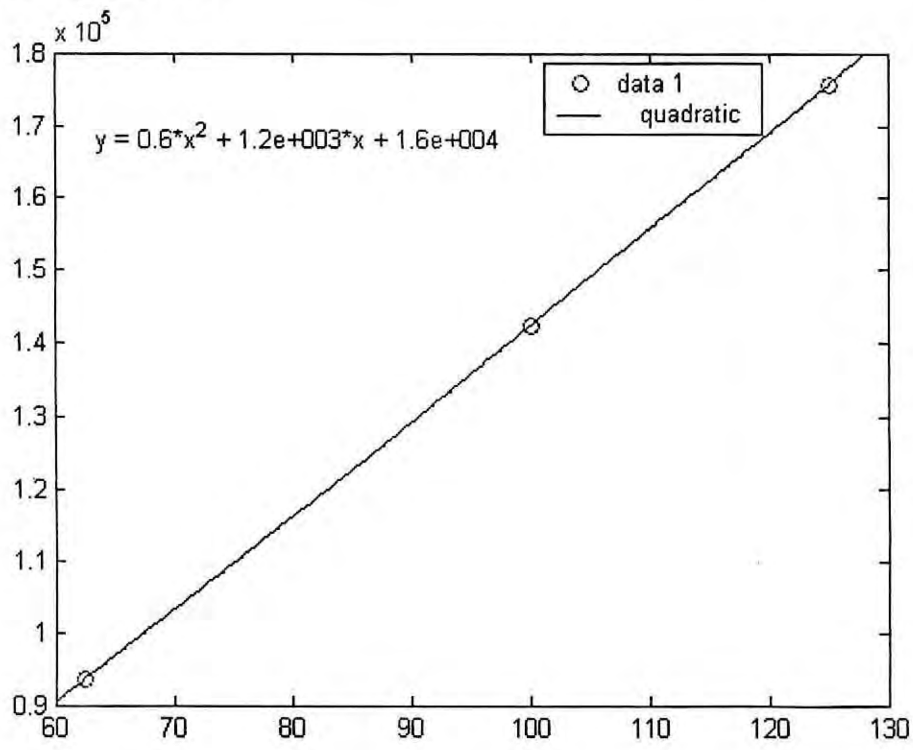
WMPL



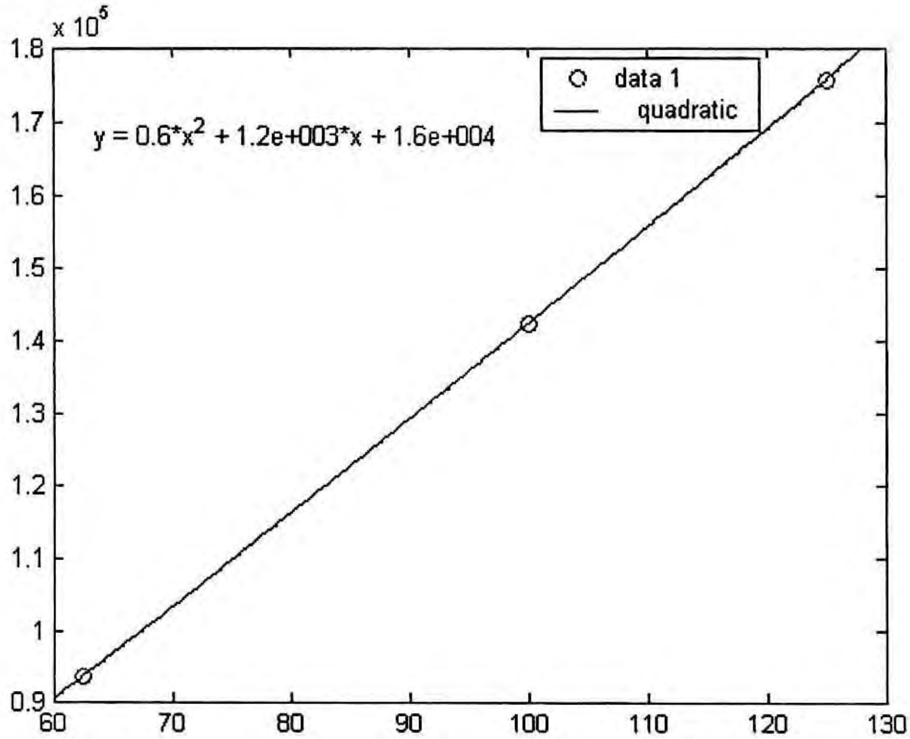
Rangpur GT



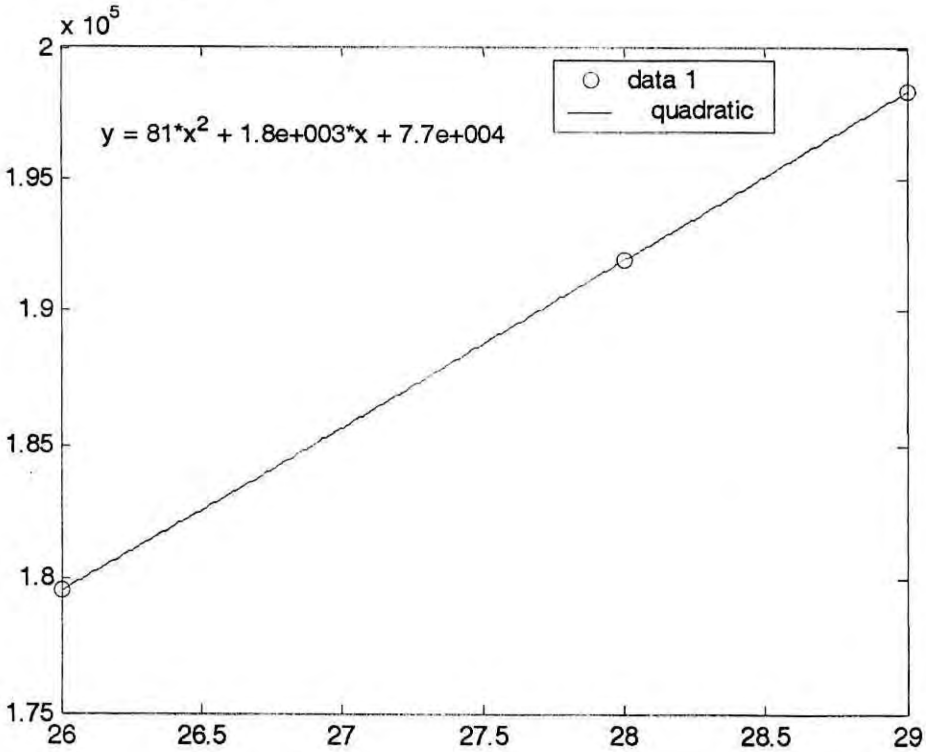
Barapukuria -1



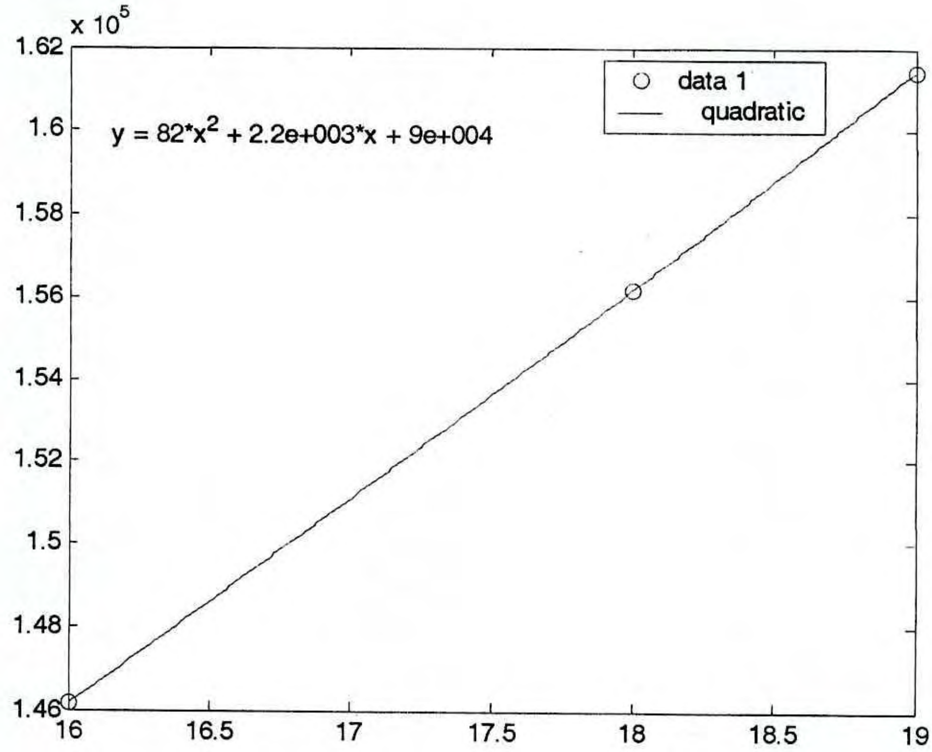
Barapukuria - 2



Khulna Barge 1&2



Saidpur GT


x 10^5
1.62
1.6
1.58
1.56
1.54
1.52
1.5
1.48
1.46
16
16.5
17
17.5
18
18.5
19
y = 82*x^2 + 2.2e+003*x + 9e+004
data 1
quadratic

B: Generation Data (MW) of BPS for 2006

January

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/01/2006	2016	1945	1899	1878	1903	1973	2116	2319	2504	2406	2404	2441	2361	2212	2295	2325	2497	3381.2	3408.7	3483.2	3424.2	3426.7	3276.7	2929	2510	2258
02/01/2006	2018	1915	1847	1828	1856	2144	2207	2274	2448	2409	2400	2429	2370	2219	2284	2420	2660.5	3537.2	3519.2	3554.2	3553.2	3463.7	3356.2	3097.5	2645.5	2267.8
03/01/2006	2033	1926	1897	1864	1887	2103	2246	2322	2467	2404	2470	2456	2360	2290	2351	2425	2598	3513.7	3513.2	3493.7	3175.2	3138.2	3361.2	3140	2614.5	2226
04/01/2006	2043	1949	1887	1888	1900	2174	2212	2349	2459	2477	2438	2462	2388	2281	2324	2366	2592	2533.2	3555.7	3579.2	3530.2	3508.2	3242.2	3559.2	2675	2249
05/01/2006	1979	1953	1906	1887	1903	2155	2275	2315	2498	2424	2460	2482	2377	2361	2354	2393	2661	3472.2	3485.7	3522.2	3476.5	3442.2	3322.7	3089	2596	2307
06/01/2006	2036	1962	1909	1901	1928	2138	2142	2263	2330	2296	2208	2235	2033	1966	2132	2232	2595	3565.2	3562.5	3611.5	3589.5	3505	3289	3015.8	2514.8	2264
07/01/2006	1918	1846	1815	1781	1831	2028	2186	2372	2541	2443	2406	2452	2411	2392	2460	2511	2777	3506.3	3512.3	3504.3	3510.3	3502.8	3420.3	3176.1	2575.1	2260
08/01/2006	2056	1903	1868	1861	1844	2036	2201	2445	2620	2670	2619	2562	2458	2408	2375	2377	2556	3435.8	3450.3	3464.3	3463.8	3450.2	3368.2	3071.5	2612	2227
09/01/2006	1991	1848	1845	1776	1783	2022	2289	2388	2419	2641	2650	2644	2510	2335	2317	2401	2467	3313.4	3328.5	3328.7	3299.7	3260.7	3158.2	2972.7	2570.5	2027
10/01/2006	1838	1728	1641	1630	1624	1802	1844	2032	2070	2053	1977	1917	1888	1780	1850	1759	1976	3009.2	3049.2	3088.7	3076.7	3079.5	2966.7	2842.7	2500.5	2010.2
11/01/2006	1717	1554	1449	1375	1384	1650	1695	1952	1690	1438	1328	1303	1317	1370	1408	1480	1734	2897.2	2833.2	2884.2	2959.7	2968.2	2830.7	2532.5	2041	1753
12/01/2006	1519	1382	1366	1338	1355	1507	1503	1615	1875	1814	1735	1727	1731	1632	1544	1585	1794	2478.6	2527.6	2501.6	2509.1	2583.3	2674.3	2561.1	2086.1	1704
13/01/2006	1540	1427	1387	1367	1381	1502	1509	1719	1820	1807	1773	1788	1754	1628	1580	1507	1801	2961.4	3017.4	3029.3	3002.1	2986.1	2892.6	2541.6	2099	1728
14/01/2006	1527.0	1495.0	1462.0	1438.0	1444.0	1580.0	1670.0	1819.0	1941.0	1950.0	1814.0	1852.0	1884.0	1867.0	1827.0	1880.0	2130.0	2846.7	2877.7	2934.7	2979.7	2943.7	2898.7	2444.0	2093.5	1817.0
15/01/2006	1626.0	1543.0	1533.0	1486.0	1435.0	1575.0	1808.0	1962.0	2189.0	2125.0	2161.0	2107.0	2150.0	2060.0	2077.0	2071.0	2291.0	2688.8	2726.8	2758.3	2771.3	2770.8	2711.3	2657.3	2271.6	1960.0
16/01/2006	1719.0	1613.0	1603.0	1577.0	1632.0	1823.0	1965.0	2131.0	2368.0	2350.0	2270.0	2254.0	2247.0	2242.0	2209.0	2136.0	2330.0	2849.7	2900.7	2897.2	2920.7	2937.7	2943.7	2863.2	2455.5	2092.0
17/01/2006	1817.0	1700.0	1604.0	1574.0	1610.0	1868.0	2032.0	2300.0	2511.0	2532.0	2419.0	2392.0	2409.0	2355.0	2359.0	2385.0	2528.5	2840.1	2861.7	2855.7	2854.2	2859.7	2809.2	2792.2	2580.5	2084.0
18/01/2006	1844.0	1803.0	1712.0	1702.0	1705.0	1986.0	2149.0	2299.0	2362.0	2478.5	2509.5	2502.5	2467.5	2330.5	2394.5	2463.0	2563.5	2816.6	2810.1	2823.2	2818.7	2800.2	2838.2	2826.7	2640.5	2260.5
19/01/2006	1895.0	1870.0	1815.0	1787.0	1798.0	2093.0	2324.0	2378.0	2502.5	2452.5	2480.0	2464.5	2486.0	2376.0	2396.0	2411.0	2426.0	2522.3	2570.3	2610.3	2622.3	2715.3	2777.3	2731.1	2709.6	2327.6
20/01/2006	2054.0	1956.0	1832.0	1821.0	1790.0	2028.0	2070.0	2124.0	2125.5	2102.5	2038.0	1800.0	1817.0	1711.0	1854.0	2014.0	2223.0	2877.7	2924.7	3004.3	3082.3	3056.3	2997.3	2880.3	2481.1	2138.1
21/01/2006	1859.0	1828.0	1799.0	1758.0	1800.0	2041.0	2239.0	2237.0	2445.0	2474.0	2462.0	2456.0	2362.0	2339.0	2395.0	2493.0	2585.0	3104.2	3074.2	3166.2	3203.2	3181.7	3173.7	3059.5	2708.8	2297.1
22/01/2006	2105.0	2030.0	1989.0	1953.0	2035.0	2226.0	2379.0	2429.0	2694.0	2678.0	2632.0	2635.0	2550.0	2407.0	2441.0	2479.0	2631.5	3009.7	3062.2	3057.2	3033.2	2961.7	2968.2	2940.2	2712.7	2353.1
23/01/2006	2149.0	2074.0	2033.0	2002.0	2020.0	2276.0	2434.5	2510.0	2635.5	2570.0	2613.0	2676.0	2510.0	2420.0	2555.0	2583.0	2645.2	2801.7	2811.2	2917.2	2960.2	2914.7	2968.2	2950.7	2770.7	2402.6
24/01/2006	2183.0	2068.0	2058.0	2013.0	2039.0	2226.0	2399.0	2482.0	2663.0	2625.0	2608.0	2596.0	2508.0	2500.0	2559.0	2392.0	2541.2	2977.2	3023.2	3036.2	3027.2	3034.7	3024.7	2916.7	2754.2	2454.3
25/01/2006	2195.5	2136.5	2084.5	2049.0	2070.0	2333.0	2315.0	2529.0	2633.0	2648.0	2588.0	2547.0	2486.0	2435.0	2510.0	2371.0	2529.5	2962.2	2987.7	3001.2	3002.6	3001.1	2935.1	2898.3	2681.8	2471.3
26/01/2006	2223.7	2144.5	2116.5	2074.5	2093.5	2253.0	2275.0	2482.0	2602.0	2625.7	2509.7	2544.7	2562.2	2531.2	2563.2	2591.7	2607.7	2848.8	2911.0	2912.0	2936.5	2940.5	3090.0	3150.0	2889.4	2605.1
27/01/2006	2369.0	2248.0	2154.0	2117.0	2117.0	2251.0	2304.0	2351.0	2314.0	2277.0	2255.0	2264.0	2097.0	2036.0	2159.0	2225.0	2449.0	2831.5	2936.4	2992.5	3072.5	3103.5	3101.5	2971.0	2652.5	2392.5
28/01/2006	2183.5	2045.0	2023.0	2031.0	2041.5	2281.5	2426.5	2425.0	2634.0	2683.0	2650.0	2658.0	2632.0	2577.0	2577.0	2586.0	2603.0	3028.2	3057.7	3072.2	3130.2	3126.2	3095.2	2982.2	2812.7	2598.5
29/01/2006	2314.5	2275.0	2196.0	2204.0	2203.0	2376.0	2491.0	2525.0	2666.5	2531.5	2586.5	2573.5	2541.6	2513.6	2502.6	2575.6	2653.1	3027.2	3052.7	3068.2	3116.2	3123.2	3030.7	2988.7	2834.7	2543.5
30/01/2006	2299.5	2215.0	2191.0	2192.0	2189.0	2456.0	2555.0	2618.0	2682.0	2643.0	2714.0	2639.0	2538.0	2561.5	2591.5	2620.5	2693.5	3006.1	3048.1	3072.2	3071.7	3062.7	3083.7	3074.2	2967.7	2598.5
31/01/2006	2347.5	2283.0	2192.0	2207.0	2253.0	2524.0	2612.0	2646.0	2631.0	2729.0	2709.0	2657.0	2654.0	2579.0	2620.0	2679.0	2637.0	2856.1	2838.1	2861.6	2879.1	2905.6	2927.1	2928.6	2688.6	2588.1

February

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/02/2006	2439.5	2316.0	2228.0	2189.0	2316.0	2507.5	2607.5	2693.0	2687.0	2726.0	2745.0	2694.0	2733.0	2669.0	2638.5	2677.5	2743.5	2976.5	3020.4	3041.4	3078.4	3077.4	3099.9	3049.9	2906.9	2554.9
02/02/2006	2417.0	2298.0	2208.0	2189.0	2251.5	2412.5	2569.5	2579.0	2756.0	2617.5	2641.0	2638.0	2646.0	2598.5	2689.5	2694.0	2672.0	3039.7	3040.8	3156.8	3207.3	3246.8	3231.8	3126.3	2902.3	2645.8
03/02/2006	2476.5	2318.0	2255.0	2255.0	2259.0	2434.0	2446.0	2394.0	2414.5	2328.0	2257.5	2258.5	2165.0	2093.0	2187.5	2304.5	2412.5	2835.7	2870.7	2840.7	2911.7	2964.7	2981.3	2885.7	2770.7	2488.6
04/02/2006	2326.5	2241.0	2181.0	2174.0	2187.0	2444.0	2532.0	2563.0	2650.0	2588.5	2550.5	2583.0	2550.0	2512.0	2569.5	2630.5	2707.0	2839.1	2851.6	2833.1	2824.1	2859.1	2850.6	2834.1	2818.6	2646.6
05/02/2006	2430.0	2326.0	2312.0	2273.0	2326.0	2508.0	2614.0	2645.0	2685.6	2676.6	2580.6	2606.6	2590.1	2565.1	2599.1	2586.6	2692.1	2857.7	2847.2	2870.1	2854.6	2844.6	2857.1	2846.1	2796.1	2654.0
06/02/2006	2405.0	2320.0	2272.0	2247.0	2281.0	2520.0	2513.0	2619.0	2659.2	2672.2	2682.2	2651.0	2606.0	2608.0	2657.0	2696.0	2771.0	2817.3	2865.8	2927.2	3014.7	3058.2	3091.2	3028.2	2931.7	2735.1
07/02/2006	2488.5	2397.0	2284.0	2233.0	2252.0	2304.0	2509.0	2519.0	2738.2	2709.2	2653.2	2731.2	2639.2	2619.2	2659.2	2723.2	2764.7	3017.5	3067.5	3088.0	3203.1	3236.6	3155.1	3099.1	2950.1	2663.1
08/02/2006	2436.0	2303.5	2273.5	2265.5	2237.5	2403.0	2575.0	2657.0	2827.0	2752.0	2778.0	2757.0	2509.0	2493.0	2665.0	2654.0	2728.0	3190.5	3306.8	3357.8	3382.8	3344.3	3323.3	3193.8	2955.3	2659.8
09/02/2006	2460.0	2310.0	2285.0	2282.5	2330.5	2484.0	2659.0	2615.0	2763.0	2729.0	2697.0	2716.0	2666.0	2595.0	2618.0	2695.0	2709.5	3202.4	3401.9	3392.4	3394.1	3381.6	3317.6	3186.1	3004.1	2737.6
10/02/2006	2489.0	2381.0	2340.5	2320.0	2348.0	2474.0	2468.0	2383.0	2411.5	2375.5	2366.0	2307.5	2188.5	2117.0	2212.0	2243.0	2251.0	2779.3	3151.3	3237.8	3301.8	3251.3	3237.5	3049.0	2814.0	2492.5
11/02/2006	2263.0	2194.5	2175.5	2152.5	2171.5	2360.5	2486.5	2547.0	2711.0	2814.0	2704.0	2749.0	2670.0	2640.5	2696.5	2668.5	2719.5	3110.1	3258.1	3318.1	3321.1	3333.1	3271.6	3205.1	2948.1	2718.5
12/02/2006	2464.5	2318.5	2287.5	2250.5	2261.5	2387.0	2514.5	2531.5	2714.5	2747.5	2773.5	2789.5	2722.5	2620.5	2725.0	2725.0	2713.0	3113.2	3197.2	3214.7	3236.7	3253.7	3200.7	3043.7	3007.7	2712.1
13/02/2006	2427.5	2332.5	2300.5	2261.5	2267.5	2521.5	2646.5	2676.5	2780.5	2718.0	2729.5	2769.5	2731.5	2682.5	2731.5	2707.0	2748.0	3227.5	3223.5	3160.1	3234.1	3167.6	3225.6	3173.1	2952.1	2804.1
14/02/2006	2155.0	2338.0	2286.0	2285.0	2299.0	2441.0	2641.0	2589.0	2718.5	2654.5	2575.0	2556.5	2571.0	2591.0	2636.0	2774.0	2819.0	2976.6	3026.6	3033.6	3051.6	3045.6	3057.1	3059.1	2937.6	2773.6
15/02/2006	2550.5	2471.5	2440.5	2410.0	2425.0	2507.5	2650.5	2685.0	2779.5	2794.0	2744.5	2798.0	2671.0	2656.0	2844.0	2770.0	2865.0	3131.7	3156.2	3101.7	3106.6	3129.6	3062.1	3096.6	3036.1	2902.6
16/02/2006	2552.0	2518.0	2496.0	2447.0	2503.0	2649.0	2785.0	2794.5	2940.0	2974.0	2897.5	2942.0	2661.5	2797.5	2948.5	2911.0	2986.5	3171.0	3190.1	3193.0	3210.5	3208.0	3219.0	3203.0	3134.0	2983.3
17/02/2006	2829.5	2697.5	2612.5	2567.5	2567.5	2678.5	2638.0	2642.0	2647.5	2524.5	2477.5	2640.5	2453.0	2355.0	2519.0	2669.0	2655.0	2850.0	2941.0	2942.0	2955.0	2936.0	2906.5	2902.5	2903.5	2787.7
18/02/2006	2618.5	2493.5	2430.0	2403.0	2397.0	2619.5	2805.0	2730.0	2795.0	2756.0	2711.0	2681.0	2696.0	2666.0	2713.5	2707.5	2714.5	2849.1	2877.6	2905.6	2937.6	2900.6	2928.1	2949.6	2912.6	2947.6
19/02/2006	2854.5	2814.0	2768.5	2704.0	2702.5	2820.0	2784.0	2699.5	2813.5	2800.0	2810.0	2838.5	2757.5	2813.5	2714.0	2665.0	2745.0	2881.6	2911.6	2919.6	2955.6	2953.6	2925.6	2924.1	2929.1	2860.3
20/02/2006	2812.0	2793.5	2700.5	2722.5	2773.5	2793.5	2796.5	2761.5	2776.5	2763.5	2761.0	2739.5	2782.5	2802.5	2812.0	2808.5	2816.5	2914.6	2951.1	2957.6	2961.6	2957.1	2966.6	2931.1	2949.6	2935.4
21/02/2006	2861.8	2846.8	2844.5	2843.5	2751.5	2714.5	2676.5	2312.0	2497.0	2569.5	2663.0	2684.0	2606.0	2730.5	2776.5	2816.5	2823.5	2867.1	2954.6	2967.6	2993.5	2971.5	2978.5	2955.0	2938.5	2914.8
22/02/2006	2872.0	2740.5	2607.5	2658.5	2663.0	2648.0	2758.0	2785.5	2785.0	2773.0	2795.0	2791.5	2759.0	2788.0	2777.5	2784.5	2783.0	2847.1	2835.1	2896.1	2893.6	2916.6	2921.6	2908.6	2930.1	2871.1
23/02/2006	2913.5	2892.0	2856.0	2826.5	2800.5	2769.5	2724.0	2629.0	2753.5	2771.5	2785.0	2789.5	2773.5	2775.5	2744.0	2787.0	2793.0	2896.6	2898.1	2892.1	2921.6	2867.6	2898.6	2887.6	2889.6	2863.9
24/02/2006	2812.5	2822.5	2875.5	2835.5	2825.5	2827.5	2755.5	2643.5	2655.0	2690.0	2709.0	2759.0	2665.0	1695.5	1804.0	1684.5	1941.0	2230.6	2259.6	2368.6	2423.6	2433.6	2573.1	2667.6	2624.6	2611.9
25/02/2006	2597.7	2597.0	2611.0	2579.0	2560.0	2602.0	2627.0	2623.0	2573.0	2557.5	2571.0	2559.0	2584.5	2589.0	2595.5	2614.0	2638.5	2578.4	2599.9	2618.5	2652.0	2661.0	2745.5	2848.5	2900.5	2835.9
26/02/2006	2821.6	2693.6	2685.6	2683.6	2681.6	2684.6	2638.6	2577.1	2604.1	2563.1	2618.6	2542.1	2575.6	2557.6	2542.5	2535.5	2581.0	2680.6	2680.6	2694.6	2700.1	2742.6	2780.1	2781.6	2818.6	2813.0
27/02/2006	2725.8	2721.8	2733.7	2709.7	2721.1	2833.2	2824.2	2798.2	2865.2	2784.2	2859.0	2988.0	2879.5	2993.5	2922.5	2901.5	2900.5	2886.1	3073.6	3239.1	3303.6	3314.6	3319.1	3231.6	3209.1	3108.4
28/02/2006	3053.1	2917.1	2902.1	2791.1	2839.1	2888.1	2873.1	2853.1	3028.1	3036.1	3014.5	2980.5	2958.5	3033.5	2995.5	3001.0	2806.0	3000.6	3201.1	3115.5	3120.0	3258.0	3288.0	3269.0	2374.5	2505.0

March

Time / Date	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00.	24.00
01/03/2006	2615.8	2803.6	2737.6	2704.6	2720.6	2817.6	2544.6	2627.6	2730.5	2669.5	2786.0	2831.0	2799.5	2878.0	2836.5	2714.0	2739.0	2966.4	3036.9	3154.4	3309.9	3342.4	3382.4	3377.4	3315.4	3202.5
02/03/2006	2940.1	2898.1	2893.1	2878.1	2880.6	2890.6	2888.1	2879.1	2945.6	2943.1	2973.0	2977.0	2992.5	2993.4	3069.9	3057.4	2943.4	3135.0	3462.5	3475.5	3450.5	3425.5	3410.5	3414.0	3272.3	3100.9
03/03/2006	2893.5	2768.0	2721.0	2709.0	2701.0	2700.5	2523.0	2438.5	2214.0	2387.5	2402.4	2450.4	2300.4	2308.4	2366.4	2438.4	2506.4	2709.0	3107.0	3246.0	3320.0	3293.0	3281.0	3072.0	3016.0	2906.7
04/03/2006	2595.6	2547.4	2531.4	2498.3	2492.8	2583.6	2544.4	2446.4	2617.4	2570.4	2684.4	2768.8	2732.8	2821.8	2918.8	2872.8	2780.8	3099.4	3206.9	3361.4	3354.9	3353.4	3317.4	3344.9	3207.9	2973.6
05/03/2006	2897.1	2853.6	2679.6	2627.6	2853.0	2756.6	2723.4	2750.5	2879.5	2913.0	2898.4	2992.4	2957.4	2950.4	2924.4	2935.4	2940.4	3104.3	3206.0	3241.6	3260.6	3276.6	3243.6	3246.1	3203.1	3144.3
06/03/2006	2980.8	2848.8	2818.8	2762.8	2777.8	2614.8	2814.4	2751.4	2879.4	2915.4	3002.8	3016.8	2633.8	2752.8	2839.8	2856.8	2968.8	3147.1	3276.1	3273.1	3290.6	3261.6	3224.6	3208.6	3226.6	3207.8
07/03/2006	2885.6	2884.6	2892.6	2822.6	2844.6	2874.6	2838.0	2763.0	2950.0	2991.0	3011.0	3040.0	3031.0	3036.0	3047.0	3064.0	3041.0	3149.1	3154.5	3116.5	3227.5	3240.5	3209.5	3208.0	3181.0	3072.0
08/03/2006	3068.2	2955.1	2849.1	2854.5	2850.5	2891.6	2844.6	2799.6	2932.9	3084.6	2987.0	3055.0	2945.0	2987.0	2951.0	2903.0	2892.6	3085.7	3240.7	3222.4	3244.4	3247.9	3228.4	3194.4	3164.4	3128.4
09/03/2006	3111.1	3002.1	2965.1	2935.1	2948.1	2978.1	2923.1	2914.1	3084.5	3068.0	3091.0	3029.0	3062.0	3131.0	3153.0	3150.0	3055.5	3211.1	3205.1	3206.1	3262.1	3276.1	3274.1	3249.6	3244.1	3190.1
10/03/2006	3151.2	3092.2	3061.7	3043.2	3020.2	2970.2	2735.2	2716.2	2545.6	2541.1	2547.7	2667.1	2587.1	2670.1	2806.1	2822.1	2886.1	3175.2	3352.7	3331.7	3353.2	3351.2	3358.7	3282.7	3035.7	3000.0
11/03/2006	3037.6	2991.1	2936.1	2912.1	2953.1	2982.1	2930.1	2894.8	2759.5	2604.0	2407.0	2459.0	2500.0	2536.0	2542.0	2554.0	2618.0	2849.6	2932.9	3018.0	3109.5	3096.5	3057.5	3018.1	3014.1	2817.1
12/03/2006	2601.6	2590.0	2504.5	2499.0	2511.0	2635.0	2656.5	2718.5	2817.5	2929.5	2903.5	2959.0	2909.0	2892.0	2980.0	2928.0	2892.0	2930.0	3070.0	3034.0	3140.0	3170.0	3127.0	3120.5	3148.5	3078.7
13/03/2006	2921.3	2856.3	2828.6	2794.6	2790.6	2830.6	2834.6	2758.6	2815.0	2809.0	2815.0	2857.0	2677.0	2952.0	2948.0	3001.0	2924.0	3022.5	3114.7	2945.2	2931.2	2940.7	3025.7	3073.2	3080.2	3094.7
14/03/2006	2970.7	2919.2	2868.1	2842.1	2851.1	2910.1	2874.1	2795.1	2962.0	2966.0	2959.0	3035.5	3022.0	2970.0	3017.0	3013.0	3036.0	3127.2	3268.8	3308.9	3330.9	3147.9	3150.9	3154.9	3153.9	3069.3
15/03/2006	2986.4	2948.3	2858.2	2834.2	2864.2	2939.9	2874.4	2895.4	2953.3	2929.3	2937.3	2966.3	2937.3	2984.3	2979.3	2968.3	2526.8	2668.1	2721.6	2753.6	2796.6	2815.6	2914.1	3061.1	3156.1	3093.1
16/03/2006	2962.1	2857.1	2837.1	2719.1	2609.1	2857.6	2777.3	2802.5	2985.0	2998.0	3012.5	3024.5	2936.5	2922.0	2939.0	2878.0	2812.5	3048.0	3083.1	3109.1	3120.6	3117.1	3089.6	3082.1	3114.6	2995.3
17/03/2006	2873.1	2865.1	2876.1	2872.1	2875.6	2832.6	2748.6	2683.8	2682.5	2707.0	2747.0	2773.5	2745.0	2703.0	2749.5	2736.5	2712.5	2831.0	2906.5	2917.0	2927.9	2942.9	2949.9	2923.9	2918.9	2902.8
18/03/2006	2811.6	2713.6	2707.6	2695.6	2697.6	2681.6	2654.6	2641.1	2690.5	2700.5	2658.0	2680.0	2695.0	2656.0	2652.0	2739.5	2737.0	2856.1	2913.1	2945.1	2967.1	2958.1	2936.6	2975.6	3016.6	3022.1
19/03/2006	2907.8	2829.2	2771.5	2733.5	2752.5	2715.5	2745.0	2722.0	2895.0	2919.0	2986.5	3025.0	2956.0	2946.0	2994.0	2865.0	2915.0	2891.6	3029.1	3055.5	3059.5	3179.5	3203.5	3135.5	3181.0	2972.4
20/03/2006	2887.0	2875.5	2804.5	2741.5	2790.0	2791.0	2775.5	2769.5	2903.5	2863.0	2903.0	2962.0	2930.0	2958.5	2975.5	2910.0	2836.0	3017.8	3137.6	3085.6	3097.6	3132.6	3173.1	3152.1	3088.3	3112.9
21/03/2006	2982.8	2826.8	2812.3	2764.3	2753.8	2813.8	2601.3	2740.3	2985.0	2968.0	2976.0	2974.5	2962.5	2988.5	3037.5	3000.0	3034.5	3099.0	3148.0	3186.0	3170.0	3190.0	3153.5	3205.0	3241.0	3153.5
22/03/2006	3026.8	2900.0	2858.0	2795.0	2846.5	2808.5	2610.0	2840.5	2994.5	3052.5	3090.0	3145.5	3081.5	2957.5	3181.5	3147.5	3031.5	3139.2	3231.2	3291.2	3183.2	3358.2	3332.7	3351.7	3300.2	3222.7
23/03/2006	3034.7	2982.7	2961.0	2932.0	2964.5	2833.0	2868.0	2866.0	3076.5	3081.0	3162.0	3115.0	3063.0	3045.0	3087.0	3044.0	2994.0	3115.3	3220.3	3201.3	3229.3	3341.7	3307.7	3255.7	3260.2	3130.6
24/03/2006	3108.0	2930.0	2869.8	2814.3	2815.8	2803.8	2675.8	2649.8	2658.3	2665.3	2704.8	2651.3	2607.3	2631.8	2796.8	2825.3	2422.8	2648.0	2878.5	2802.5	2930.0	2968.5	2965.5	2958.0	2981.0	2992.5
25/03/2006	2915.7	2855.4	2785.8	2739.3	2772.3	2728.8	2666.8	2750.8	2779.8	2839.8	2904.8	2880.8	2862.8	2841.3	2679.3	2698.3	2741.8	2794.0	2846.9	2905.4	2879.4	2914.4	2922.9	3009.9	3022.4	3025.9
26/03/2006	3102.9	3101.8	3084.8	3013.8	3019.3	2918.3	2820.2	2814.3	2835.3	2883.3	2973.8	2986.3	2982.3	2948.8	3076.8	3013.8	2921.8	3050.4	3080.9	3133.9	3130.9	3155.9	3132.4	3148.9	3184.9	3210.1
27/03/2006	3274.9	3270.9	3234.9	3228.9	3227.9	3136.9	2995.9	3038.1	3199.3	3223.8	3191.3	3186.0	3145.0	3037.0	3131.0	3169.0	3160.0	3286.6	3262.6	3351.6	3362.1	3427.1	3392.1	3380.1	3422.6	3428.8
28/03/2006	3421.3	3380.3	3393.3	3370.3	3412.3	3366.3	3282.3	3202.3	3350.7	2918.2	3117.2	3186.7	3131.7	3175.2	3189.7	3169.2	3226.2	3348.0	3347.0	3345.2	3406.7	3417.5	3413.5	3431.5	3423.0	3390.1
29/03/2006	3349.0	3280.7	3252.7	3217.4	3211.1	3161.9	3093.9	3063.9	3222.1	3259.1	3286.1	3283.1	2664.1	2834.1	2710.1	2760.1	2828.1	2860.7	2910.2	2937.7	2991.7	3002.2	3026.7	3036.7	3125.2	3139.4
30/03/2006	3167.8	3146.2	3120.7	3074.2	3047.2	2949.7	2928.7	2974.2	3064.2	3037.1	3020.6	3001.6	2970.6	2973.1	2971.6	3023.6	3041.6	3135.9	3242.4	3283.3	3292.8	3295.8	3294.3	3299.8	3282.8	3254.1
31/03/2006	3193.1	3152.1	3127.1	3102.6	3107.1	2998.1	2794.0	2788.0	2759.5	2711.0	2884.5	2949.5	2865.5	2736.0	2892.5	3045.5	3008.0	3014.6	3177.1	3161.1	3280.1	3295.1	3252.1	3285.1	3287.6	3231.4

April

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/04/2006	3220.8	3243.8	3220.3	3181.3	3201.3	3080.3	3055.3	3036.8	3211.2	3187.7	3197.7	3177.2	3065.7	3081.7	3110.7	3152.2	3159.2	3241.7	3344.4	3343.6	3341.6	3360.1	3320.1	3258.6	3264.6	3246.6
02/04/2006	3280.0	3257.0	3224.5	3214.5	3225.0	3108.0	3018.0	3025.0	3194.0	3210.0	3213.5	3213.0	3156.0	3208.5	3274.0	3304.0	3313.0	3232.6	3361.8	3290.0	3387.0	3358.0	3300.5	3286.5	3293.0	3297.1
03/04/2006	3340.1	3295.1	3213.6	3175.6	3164.6	3125.6	2750.6	2828.6	2998.0	3140.0	3102.0	3112.5	3141.5	3126.0	3072.5	3063.0	2889.5	2826.7	3205.7	3311.1	3310.6	3347.1	3225.6	3253.6	3254.6	3077.6
04/04/2006	2870.5	2784.5	2741.5	2713.5	2737.5	2636.5	2697.0	2694.0	2994.0	2964.5	2915.0	2670.0	2883.5	2885.5	2899.5	2919.5	2954.0	2977.4	2672.4	2280.1	2415.6	2621.1	2769.1	2795.6	2759.6	2636.5
05/04/2006	2614.5	2317.5	2465.0	2481.0	2513.0	2370.0	2436.0	2460.0	2736.0	2839.0	2856.5	2907.0	2916.5	2937.0	2940.0	2944.0	2928.0	2920.4	3068.6	2955.1	3013.1	3103.1	3075.1	3066.6	2980.1	2699.6
06/04/2006	2480.2	2427.0	2405.0	2427.0	2477.5	2445.5	2522.5	2461.0	2785.0	2857.5	2902.0	2983.0	3014.0	3043.5	3121.5	3141.5	3128.5	3185.4	3264.4	3244.5	3328.0	3325.0	3328.0	3271.0	3265.0	3027.1
07/04/2006	2931.0	2842.0	2764.5	2667.5	2707.5	2571.5	2638.5	2533.5	2553.0	2592.5	2563.0	2620.5	2589.0	2554.0	2805.0	2739.0	2639.0	2838.7	3099.3	3166.8	3225.0	3212.0	3108.5	2418.5	2624.5	2606.6
08/04/2006	2451.6	2447.6	2440.5	2407.5	2442.5	2436.5	2467.5	2496.5	2781.5	2849.5	2892.5	2987.5	2984.5	2964.5	3027.0	2996.5	3030.5	3075.3	3177.3	3226.5	3224.5	3253.0	3207.0	3205.0	3187.5	3166.5
09/04/2006	3063.5	2899.9	2855.9	2840.4	2826.0	2775.0	2785.0	2854.5	3017.0	3000.5	2984.5	2993.0	2943.0	2941.5	2980.5	2978.5	2981.5	3049.7	3064.1	3081.2	3069.7	3086.7	3071.7	3077.7	3059.7	3045.1
10/04/2006	3040.1	3041.1	3041.6	3043.6	3047.1	2963.6	2890.6	2858.1	3009.5	2900.0	2876.0	2838.2	2836.2	2869.2	2878.7	2905.7	2926.2	3095.2	3181.8	3244.9	3275.9	3124.4	3144.9	3131.9	3136.4	3079.6
11/04/2006	3015.1	2993.1	2982.1	2873.1	2850.1	2598.1	2617.1	2628.6	2808.0	2794.5	2802.0	2883.0	2902.5	2889.5	2862.2	2911.7	2923.7	2962.2	3029.2	3064.9	3070.9	3060.9	3031.4	3013.4	3004.4	3024.0
12/04/2006	2991.7	3005.7	3007.2	2975.7	2978.2	2884.7	2903.7	2869.7	2934.7	2902.4	2895.9	2923.9	2983.4	2996.4	2935.4	2964.4	3019.4	3094.9	3178.2	3213.4	3217.6	3233.1	3238.6	3243.1	3219.1	3211.6
13/04/2006	3142.8	3153.8	3157.3	3150.8	3128.8	3061.3	3033.3	3096.3	3071.8	3066.0	3070.5	3049.0	3091.5	3139.5	3122.0	3124.0	3089.0	3249.0	2610.5	2831.3	3118.8	3204.3	3210.3	3264.3	3254.3	3225.0
14/04/2006	2994.6	2932.6	2817.6	2810.6	2829.6	2587.6	2450.6	2490.0	2630.0	2658.0	2749.0	2790.0	2652.0	2719.0	2887.0	2967.0	2878.0	2904.2	3221.2	3225.3	3341.3	3337.3	3276.3	3305.3	3268.8	3231.5
15/04/2006	3094.2	3114.2	3104.2	2964.2	3015.2	2850.2	2753.2	2744.2	3029.2	3058.2	3084.2	3078.2	3073.2	3037.2	2990.2	2992.2	3076.2	2980.2	3251.2	3270.3	3295.3	3343.3	3312.3	3320.8	3260.3	3247.6
16/04/2006	3213.1	3132.1	3110.1	3107.6	3110.1	3109.6	2957.6	2987.1	3017.1	2997.5	3037.0	3041.0	2972.0	2882.0	2874.0	3006.5	2948.5	3039.5	3213.5	3188.5	3181.5	3232.5	3240.5	3244.5	3213.0	3199.1
17/04/2006	3178.9	3165.9	3161.9	3147.9	3162.9	2862.9	2862.9	2868.9	2996.5	2904.5	2909.5	2974.0	2890.5	2916.5	3003.0	3008.0	3037.5	3073.5	3202.5	3239.2	3276.7	3205.7	3245.0	3186.5	3225.0	3222.9
18/04/2006	3029.7	2947.7	2879.7	2860.7	2814.7	2592.7	2621.7	2674.5	2880.5	2863.0	2918.0	3000.0	2881.5	2850.5	3061.5	2957.5	2937.4	2915.9	3257.6	3220.6	3339.6	3372.5	3366.6	3316.5	3271.1	3044.0
19/04/2006	2902.8	2680.2	2537.2	2356.2	2351.2	2232.2	2242.2	2217.0	2632.0	2681.0	2786.0	2890.0	2812.0	2815.0	2915.0	2974.0	2870.0	2889.7	3179.0	3536.5	3511.7	3516.2	3505.7	3503.2	3364.2	3127.4
20/04/2006	2935.0	2745.5	2633.0	2578.0	2606.0	2431.0	2463.0	2503.0	2857.0	2916.0	2976.0	3056.0	3023.0	3037.0	3102.0	3182.0	2987.0	2979.2	3319.2	3464.1	3505.6	3485.6	3392.1	3374.6	3301.6	3167.1
21/04/2006	2994.0	2865.0	2820.0	2756.0	2683.0	2496.0	2471.0	2327.0	2386.0	2411.0	2437.0	2470.0	2433.0	2512.0	2802.0	2867.0	2788.0	2771.7	3168.5	3335.7	3397.2	3383.2	3373.2	3359.7	3379.7	3201.5
22/04/2006	2962.0	2831.0	2712.0	2589.0	2619.0	2450.0	2514.0	2594.0	2898.0	2955.0	3011.0	2995.0	3060.5	3065.5	3102.5	3211.5	2948.0	2963.2	3125.0	3233.2	3296.2	3298.2	3162.2	3090.7	2941.9	2683.5
23/04/2006	2531.0	2477.0	2460.0	2314.0	2328.0	2243.0	2306.0	2367.0	2634.0	2841.0	2911.0	2934.0	3006.0	2960.0	3064.0	2899.0	2786.0	2796.4	3030.1	3050.6	3036.6	3054.1	3061.1	3052.1	3106.6	3115.3
24/04/2006	3099.2	3048.0	2978.0	2925.0	2946.0	2693.0	2666.0	2824.0	2991.0	2862.0	2993.0	2966.0	2865.0	2699.0	2812.0	2820.0	2869.0	2776.2	2958.9	3265.1	3274.1	3327.1	3313.1	3119.6	3072.6	2885.1
25/04/2006	2609.0	2539.0	2490.0	2458.0	2491.0	2301.0	2382.0	2415.0	2670.0	2855.0	3031.0	3076.0	3076.0	3137.0	3190.5	3189.0	3161.0	2992.0	3239.5	3309.4	3339.9	3398.4	3405.9	3330.9	3383.4	3362.0
26/04/2006	3337.5	3254.0	3236.0	3151.0	3170.0	2866.0	2872.0	2915.5	3179.5	3078.0	3183.0	3154.5	3154.5	3149.5	3160.0	3252.5	3180.5	3139.2	3370.8	3383.5	3377.0	3391.0	3394.0	3330.0	3146.4	2756.7
27/04/2006	2576.0	2585.0	2580.0	2552.0	2584.0	2389.0	2415.0	2478.0	2861.0	2850.0	2962.0	2966.0	3002.0	3075.0	3148.0	3113.0	3037.0	2985.0	3194.0	3431.0	3401.0	3450.9	3424.9	3429.9	3342.9	3259.7
28/04/2006	3068.2	2988.7	2958.5	2929.0	2908.0	2568.0	2498.0	2495.5	2692.2	2718.7	2817.2	2828.7	2753.7	2758.7	2934.7	2938.7	2900.5	2972.5	3111.5	3096.0	3059.5	3162.5	3121.0	3140.0	3184.3	3147.0
29/04/2006	2994.5	2920.5	2860.5	2811.5	2822.9	2542.9	2613.6	2737.6	2976.6	2985.1	2993.6	2992.1	2981.6	2937.1	3006.6	2996.1	3039.1	3027.6	3142.3	3207.3	3203.5	3301.5	3297.5	3248.0	3232.0	3225.0
30/04/2006	2994.3	3158.5	3143.0	3147.0	3128.0	2806.0	2800.0	2811.0	3142.0	3155.0	3109.5	3105.5	3066.5	3077.5	3130.0	3131.0	3061.5	3014.5	3254.2	3324.7	3309.0	3327.0	3314.0	3121.0	3110.0	3131.0

May

Time / Date	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/05/2006	3079.4	3056.4	3076.9	3122.9	3128.4	2923.4	2809.4	2723.2	2842.0	2811.0	2832.0	2812.0	2914.0	2892.0	2958.0	2966.0	2920.0	2809.1	3066.2	3075.7	3210.2	3306.5	3274.5	3330.5	3306.0	3230.1
02/05/2006	3217.6	3198.1	3165.1	3112.1	3034.1	2756.1	2809.1	2901.6	3119.5	3129.5	3107.0	3100.5	3085.0	3078.5	3144.0	3117.5	3069.0	3018.5	3208.7	3240.2	3304.2	3331.7	3342.7	3310.7	3249.7	3251.5
03/05/2006	3180.3	3113.2	3113.7	3036.7	3066.2	2634.0	2795.8	2823.0	2939.0	2926.5	2901.0	2910.0	2901.0	2872.5	2918.0	2895.0	2953.0	2933.9	3084.5	3086.5	3109.6	3169.1	3162.6	3162.1	3121.6	3108.6
04/05/2006	3056.5	3047.5	3044.0	2963.5	2972.0	2978.5	2862.0	2926.0	2922.0	2895.0	2905.0	2885.0	2885.0	2840.0	2844.5	2836.5	2871.5	2925.1	3047.3	3069.8	3100.6	3093.1	2919.6	2921.6	2931.6	2909.3
05/05/2006	2695.5	2864.0	2861.0	2864.0	2869.0	2581.0	2505.0	2486.0	2555.0	2661.0	2703.0	2757.0	2627.0	2620.0	2868.5	2928.5	2896.5	2703.6	2985.6	2996.4	3011.4	2938.9	2949.9	2789.9	2932.4	2958.9
06/05/2006	2922.5	2858.5	2789.5	2742.0	2757.0	2484.5	2479.5	2574.5	2836.0	2845.0	2798.0	2793.0	2713.5	2706.0	2725.0	2713.0	2761.2	2828.0	2936.7	2952.7	2978.2	2991.7	2934.7	2458.7	2762.7	2712.4
07/05/2006	2503.0	2004.0	1920.0	1844.0	1781.0	1750.0	1810.0	1890.0	2335.0	2272.0	2368.0	2604.0	2585.0	2540.0	2701.0	2652.0	2667.0	2723.0	2948.7	3131.8	3110.3	3186.8	3160.8	3127.3	3072.8	2823.0
08/05/2006	2566.0	2445.0	2335.0	2295.0	2340.0	2159.0	2266.0	2326.0	2721.0	2832.5	2859.5	2882.5	2914.5	2899.0	2922.5	2915.0	2921.0	2920.2	2997.4	3103.5	3129.0	3136.0	3178.0	3127.5	3136.5	3122.2
09/05/2006	2789.5	2795.0	2871.5	2977.5	2981.5	2680.5	2680.5	2700.4	2702.5	2648.5	2689.5	2661.0	2683.0	2724.0	2773.0	2795.0	2759.2	3005.5	3006.5	3030.5	3061.5	3064.5	3059.5	2974.0	2858.5	2791.5
10/05/2006	2951.0	2949.0	2869.0	2882.0	2841.0	2492.0	2509.0	2602.0	2909.0	2975.0	2981.5	2994.5	2936.0	2975.5	2972.5	3051.5	3055.5	2994.1	3013.8	3065.8	3046.5	3030.0	2085.5	2375.0	2504.3	2503.0
11/05/2006	2344.0	2162.0	2165.0	2014.0	2060.0	1922.0	1987.0	2028.0	2357.0	2490.0	2593.0	2602.0	2644.0	2668.5	2658.5	2696.0	2704.0	2792.5	2807.1	3013.8	3021.8	3023.3	2985.3	3022.8	2979.8	2813.1
12/05/2006	2675.6	2449.6	2432.3	2372.2	2327.2	2039.0	1971.0	2019.5	2016.5	2086.5	2088.5	2094.5	1836.5	1815.5	1913.5	1979.5	2023.5	2268.5	2560.7	2771.2	2837.1	2846.5	2887.1	2731.6	2655.0	2185.0
13/05/2006	1993.0	1871.0	1661.0	1847.0	1870.0	1787.0	1860.0	2106.0	2513.0	2546.0	2633.5	2666.5	2688.5	2678.5	2655.5	2649.5	2657.0	2661.0	2772.6	2803.3	2790.3	2844.7	2809.2	2835.2	2812.7	2778.5
14/05/2006	2746.0	2726.5	2711.0	2647.0	2653.0	2330.4	2298.4	2309.4	2656.0	2762.0	2729.0	2740.0	2712.0	2723.5	2794.0	2788.5	2734.0	2738.0	2798.6	2824.6	2856.6	2890.1	2964.6	2959.6	2948.1	2912.6
15/05/2006	2742.0	2630.0	2519.0	2448.0	2490.0	2226.0	2330.4	2424.4	2733.4	2649.9	2720.9	2744.4	2727.4	2700.9	2739.9	2723.4	2713.9	2713.4	2889.2	2914.8	2957.8	2965.3	2972.8	2934.8	2926.8	2916.2
16/05/2006	2856.6	2803.6	2810.6	2828.1	2826.1	2568.6	2627.0	2759.0	2908.0	2797.0	2867.0	2841.5	2889.5	2869.0	2869.0	2865.0	2867.0	2834.0	3012.1	3013.1	3044.6	3054.6	3164.6	3049.6	3042.1	3079.1
17/05/2006	3060.7	3034.7	2999.7	2998.7	3000.7	2758.2	2803.6	2908.1	3038.1	3056.1	3045.1	2994.6	3036.6	3022.6	3037.1	3058.1	3011.6	3014.6	3017.7	3174.4	3176.9	3241.9	3256.4	3241.4	3191.9	3246.9
18/05/2006	3238.7	3200.2	3210.7	3222.7	3151.2	2836.2	2829.1	2929.1	3192.5	3220.5	3236.0	3209.5	3126.0	3199.5	3162.5	3172.0	3001.0	2945.9	2421.5	2308.5	2393.9	2560.9	2718.4	2801.1	2667.6	3084.5
19/05/2006	3165.7	3105.7	3138.7	3162.7	3137.2	2821.7	2736.1	2698.5	2771.0	2811.0	2782.5	2790.5	2482.5	2509.5	2752.0	2868.0	2809.0	2623.8	2772.0	3157.9	3178.4	3246.9	3275.4	3243.9	3245.9	3229.1
20/05/2006	3027.6	2958.1	2882.0	2868.0	2800.5	2380.5	2360.0	2445.0	2899.0	2979.0	2966.0	2953.5	2938.0	2972.5	3000.0	3101.7	2978.2	2887.2	3020.3	3313.4	3342.4	3385.4	3382.9	3381.9	3379.9	3305.9
21/05/2006	3296.5	3006.5	2934.0	2918.0	2906.0	2699.0	2750.5	2876.0	2881.0	2904.0	2898.0	2889.0	2877.0	2832.0	2804.5	2823.5	2814.5	2802.7	2915.9	2979.0	3018.5	3024.0	3012.0	3020.0	3004.5	2998.5
22/05/2006	2965.3	2963.3	2941.3	2929.3	2900.3	2861.3	2734.3	2803.6	2783.0	2805.0	2851.0	2834.0	2809.0	2814.0	2811.0	2587.0	2693.0	2748.5	2810.1	2845.1	2854.1	2939.5	2504.6	2945.1	2866.1	2871.1
23/05/2006	2800.2	2787.9	2783.9	2773.2	2783.7	2708.7	2730.7	2703.6	2856.6	2919.0	2894.0	2893.5	2899.0	2903.0	2922.5	2884.9	2851.4	2759.9	3137.1	3330.6	3342.6	3307.1	3319.6	3310.6	3230.1	3229.1
24/05/2006	3181.0	3183.3	3152.8	3147.8	3075.8	2667.3	2654.3	2796.0	3003.0	3007.5	2986.0	2992.5	2972.5	3067.0	2940.0	2929.5	2860.0	3012.5	3076.1	3259.1	3256.6	3279.5	3264.6	3322.5	3326.6	3290.6
25/05/2006	3299.1	3176.1	3194.6	2966.6	2790.6	2485.6	2517.6	2777.0	3113.0	3059.5	3084.0	2900.0	2914.0	2631.0	2681.0	2696.0	2795.0	2872.0	3060.6	3150.6	2850.6	2989.1	3007.1	3014.1	2935.6	2993.6
26/05/2006	2993.6	3023.6	3032.1	3014.6	2928.6	2458.6	2366.6	2383.0	2506.0	2509.0	2541.0	2479.5	2290.0	2229.0	2420.0	2514.5	2456.5	2547.0	2783.1	3081.1	3168.1	3102.6	3056.1	3004.1	2605.1	2367.1
27/05/2006	2197.5	2220.5	2191.0	2202.5	2170.5	2043.5	2170.0	2324.0	2543.0	2742.0	2740.5	2797.5	2746.5	2782.0	2944.5	2878.0	2750.0	2908.0	2935.1	3052.1	3022.1	3053.1	3063.1	3077.1	3089.1	3070.6
28/05/2006	2749.8	2671.8	2632.8	2590.8	2537.8	2366.2	2388.7	2508.2	2710.2	2838.7	2908.7	2952.7	2945.7	2777.2	2689.7	2846.2	2830.2	2947.2	3002.3	3022.2	3052.2	3056.2	3073.2	3068.7	3058.9	3037.1
29/05/2006	2831.1	2652.1	2608.1	2568.1	2549.1	2323.6	2444.1	2425.6	2848.0	2910.0	2914.5	2933.5	2920.5	2872.5	2891.5	2907.0	2897.0	2875.0	3000.0	3120.0	3153.6	3162.6	3121.1	3177.6	3115.6	3156.6
30/05/2006	2891.1	2712.1	2668.1	2628.1	2609.1	2383.6	2504.1	2465.6	2904.0	2970.0	2974.5	2993.5	2980.5	2932.5	2951.5	2967.0	2957.0	2915.0	3040.0	3200.0	3233.6	3242.6	3177.1	3237.6	3175.6	3216.6
31/05/2006	2859.1	2723.6	2736.6	2701.6	2682.6	2449.6	2463.6	2619.6	2943.6	2833.5	2876.0	2977.9	2940.9	2966.9	2989.9	3017.4	2946.9	2913.9	3062.0	3225.5	3273.0	3266.5	3237.0	3250.0	3232.5	3067.5

June

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/06/2006	2929.4	2726.1	2700.1	2665.1	2620.1	2430.1	2462.0	2582.5	2848.0	2870.0	2768.0	2846.0	2885.0	2821.0	2926.0	2912.0	2868.0	2942.5	3062.1	3235.2	3272.2	3297.7	3300.7	3275.7	3299.2	3252.2
02/06/2006	2963.1	2901.1	2840.1	2755.1	2618.1	2288.1	2238.5	2266.5	2333.5	2320.0	2329.0	2293.0	2188.0	2153.0	2304.0	2399.0	2443.0	2411.5	2627.5	3118.8	3266.8	3381.8	3432.3	3398.8	3342.8	3035.6
03/06/2006	2795.0	2651.5	2504.0	2420.0	2415.0	2164.0	2232.0	2320.0	2733.3	2855.3	2922.3	2989.3	2909.3	2914.3	3034.3	3043.3	2946.3	2899.0	3063.1	3598.1	3622.5	3667.5	3652.5	3591.5	3588.5	3403.1
04/06/2006	3212.5	3056.5	3013.5	2899.5	2843.5	2521.5	2561.5	2642.5	3063.5	3080.5	3098.0	3100.5	3191.0	3104.0	3225.0	3204.0	3085.0	3041.0	3182.6	3528.6	3612.6	3644.1	3627.6	3617.6	3629.6	3461.1
05/06/2006	3275.0	3143.5	3090.5	2942.0	2859.0	2615.0	2560.5	2633.0	2967.5	3066.5	3118.0	3011.0	3060.0	3005.0	3130.5	3100.0	3003.0	3009.5	3203.1	3492.6	3673.6	3685.1	3677.1	3592.1	3588.6	3425.6
06/06/2006	3196.0	3062.0	2900.0	2893.0	2727.0	2378.0	2399.0	2475.0	2915.0	3006.0	3010.0	2994.0	2942.0	2855.0	2915.0	2979.0	2957.0	2902.0	3136.6	3382.1	3650.6	3658.6	3667.6	3640.6	3557.6	3310.5
07/06/2006	3136.0	3004.0	2852.5	2818.5	2734.5	2413.5	2465.5	2550.5	2865.0	3009.0	3026.0	3036.0	2971.5	2866.5	3045.0	3065.0	3046.0	2942.0	3092.6	3519.6	3586.1	3591.1	3586.1	3562.6	3521.1	3429.1
08/06/2006	3246.6	3117.6	3061.0	2974.0	2851.0	2462.0	2495.5	2618.5	2771.0	2948.0	3016.0	3027.0	3030.0	2987.0	3114.0	3106.0	3062.0	2972.0	3153.6	3426.6	3515.6	3584.1	3555.1	3484.6	3407.1	3330.1
09/06/2006	3214.1	3077.1	3012.1	2971.1	2940.1	2411.0	2324.0	2325.0	2344.0	2311.0	2273.0	2277.0	2193.0	2183.0	2365.0	2460.0	2481.0	2651.5	3064.9	3361.9	3429.9	3508.9	3574.9	3536.9	3495.9	3263.9
10/06/2006	2988.5	2771.5	2663.5	2557.0	2549.0	2301.0	2324.0	2393.0	2608.0	2749.0	2811.0	2846.0	2840.0	2848.0	2936.0	2850.0	2772.0	2894.5	3110.6	3468.2	3573.7	3525.2	3516.7	3498.7	3375.7	3234.0
11/06/2006	3003.5	2902.0	2843.5	2786.0	2732.0	2401.5	2541.5	2674.0	3046.0	3069.0	3127.5	3109.0	3126.5	3171.5	3280.5	3236.0	3140.5	3154.5	3275.2	3534.2	3552.7	3565.2	3551.2	3532.7	3518.7	3500.6
12/06/2006	3340.6	3226.6	3164.6	3040.6	3026.6	2858.6	2868.6	2884.0	3053.0	3100.0	3069.0	3064.0	3086.0	3116.0	3180.0	3182.0	3003.0	2987.0	3239.6	3479.2	3532.2	3564.2	3527.7	3550.7	3545.7	3523.2
13/06/2006	3372.7	3301.7	3246.7	3162.2	3098.7	2757.7	2756.5	2814.5	3022.0	3012.0	3010.0	3057.0	3030.0	3030.0	3270.0	3202.0	3055.0	3032.4	3100.9	3259.6	3554.7	3608.0	3565.2	3594.2	3546.2	3438.2
14/06/2006	3245.6	3166.6	3123.6	2932.2	2835.2	2658.2	2578.0	2654.0	2965.0	3061.0	3036.0	3028.0	2837.0	2923.0	3010.0	2885.0	2894.0	2898.4	3130.1	3349.6	3508.6	3591.8	3520.3	3577.8	3398.3	3269.8
15/06/2006	2953.7	2909.2	2765.0	2682.0	2648.0	2381.0	2417.0	2519.0	2909.0	3078.0	3074.0	3114.0	3095.0	3093.0	3204.0	3181.5	3065.0	3141.0	3237.2	3466.2	3539.7	3567.7	3558.2	3541.7	3475.2	3514.2
16/06/2006	3347.2	3260.2	3148.0	3041.0	3004.0	2697.0	2564.0	2571.0	2646.0	2690.0	2686.0	2714.0	2624.0	2576.0	2883.0	2894.0	2803.0	2786.0	2844.7	3450.2	3464.2	3468.2	3247.7	3396.2	3363.7	3124.7
17/06/2006	2902.7	2908.7	2881.7	2881.7	2838.2	2460.0	2463.0	2590.0	2866.0	2942.0	2979.0	3007.0	3142.0	3258.0	3276.5	3290.0	3215.0	3003.0	3066.7	3356.2	3416.2	3435.2	3453.2	3445.2	3401.7	3460.7
18/06/2006	3251.7	3270.7	3293.7	3344.7	3228.7	2916.7	2868.7	2943.5	3203.0	3126.0	3163.5	3178.0	3164.5	3160.5	2927.5	3149.5	3090.5	2992.5	3050.7	3390.2	3502.6	3532.6	3530.1	3512.1	3522.6	3499.1
19/06/2006	3434.6	3376.6	3167.6	3132.6	3113.6	2863.5	2757.1	2855.6	3142.0	3199.0	3209.0	3204.0	3176.0	3168.0	3244.0	3116.0	3129.0	3134.5	3186.7	3383.7	3431.2	3433.2	3389.7	3426.7	3441.2	3427.7
20/06/2006	3402.2	3363.2	3283.2	3280.2	3167.7	2852.7	2816.5	2824.5	3036.0	3147.5	3116.5	3174.0	3004.0	3102.5	3176.5	3107.0	3065.5	3117.5	3065.7	3470.2	3478.2	3488.7	3541.2	3515.7	3432.7	3473.2
21/06/2006	3371.7	3325.7	3217.7	3156.7	3041.7	2655.7	2614.5	2757.5	3087.0	3115.5	3154.0	3232.5	3203.0	3235.0	3245.5	3257.5	3114.5	3089.0	3195.7	3451.7	3453.7	3485.7	3502.2	3488.7	3432.7	3464.2
22/06/2006	3412.7	3382.2	3290.2	3169.7	3018.7	2668.2	2670.0	2638.0	2924.0	3012.0	3070.0	3138.0	3121.0	3206.0	3260.0	3249.0	3075.0	2993.0	3103.7	3351.2	3470.7	3484.2	3401.3	3416.3	3400.3	3457.3
23/06/2006	3358.3	3361.8	3241.8	3079.8	3033.3	2666.3	2611.8	2496.5	2581.5	2620.0	2602.0	2651.0	2560.0	2535.5	2781.0	2783.5	2777.5	2662.5	2734.9	3215.9	3418.4	3484.9	3515.9	3496.9	3435.9	3436.4
24/06/2006	3271.3	3223.3	3153.3	3075.3	2964.3	2623.3	2585.5	2686.5	2974.5	3025.5	2995.0	3083.9	3107.9	3216.9	3248.9	3206.9	3089.9	3124.7	3220.2	3259.7	3329.7	3349.7	3335.2	3365.2	3345.2	3364.6
25/06/2006	3339.5	3340.5	3353.5	3292.0	3221.5	2942.0	2786.0	2835.0	3192.0	3225.0	3195.5	3294.5	3308.5	3293.5	3302.5	3246.5	3247.5	3104.2	3211.0	3492.5	3523.0	3549.0	3543.5	3533.5	3542.0	3496.9
26/06/2006	3353.4	3215.4	3209.4	3171.4	3100.4	2793.4	2813.4	2808.8	3093.8	3121.8	3198.8	3200.8	3220.8	3226.3	3237.3	3266.3	3166.8	3049.5	2969.2	3190.2	3255.7	3316.8	3363.3	3437.8	3462.3	3380.7
27/06/2006	3362.4	3334.4	3280.4	3191.9	3125.9	2812.9	2777.9	2844.6	3101.0	3158.0	3181.0	3204.0	3172.0	3164.0	3270.5	3211.5	3109.5	3084.0	3168.2	3395.6	3494.1	3549.7	3511.7	3504.7	3503.7	3457.7
28/06/2006	3418.6	3334.0	3324.0	3192.4	3059.8	2801.6	2790.6	2828.5	3089.0	3190.5	3086.5	3189.0	3191.5	3165.5	3183.5	3185.5	3110.0	3092.5	3264.7	3448.7	3509.6	3516.1	3498.6	3482.1	3408.1	3401.2
29/06/2006	3393.2	3369.2	3300.7	3288.7	3223.2	2827.2	2736.5	2948.5	3179.5	3188.5	3163.5	3209.5	3177.5	3241.0	3263.5	3297.0	3194.0	3129.0	3215.2	3408.2	3439.2	3487.7	3490.2	3487.2	3445.2	3406.2
30/06/2006	3296.2	3204.2	3209.2	3203.2	3113.7	2816.7	2736.5	2629.0	2741.0	2780.0	2784.0	2819.0	2828.0	2834.0	3042.0	3111.5	3035.5	2955.0	3007.0	3220.7	3408.2	3513.0	3559.5	3540.5	3558.5	3492.3

July

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/07/2006	3448.8	3336.8	3257.4	3148.9	3106.9	2738.7	2677.2	2797.5	3063.0	3043.5	3125.0	3173.0	3132.0	3099.0	3201.0	3167.5	3136.0	3066.5	3175.1	3397.1	3436.2	3464.7	3511.2	3482.7	3509.7	3478.2
02/07/2006	3467.2	3500.2	3442.7	3191.7	3193.7	2871.2	2732.2	2800.0	3165.0	3205.5	3195.0	3262.0	3265.0	3298.0	3327.0	3224.0	3261.0	3140.5	3154.9	3457.9	3466.9	3521.4	3550.9	3551.4	3537.9	3481.9
03/07/2006	3432.1	3375.6	3315.6	3226.6	3168.6	2737.6	2738.6	2790.0	2960.5	3069.5	3097.0	3129.0	3083.5	3002.5	3175.0	3130.0	3015.0	2975.5	3079.5	3318.2	3489.2	3554.2	3585.2	3549.7	3546.7	3478.3
04/07/2006	3340.3	3231.3	3175.3	3161.3	3054.8	2602.3	2583.7	2728.7	3031.7	3053.7	3069.7	3098.7	3115.7	3057.7	3135.7	3161.7	3077.7	3058.7	3054.2	3347.3	3541.3	3586.8	3554.3	3555.3	3540.3	3523.5
05/07/2006	3554.5	3496.5	3425.4	3180.2	3161.2	2778.2	2618.6	2778.1	3009.6	3104.1	2967.6	2994.6	2974.0	3066.5	3065.0	3074.0	3151.0	3132.0	3232.6	3395.6	3428.1	3479.1	3468.1	3437.1	3427.6	3422.1
06/07/2006	3386.6	3399.6	3311.6	3258.1	3190.1	2962.1	2823.1	2861.5	3098.5	3097.0	3134.3	3084.8	3130.8	3138.5	3177.5	3180.3	3119.8	3096.8	3221.9	3336.4	3338.0	3188.5	3246.5	3266.1	3295.6	3282.9
07/07/2006	3249.2	3159.1	3102.6	3104.6	3075.6	2761.7	2606.7	2600.1	2704.0	2691.0	2818.5	2833.5	2672.5	2527.5	2818.5	2814.5	2803.5	2915.0	3260.6	3400.6	3428.1	3490.6	3472.1	3452.1	3473.6	3343.2
08/07/2006	3079.6	3004.1	2966.1	2904.1	2752.1	2366.6	2402.5	2422.5	2717.5	2887.5	2997.5	3031.5	3050.5	2998.5	3089.5	3131.5	3040.5	2968.5	3183.1	3283.6	3414.1	3519.6	3485.6	3482.1	3473.1	3434.2
09/07/2006	3249.2	3167.2	2973.2	2861.2	2831.2	2514.2	2503.1	2623.0	3011.0	3135.0	3131.0	3133.0	3128.0	3038.5	3149.0	3148.0	3095.2	3122.7	3222.2	3395.8	3477.0	3448.0	3414.5	3421.0	3428.5	3555.9
10/07/2006	3443.4	3348.4	3280.9	2842.9	2725.4	2423.9	2357.6	2433.0	2837.0	3000.0	2930.0	2977.0	3003.0	2995.0	3106.0	3055.0	2970.0	3041.6	3271.2	3416.2	3410.6	3416.6	3409.1	3197.6	3200.1	3197.3
11/07/2006	3074.1	2881.7	2761.2	2745.7	2716.7	2497.7	2482.5	2537.0	2728.0	2825.0	2922.0	2969.5	2975.5	2956.5	2990.5	3029.5	3001.5	2956.3	3101.3	3225.9	3228.9	3211.5	3188.5	3216.6	3208.1	3213.4
12/07/2006	3127.6	2916.2	2825.2	2805.2	2794.2	2473.2	2489.5	2586.0	2859.0	3003.0	3017.0	3002.0	2934.0	2974.0	3042.5	3029.0	3013.5	2896.6	2971.1	3207.1	3145.1	3139.1	3129.5	3183.1	3171.1	3210.8
13/07/2006	3167.8	3220.8	3185.8	3158.8	3100.8	2645.8	2619.2	2671.7	2974.7	3084.0	3111.0	3168.0	3170.0	3087.0	3153.5	3164.5	3169.0	3050.4	3145.9	3404.7	3415.2	3418.7	3412.2	3331.7	3363.7	3358.4
14/07/2006	3315.7	3293.7	3232.2	3163.2	3115.0	2707.0	2600.5	2537.0	2640.0	2734.0	2760.0	2599.0	2644.0	2617.0	2778.0	2900.0	2807.0	2667.4	2844.7	3353.8	3369.3	3430.8	3393.3	3420.8	3387.8	3360.4
15/07/2006	3303.7	3239.3	3153.5	3137.5	3094.5	2651.5	2580.0	2572.0	2921.0	2960.0	3007.0	3037.0	2976.0	3047.0	3104.0	3151.5	3098.5	2958.5	3020.1	3362.4	3380.8	3383.3	3414.8	3368.8	3378.8	3376.8
16/07/2006	3262.1	3177.1	3189.5	3170.5	3044.5	2700.0	2593.5	2663.0	2990.0	3069.0	3024.5	3090.5	3050.5	3040.0	3055.5	3050.0	3035.5	2987.6	3020.1	3264.6	3324.3	3336.3	3318.3	3319.6	3336.8	3269.0
17/07/2006	3174.4	3174.1	3134.1	3117.1	3056.6	2712.6	2685.7	2755.2	3028.7	3125.7	3113.7	3134.7	3123.7	3111.7	3097.7	3114.7	3127.2	3071.7	3135.2	3343.2	3375.2	3397.7	3357.0	3343.6	3334.8	3276.5
18/07/2006	3088.9	3023.9	3059.4	3042.9	3050.4	2894.4	2807.5	2896.5	2987.0	2960.0	3025.0	3072.5	3075.5	3061.0	3043.5	3073.5	3098.0	3006.7	3186.0	3277.3	3363.3	3372.8	3366.3	3397.3	3378.3	3354.9
19/07/2006	3134.2	3139.8	3125.3	3139.3	3117.8	2710.0	2710.5	2704.5	3018.5	3053.5	3037.5	3093.5	3097.5	3058.0	3069.5	3104.5	3003.5	3048.5	3168.0	3358.8	3339.7	3433.7	3395.7	3400.2	3385.2	3285.7
20/07/2006	3211.7	3077.4	3030.4	2970.4	2693.9	2486.9	2456.9	2556.9	2939.0	3015.0	3000.5	2988.0	2921.5	2940.0	3020.0	3017.0	2940.0	2880.9	2972.8	3251.8	3276.3	3437.3	3429.3	3393.8	3394.8	3360.3
21/07/2006	3190.6	3094.6	3058.6	2902.6	2869.6	2382.6	2387.6	2347.6	2472.0	2451.0	2490.0	2425.0	2303.0	2268.0	2529.0	2631.0	2549.0	2442.7	2685.5	3103.4	3480.4	3559.4	3533.9	3528.5	3471.9	3292.9
22/07/2006	3120.0	2945.5	2975.5	2744.0	2781.0	2408.0	2464.0	2555.0	2849.0	2917.0	2959.0	2982.0	3045.0	3027.0	3147.0	3089.0	3083.1	2920.6	3024.3	3349.3	3456.5	3466.0	3472.0	3444.5	3454.5	3428.6
23/07/2006	3253.0	3128.5	3030.5	2991.5	2938.0	2569.5	2567.5	2662.0	2991.0	3054.0	3105.0	3069.0	2646.0	2656.0	2900.0	2693.0	2853.0	2881.5	3035.0	3104.5	3165.0	3189.0	3183.5	3153.5	3159.2	3134.4
24/07/2006	3096.5	3079.5	3079.5	3101.5	3086.5	2766.5	2739.5	2833.5	2988.5	2958.5	2950.0	3069.0	3027.0	3036.0	3109.5	3130.0	3022.5	2970.4	3054.7	3240.3	3286.8	3302.3	3360.9	3334.3	3394.3	3411.4
25/07/2006	3275.5	3130.5	3112.5	3096.0	3094.0	2953.0	2862.0	2944.0	3087.5	3064.5	3041.5	3068.0	3045.0	3031.5	3043.5	3015.0	3033.0	3090.5	3104.8	3158.3	3200.8	3198.8	3072.8	3164.8	3137.3	3156.0
26/07/2006	3144.4	3068.8	3068.8	3069.8	3030.8	2927.1	2901.7	2958.7	3042.6	2918.5	3037.5	3040.0	3060.5	3010.0	3107.0	3094.0	3107.7	3092.2	3180.5	3253.0	3279.1	3284.6	3302.1	3290.1	3254.6	3266.9
27/07/2006	3190.2	3179.2	3168.7	3184.7	3104.2	2766.7	2675.0	2753.5	3137.0	3073.0	3069.5	3046.0	3050.0	3046.5	3129.5	3153.0	3097.0	3052.0	3196.5	3263.3	3306.3	3335.3	3277.2	3298.2	3340.2	3327.5
28/07/2006	3199.0	3173.5	3142.0	2997.5	2941.0	2330.0	2362.0	2340.0	2346.0	2508.0	2576.0	2613.0	2537.0	2505.0	2746.0	2901.0	2721.5	2687.0	2846.3	3230.3	3315.8	3467.3	3487.3	3432.8	3425.3	3372.3
29/07/2006	3215.5	3027.5	2998.0	2916.0	2863.0	2513.0	2479.5	2524.5	2967.0	2956.0	3070.5	3096.5	3014.0	3030.0	3138.0	3112.0	3102.5	3136.0	3246.8	3345.3	3335.3	3347.3	3333.8	3392.8	3402.3	3317.3
30/07/2006	3152.3	3081.3	2995.3	2981.8	2976.8	2681.8	2607.5	2662.5	2851.5	2853.5	2848.5	2833.5	2866.0	2920.0	2852.4	2956.4	3041.4	2988.9	3115.9	3278.8	3290.8	3295.8	3334.8	3394.8	3372.3	3351.1
31/07/2006	3137.1	3028.8	3135.3	2933.3	2899.3	2846.3	2781.3	2735.0	3025.0	3020.0	2987.0	2977.0	3070.0	3115.0	3108.0	3095.0	3100.5	3069.2	3190.2	3354.2	3326.7	3387.2	3373.7	3368.2	3362.2	3303.3

August

Time / Date	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/08/2006	3133.4	3112.8	3119.6	3119.6	3127.8	2882.3	2885.3	2970.4	3096.5	3121.0	3092.5	3095.0	3087.0	3082.5	3075.5	2980.0	3084.5	3086.5	3134.7	3362.2	3407.2	3377.2	3390.4	3371.9	3367.4	3306.4
02/08/2006	3123.4	3117.4	3124.9	3134.9	3115.9	2723.4	2684.7	2741.7	3105.7	3023.7	2997.7	3098.2	3078.2	3094.2	3092.2	3075.2	3086.7	3106.2	3209.4	3382.6	3360.3	3406.8	3370.2	3387.7	3333.2	3301.2
03/08/2006	3090.2	3097.2	3103.2	3126.2	3102.2	2763.2	2717.5	2719.5	3061.0	3050.0	3044.0	3058.0	3043.0	3045.5	3106.0	3130.0	3088.5	3034.5	3126.7	3378.7	3370.0	3385.0	3380.5	3399.8	3287.3	3172.8
04/08/2006	3049.5	3013.5	3018.5	3029.5	3030.5	2660.5	2502.5	2531.5	2393.0	2278.0	2379.6	2348.6	2374.6	2429.6	2629.6	2698.1	2673.1	2520.6	2741.5	3030.0	3058.5	3069.0	3094.6	3151.6	3258.1	3180.0
05/08/2006	3091.0	2938.0	2841.0	2834.5	2801.5	2484.5	2389.0	2441.5	2729.5	2831.5	2873.5	2900.0	2915.0	2828.0	2929.8	2916.3	2835.3	2883.7	2960.7	3162.7	3216.2	3211.2	3198.3	3228.8	3167.6	3096.7
06/08/2006	2917.9	2877.9	2819.9	2647.9	2653.9	2495.9	2456.9	2561.9	2871.9	2890.4	2879.9	2905.4	2911.4	2970.4	3027.9	3060.9	3069.4	2987.4	3183.4	3320.7	3369.7	3359.7	3355.7	3348.2	3334.2	3267.0
07/08/2006	3156.5	3022.5	2978.5	2838.5	2810.5	2517.5	2491.0	2575.0	3025.5	3151.5	3125.5	3168.0	3173.0	3148.0	3162.5	3053.5	3103.5	3113.6	3330.3	3382.3	3338.7	3444.4	3441.4	3379.4	3392.4	3363.0
08/08/2006	3212.0	3170.0	3106.0	3019.0	3000.0	2774.0	2674.5	2739.0	2880.0	2892.0	2790.5	2873.0	3078.0	3128.0	3114.8	3094.8	3083.8	3117.5	3284.5	3380.9	3371.4	3422.4	3384.9	3365.9	3342.9	3320.3
09/08/2006	3117.0	3123.0	3139.0	3149.0	3129.0	2831.0	2774.5	2858.5	3080.5	3097.5	3052.0	3065.0	3060.0	3049.5	3071.0	3058.5	3052.0	3089.6	3260.1	3323.9	3377.9	3481.9	3411.9	3446.9	3336.9	3249.9
10/08/2006	3045.6	3060.6	3001.6	2855.1	2822.1	2541.6	2476.1	2528.6	3024.5	3115.5	3128.5	3120.0	3097.0	3084.0	3101.5	3084.5	3111.0	3218.8	3355.3	3401.1	3448.2	3472.2	3462.2	3431.2	3397.7	3381.4
11/08/2006	3115.2	3039.0	3024.0	3013.0	3023.0	2825.0	2645.0	2713.0	2883.0	2907.0	2929.0	2924.0	2835.0	2802.0	2808.0	2828.0	2913.0	2947.4	3019.2	3131.2	3162.3	3151.8	3147.3	3131.8	3132.8	3133.6
12/08/2006	2985.3	2967.3	2980.3	2978.2	2849.2	2757.3	2710.3	2750.2	2852.0	2846.0	2841.0	2846.0	2852.0	2822.0	2827.0	2816.0	2866.0	2898.0	3091.3	3172.7	3205.7	3196.7	3204.7	3205.7	3175.7	3176.2
13/08/2006	3045.3	2982.3	2983.3	2986.3	2984.3	2920.3	2792.0	2813.0	2973.0	2979.0	2906.0	2980.0	2974.0	2931.0	2920.0	2926.0	2909.0	2955.0	3115.8	3192.4	3200.9	3207.4	3250.4	3235.4	3175.9	3105.8
14/08/2006	3069.7	3062.7	3127.7	3119.7	3128.7	2867.2	2860.2	2970.2	3007.0	2976.0	3014.5	3005.0	2991.5	2950.5	2944.0	2998.0	2980.0	3018.0	3180.3	3235.4	3257.4	3240.4	3258.9	3269.4	3238.4	3202.8
15/08/2006	3129.5	3011.5	3027.5	3013.5	3028.5	2843.5	2821.0	2933.0	2984.5	2988.0	3022.5	3010.1	2999.6	2919.1	2924.6	2927.6	2941.1	3099.1	3222.9	3286.7	3342.2	3343.2	3341.7	3310.7	3264.7	3225.2
16/08/2006	3132.2	2930.7	2936.7	2933.7	2965.7	2852.7	2878.7	2951.6	2892.6	2889.6	2908.1	2887.1	2855.5	2865.0	2895.0	2984.0	2958.0	3016.5	3237.7	3394.4	3398.4	3382.4	3363.9	3321.9	3333.9	3303.2
17/08/2006	3095.6	3070.3	3067.3	3060.3	3059.8	2997.3	2817.5	2864.0	3039.5	3043.5	3090.5	3070.5	3087.5	3066.5	3045.0	3054.5	3091.5	2854.2	3194.5	3276.0	3230.7	3362.7	3367.2	3311.2	3302.7	3280.1
18/08/2006	3180.1	3041.1	2997.1	3005.1	3002.6	2828.6	2538.1	2507.6	2555.6	2606.6	2577.6	2592.5	2469.5	2429.0	2660.0	2770.0	2691.4	2747.2	2977.0	3297.9	3300.9	3347.9	3332.5	3330.0	3301.5	3305.5
19/08/2006	3009.9	2976.7	2982.2	2991.2	2986.7	2767.6	2764.6	2774.5	2988.0	2835.5	3004.0	3023.2	2992.2	2992.2	2975.7	2953.2	2944.2	3085.5	3243.7	3259.6	3275.6	3309.1	3315.6	3300.6	3261.6	3290.6
20/08/2006	3087.2	3079.0	3073.0	3070.0	3044.0	2835.5	2813.5	2920.5	3051.0	2992.5	3074.5	3059.5	3046.0	3016.0	2914.0	2990.0	2987.5	3050.6	3216.8	3302.8	3327.8	3328.3	3334.3	3325.8	3323.8	3294.8
21/08/2006	3193.3	3148.3	3075.3	3036.1	3012.6	2863.1	2816.1	2895.6	3189.6	3212.6	3212.1	3176.6	3196.1	3189.6	3186.1	3124.6	3128.1	3133.1	3324.6	3408.5	3519.0	3525.0	3534.5	3519.0	3483.5	3374.6
22/08/2006	3154.2	3145.5	3130.5	3117.5	3024.5	2623.5	2503.5	2578.5	2993.0	3011.5	3005.5	3067.5	3034.0	2980.5	3070.5	3109.0	3087.0	3104.8	3336.0	3373.7	3438.7	3497.2	3478.2	3454.2	3422.2	3317.6
23/08/2006	3261.5	3065.5	2947.5	2900.5	2879.5	2595.5	2557.5	2644.5	3020.5	3082.5	3075.0	3080.0	3040.0	3032.0	3053.0	3080.0	3093.0	3186.8	3245.0	3356.0	3367.0	3409.0	3376.0	3296.5	3357.0	3301.0
24/08/2006	3173.2	3069.5	2941.5	2919.5	2930.5	2661.5	2599.5	2647.0	2970.0	3039.5	3083.5	3156.0	3141.0	3166.0	3137.0	3176.0	3232.0	3264.2	3365.9	3378.9	3402.6	3354.6	3316.6	3276.6	3391.6	3353.1
25/08/2006	3260.0	3264.5	3179.0	3087.5	3092.5	2691.5	2458.0	2465.0	2531.0	2573.0	2578.0	2648.0	2764.0	2701.0	2809.0	2968.0	2954.7	2960.7	3327.4	3451.5	3507.0	3529.0	3496.0	3508.0	3501.5	3459.0
26/08/2006	3274.5	3220.5	3181.5	3108.5	3109.5	2711.5	2739.5	2802.5	3055.0	3175.0	3171.0	3217.5	3223.5	3179.5	3148.5	3090.5	3100.5	3123.6	3325.3	3340.8	3344.6	3376.6	3356.6	3344.1	3297.1	3271.8
27/08/2006	3193.9	3152.5	3159.5	3077.5	3107.5	2872.5	2859.5	2925.5	3035.5	2968.0	3107.5	3080.0	3141.0	3136.0	3163.0	3150.0	3179.0	3204.2	3294.4	3392.5	3396.7	3393.7	3415.1	3361.1	3356.6	3351.5
28/08/2006	3337.8	3259.3	3252.3	3199.8	3089.8	3056.3	2933.8	3000.3	3167.0	3151.5	3183.5	3053.5	3058.0	3070.0	3049.0	3029.0	2925.1	3266.1	3343.2	3323.7	3345.3	3443.3	3356.3	3391.8	3277.3	3322.9
29/08/2006	3248.7	3212.7	3253.7	3273.2	3264.2	2869.2	2686.2	2851.7	3127.0	2993.0	2960.0	3096.5	2992.0	3025.0	3055.0	3135.0	3167.0	3190.9	3277.7	3268.2	3283.2	3248.7	3242.7	3249.6	3322.3	3305.7
30/08/2006	3219.9	3184.9	3176.1	3153.1	3160.0	2878.0	2713.0	2740.5	2970.5	3035.0	3118.0	3163.0	3127.5	3115.5	3124.5	3168.5	3203.5	3218.6	3298.9	3317.0	3300.0	3297.5	3282.2	3268.7	3334.2	3372.2
31/08/2006	3191.1	3190.6	3157.1	3155.1	3127.1	2810.1	2754.6	2819.6	3100.1	3090.5	3028.5	3039.5	3047.0	2995.5	2973.5	2996.5	2998.6	3046.6	3134.4	3162.4	3166.4	3154.9	3180.4	3194.4	3223.4	3235.2

September

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/09/2006	3085.6	3088.6	3021.6	3039.6	3029.6	2635.1	2551.1	2542.6	2734.0	2761.0	2753.0	2800.0	2662.5	2606.5	2885.5	2958.5	2902.5	2939.2	3220.9	3327.8	3332.3	3340.9	3334.4	3299.4	3288.4	3231.8
02/09/2006	3122.0	3105.8	3069.3	3104.7	3098.7	2915.2	2762.2	2868.7	3119.8	3085.8	3113.8	3060.8	3074.3	3078.3	3108.2	3100.7	3144.7	3203.7	3238.5	3204.1	3273.1	3332.6	3323.1	3355.6	3354.0	3234.3
03/09/2006	3270.0	3247.0	3214.5	3045.5	3171.5	2793.5	2759.5	2862.5	3185.5	3229.5	3233.5	3230.0	3210.0	3185.0	3155.0	3150.0	3140.5	3222.4	3313.0	3356.0	3338.0	3307.0	3281.5	3266.0	3305.0	3279.8
04/09/2006	3189.0	3137.0	3062.5	3030.5	3024.5	2691.5	2609.5	2725.0	2981.0	2922.0	2977.0	3049.5	3022.0	3005.5	3025.5	3016.5	3025.5	3056.9	3173.4	3155.5	3138.5	3129.5	3139.5	3150.5	3172.8	3136.4
05/09/2006	3053.1	3038.6	3068.6	3069.6	3076.6	2951.1	2876.1	2937.6	3074.0	2996.0	2963.0	3081.5	3054.0	2919.0	2891.0	2924.0	2880.0	2987.0	3120.0	3160.7	3173.2	3167.2	3163.7	3151.2	3137.7	3124.5
06/09/2006	3082.2	3083.2	3077.2	3078.2	3066.2	2999.2	2999.2	3069.5	3050.0	3038.0	2998.5	3083.0	3033.0	2985.0	3011.0	2997.5	2991.5	3054.5	3117.7	3153.7	3154.9	3096.9	3088.2	3083.2	3068.2	3040.2
07/09/2006	3031.4	3014.4	3028.4	3014.9	2998.9	3022.9	3033.9	3003.5	2996.5	2891.5	2911.5	2932.5	2936.0	2970.5	3002.0	3032.0	3048.0	3123.0	3228.1	3212.2	3255.7	3272.7	3284.2	3276.0	3257.3	3259.3
08/09/2006	3214.8	3184.8	3171.6	3168.6	3184.6	3081.1	2971.6	2881.6	2862.5	2947.5	2923.0	2934.0	2840.5	2773.5	2980.5	2954.0	2791.8	3003.3	3341.9	3422.3	3442.3	3480.3	3446.3	3472.3	3391.5	3387.4
09/09/2006	3234.1	3103.2	3039.1	3064.2	2962.1	2481.6	2314.2	2305.0	2416.0	2542.0	2576.0	2622.0	2705.0	2734.0	2872.0	2831.0	2717.0	2974.5	3391.8	3384.3	3452.3	3458.8	3422.3	3427.3	3398.3	3314.9
10/09/2006	3244.5	3158.5	3101.5	3034.5	3024.0	2983.0	2864.5	2900.0	3108.5	3106.0	3076.5	3128.5	3170.5	3109.5	3202.0	3186.6	3187.1	3283.1	3367.3	3346.8	3317.8	3375.8	3385.3	3352.3	3342.4	3350.1
11/09/2006	3251.0	3204.0	3125.0	2945.0	2961.0	2705.5	2639.5	2651.5	2964.5	3070.5	3031.5	3023.5	3029.5	3042.5	3155.0	3076.0	3176.0	3283.5	3376.0	3348.4	3380.4	3410.4	3389.9	3390.9	3330.4	3244.1
12/09/2006	3171.5	3097.5	2991.5	2697.5	2865.5	2658.5	2642.0	2624.5	2938.5	2869.0	2880.0	2939.0	2894.0	2898.0	2922.0	3008.0	3019.5	3084.6	3187.7	3167.3	3229.3	3281.3	3212.3	3192.9	3195.4	3107.4
13/09/2006	3041.5	2952.5	2827.5	2825.5	2842.5	2663.0	2555.0	2654.0	2975.5	3004.5	3040.0	3083.5	3073.5	3057.5	2995.0	3049.0	2999.0	3187.2	3277.9	3287.9	3323.9	3335.9	3307.4	3320.9	3319.9	3306.4
14/09/2006	3243.1	3251.6	3228.6	3169.1	3173.1	2870.6	2769.0	2834.5	3103.5	2945.5	3016.5	3084.5	3115.5	3044.5	3083.0	3038.0	3065.0	3186.5	3353.7	3314.4	3351.4	3361.4	3253.4	3321.4	3346.4	3279.4
15/09/2006	3236.0	3213.0	3182.0	2998.0	2992.0	2888.0	2751.0	2735.5	2740.0	2744.0	2659.0	2719.5	2722.0	2708.0	2810.5	2851.5	2859.5	2895.8	3002.0	3007.0	3039.0	3069.0	3049.5	3019.0	2980.0	3004.1
16/09/2006	2939.0	2932.9	2931.9	2925.6	2910.8	2804.6	2814.8	2811.8	2734.5	2756.5	2741.0	2778.3	2840.3	2796.3	2795.3	2645.3	2679.3	2726.2	2815.9	2809.4	2826.9	2850.9	2839.4	2830.4	2805.9	2823.2
17/09/2006	2808.2	2799.7	2799.7	2778.7	2771.2	2793.2	2773.5	2767.5	2724.7	2690.7	2762.2	2738.2	2707.2	2748.2	2794.2	2717.2	2819.2	2865.2	2949.4	2976.1	3006.6	3009.6	3039.1	3033.6	3007.6	2976.4
18/09/2006	2941.5	2900.5	2920.5	2930.5	2912.5	2817.0	2829.0	2947.5	2929.0	2795.0	2852.0	2853.0	2830.5	2779.0	2780.0	2781.0	2791.2	2937.7	3053.0	3014.0	3071.5	3067.5	3068.0	3010.0	3011.6	2970.4
19/09/2006	2663.0	2814.0	2817.0	2813.0	2815.0	2734.0	2722.5	2717.5	2702.5	2664.0	2692.0	2676.0	2685.5	2636.5	2705.5	2778.0	2772.2	2893.4	2988.9	2981.7	3032.2	3027.2	2999.7	3001.7	2981.8	2948.1
20/09/2006	2836.9	2820.9	2811.9	2809.9	2823.9	2708.9	2709.9	2737.4	2766.0	2759.0	2670.0	2782.0	2748.0	2738.0	2791.0	2750.5	2767.0	2942.5	3010.8	2963.8	2999.8	3007.8	2995.8	2921.8	2896.3	2772.3
21/09/2006	2561.5	2354.5	2361.0	2260.0	2225.0	2137.0	2181.0	2337.0	2516.0	2566.0	2458.0	2504.0	2506.0	2483.0	2580.0	2605.0	2799.0	2978.0	3025.3	2990.8	3050.8	3085.8	3040.3	3017.3	2857.3	2626.5
22/09/2006	2420.0	2200.0	2150.0	2064.0	2036.0	1911.0	1975.0	2151.0	2251.0	2308.0	2307.0	2304.0	2256.0	2232.0	2362.0	2506.0	2705.5	2917.0	3108.7	3086.7	3127.2	3140.2	3141.2	3025.2	2808.5	2641.5
23/09/2006	2325.0	2179.0	2154.0	2081.0	2111.0	2054.0	2209.0	2460.0	2666.0	2769.0	2781.0	2789.0	2662.0	2696.5	2743.0	2806.4	2879.9	3067.4	3119.6	3143.6	3139.6	3161.6	3127.6	3100.6	3090.6	2839.5
24/09/2006	2649.0	2542.0	2442.0	2352.0	2350.5	2160.5	2376.5	2512.0	2788.0	2849.0	2879.0	2868.0	2871.5	2860.5	2933.5	2879.5	2874.0	3065.0	3142.3	3136.3	3234.7	3166.7	3159.7	3181.7	3061.7	3032.4
25/09/2006	3006.6	3014.6	3110.6	3161.6	2974.6	2517.6	2502.0	2589.0	2941.0	2952.0	2891.0	2861.0	2968.5	2943.0	2935.5	2962.0	2873.5	3248.4	3241.4	3212.7	3255.7	3220.7	3207.7	3163.7	3084.2	2993.0
26/09/2006	2994.5	2979.5	3064.5	3175.5	3060.0	2780.0	2707.0	2794.0	2782.0	2791.0	2760.0	2776.0	2734.5	2760.5	2779.5	2769.5	2797.5	3028.7	3062.2	3063.2	3065.2	3048.2	2954.7	2996.2	2891.0	2778.3
27/09/2006	2789.5	2795.0	2871.5	2977.5	2961.5	2680.5	2680.5	2700.4	2702.5	2648.5	2689.5	2661.0	2683.0	2724.0	2773.0	2795.0	2759.2	3005.5	3006.5	3030.5	3061.5	3064.5	3059.5	2974.0	2858.5	2791.5
28/09/2006	2783.5	2780.5	2761.5	2943.0	2907.5	2754.0	2736.0	2723.0	2699.0	2657.0	2668.5	2682.5	2697.5	2683.6	2665.1	2735.6	2753.5	2885.7	2892.7	2894.7	2881.2	2930.7	2906.2	2855.7	2844.7	2797.4
29/09/2006	2758.2	2860.4	2895.4	2970.4	2988.9	2751.9	2555.9	2594.9	2769.0	2731.5	2752.5	2781.0	2670.0	2865.0	2934.0	2886.0	2912.0	3076.7	3104.0	3131.4	3117.4	3116.9	3106.9	3071.9	3081.9	3043.9
30/09/2006	3028.7	3035.2	3021.7	3042.2	3147.7	2751.2	2674.2	2811.2	2963.7	2907.0	2935.0	2929.0	2854.0	2863.0	2914.0	2945.0	2858.5	3137.8	3148.8	3168.3	3180.8	3183.8	3192.8	3176.8	3187.8	3149.6

October

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/10/2006	3149.1	3153.1	3153.1	3186.1	3175.1	2858.1	2763.6	2820.0	3062.0	2968.0	2988.0	3054.0	2918.0	2965.0	2989.0	2970.0	2911.5	3169.2	3201.2	3206.2	3218.2	3240.2	3223.7	3179.7	3071.7	3014.6
02/10/2006	2926.8	2918.8	2922.8	2958.0	2953.0	2793.0	2682.0	2779.0	2849.0	2741.0	2794.0	2840.0	2838.0	2855.0	2851.0	2827.0	2851.2	2996.5	3009.0	3013.0	2995.0	3002.5	2998.5	2955.4	2951.9	2919.9
03/10/2006	2935.6	2922.6	2929.1	2975.1	2965.1	2878.0	2879.0	2819.0	2827.0	2765.5	2832.1	2834.6	2857.1	2856.6	2857.6	2829.1	2879.1	2940.1	2978.1	2967.1	2978.6	2984.1	2993.6	2959.3	2951.8	2943.1
04/10/2006	2925.4	2907.6	2916.1	2974.1	2955.1	2894.1	2869.1	2865.6	2847.0	2827.0	2820.0	2826.0	2839.5	2856.5	2828.5	2831.5	2846.2	2933.7	2987.7	2989.7	2973.2	2967.2	2991.2	2953.2	2945.7	2931.3
05/10/2006	2909.2	2915.2	2900.4	2913.4	2910.4	2867.4	2856.4	2858.9	2772.3	2758.3	2751.8	2796.3	2804.3	2807.8	2837.8	2805.8	2846.8	2939.6	2979.6	2969.6	2974.6	2976.6	2966.6	2931.6	2926.6	2901.3
06/10/2006	2891.6	2897.8	2903.1	2920.1	2908.1	2671.1	2650.6	2683.0	2787.5	2822.0	2776.0	2797.0	2712.0	2753.0	2810.0	2797.5	2760.5	2954.4	2961.4	2965.2	2959.2	2959.2	2958.2	2935.2	2936.7	2920.6
07/10/2006	2885.0	2887.7	2884.0	2928.8	2940.8	2728.3	2733.0	2834.5	2871.5	2877.5	2882.5	2766.0	2817.0	2800.0	2824.0	2631.0	2686.0	2757.3	2760.8	2783.8	2793.8	2817.2	2808.2	2772.2	2758.7	2721.6
08/10/2006	2715.5	2720.5	2743.0	2756.3	2740.3	2688.3	2660.8	2680.3	2671.3	2527.3	2644.3	2644.8	2635.8	2610.8	2292.8	2359.3	2450.3	2672.6	2709.1	2745.6	2759.1	2771.1	2741.6	2721.6	2715.6	2673.1
09/10/2006	2722.6	2748.8	2789.8	2827.8	2807.8	2751.8	2750.8	2759.3	2716.8	2719.8	2741.8	2729.8	2717.0	2721.0	2743.0	2750.0	2861.5	2947.3	2987.8	3059.6	3082.6	3063.1	3069.6	3051.1	3029.1	2986.9
10/10/2006	2980.9	2995.9	2987.2	3020.2	3029.7	2919.7	2914.7	2910.7	2910.5	2878.5	2846.0	2898.0	2914.5	2921.0	2889.0	2900.0	2934.0	3050.7	3073.7	3069.2	3083.7	3088.2	3064.2	3022.7	2964.7	2917.7
11/10/2006	2903.7	2921.7	2907.9	2972.0	2956.0	2906.9	2941.9	2934.7	2922.5	2876.5	2907.0	2929.5	2917.5	2917.5	2902.0	2881.0	2927.1	3021.1	3037.1	3047.1	3063.1	3068.1	3029.6	2996.6	2993.4	2970.4
12/10/2006	2965.9	2972.9	2979.9	2988.9	2997.9	2902.4	2841.9	2871.9	2851.9	2823.9	2871.9	2866.9	2894.4	2890.4	2827.4	2848.4	2907.5	3017.8	3044.8	3045.8	3056.8	3036.8	3031.3	2973.3	2983.8	2979.6
13/10/2006	2970.4	2941.9	2956.6	3001.6	2987.6	2844.5	2840.5	2837.5	2793.5	2737.5	2787.5	2743.5	2755.0	2803.0	2857.5	2780.5	2855.7	3036.0	3057.2	3091.7	3099.2	3104.2	3078.2	3070.7	3070.7	2990.7
14/10/2006	2983.2	3006.2	3018.2	3041.2	2996.5	2805.0	2703.8	2806.6	2888.5	2860.5	2836.5	2840.5	2786.0	2826.0	2832.0	2828.0	2904.5	3023.8	3069.1	3068.6	3096.6	3094.6	3107.6	3084.1	3043.6	3021.1
15/10/2006	2858.2	2856.7	2854.4	2993.4	2987.4	2830.9	2716.4	2875.4	2934.9	2878.9	2900.9	2867.9	2905.9	2975.4	2925.4	2922.9	2955.0	3004.3	3040.0	3036.5	3066.5	3040.5	3054.0	3015.1	2986.0	2966.8
16/10/2006	2967.2	2965.2	2936.5	3015.0	2973.0	2865.0	2825.5	2930.0	2875.5	2737.0	2756.0	2874.5	2876.0	2873.0	2866.0	2919.0	2938.0	3014.2	3052.2	3052.7	3053.7	3063.7	3066.2	3009.7	3007.7	2987.0
17/10/2006	2990.4	2993.4	2990.7	3021.7	2960.7	2923.7	2913.7	2945.7	2878.0	2850.5	2873.5	2824.0	2826.0	2818.0	2842.0	2866.0	2925.5	3037.5	2979.5	3049.0	3040.5	3071.5	3047.0	3021.0	2998.5	2998.6
18/10/2006	2964.2	2948.2	2982.5	3035.5	2961.5	2571.0	2536.0	2754.0	2843.4	2808.4	2868.4	2867.4	2868.4	2860.9	2875.9	2821.4	2887.9	3019.6	3025.6	3056.1	3072.1	3068.6	3069.6	3042.1	3011.1	2993.7
19/10/2006	3001.7	3000.7	3012.4	3028.4	2996.9	2787.4	2751.4	2860.0	2910.5	2903.5	2683.0	2892.5	2893.0	2773.0	2772.0	2663.0	2866.5	2947.5	2992.5	3046.0	3058.5	3070.0	3017.5	3007.0	3006.0	2906.0
20/10/2006	2895.7	2902.7	2904.7	2903.4	2852.9	2560.9	2486.9	2496.3	2619.0	2607.0	2598.0	2609.0	2542.0	2555.0	2736.5	2710.5	2828.5	2905.2	2973.2	2991.7	2970.2	2992.2	2765.2	2748.2	2741.7	2683.7
21/10/2006	2737.7	2710.7	2779.4	2799.4	2716.4	2217.0	2113.0	2364.0	2545.0	2642.0	2598.0	2604.0	2557.5	2603.5	2599.5	2586.5	2696.5	2943.0	3025.5	3040.7	3088.7	3055.7	3017.7	2893.7	2807.7	2796.7
22/10/2006	2721.5	2725.8	2758.5	2862.5	2777.5	2205.5	2205.5	2371.5	2578.5	2555.5	2552.5	2558.5	2596.5	2596.5	2594.0	2617.0	2573.5	2842.5	2945.5	2923.0	2984.0	3003.0	3002.0	2923.5	2832.0	2764.5
23/10/2006	2704.3	2622.3	2788.3	2774.6	2573.1	2133.6	1849.0	1819.0	2120.0	2225.0	2251.0	2286.0	2284.0	2354.0	2328.0	2364.0	2369.5	2850.2	2924.2	2952.7	2963.7	2969.2	2971.7	2903.0	2751.0	2623.7
24/10/2006	2436.9	2361.9	2447.2	2793.2	2417.7	1729.0	1665.0	1662.0	1811.0	1928.0	1952.0	2141.0	2200.0	2153.0	2177.0	2172.0	2197.5	2847.0	2905.0	2926.5	2955.0	2954.0	2931.0	2925.5	2863.5	2715.9
25/10/2006	2527.0	2395.0	2192.0	2140.0	2250.0	2285.0	1996.0	1779.0	1599.0	1665.0	1761.0	1950.0	2034.0	2032.0	2000.0	1820.0	1963.0	2866.6	2962.3	2949.3	2947.3	2950.8	2929.8	2868.3	2748.7	2453.0
26/10/2006	2271.0	2069.0	2027.0	1946.0	1902.0	1603.0	1702.0	1733.0	1916.0	2007.0	2094.0	2156.0	2190.0	2180.0	2207.0	2166.0	2204.0	2726.0	2773.2	2802.7	2806.7	2799.7	2789.2	2771.2	2718.2	2646.3
27/10/2006	2460.5	2284.5	2288.5	2179.5	2196.5	2039.5	1775.0	1808.0	1999.0	2040.0	2157.0	2225.0	2168.0	2196.0	2106.0	2179.0	2238.0	2710.6	2707.6	2757.1	2727.1	2759.6	2773.1	2742.6	2627.1	2562.6
28/10/2006	2445.5	2306.5	2273.5	2189.5	2226.5	2150.5	2130.0	2134.0	2242.0	2247.0	2252.5	2441.5	2431.5	2432.5	2440.5	2348.5	2483.5	2616.0	2755.5	2759.5	2757.5	2760.5	2748.5	2684.5	2645.5	2572.1
29/10/2006	2437.9	2307.9	2275.9	2201.4	2210.4	2210.4	2122.5	2180.5	2405.5	2442.5	2473.0	2479.0	2486.0	2466.0	2535.0	2458.0	2513.0	2719.0	2800.5	2854.5	2889.0	2904.0	2840.0	2799.5	2712.0	2584.9
30/10/2006	2435.7	2318.7	2214.7	2178.7	2152.7	2069.7	2068.0	2124.0	2391.5	2478.5	2560.0	2591.0	2502.0	2503.0	2546.0	2546.0	2606.0	2790.1	2819.6	2809.1	2826.6	2831.1	2782.1	2770.6	2705.1	2579.4
31/10/2006	2481.0	2430.0	2371.0	2320.0	2318.0	2324.0	2356.0	2375.0	2398.0	2452.5	2532.5	2649.0	2644.0	2617.0	2671.0	2651.0	2748.0	2978.4	3008.4	3079.4	3121.4	3124.4	3105.4	2996.4	2950.4	2699.6

November

Time / Date	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/11/2006	2476.0	2372.0	2324.0	2303.0	2251.0	2276.0	2255.0	2344.0	2627.0	2610.0	2655.0	2767.0	2739.5	2651.5	2714.0	2679.5	2839.0	3148.0	3187.5	3193.5	3210.5	3187.5	3124.5	3061.5	2929.5	2722.5
02/11/2006	2479.0	2241.0	2208.0	2206.0	2217.0	2259.0	2262.0	2453.0	2691.5	2732.5	2732.0	2757.5	2748.5	2750.5	2750.5	2732.5	2784.5	3076.8	3109.8	3143.8	3146.6	3110.1	3107.6	3041.1	2974.6	2882.9
03/11/2006	2644.0	2404.0	2312.0	2307.0	2327.0	2309.0	2169.0	2204.0	2325.0	2372.5	2406.0	2487.0	2350.0	2305.0	2470.5	2537.0	2686.5	3021.4	3052.4	3067.9	3076.9	3068.4	3089.4	2967.4	2882.4	2745.3
04/11/2006	2487.0	2286.0	2230.0	2195.0	2206.0	2217.0	2163.0	2308.0	2596.0	2659.0	2701.5	2712.5	2689.5	2656.5	2672.0	2691.0	2718.5	3055.3	2989.5	2996.0	3000.0	3011.0	2926.0	2848.0	2800.0	2780.3
05/11/2006	2608.0	2489.0	2359.0	2332.0	2330.0	2402.0	2366.0	2459.0	2678.0	2731.0	2799.5	2796.0	2770.0	2719.0	2754.0	2742.0	2772.5	3015.6	3019.6	2988.6	3023.6	3037.6	3015.6	2955.6	2955.6	2786.6
06/11/2006	2537.5	2385.0	2281.0	2266.0	2289.0	2374.0	2437.0	2467.0	2703.5	2804.5	2886.5	2929.5	2875.5	2839.5	2828.5	2799.5	2814.5	3027.2	3045.1	3032.1	3042.6	2997.1	3007.6	2989.6	2784.6	2774.9
07/11/2006	2508.0	2403.0	2404.0	2331.0	2361.0	2522.0	2443.0	2466.0	2686.5	2684.5	2699.5	2729.5	2697.0	2677.5	2667.0	2666.0	2802.0	3005.6	3015.1	3027.1	3021.1	3047.1	3028.6	2963.1	2878.1	2717.8
08/11/2006	2480.0	2370.0	2323.0	2150.0	2262.0	2272.0	2382.0	2498.0	2743.0	2746.5	2754.5	2679.5	2650.5	2682.0	2678.0	2721.0	2917.0	3043.0	3061.0	3067.5	3029.5	3042.5	3014.0	2939.0	2908.0	2740.5
09/11/2006	2562.0	2500.0	2431.0	2409.0	2424.0	2437.0	2559.0	2666.0	2808.0	2796.0	2836.5	2811.5	2731.0	2719.5	2711.5	2749.5	2756.0	2901.3	2898.8	2916.8	2925.8	2931.8	2898.8	2887.3	2839.3	2749.7
10/11/2006	2463.0	2338.0	2289.0	2295.0	2296.0	2343.0	2285.0	2231.0	2250.0	2234.0	2234.0	2240.0	2149.0	2055.0	2337.0	2399.0	2748.5	2895.8	2957.8	2977.8	2974.8	2947.8	2929.3	2875.3	2796.3	2591.6
11/11/2006	2379.0	2282.0	2231.0	2123.0	2162.0	2224.0	2258.0	2326.0	2553.0	2482.0	2553.0	2611.5	2555.0	2540.0	2686.0	2684.1	2714.1	2952.4	2953.9	2965.9	2997.9	2985.4	2986.4	2871.9	2845.4	2680.4
12/11/2006	2351.0	2209.0	2155.0	2107.0	2156.0	2229.0	2258.0	2269.0	2527.0	2586.0	2613.0	2621.0	2558.0	2599.0	2603.0	2712.0	2773.0	2930.3	2945.3	2960.3	2981.3	2996.3	2954.3	2888.3	2848.3	2544.0
13/11/2006	2310.0	2230.0	2154.0	2113.0	2143.0	2297.0	2318.0	2382.0	2552.0	2555.0	2610.0	2739.0	2641.0	2632.0	2654.0	2646.0	2643.3	2801.6	2841.6	2854.1	2860.1	2863.1	2825.1	2847.1	2799.6	2537.4
14/11/2006	2397.0	2278.0	2201.0	2158.0	2184.5	2311.5	2325.5	2373.0	2570.0	2560.0	2598.0	2591.5	2471.0	2541.5	2644.5	2644.5	2611.5	2763.2	2800.9	2852.9	2890.4	2904.9	2885.9	2852.9	2809.9	2662.7
15/11/2006	2346.0	2205.0	2207.0	2095.0	2147.0	2350.0	2362.0	2438.0	2592.0	2584.5	2652.0	2672.0	2632.0	2613.0	2656.0	2663.0	2740.0	2925.7	2926.7	2923.7	2924.7	2931.7	2936.7	2805.7	2805.7	2642.5
16/11/2006	2316.0	2220.0	2102.0	2074.0	2168.0	2329.0	2295.0	2353.0	2520.0	2637.0	2646.0	2692.0	2601.0	2611.0	2682.0	2696.0	2693.0	2877.6	2917.7	2917.7	2934.7	2942.7	2917.7	2896.2	2780.0	2713.5
17/11/2006	2376.5	2285.5	2211.5	2126.5	2137.5	2233.5	2121.5	2116.5	2116.0	2128.0	2087.5	2158.0	2012.0	1969.0	2291.0	2315.0	2498.5	2838.5	2906.4	2944.4	2951.4	2961.4	2935.4	2818.4	2714.1	2439.6
18/11/2006	2211.5	2071.5	1982.5	1931.5	2008.0	2178.0	2171.0	2278.5	2438.0	2395.5	2505.5	2518.0	2488.0	2488.0	2595.0	2678.0	2780.0	2913.0	2932.0	2940.5	2945.5	2946.5	2927.5	2883.0	2814.2	2514.6
19/11/2006	2340.5	2192.5	2042.5	2034.5	2082.0	2327.0	2364.0	2397.5	2546.0	2514.0	2579.0	2616.0	2575.0	2553.0	2624.0	2648.0	2788.5	2935.3	2950.3	2969.3	2952.7	2962.2	2898.2	2859.7	2832.7	2513.5
20/11/2006	2297.5	2126.5	2066.0	2034.0	2079.0	2264.0	2308.0	2419.5	2572.5	2500.5	2575.5	2585.5	2551.5	2482.0	2608.0	2665.0	2765.0	2935.8	2936.8	2973.8	2979.8	2966.0	2884.2	2804.5	2855.0	2465.9
21/11/2006	2212.5	2035.5	2040.5	1983.0	2064.0	2240.0	2334.0	2394.0	2448.0	2425.0	2452.0	2429.0	2425.0	2426.0	2443.0	2444.0	2616.5	2753.6	2744.6	2777.6	2764.1	2763.1	2747.6	2665.6	2608.6	2444.0
22/11/2006	2197.0	2026.5	1960.0	1919.5	1975.0	2355.0	2470.5	2452.5	2443.0	2346.0	2387.0	2416.0	2392.0	2392.0	2326.5	2332.5	2433.1	2627.5	2638.5	2624.5	2653.0	2676.5	2655.5	2595.0	2578.0	2492.8
23/11/2006	2178.5	2025.5	2007.5	1982.5	1991.5	2323.5	2387.5	2425.5	2482.0	2422.5	2412.5	2435.0	2403.0	2413.0	2460.0	2455.0	2544.0	2679.8	2706.8	2694.8	2703.3	2711.8	2675.3	2597.3	2566.3	2474.3
24/11/2006	2231.0	2147.0	1962.0	1956.0	1978.0	2173.0	2139.0	2177.0	2110.0	2069.0	2015.0	2054.0	1918.0	1876.5	2115.0	2340.5	2465.5	2664.5	2668.9	2671.9	2611.9	2608.9	2582.4	2567.4	2566.9	2374.2
25/11/2006	2214.5	1965.5	1867.5	1860.5	1868.5	2175.5	2307.5	2341.5	2342.0	2236.0	2240.0	2266.5	2254.5	2331.5	2401.5	2525.5	2610.0	2825.5	2844.5	2850.0	2872.0	2900.0	2882.0	2740.0	2707.0	2495.4
26/11/2006	2318.0	2127.0	2095.0	2075.0	2120.0	2420.5	2516.0	2537.0	2623.5	2549.0	2561.5	2567.5	2507.5	2434.5	2562.5	2578.5	2564.0	2803.0	2826.0	2828.0	2830.0	2814.5	2708.0	2624.0	2568.0	2337.0
27/11/2006	2250.0	2116.0	2076.0	2031.0	2091.0	2403.0	2429.0	2425.0	2402.0	2336.5	2401.5	2405.5	2379.0	2396.0	2442.0	2449.5	2547.5	2669.6	2682.4	2681.0	2676.0	2693.0	2643.0	2620.0	2507.0	2460.6
28/11/2006	2239.0	2046.0	1950.0	1926.0	2006.0	2241.0	2354.0	2402.0	2415.5	2396.0	2391.0	2381.5	2331.5	2387.5	2342.5	2380.5	2434.0	2665.3	2678.9	2701.8	2699.8	2710.8	2660.7	2571.2	2520.7	2392.2
29/11/2006	2144.0	1976.0	1965.5	1973.5	2061.5	2267.5	2411.5	2353.0	2410.0	2145.0	2173.0	2247.0	2279.0	2313.0	2326.0	2336.0	2417.0	2648.6	2643.1	2656.6	2763.6	2782.6	2719.1	2620.6	2618.7	2425.9
30/11/2006	2133.0	2000.0	1980.5	1958.5	1991.5	2340.5	2469.0	2499.0	2504.0	2461.0	2399.0	2487.0	2497.0	2494.0	2549.0	2563.5	2587.5	2790.5	2796.0	2817.0	2821.0	2824.0	2782.1	2772.1	2602.1	2398.9

December

Date \ Time	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	18.30	19.00	19.30	20.00	21.00	22.00	23.00	24.00
01/12/2006	2045.0	2026.0	1918.0	1948.0	1961.0	2185.0	2237.0	2333.0	2264.0	2220.0	2144.5	2093.5	2006.5	1857.0	2203.5	2276.0	2467.0	2670.9	2689.9	2759.9	2756.4	2762.4	2647.4	2569.9	2533.4	2193.3
02/12/2006	1904.0	1844.0	1793.0	1751.0	1835.0	2116.0	2374.5	2348.0	2359.0	2433.5	2427.5	2496.5	2491.5	2348.5	2457.5	2516.5	2602.0	2742.0	2768.0	2803.0	2825.5	2830.0	2776.5	2722.0	2625.7	2281.0
03/12/2006	1998.0	1906.0	1860.0	1845.0	1892.0	2229.0	2414.0	2523.0	2543.5	2510.5	2512.5	2441.0	2402.0	2417.0	2454.0	2488.0	2380.0	2737.7	2745.7	2743.7	2749.2	2769.2	2776.2	2737.7	2616.3	2280.3
04/12/2006	1975.0	1896.0	1807.0	1815.0	1844.0	2130.0	2300.0	2445.0	2579.5	2452.5	2557.0	2576.0	2484.0	2351.5	2486.5	2582.5	2774.5	2936.1	2898.1	2940.3	3082.3	3107.3	3030.3	2866.3	2656.5	2250.0
05/12/2006	1960.0	1922.0	1871.0	1860.0	1891.0	2297.0	2459.0	2537.0	2640.5	2551.5	2552.0	2654.0	2565.5	2513.5	2560.0	2648.0	2746.0	3048.8	3109.8	3131.8	3137.8	3118.8	3075.8	2967.8	2686.0	2288.4
06/12/2006	1992.0	1885.0	1837.0	1839.0	1862.0	2152.0	2351.0	2358.0	2512.5	2485.0	2543.0	2545.0	2459.5	2439.5	2618.0	2705.5	2759.0	2984.8	2964.8	2972.3	2985.8	2977.8	2934.3	2821.8	2713.3	2356.4
07/12/2006	2020.0	1929.0	1958.0	1931.0	1969.0	2322.0	2510.0	2532.0	2680.0	2323.0	2445.0	2595.0	2566.5	2407.5	2528.5	2628.0	2799.0	2965.1	2962.1	2972.1	2983.6	2988.6	2958.1	2882.0	2771.7	2390.9
08/12/2006	2014.0	1974.0	1894.0	1861.0	1900.0	2155.0	2185.0	2311.0	2180.0	2056.5	2019.0	1979.0	1889.0	1756.0	2051.5	2185.0	2486.5	2816.6	2887.7	2907.7	3032.7	3002.7	2931.2	2829.2	2512.1	2421.3
09/12/2006	1968.0	1855.0	1814.0	1821.0	1883.0	2221.0	2246.0	2426.0	2552.0	2573.0	2577.0	2585.0	2549.0	2440.0	2549.0	2643.5	2664.5	2923.8	2913.4	2960.4	2970.4	2975.4	2944.4	2865.9	2729.9	2447.4
10/12/2006	2113.0	2014.0	1984.0	1940.0	1956.0	2265.0	2414.0	2528.0	2550.5	2548.5	2535.0	2552.0	2538.0	2471.5	2501.0	2474.0	2540.3	2742.8	2753.0	2729.0	2727.5	2695.5	2683.5	2624.0	2621.0	2477.7
11/12/2006	2208.0	2056.0	1970.0	1944.0	1972.0	2418.0	2506.0	2546.0	2562.0	2512.0	2553.0	2600.0	2537.0	2528.0	2572.5	2593.5	2645.0	2768.0	2770.0	2788.0	2812.5	2817.5	2822.5	2768.5	2719.5	2536.4
12/12/2006	2246.0	2021.0	1960.0	1940.0	2010.0	2319.0	2475.0	2499.0	2592.0	2524.0	2583.0	2607.0	2572.5	2532.0	2595.0	2567.0	2660.5	2803.8	2809.3	2814.3	2813.8	2816.3	2784.3	2731.3	2690.3	2484.4
13/12/2006	2243.0	2075.0	2001.0	1982.0	1993.0	2291.0	2460.0	2461.0	2495.0	2526.5	2532.5	2564.5	2545.0	2547.0	2539.0	2556.0	2623.6	2772.3	2742.3	2748.1	2762.1	2750.5	2729.5	2682.5	2637.0	2493.4
14/12/2006	2162.0	2014.0	1921.0	1908.0	1973.0	2231.0	2462.0	2455.0	2465.0	2465.0	2489.5	2486.5	2492.5	2451.0	2422.0	2447.0	2540.8	2628.2	2657.8	2676.3	2655.3	2661.8	2652.8	2587.8	2548.8	2441.7
15/12/2006	2243.0	2128.0	2010.5	1993.5	2011.5	2266.5	2169.5	2323.5	2326.5	2344.5	2284.0	2272.0	1990.0	1893.0	2202.0	2335.0	2525.6	2773.8	2770.3	2780.3	2774.8	2763.3	2729.3	2728.3	2625.3	2300.4
16/12/2006	2075.0	1960.0	1877.0	1830.0	1834.0	2105.0	2200.0	2243.0	2299.0	2186.0	2153.0	2266.0	2228.0	2107.0	2105.0	2250.0	2471.8	2850.9	2813.4	2868.4	2870.4	2861.4	2821.4	2780.9	2537.1	2225.0
17/12/2006	1930.0	1853.0	1815.0	1811.0	1855.0	2217.0	2377.0	2500.0	2511.5	2556.5	2531.5	2532.5	2513.0	2489.0	2494.0	2493.0	2602.8	2721.6	2721.8	2729.8	2735.8	2743.8	2707.8	2666.8	2620.8	2531.4
18/12/2006	2260.0	2060.0	1965.0	1976.0	2004.0	2334.0	2416.0	2406.0	2411.5	2363.5	2446.0	2415.0	2409.5	2389.5	2407.5	2401.3	2526.4	2621.4	2626.4	2618.4	2642.7	2642.2	2633.2	2571.2	2522.2	2475.2
19/12/2006	2238.0	2068.0	2025.0	1984.0	1996.0	2237.0	2354.0	2382.0	2367.0	2365.5	2376.5	2367.0	2371.0	2331.0	2339.0	2329.0	2418.8	2523.8	2536.3	2529.3	2536.7	2541.7	2508.7	2440.7	2449.7	2434.8
20/12/2006	2321.5	2215.0	2137.0	2120.0	2164.0	2321.0	2316.0	2334.0	2331.5	2375.5	2350.5	2344.5	2332.5	2308.5	2296.5	2298.5	2332.5	2566.8	2551.8	2589.8	2603.3	2600.8	2587.3	2534.3	2488.3	2467.8
21/12/2006	2417.0	2267.0	2172.0	2097.0	2111.0	2312.0	2364.0	2379.5	2383.0	2392.0	2390.4	2429.9	2389.4	2340.4	2335.9	2337.4	2387.0	2599.5	2605.5	2624.5	2700.0	2680.0	2699.5	2582.5	2573.5	2409.7
22/12/2006	2331.0	2233.0	2160.0	2080.0	2172.0	2332.0	2379.0	2150.0	2159.5	2063.0	1996.0	2036.0	1961.0	1874.0	1974.0	2198.0	2607.8	2877.0	2870.0	2890.5	2914.5	2902.5	2868.5	2713.0	2565.0	2439.4
23/12/2006	2110.0	1982.0	1971.0	1949.0	1960.0	2296.0	2345.0	2270.0	2359.0	2219.0	2312.0	2418.0	2273.5	2308.5	2512.0	2547.0	2650.8	2730.3	2861.3	2853.3	2883.3	2879.8	2877.8	2839.3	2813.8	2458.9
24/12/2006	2177.0	2064.0	2024.0	1991.0	2009.0	2399.0	2494.0	2546.0	2670.0	2662.0	2600.0	2643.0	2489.0	2448.0	2541.0	2573.0	2640.2	2822.2	2855.7	2885.7	2898.2	2903.2	2827.7	2910.7	2787.7	2476.4
25/12/2006	2167.5	1996.0	1940.0	1942.0	1944.0	2297.0	2396.0	2513.0	2536.0	2528.0	2531.0	2503.0	2524.0	2483.5	2480.5	2510.0	2512.7	2750.7	2766.2	2793.2	2792.7	2782.2	2757.2	2700.7	2661.7	2496.4
26/12/2006	2166.0	2030.0	1987.0	1996.0	2071.0	2407.5	2492.5	2528.0	2543.0	2533.5	2544.0	2542.0	2535.5	2489.5	2537.0	2553.5	2639.2	2827.2	2890.0	2825.0	2815.0	2777.5	2745.5	2426.5	2391.5	2374.1
27/12/2006	2248.0	2194.0	2073.0	2023.0	2021.0	2215.0	2448.0	2555.0	2515.5	2439.0	2424.5	2455.0	2483.0	2479.0	2519.0	2521.0	2602.2	2697.5	2714.5	2723.5	2714.5	2678.5	2669.5	2599.5	2589.5	2371.1
28/12/2006	2253.0	2083.0	2025.0	2003.0	2045.0	2367.0	2516.0	2564.0	2536.0	2493.0	2445.5	2492.5	2469.0	2507.0	2505.0	2526.0	2599.7	2713.7	2721.7	2724.7	2733.7	2693.2	2652.7	2617.7	2627.2	2610.9
29/12/2006	2362.0	2117.0	2108.0	2064.0	2089.0	2271.0	2475.0	2583.0	2594.0	2552.0	2545.5	2490.5	2239.0	2073.0	2341.0	2465.0	2541.7	2771.4	2830.4	2823.4	2846.4	2854.9	2809.9	2746.9	2692.9	2414.2
30/12/2006	2091.0	1996.0	1939.0	1895.0	1917.0	2172.0	2315.5	2493.5	2562.5	2595.5	2567.5	2624.0	2506.0	2445.0	2469.0	2540.0	2637.7	2899.7	2875.4	2871.4	2904.4	2913.4	2872.9	2832.4	2625.7	2264.0
31/12/2006	1854.5	1817.5	1749.5	1727.5	1749.5	1937.5	1974.5	2112.0	2213.5	2029.5	2010.0	2019.0	1993.0	1896.0	1888.0	1867.0	2269.7	2710.1	2926.1	2967.1	2985.1	3008.1	3002.6	2882.1	2502.4	2037.7