

Committing to Prudent Fuel Use: GPA's Process to Reduce Fuel Expenses

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1 Introduction

This paper describes the history behind Guam Power Authority's current process to reduce fuel expenses. GPA and the Guam Public Utilities Commission (PUC) collaboratively formulated the current processes. This paper discusses briefly several papers submitted by GPA to the PUC that laid the foundation for current practice.

2 Levelized Energy Adjustment Clause (LEAC)

About 47% of GPA's budget is made up of items such as debt service, maintenance, labor, insurance and other costs that are reasonably predictable and estimable. GPA expends the other 53% of its budget on fuel costs. Fuel prices are highly susceptible to wide market fluctuations. Because of this, GPA's power rates have two major components: a fixed base rate and a variable fuel rate.

Prior to 1999, GPA reset its fuel rate on a monthly basis to reflect current market conditions. In 1999, GPA adopted the Levelized Energy Adjustment Clause (LEAC) to set fuel costs on a bi-annual basis. The LEAC allows sharp market price fluctuations to be spread over a six month period. It also provides increased consistency to customer bills. The intent and character of the LEAC is a revenue neutral pass-through of expenses characterized by price or quantity of use volatility. It allows ratepayers to better plan their budgets for electric energy.

Every six months, GPA provides the Public Utilities Commission with a schedule of projected fuel costs. The PUC evaluates these projections and uses them as a basis for setting the LEAC rate over the next six month period. Any under recovery or over recovery is trued up during the review process. In the event that GPA's fuel forecasts indicate an under recovery exceeding \$2 million, it is allowed to petition for an adjustment before the expiration of the LEAC period.

3 Inheriting a Whirlwind

Prior to the creation of the Consolidated Commission on Utilities, between October 1999 and December 2002, the exercise of imprudent management practices led to long-term unavailability of significant base load capacity. This led to the overuse of non-base load (diesel-fired) generation assets resulting in higher fuel costs for GPA and its ratepayers.

Additionally, prior non-collection especially of Government of Guam receivables led to under funding of this generation maintenance resulting in the unavailability or restricted use of several non-base load¹ units.

¹ The term non-base load unit refers to any diesel-fired unit available for generation dispatch on the GPA power system. At present, the operational modes of these units support peaking and reserve capacity given the current generation unit availabilities and system loads.

Furthermore, during this period, then GPA management chose not to petition to increase the LEAC rate despite increasing fuel under-recoveries. Figure 1 shows the growth of this under-recovery and subsequent decline in the under-recovery under the CCU.

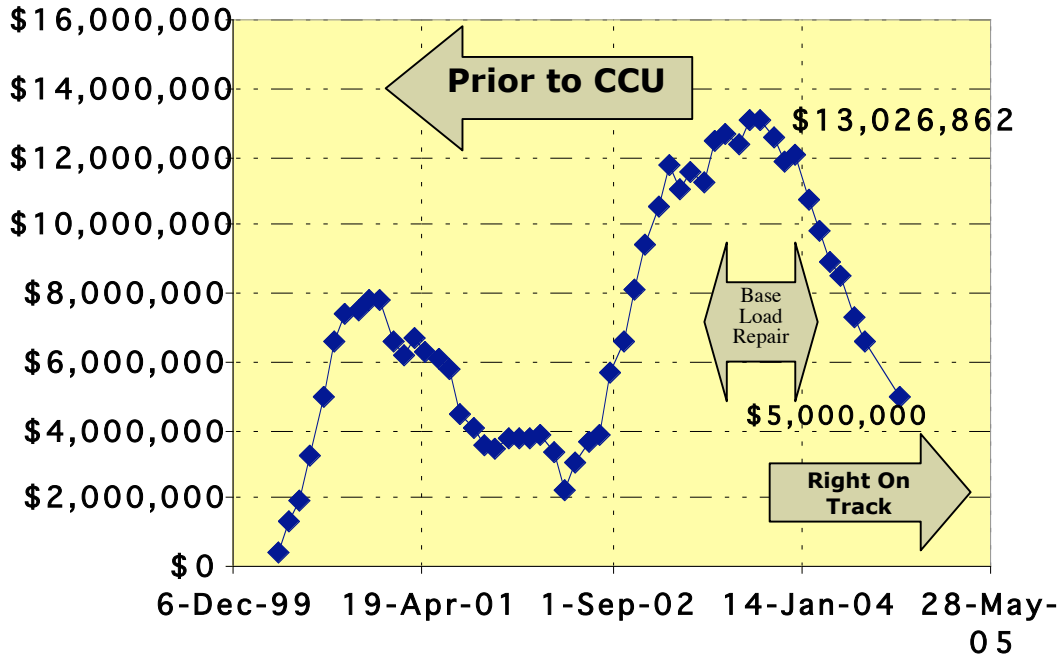


Figure 1. Growth in Under-Recovery of Fuel Expenses

In calendar year 2002, Guam experienced several typhoons including Super Typhoon Pongsona in December 2002. On January 1, 2003, the CCU and the current management team inherited a utility with the following fiscal challenges:

- A transmission and distribution system devastated by Super Typhoon Pongsona with an estimated price tag for system recovery of about \$35 million
- \$22.4 million in payables
- \$53.3 million in uncollected Government of Guam receivables
- \$26 million in uncollected non-government receivables
- A depleted working capital fund
- \$1.6 million in unsettled and disputed FEMA claims
- \$10.5 million in un-reimbursed fuel expenses.

The CCU and current GPA management met each challenge and turned them around in short order. However, it was not until June 2004 that Guam Power Authority Management and the Guam Public Utilities Commission made significant headway to resolve the matter of un-reimbursed fuel expenses. The management team had to overcome grave obstacles in order to get this matter resolved.

4 The Collaborative Process

The Guam Public Utilities Commission ruled that over this period of time, imprudent management led to imprudent fuel expenses. It was only through a collaborative effort between GPA management, the PUC and the PUC's consultants that objections to reimbursing GPA for these costs were overcome.

The PUC view can be summed in the following three sentences. A large part of customer satisfaction is price of service. GPA must exercise prudent management over fuel use. If it does not, GPA must bear, to the extent of its culpability, the consequences. GPA management made the argument that non-reimbursement of past fuel expenses unduly punished their efforts for prudently managing GPA and figured in the downgrade of the GPA bond rating. The rehabilitation of base load units and the increase in generation from RFO-fired units from 83% in years of imprudent management to 93% showed strong proof to the PUC that current management had turned the tide to the ratepayers' benefit.

The PUC acknowledged that GPA had made significant strides in increasing base load availabilities and in dispatching prudently. However, the Guam Public Utilities Commission made recovery of this prior fuel expense contingent on satisfactory performance and processes for prudent fuel use.

GPA filed the following documents with the PUC that through the collaborative process won GPA the right to recovery of its un-reimbursed fuel expenses incurred under past imprudent management practices:

- Quality Management Plan for Prudent Fuel Use
- Quality Management Plan for the Cost-Effective Reduction of Unaccounted for Energy
- Quality Management System for Ensuring LEAC Plan Performance Goals.

4.1 Quality Management Plan for Prudent Fuel Use

The *Quality Management Plan for Prudent Fuel Use* laid the groundwork for the following:

- GPA's acceptance of energy production efficiency standards
- Generation availability standards for each generation class (i.e., small diesel, slow speed diesel, combustion turbine and steam technologies)
- A commitment for better generation outage planning and outage execution
- The process for planning, executing and performance monitoring and control of generation dispatch
- A commitment to reduce system losses.

As a result of discussions using the *Quality Management Plan for Prudent Fuel Use* as its foundation, GPA and the PUC agreed upon the following:

- GPA would be held to performance standards including:
 - Energy production from RFO-fired generation units must comprise 90% or greater of total production
 - Energy production from diesel-fired generation units must comprise 10% or less of total production
 - Average heat rate for RFO-fired energy production must be less than 9.6 MBTU/MWh
 - Average heat rate for diesel-fired energy production must be less than 13.6 MBTU/MWh
 - Average heat rate for total energy production must be below 10.0 MBTU/MWh
 - Equivalent Availability Factors for each class of unit
- GPA would complete its process of procuring a performance management contractor for Cabras 3&4.

4.2 Quality Management Plan for the Cost-Effective Reduction of Unaccounted For Energy

The *Quality Management Plan for the Cost-Effective Reduction of Unaccounted for Energy* lays out a comprehensive plan for reducing unaccounted for energy such as line losses, meter errors, GPA own-use and billing errors. GPA and the PUC are still in the process of further defining these plans. The biggest issue is not what needs to be done but rather how quickly and under what funding source. Under its Meter Task Force, GPA has recovered \$1.7 million dollars through its efforts to investigate metering errors and improvements to the metering process.

4.3 Quality Management System for Ensuring LEAC Plan Performance Goals

4.3.1 LEAC/Prudent Fuel Use Process

The *Quality Management System for Ensuring LEAC Plan Performance Goals* describes GPA's prudent fuel use planning, execution and control process. Figure 2 shows the entire LEAC/Prudent Use process. Figure 3 shows the implementation process. These processes and sub-processes require the coordination of information and action between the GPA planning group, Finance/Accounting, Transmission and Distribution operations, Generation operations, Power System Control Center Operations, Engineering and GPA's upper management.

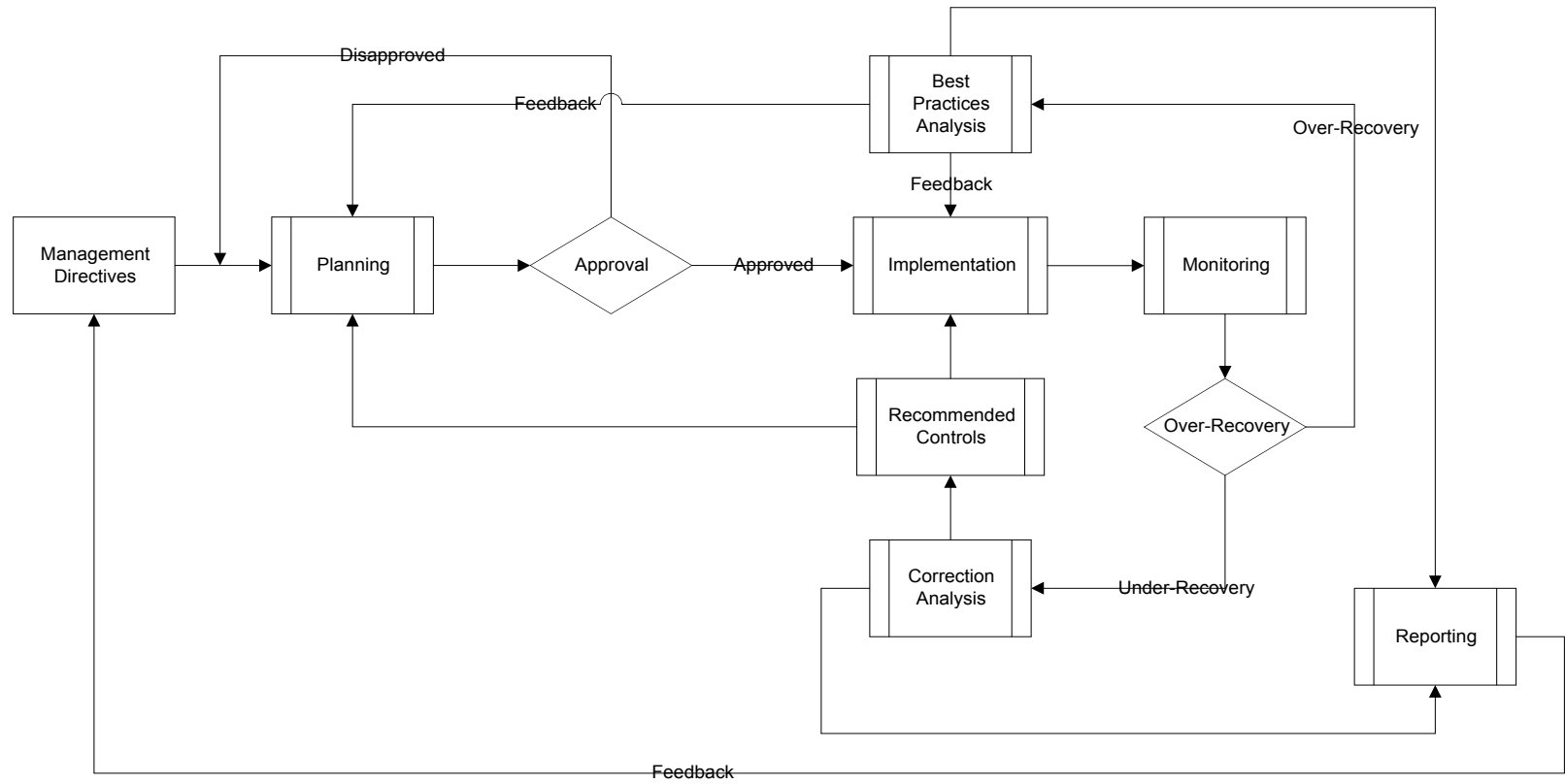


Figure 2. Quality Management System for Prudent Fuel Use²

² Refer to GPA's *Quality Management System for Prudent Fuel Use* for an explication of this process diagram.

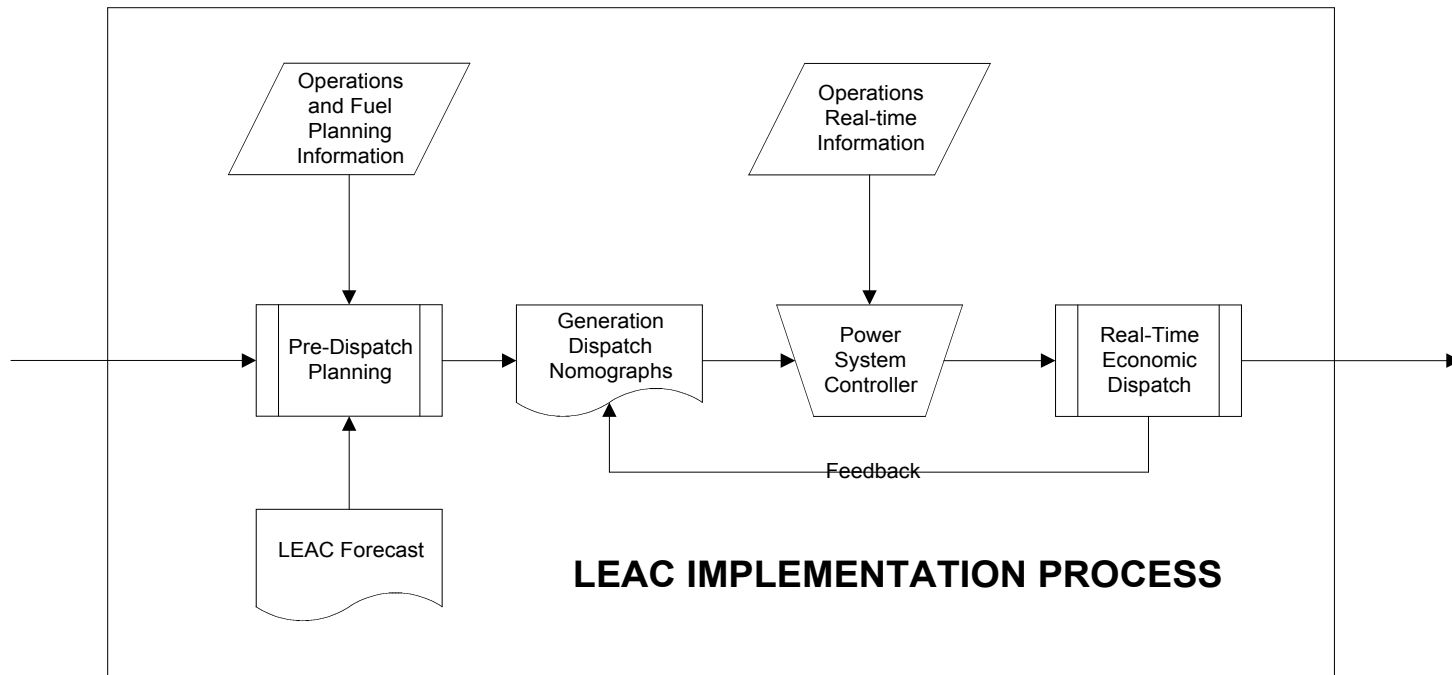


Figure 3. LEAC/Prudent Fuel Use Implementation Process

This process encompasses all of GPA operations. Transmission outages may restrict power flows and alter the generation commitment from more economic units. GPA's most efficient base load units are located far from its load centers. Therefore, GPA must closely coordinate T&D outages in order to better plan and execute for prudent fuel use. Outages of key generation units or of simultaneous outages will result in higher fuel expenses. Unless Power System Control operators dispatch the units as close to optimal, GPA is at risk of incurring higher fuel expenses. If fuel and load projections are awry, all this effort may still result in under-recoveries. GPA business must work closely and perform their key business functions well in order to meet the demands of prudent fuel use.

GPA's Finance/Accounting group prepares the LEAC forecast based on a projection of fuel use from GPA's planning group. GPA's planning group requires information on scheduled transmission and generation outages, projected fuel costs and projected loads. This places a burden upon Generation and T&D operations to keep to pre-planned outage schedules. Furthermore, the outage of more than a single major base load simultaneously is avoided. The outage of a Cabras slow speed diesel unit may increase fuel costs by about \$3000 a day. However the outage of both Cabras slow speed diesels will result in increasing fuel cost by more than \$20,400 a day. This analysis assumes \$43.16 per barrel for RFO. Therefore, planning, execution, monitoring and control are keys to success.

Using this system, GPA plans for the next six months of its entire operations. It incorporates lessons learned from previous LEAC periods into its planning process. Once the LEAC is filed, GPA operations faithfully execute monitors and adjust to meet fuel use goals.

4.3.2 LEAC Implementation Process

The Implementation Process includes the following:

- Pre-Dispatch Planning
- Real-Time Economic Dispatch of Generation Resources.

The Pre-Dispatch Planning horizon is for the next week. For this process, GPA forecasts the range of system demand for the planning period based on previous week's demand profile. Next, GPA performs the following for each load from highest to lowest in 5-MW increments:

- Generate an Economic Dispatch Plan (EDP) without spinning reserve or security constraints
- Modify the above EDP to account for spinning reserve
- Run Power Flows/Dynamic Simulations For Various Contingency Cases
- Modify EDP to Account for Contingency Constrained Operations
- Summarize Results in a Dispatch Nomograph
- Sign-Off on Pre-Dispatch Plan
- Review Nomograph with Electric Power System Dispatchers.

On a real-time basis, the generation dispatcher at PSCC runs GPA's in-house economic dispatch application to solve for the least cost allocation of committed generation resources (manual economic base points). The application captures the information for each manual base point calculation for future reference. The generation dispatcher then instructs the unit operators to meet the manual base points.

4.3.3 Control Charts

GPA uses several control charts to monitor and record its performance against the LEAC plan. These charts include:

- RFO-Fired Unit Dispatch Performance Trending Chart
- IWPS EDP Dispatch Performance Chart
- IWPS LEAC Dispatch Performance Chart
- Generation Outage Management Chart
- Fuel Use Performance Chart.

RFO-Fired Unit Dispatch Performance Trending chart compares the baseload gross energy production actual performance with the LEAC forecast. It determines if corrective action is needed to compensate for performances below the LEAC requirement. Charts are reported per week, month, quarter, and LEAC period. This family of charts is also known as Baseload Dispatch Performance Trending charts. Figures 4-6 show examples of these types of charts.

IWPS EDP Dispatch Performance chart compares the gross energy production actual performance for each unit with the Economic Dispatch Plan. It determines if corrective action regarding adhering to the Economic Dispatch Plan is needed. The weekly chart determines if the generation units were economically dispatched. Charts are reported per hour, day, and week. Figure 7 shows an example of an IWPS EDP Dispatch Performance chart for the peak demand for each day of the week.

IWPS LEAC Dispatch Performance chart compares the gross energy production actual performance for each unit with the LEAC projection for the month. It determines if corrective action regarding dispatching is needed to compensate for performances below the LEAC projection. Charts are reported per week, month, quarter, and LEAC period. Figures 8-10 show examples.

Generation Outage Management chart compares the actual generation outage performance with the LEAC forecast. It determines if corrective action regarding outage scheduling is needed to compensate for unexpected forced outages. Figure 11 shows an example.

Fuel Use Performance Charts indicate how well GPA has performed against the six-month LEAC goals and the daily Economic Dispatch goals. It may also provide post-analysis of how better to dispatch the units. Figure 12 shows an example.

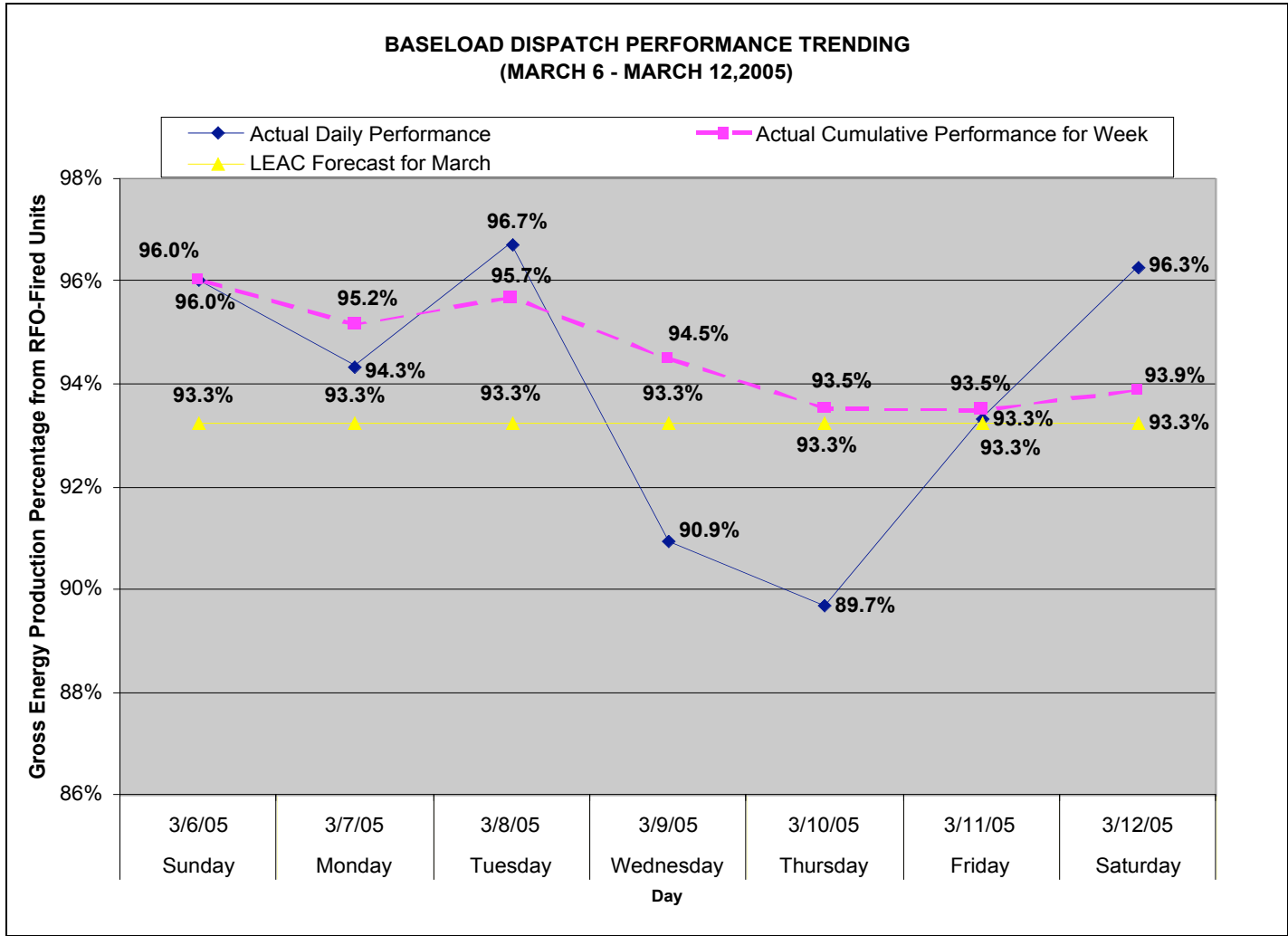


Figure 4. RFO-fired Unit Dispatch Performance Trending Chart –
Weekly Example - Actual Versus LEAC Projection

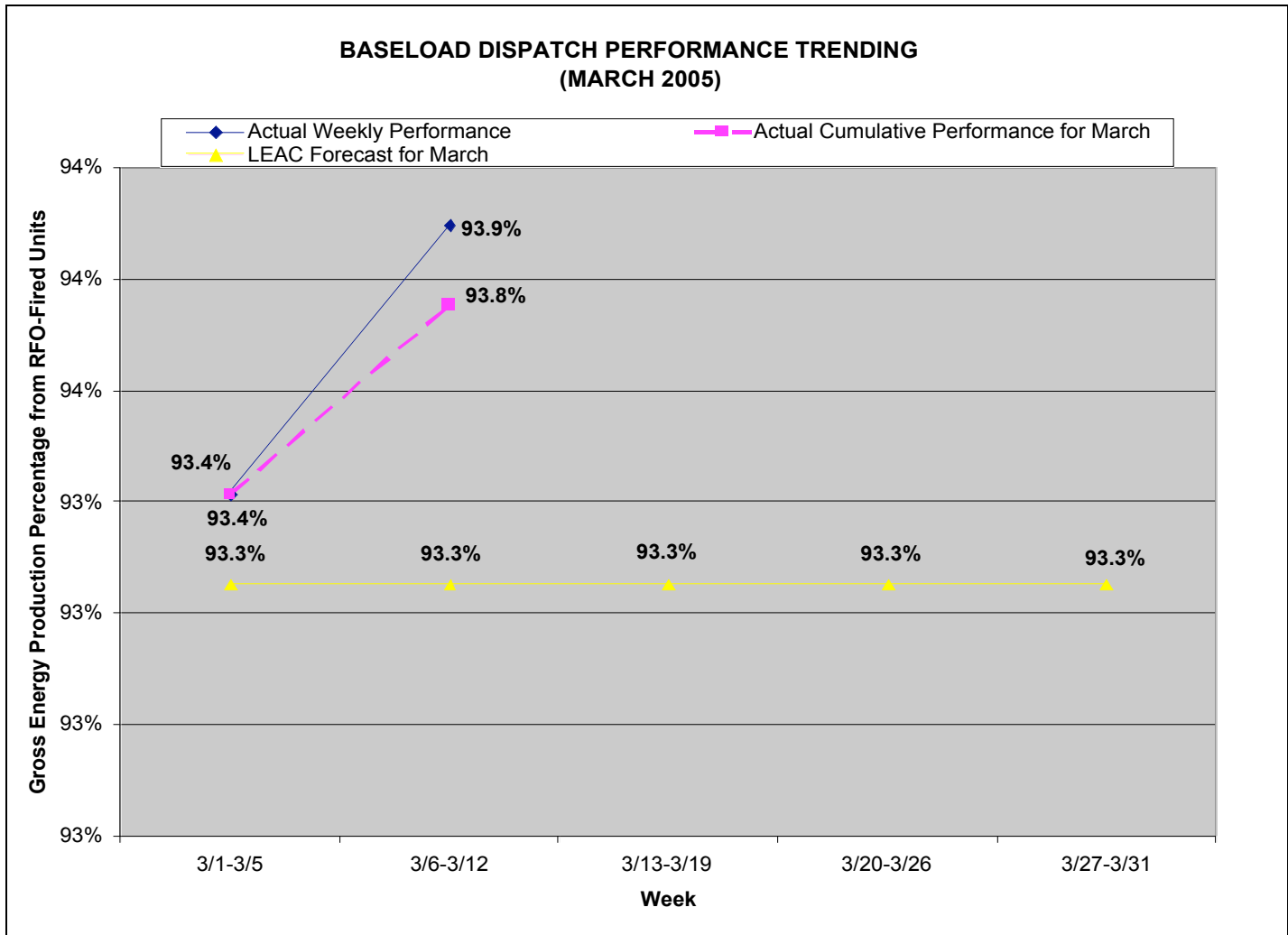


Figure 5. RFO-fired Unit Dispatch Performance Trending Chart –
Monthly Example - Actual Versus LEAC Projection

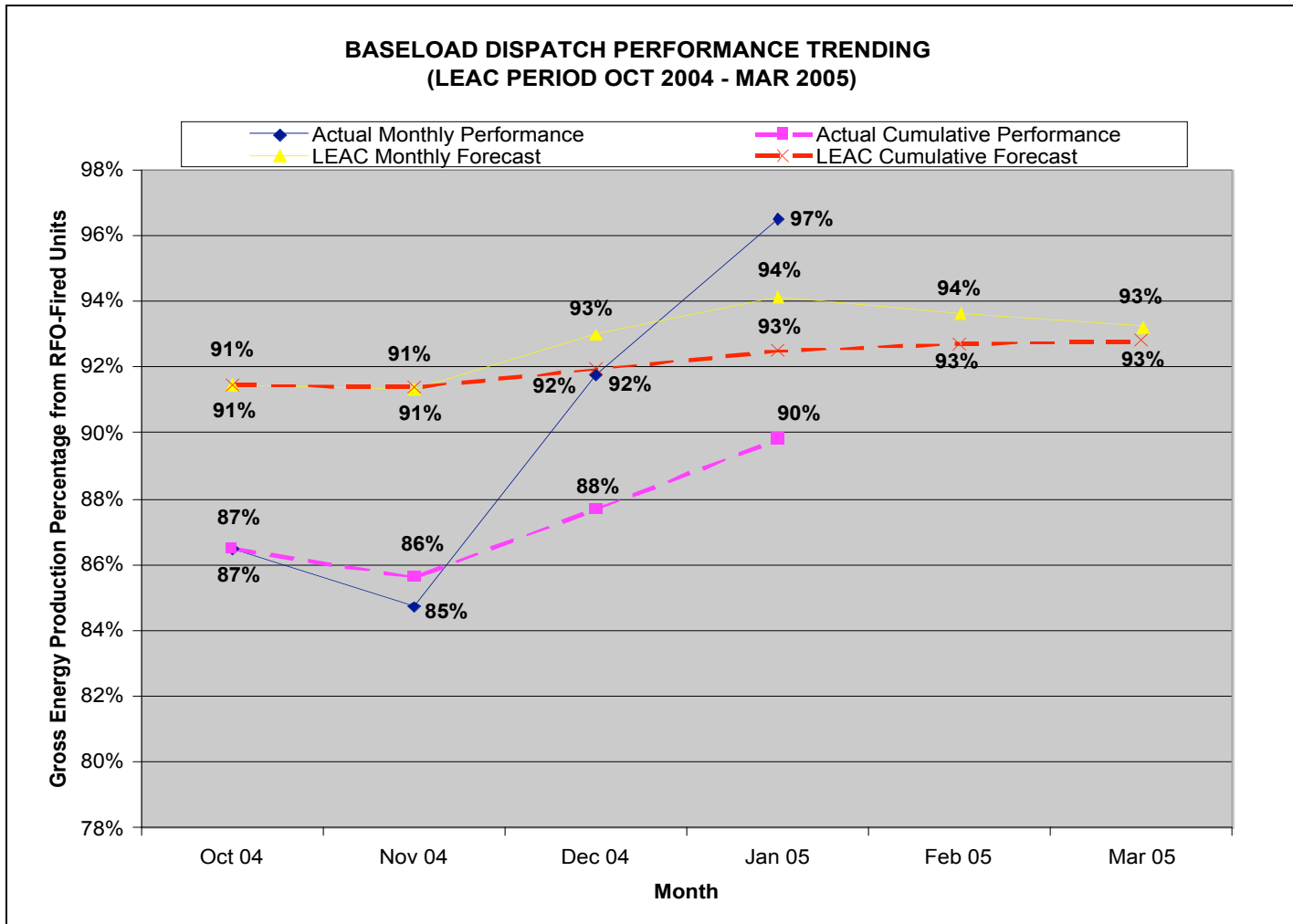
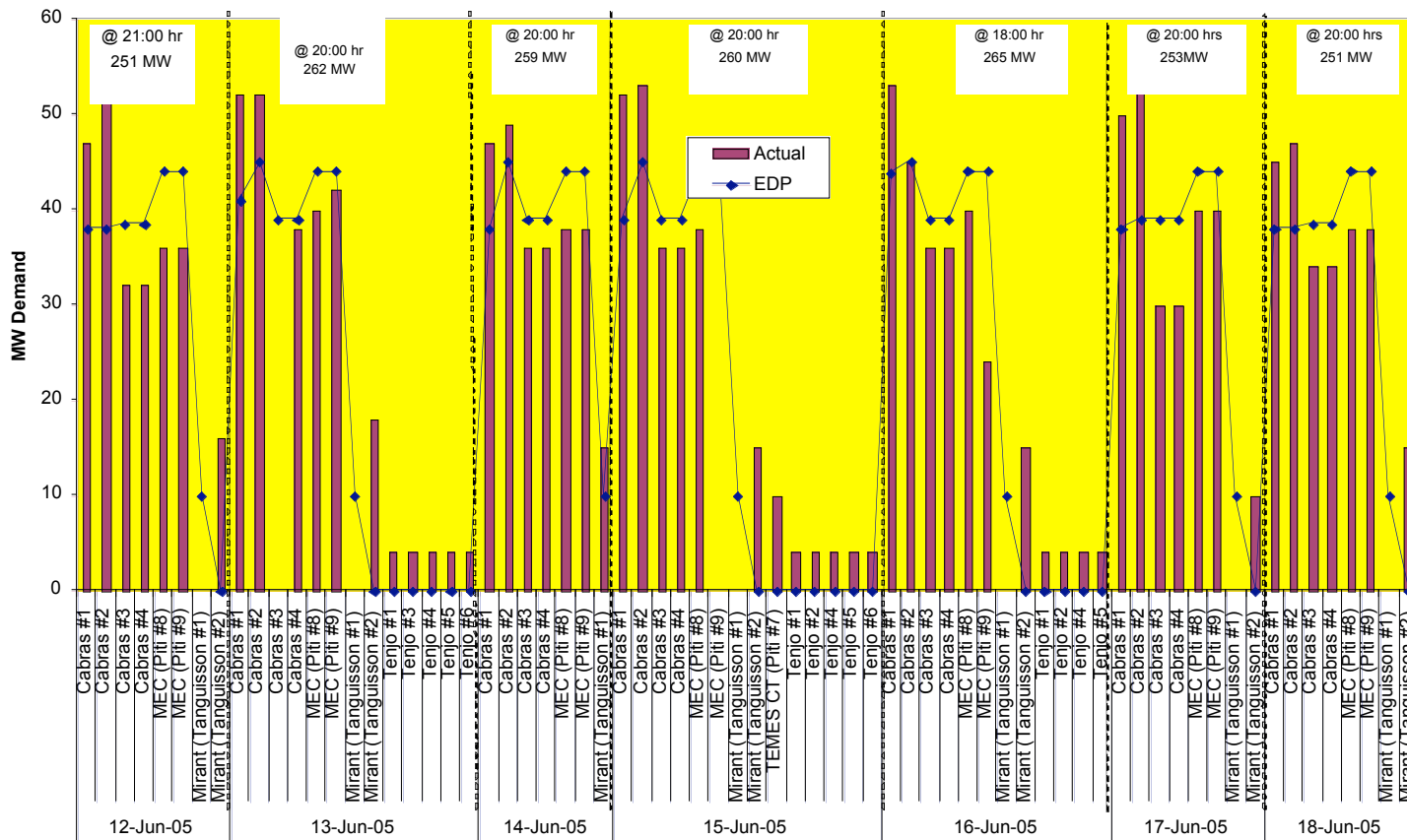


Figure 6. RFO-fired Unit Dispatch Performance Trending Chart –
LEAC Period Example - Actual versus LEAC Projection



06/13/05 @ 0319-2350 hours, Cabras #3 offline for scheduled work.
 06/17/05 @ 0834-1437 hours, Cabras #4 offline for fuel leak repair.
 06/15/05 @ 0526 to 06/16/05 @ 1700 hour, MEC#9 offline for scheduled shutdown.

Tanguisson #1 not available.
 Tenjo units needed due to Cabras and MEC outages.

Figure 7. IWPS EDP Dispatch Performance Trending Chart –
 Peak Demand Example - Actual versus Economic Dispatch Plan

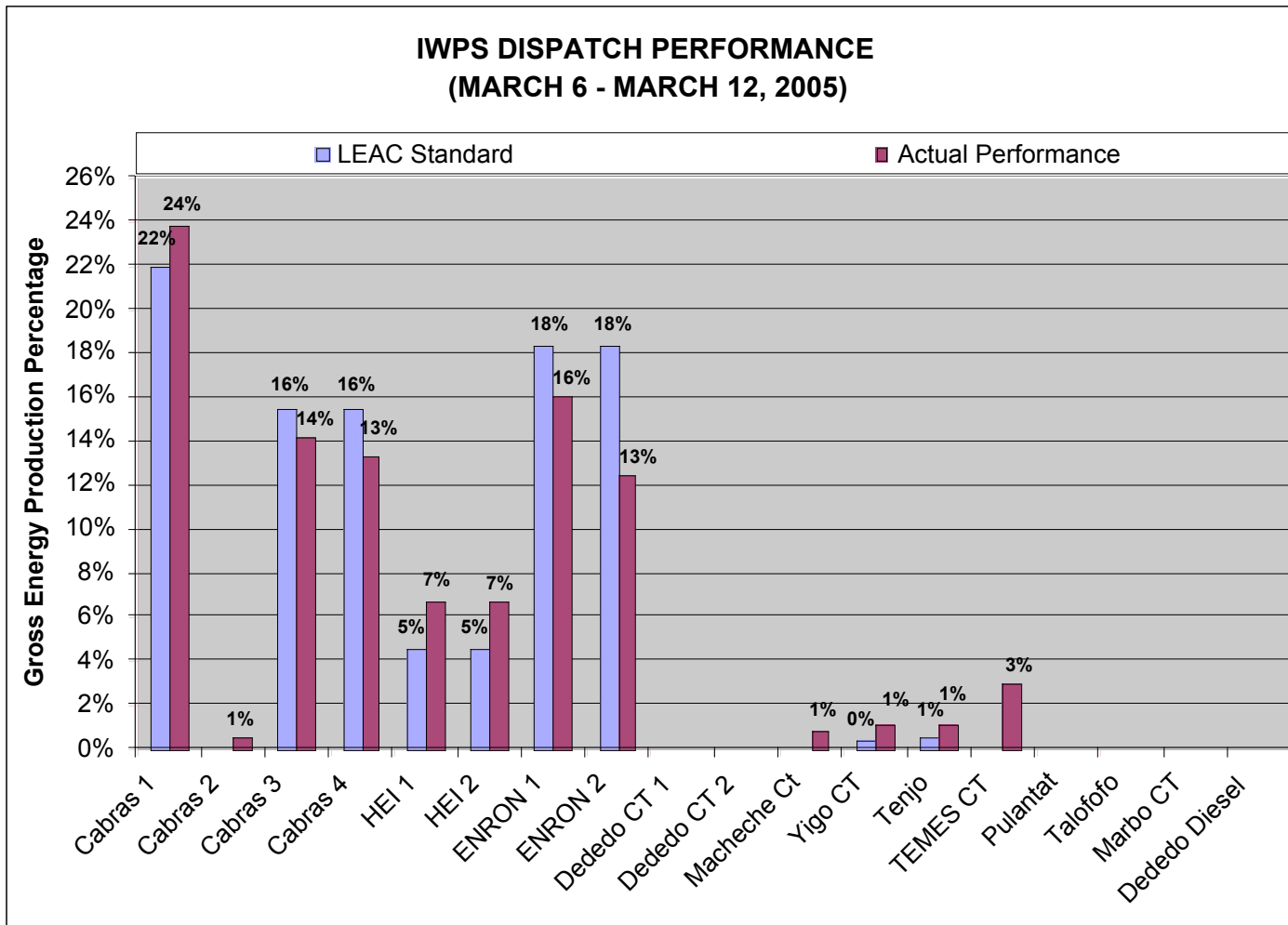


Figure 8. IWPS LEAC Dispatch Performance Trending Chart–
Weekly Performance Example - Actual versus LEAC Projection

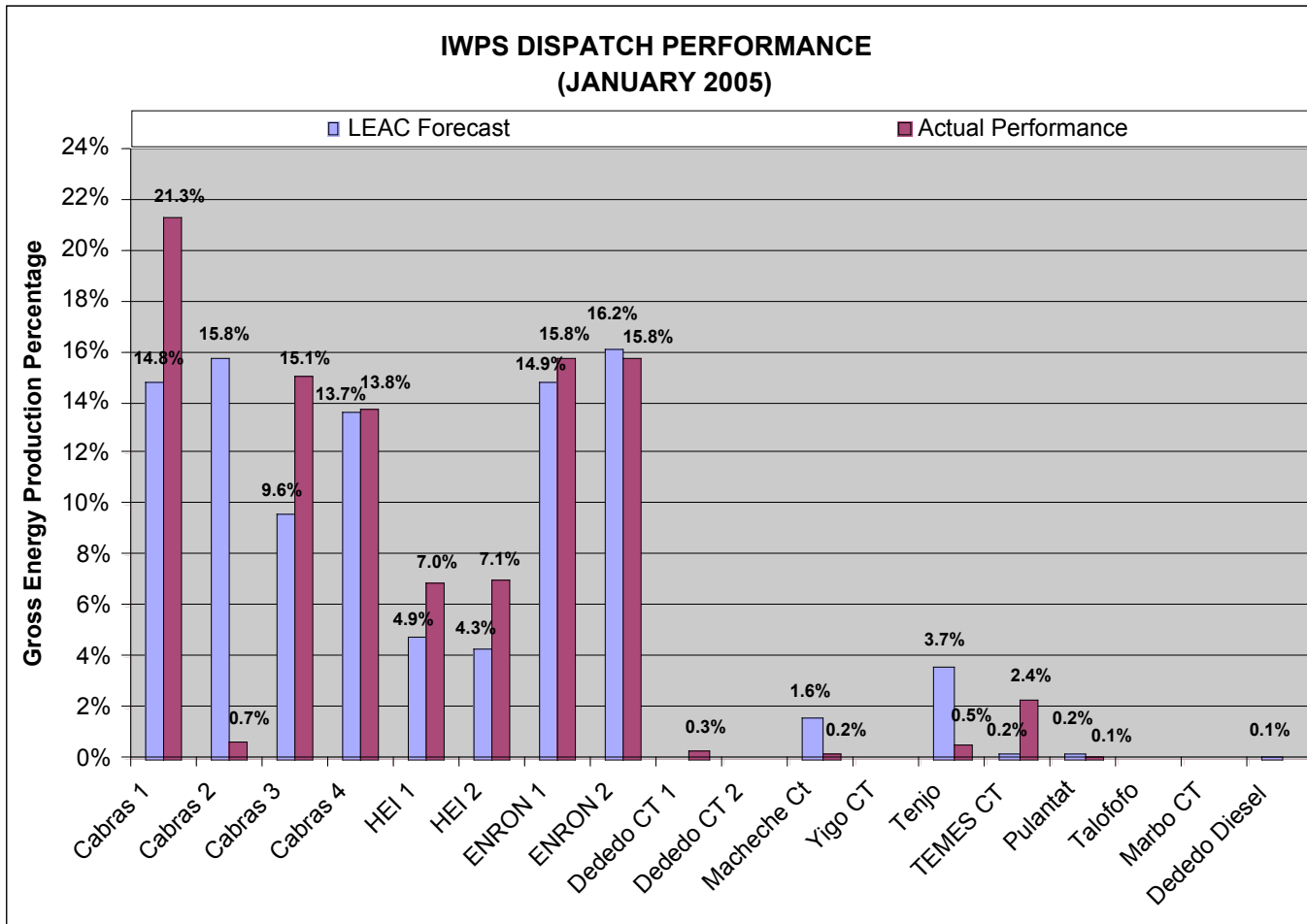


Figure 9. IWPS LEAC Dispatch Performance Trending Chart–
Monthly Performance Example - Actual versus LEAC Projection

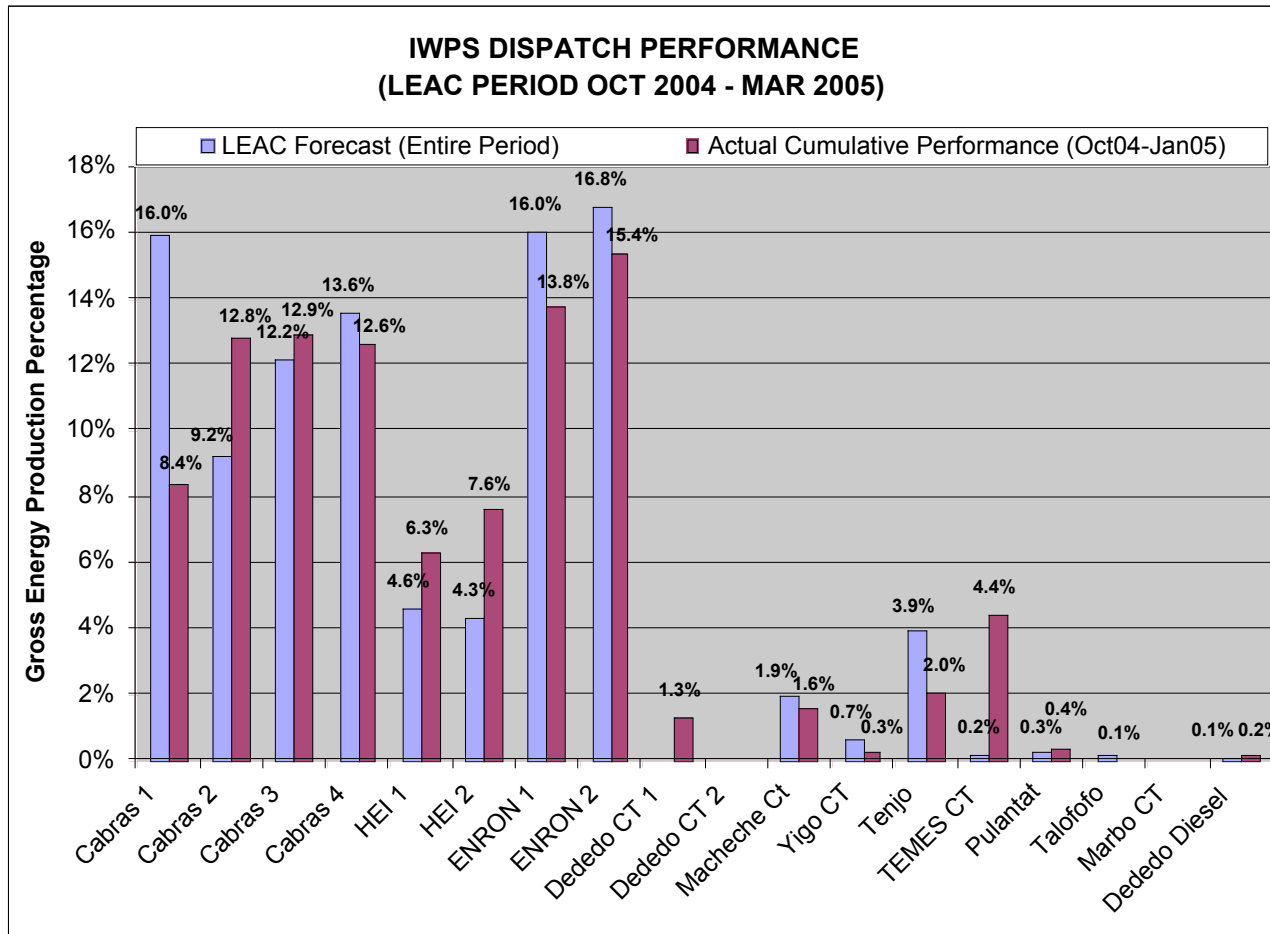


Figure 10. IWPS LEAC Dispatch Performance Trending Chart –
LEAC Period Performance Example - Actual versus LEAC Projection

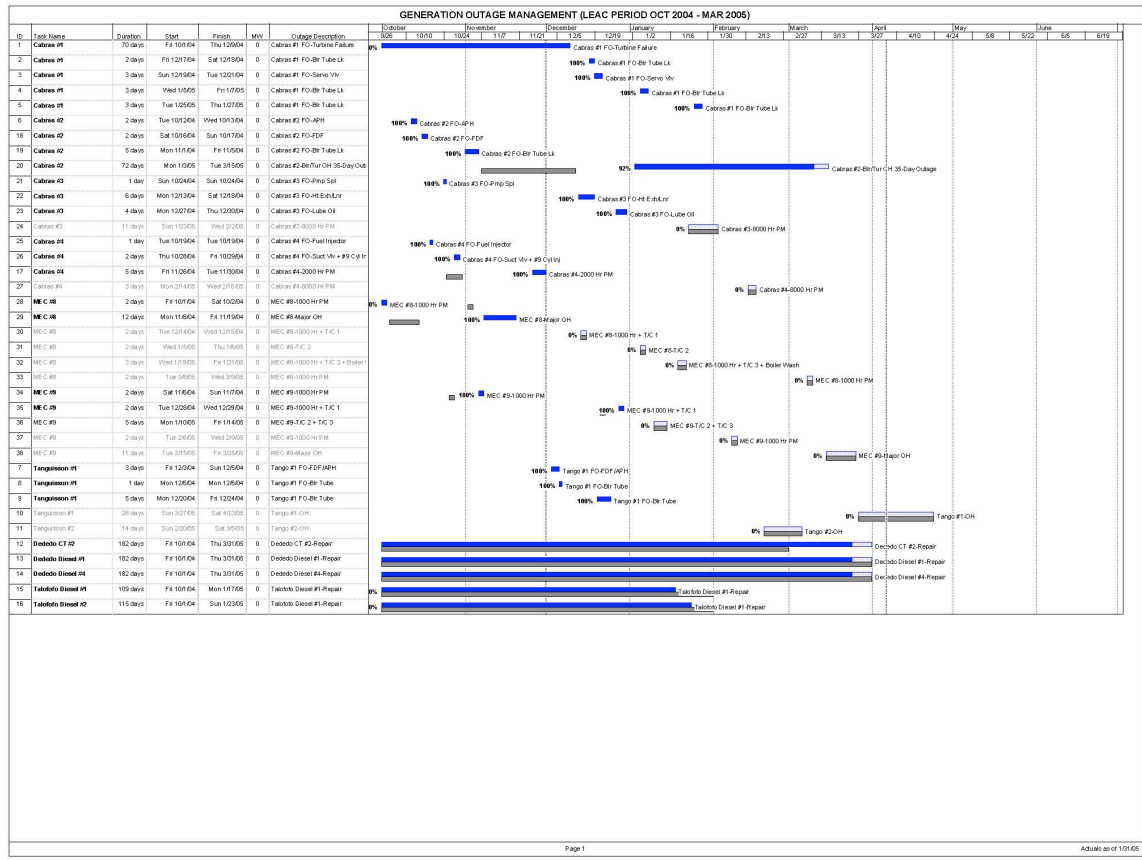


Figure 11. Generation Outage Management Performance Chart–
LEAC Period Performance Example

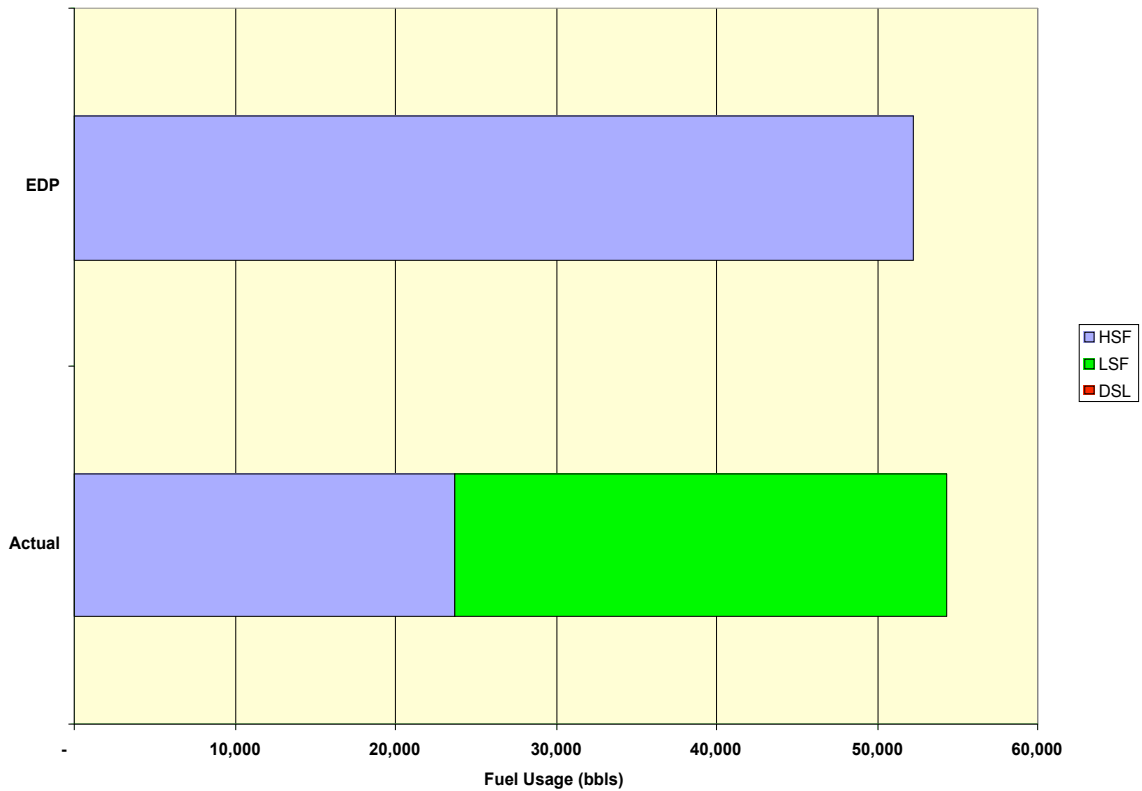


Figure 12. Fuel Use Performance Chart Example

5 Where is this Leading GPA?

Over the current LEAC period, energy production from RFO-fired units is close to 98% of total production. This has a tremendous implication for the rate payer. If over the same period, GPA maintained its previous 83% historical performance, rate payers would have realized an additional \$4.5 million in fuel costs.

Although GPA's processes are still evolving and improving, GPA hopes to move towards performance-based rates in order to institutionalize good practice beyond the current management. GPA would garner bonuses or penalties based upon its performance. These bonuses or penalties would be allocated to key employees. This would better serve the ratepayer and GPA by institutionalizing performance standards. This will ensure that high performance is met beyond the current management.

About the Authors

Jennifer G. Sablan is a Special Projects Engineer – Mechanical under GPA’s Strategic Planning & Operations Research Division. She has ten years in GPA’s Generation Division. Jennifer received her B.S.M.E. at Marquette University. Sablan is currently detailed to the Generation Division as the Assistant Manager for Generation. She was recognized by then General Manager, John M. Benavente, P.E., for her technical and managerial skills and spent the better part of a year with the executive office as part of GPA’s mentorship program. Sablan has also held detail appointments as Acting Generation Manager. She is the first woman to act in the capacity of Assistant Generation Manager and Generation Manager.

Lorraine O. Shinohara, P.E. is a Special Project Engineer – Electrical working for GPA’s Strategic Planning & Operations Division (SPORD). She earned her B.S.E.E. at University of California, Los Angeles (UCLA). After graduation she was hired by Guam Power Authority and worked six years in the Distribution section of the Engineering Division. For the past year and a half, Lorraine has worked for SPORD where she quickly became the lead engineer for economic dispatching and LEAC support. As part of SPORD, Shinohara has broadened her skills into other areas including the development of an Asset Management software application currently being used by the Engineering Division. SPORD seeks multi-disciplined engineers seeking to work at all levels of GPA.

Barbara C. Cruz, P.E. is a Special Project Engineer – Electrical working for the GPA’s Power System Control Center. She supervises the engineering section and supports SCADA/EMS operations at PSCC. She and **Henry Pilayan, an Engineer I**, perform economic dispatch planning and provide the LEAC control charts vital for monitoring and controlling the prudent fuel use process. After obtaining her B.S.E.E. at the University of Oklahoma, Barbara spent five years at Boeing Aerospace Operations in Norman, Oklahoma. At Boeing Aerospace, Barbara was the chief architect for the E-3 and E-4B aircraft environmental cooling system simulation package. She also was the project engineer for the E-3 and E-4B computerized maintenance management system where she created the underlying database and supporting software applications. Barbara began at GPA in 1992 where she headed the Authority’s Demand-side Management Program. While at GPA, she was also responsible for construction and operation of GPA’s Cabras-Piti Meteorological Monitoring Station in support of air permit studies for Cabras 3&4. Recently, until 2004, she served as one of GPA’s system protection engineers and completed GPA’s Harmon substation automation project.

Joyce Sayama, MBA is Management Analyst III at Guam Power Authority. She is instrumental in overseeing and supporting the Guam Power Authority General Manager and SPORD with executive projects and most especially with issues regarding the Guam Public Utilities Commission (PUC). Joyce is involved in the CCU General Manager’s renewable energy initiative. She earned her Bachelor of Business Administration and Master of Business Administration at the University of Guam. She has worked in both

operations and administration divisions within the authority. Her tenaciousness in tracking down errant information providers and in overall coordination as part of the SWAC team is much appreciated.

John J. Cruz, Jr., P.E. is Manager of the Strategic Planning & Operations Research Division at Guam Power Authority (SPORD). His work experience includes almost seven years at Hughes Aircraft Company where worked on projects including NASA's Magellan Mission and the radar system B2 long range bomber. He began at Guam Power Authority in 1991. At the Guam Power Authority, his experience includes SCADA/EMS, software development, project management power system engineering studies including long range transmission planning and integrated resource planning, Performance Management Contracting and information technology infrastructure projects. He is proud to be working with some of the best talent at GPA. He credits a lot of his success to some talent, a lot of luck, a compassionate management, and a great supporting cast.

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