# RECLAMATION
*Managing Water in the West*

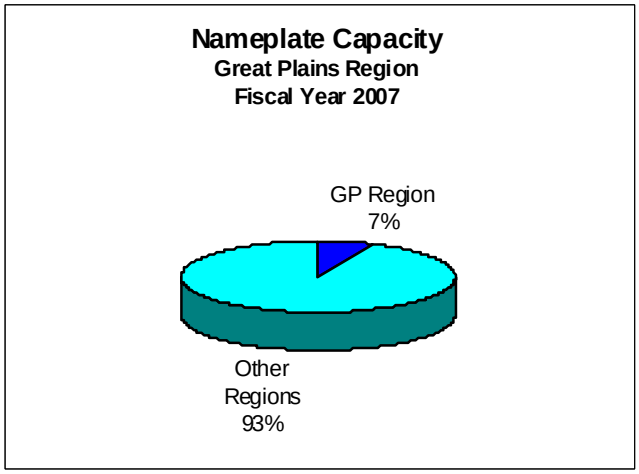
# Great Plains Region Power Performance

## For Fiscal Year 2007

**U.S. Department of the Interior**
**Bureau of Reclamation**

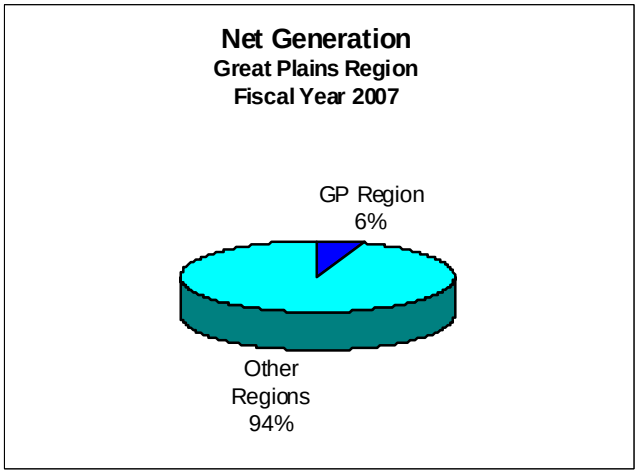
# Great Plains Regional Power Profile

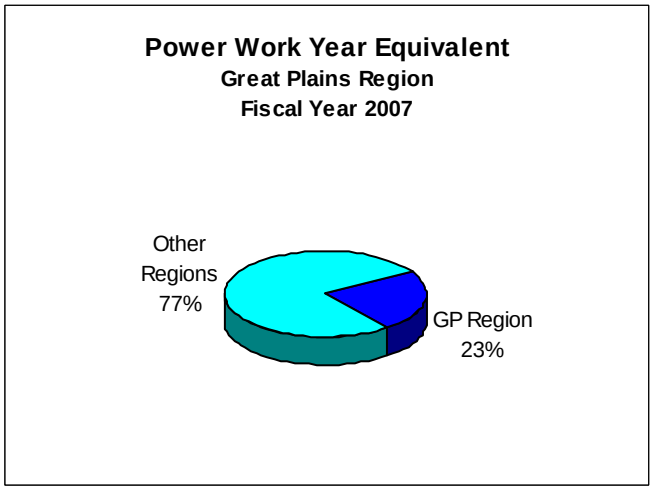
The Great Plains Regional Office is located in Billings, Montana. The regional office oversees the operation of 21 powerplants: Alcova, Big Thompson, Boysen, Buffalo Bill, Canyon Ferry, Estes, Flatiron, Fremont Canyon, Glendo, Green Mountain, Guernsey, Heart Mountain, Kortes, Marys Lake, Mt. Elbert, Pilot Butte, Pole Hill, Seminoe, Shoshone, Spirit Mountain, and Yellowtail.




The total rated nameplate capacity for the Great Plains Region in fiscal year 2007 was 1,004 megawatts, which comprises 7 percent of the Reclamation total rated nameplate capacity.

In fiscal year 2007, the Great Plains Region produced a total net generation of 2,283 net gigawatt-hours. This comprises 6 percent of the total net generation for Reclamation.

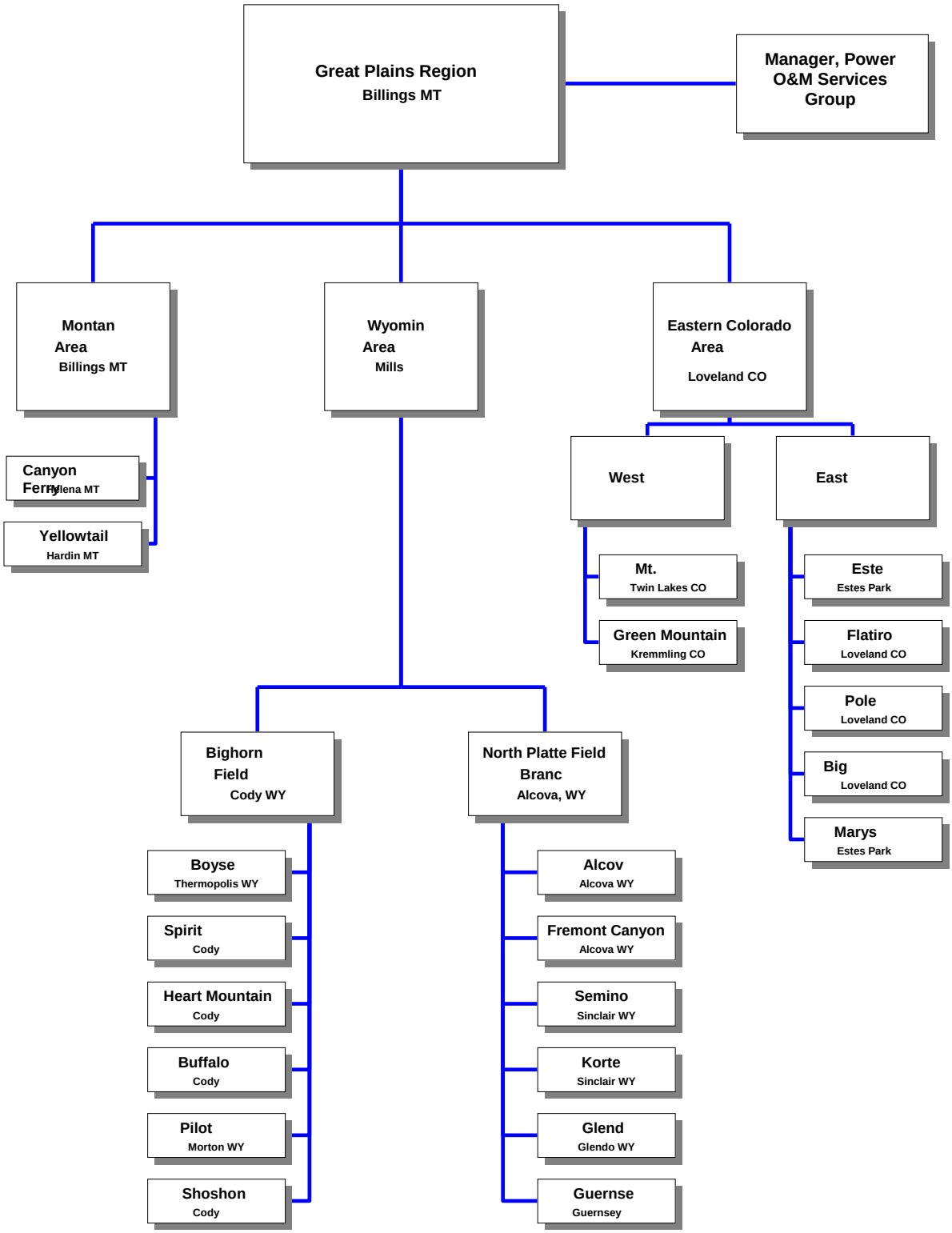



In fiscal year 2007, the Great Plains Region employed 25 percent of the total work year equivalents worked at Reclamation power facilities.

Thirty-six percent of Reclamation's power facilities are located in this region. It should be noted that multiple small capacity units require more staff than a single unit with equal or greater capacity. Also the geographic distribution of the hydropower facilities within this region impacts staff utilization and travel costs.

Great Plains Region organizational structure:




This organizational structure displays the offices directly involved with the power program.

| | |
|---|---|
| Regional Office: | Bureau of Reclamation<br>Great Plains Regional Office<br>316 North 26th Street<br>Billings MT 59101-1362<br><br>Mike Ryan<br>Regional Director, GP-1000<br>(406) 247-7600 |
| Power O&M Services Group: | Mike Ferguson, GP-2000<br>(406) 247-7705 |
| Eastern Colorado Area Office: | Eastern Colorado Area Office<br>11056 West County Road 18E<br>Loveland CO 80537, 9711<br><br>Mike Collins, EC-1000<br>(970) 667-4300 |
| Montana Area Office: | Montana Area Office<br>PO Box 30137<br>Billings MT 59107-0137<br><br>Dan Jewell, MT-1000<br>(406) 247-7298 |
| Wyoming Area Office: | Wyoming Area Office<br>PO Box 1630<br>Mills WY 82644<br><br>John Lawson, WY-1000<br>(307) 261-5671 |

WASHINGTON
OREGON
IDAHO
MONTANA
Canyon Ferry
Yellowtail
WYOMING
Spirit Mtn.
Shoshone
Buffalo Bill
Heart Mtn.
Boysen
Pilot Butte
Alcova
Fremont Canyon
Kortes
Seminoe
Glendo
Guernsey
NEVADA
UTAH
COLORADO
Big Thompson
Flatiron
Pole Hill
Estes
Marys Lake
Green Mountain
Mt. Elbert
CALIFORNIA
ARIZONA
NEW MEXICO

# Alcova Powerplant
# Kendrick Project

**Plant Contact:**
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Area Manager
Wyoming Area Office

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Alcova WY

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Fax: (307) 261-5683

**E-Mail Address:**
jlawson@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The President approved the Kendrick Project on August 30, 1935. The Alcova Powerplant was authorized for construction on August 22, 1950, under the provisions of section 9(a) of the Reclamation Project Act of 1939. Originally known as Casper-Alcova, the project was renamed Kendrick in 1937.

**Project Purposes:** The Kendrick Project conserves the waters of the North Platte River for irrigation and electric power generation. The project is a multiple-purpose development with storage at Seminoe Reservoir and diversion at Alcova Dam to project lands. Operation of the reservoirs and powerplants is integrated with other river basin developments.

**Plant Location:** Alcova Powerplant is located in Natrona County, Wyoming, on the North Platte River and about 10 miles downstream from Pathfinder Dam. The powerplant is on the right bank of the river opposite the toe of the dam.

**Plant Purpose:** Water from Alcova Dam is released for other irrigation rights downstream through the Alcova Powerplant or over a controlled spillway.

**Plant Facts:** The plant uses the 165-foot drop from the reservoir to the river for power generation. It consists of two units, each a 20,700-kilowatt vertical-shaft generator driven by a 26,500-horsepower turbine. The reservoir has a total capacity of 184,208 acre-feet, of which only the top 30,606 acre-feet is active capacity available for irrigation.

**Plant History:** Alcova Powerplant was authorized and built after Alcova Dam was completed in 1938. Construction of Alcova Powerplant was completed in 1955.

**Present Activities:** Normal Operations.

.

**Future Planned Activities:** The $CO_2$ fire suppression systems for the two generating units will be installed in FY-2008. The wicket gate greasing systems for both generating units will be installed in FY-2009.

**Special Issues:** None.

| | | | |
|---|---|---|---|
| **River:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 36,000 kW | **Installed Capacity:** | 41,400 kW |
| **Year of Initial Operation:** | 1955 | **Age:** | 52 years |
| **Net Generation (FY-2007):** | 91.3 GWh | **Rated Head:** | 165 feet |
| **Average Plant Factor (FY-2007):** | 25.5 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Peaking | | |

## Ancillary Services

**Alcova**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | No |
| Voltage Support | Yes |

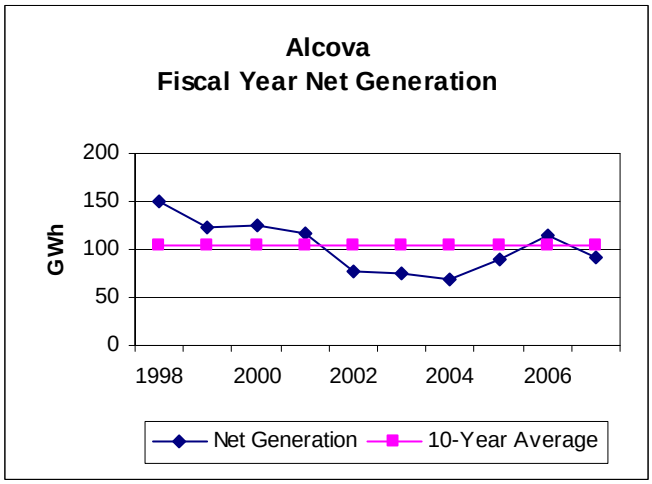
## Generators

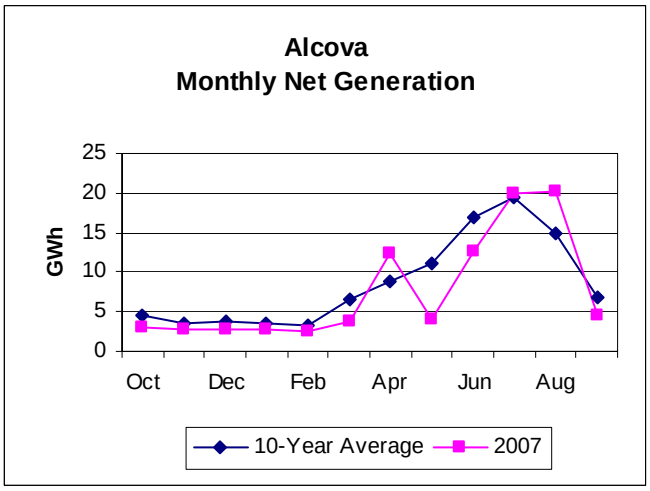
**Alcova Generators**
Existing Number and Capacity

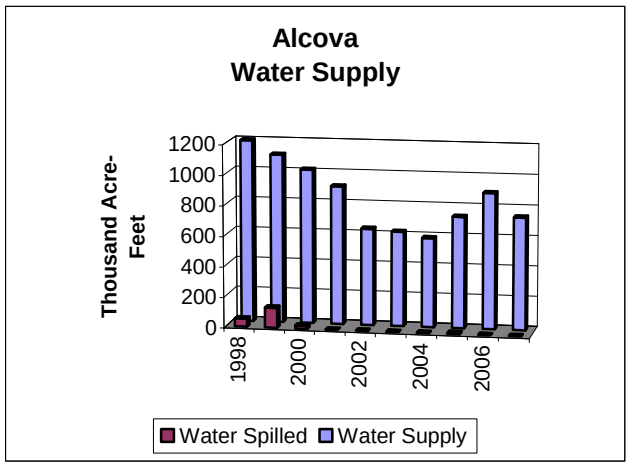
| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 18,000 | 2,700 | 20,700 |
| 2 | 18,000 | 2,700 | 20,700 |
| 2 units | 36,000 | 5,400 | 41,400 |

Units 1 and 2 were rewound in FY-2002 and FY-2001, respectively, for a 1.0 power factor which increased the rating per unit to 20,700 kW.

## Generation

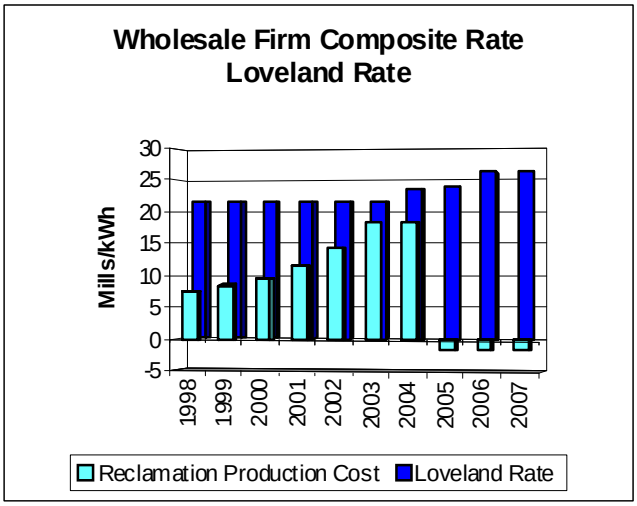

Alcova
Fiscal Year Net Generation
GWh
200
150
100
50
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Alcova
Monthly Net Generation
GWh
25
20
15
10
5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

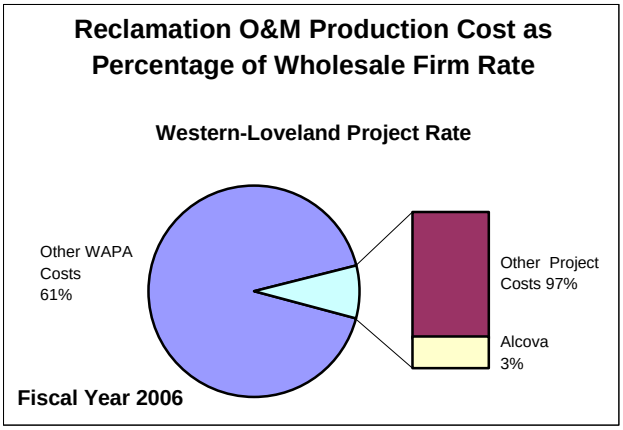

Alcova
Water Supply
Thousand Acre-Feet
1200
1000
800
600
400
200
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

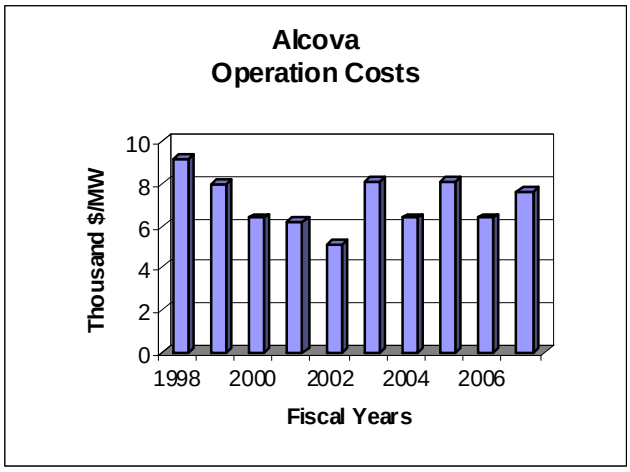
## Benchmark 1
## Wholesale Firm Rate

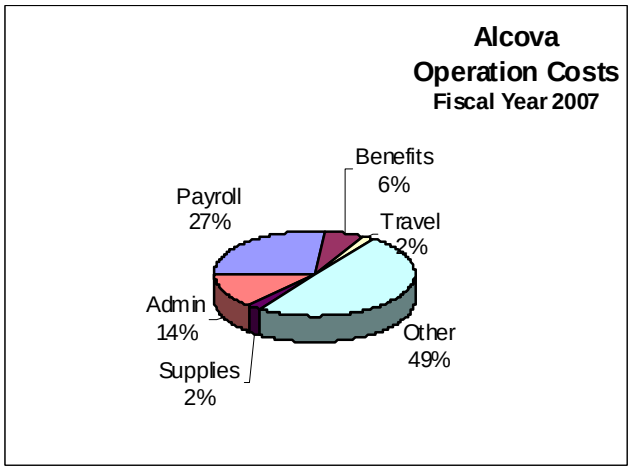


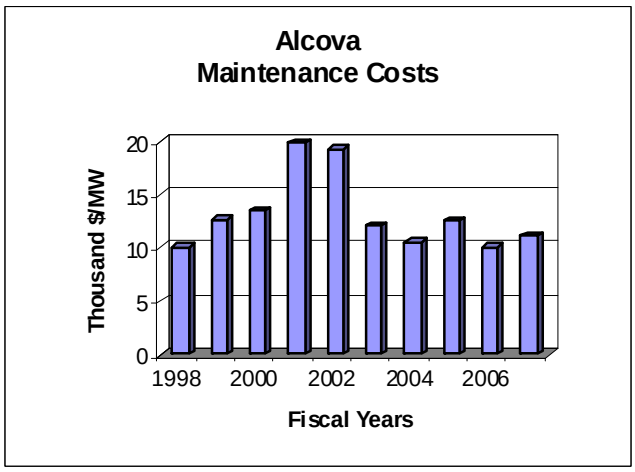

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

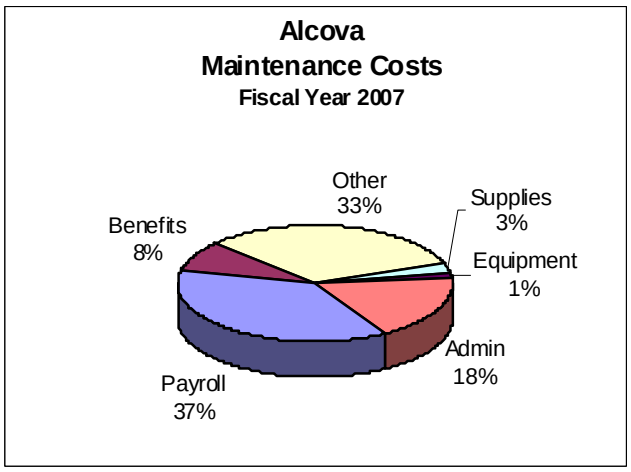


## Benchmark 3
## Production Costs



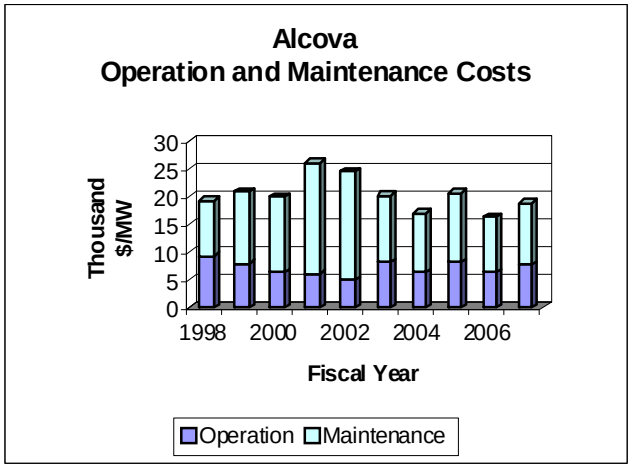



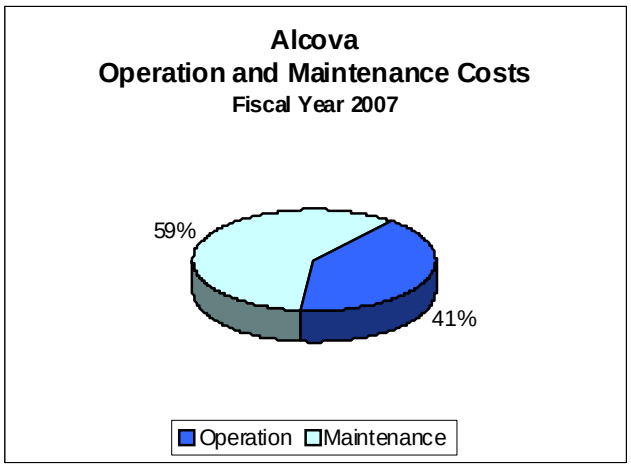



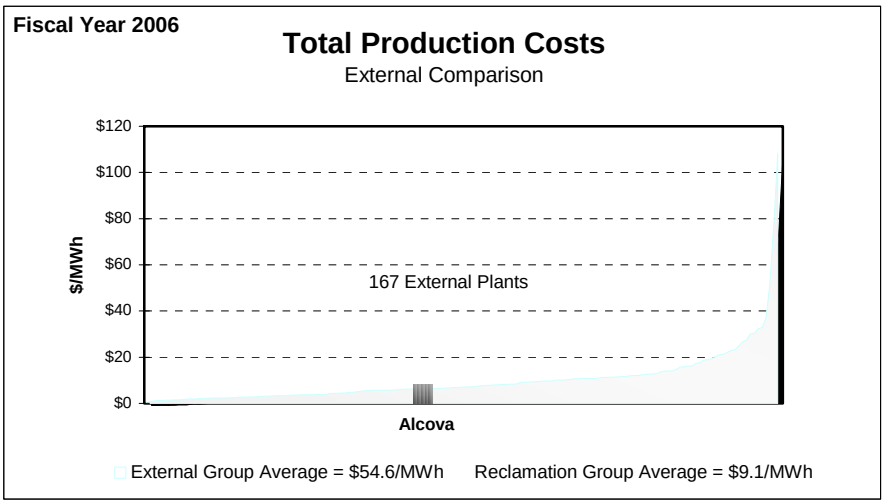



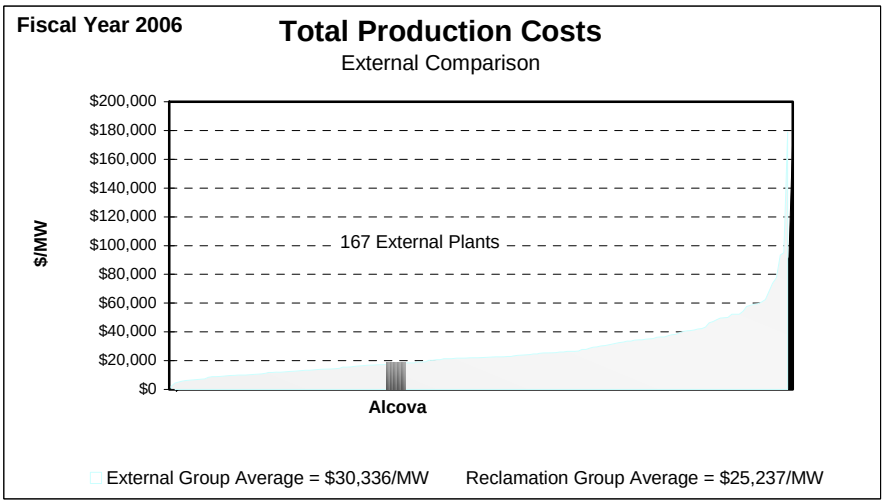

Overhaul of generator turbines in conjunction with rewind of Unit 2 in FY-2001 and Unit 1 in FY-2002.

## Benchmark 3
## Production Costs



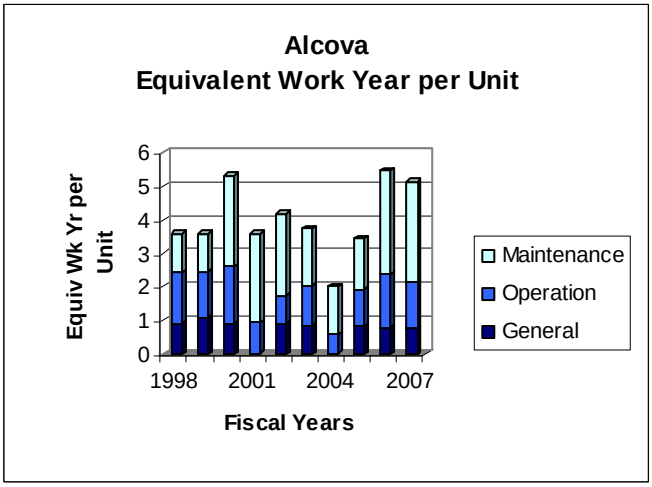



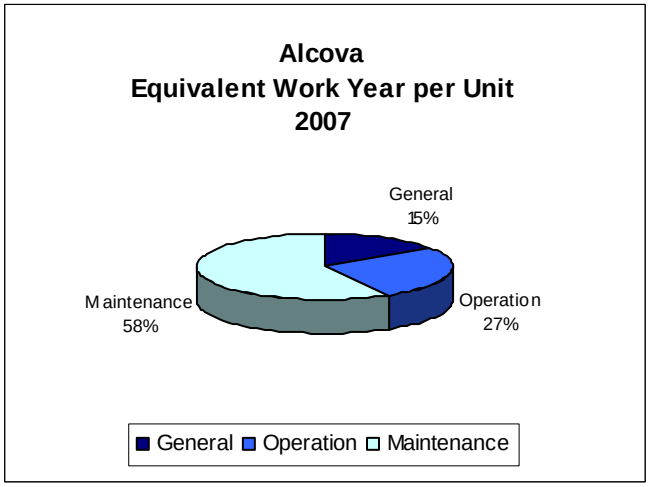



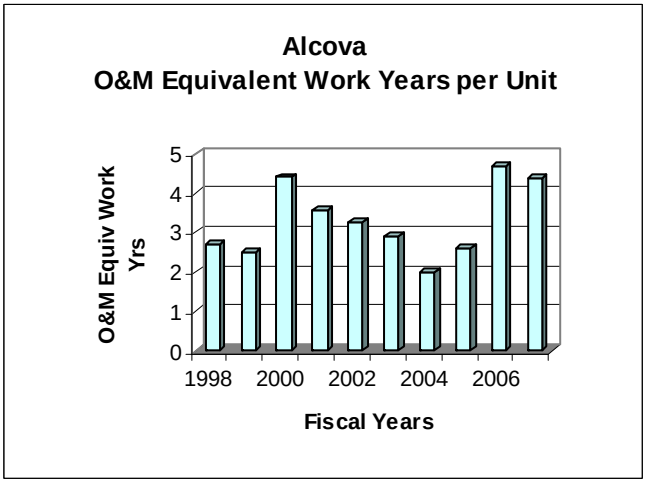
**Benchmark 4**
**Workforce Deployment**

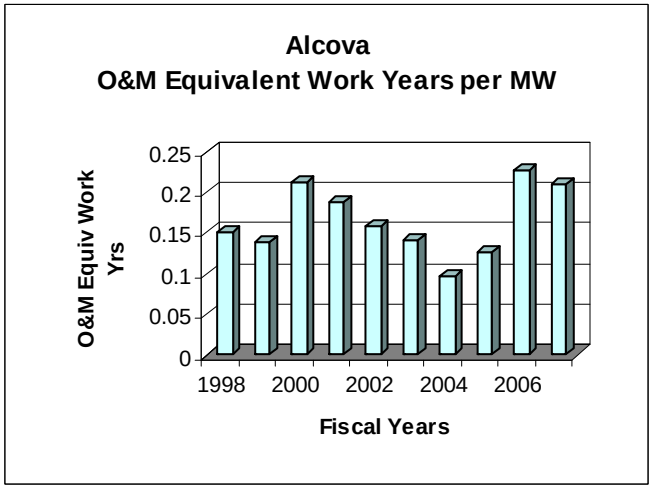
## Alcova FY 2007 Equivalent Work Staffing Year Levels

| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
|---|---|---|---|---|---|---|
| General | 1.36 | 0.15 | 0.04 | 1.55 | 0.78 | 0.04 |
| Operation | 2.45 | 0.28 | 0.00 | 2.72 | 1.36 | 0.07 |
| Maintenance | 5.39 | 0.61 | 0.00 | 6.00 | 3.00 | 0.14 |
| Total Staffing | 9.20 | 1.04 | 0.04 | 10.28 | 5.14 | 0.25 |

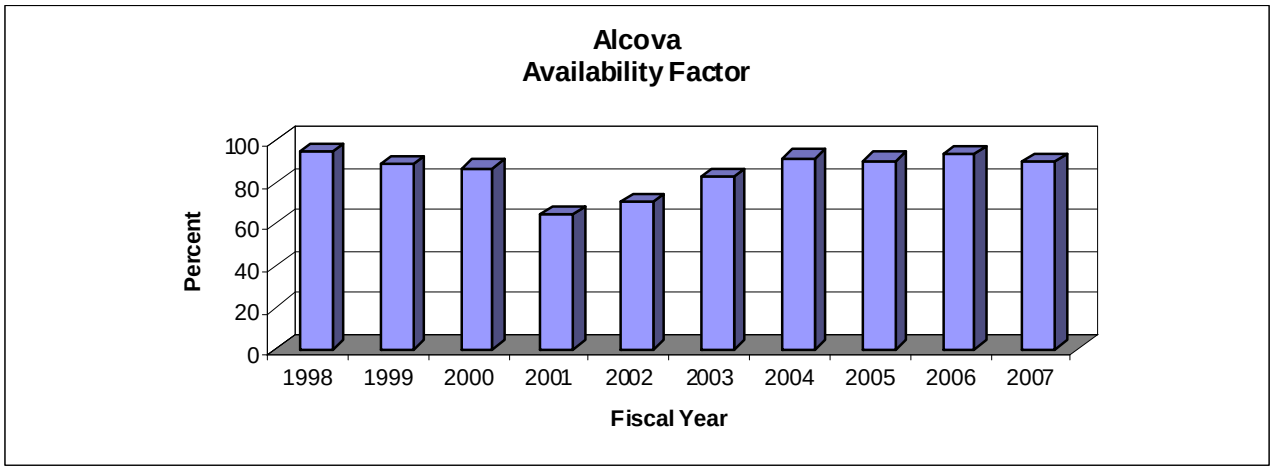


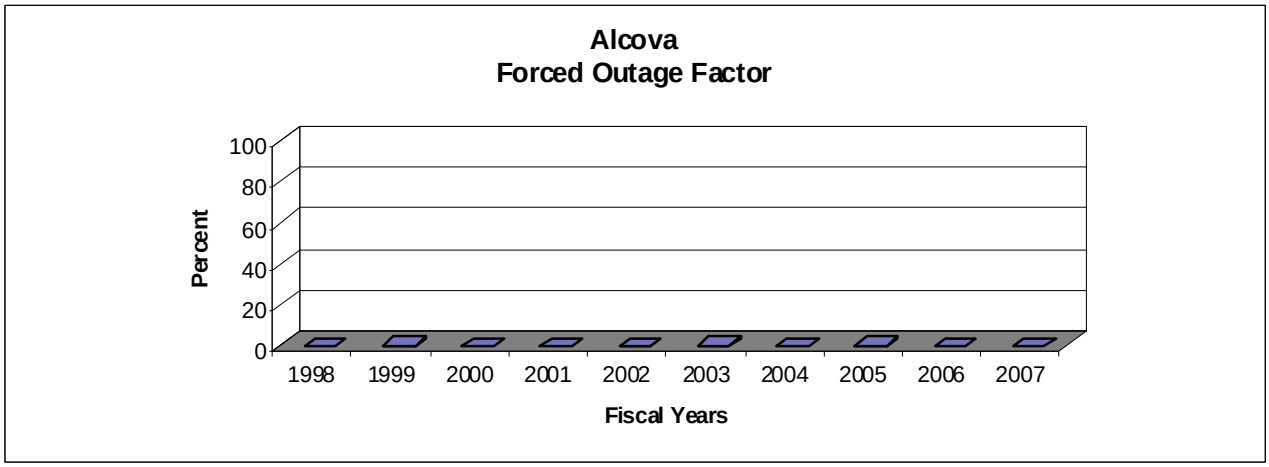



## Benchmark 5
## Plant Availability Factor

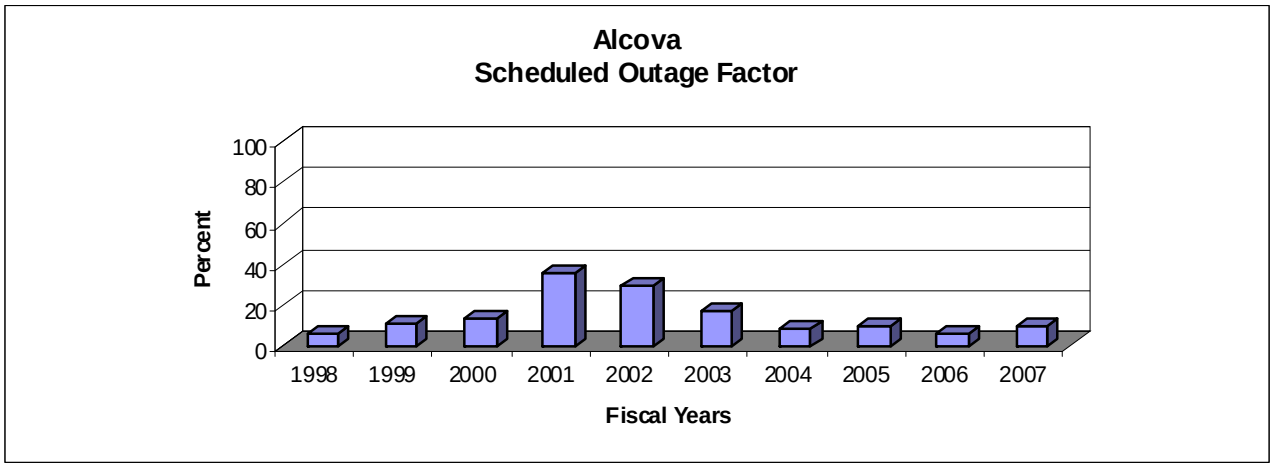



FY-2001 - Extended outage on Unit 2 for rewind and overhaul.
FY-2002 - Extended outage on Unit 1 for rewind and overhaul.

## Benchmark 6
## Plant Forced Outage Factor

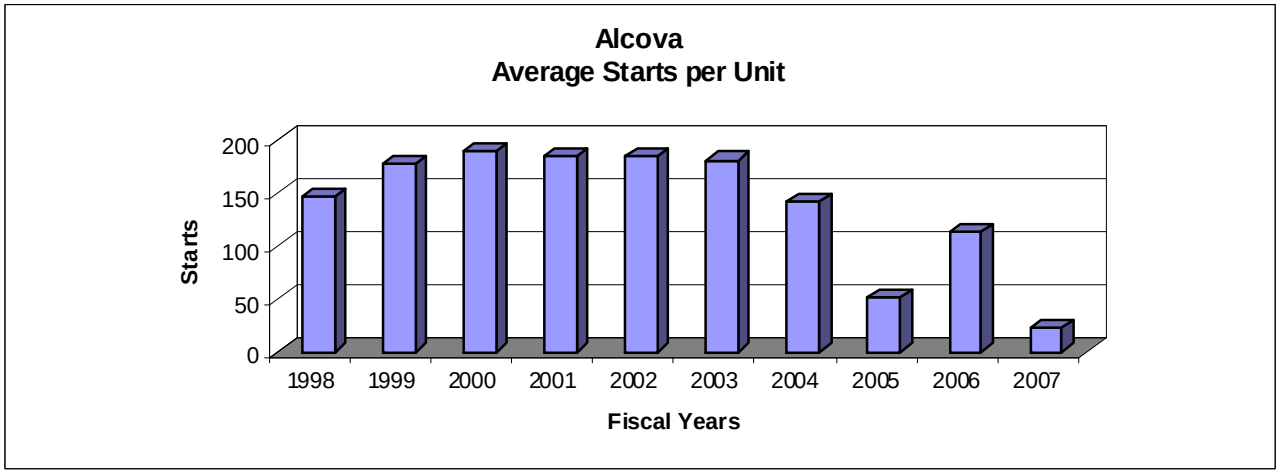


## Benchmark 7
## Plant Scheduled Outage Factor




FY-2001 - Extended outage on Unit 2 for rewind and overhaul.
FY-2002 - Extended outage on Unit 1 for rewind and overhaul.
FY-2003 - Unit 2 scheduled outage extended to rebuild governor after the annual inspection.

## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Alcova Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.8% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 8.5 | 7.8 | 2.8 | ***54.63 | 1.0 |
| **O&M Costs $/MW** | 18,745 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.10 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 90.2 | 81.3 | 82.3 | **88.3 | 98.5 |
| **Forced Outage Factor** | 0.1 | 0.2 | 2.6 | **1.8 | 0.0 |
| **Scheduled Outage Factor** | 9.7 | 18.5 | 15.1 | **9.9 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Big Thompson Powerplant
# Colorado-Big Thompson Project

**Plant Contact:**
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Chief, O&M
Flatiron Powerplant

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Loveland CO 80537-9711

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Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** First construction funds were provided by the Interior Department Appropriation Act of August 9, 1937 (50 Stat. 595). The President approved the Secretary's finding of feasibility on December 21, 1937.

**Project Purposes:** The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities.

**Plant Location:** Big Thompson Powerplant is located in Larimer County on the Big Thompson River about 9 miles west of Loveland, Colorado, and just downstream from the river crossing of the Charles Hansen Feeder Canal.

**Plant Purpose:** Hydroelectric power is generated for the Colorado-Big Thompson Project. Water is taken from Flatiron Reservoir, passed through Big Thompson Powerplant, and returned to the Big Thompson River, as needed.

**Plant Facts:** The plant operates under an effective head of 180 feet and has a generating capacity of 4,500 kilowatts.

**Plant History:** The water and power control center for the Colorado - Big Thompson Project's reservoirs, powerplants, and transmission lines in Wyoming, Colorado, and western Nebraska is located in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation powerplants.

**Present Activities:** Projects include a new plant fire alarm system, unit excitation system replacement, a new access bridge, and repairs to the Dille Diversion structure.

**Future Planned Activities:** Plant remote control (RTU SCADA and fiber communication) upgrades are planned to be completed in FY 2010. An upgrade to the governor is planned for FY 2013. Installation of online condition monitoring is planned for FY 2013. Turbine runner and wear ring replacement and a unit overhaul are scheduled to start in FY 2014.

**Special Issues:** The powerplant is only used on a seasonal basis, primarily during spring runoff and summer water deliveries.

| | | | |
|---|---|---|---|
| **River:** | Colorado River and Big Thompson River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 4,500 kW | **Installed Capacity:** | 4,500 kW |
| **Year of Initial Operation:** | 1959 | **Age:** | 48 years |
| **Net Generation (FY-2007):** | 1.8 GWh | **Rated Head:** | 180 feet |
| **Average Plant Factor (FY-2007):** | 4.8 percent (seasonal) | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Big Thompson**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | No |

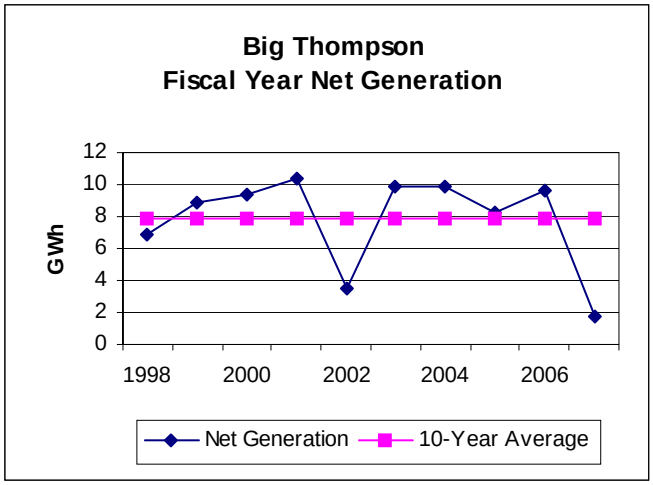
## Generators

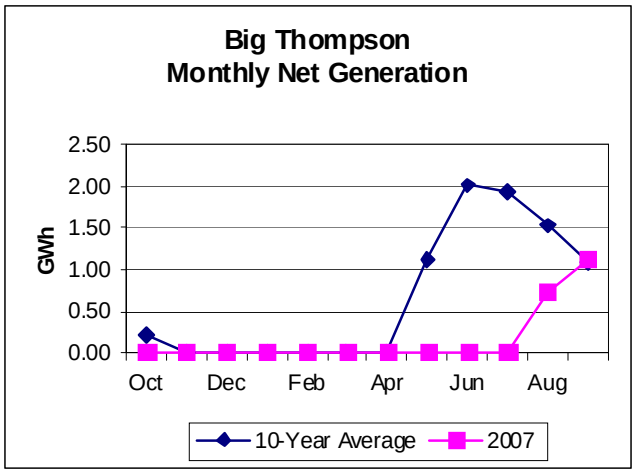
**Big Thompson Generators**

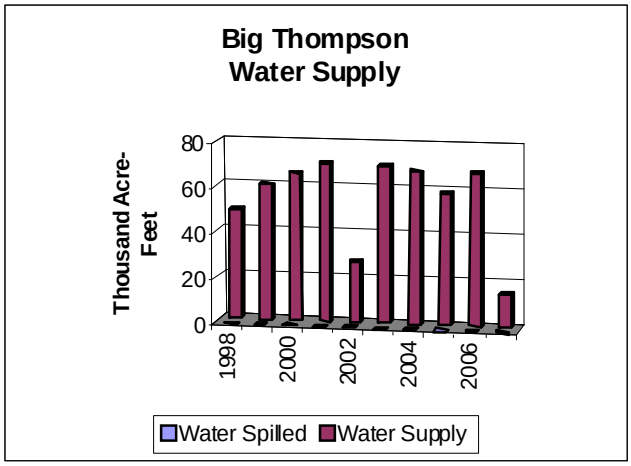
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 4,500 | - | 4,500 |
| 1 Unit | 4,500 | - | 4,500 |

## Generation

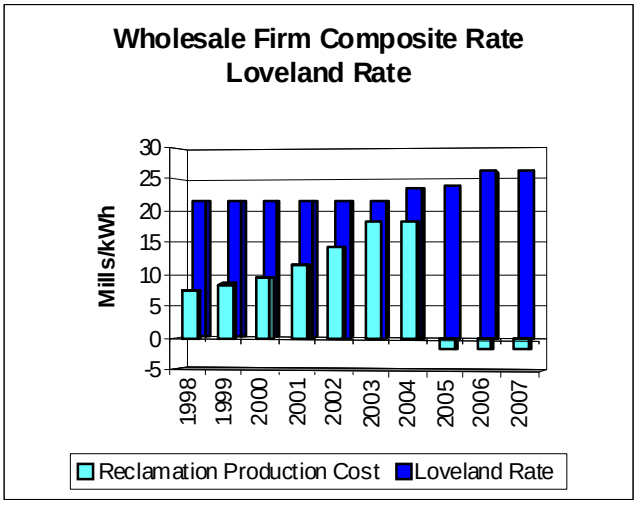

Big Thompson
Fiscal Year Net Generation
GWh
12
10
8
6
4
2
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Big Thompson
Monthly Net Generation
GWh
2.50
2.00
1.50
1.00
0.50
0.00
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

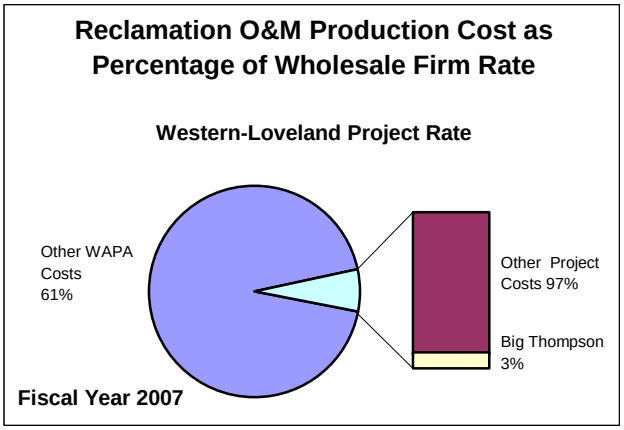

Big Thompson
Water Supply
Thousand Acre-Feet
80
60
40
20
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

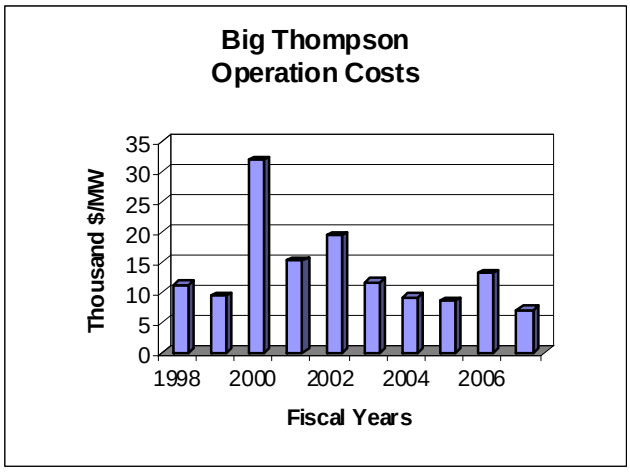
## Benchmark 1
## Wholesale Firm Rate

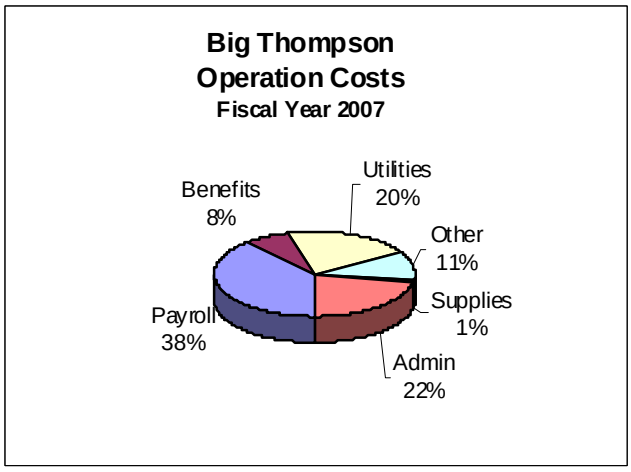


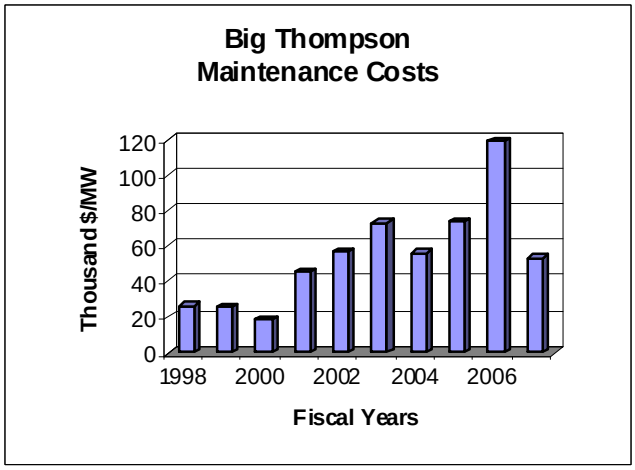

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

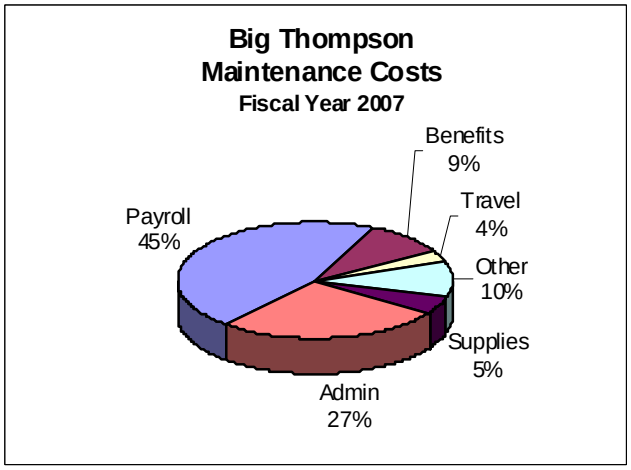


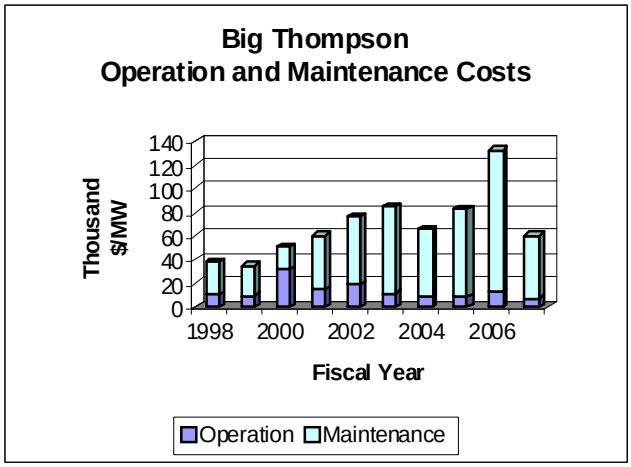
## Benchmark 3
## Production Costs

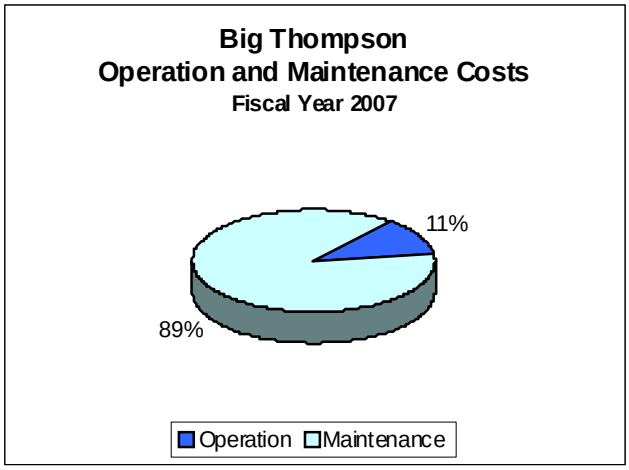


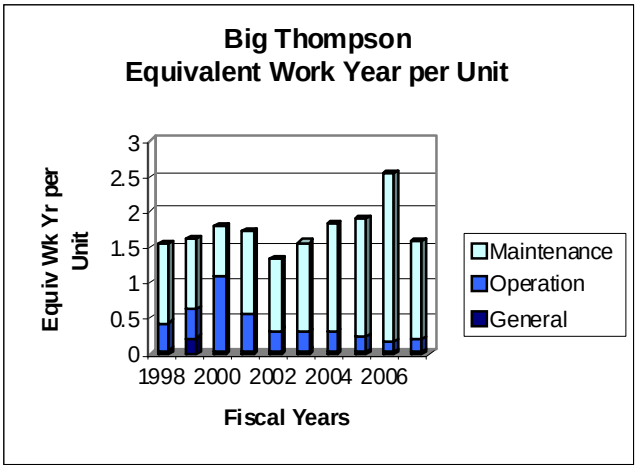



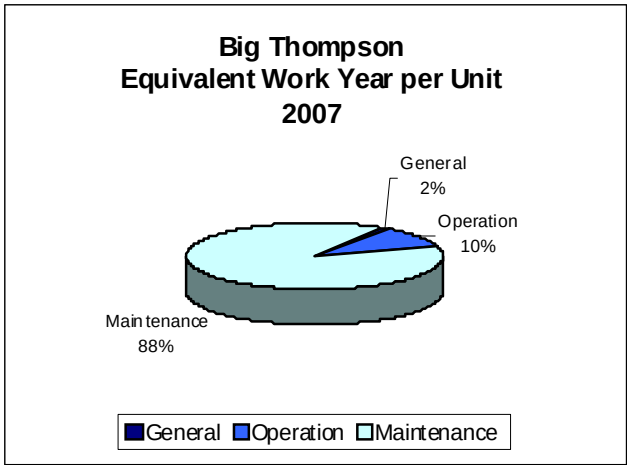



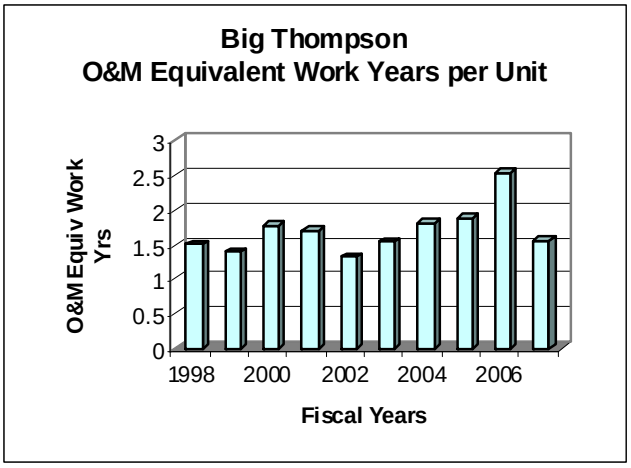



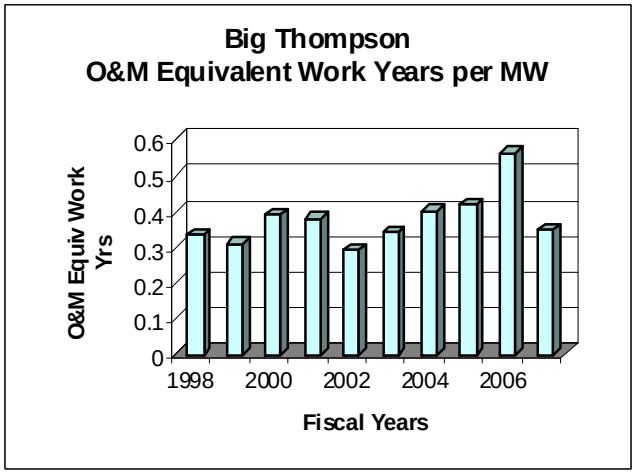
**Benchmark 4**
**Workforce Deployment**

| Big Thompson FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.01 | 0.00 | 0.02 | 0.03 | 0.03 | 0.01 |
| Operation | 0.15 | 0.02 | 0.00 | 0.17 | 0.17 | 0.04 |
| Maintenance | 1.25 | 0.14 | 0.00 | 1.40 | 1.40 | 0.31 |
| Total Staffing | 1.41 | 0.16 | 0.02 | 1.59 | 1.59 | 0.35 |

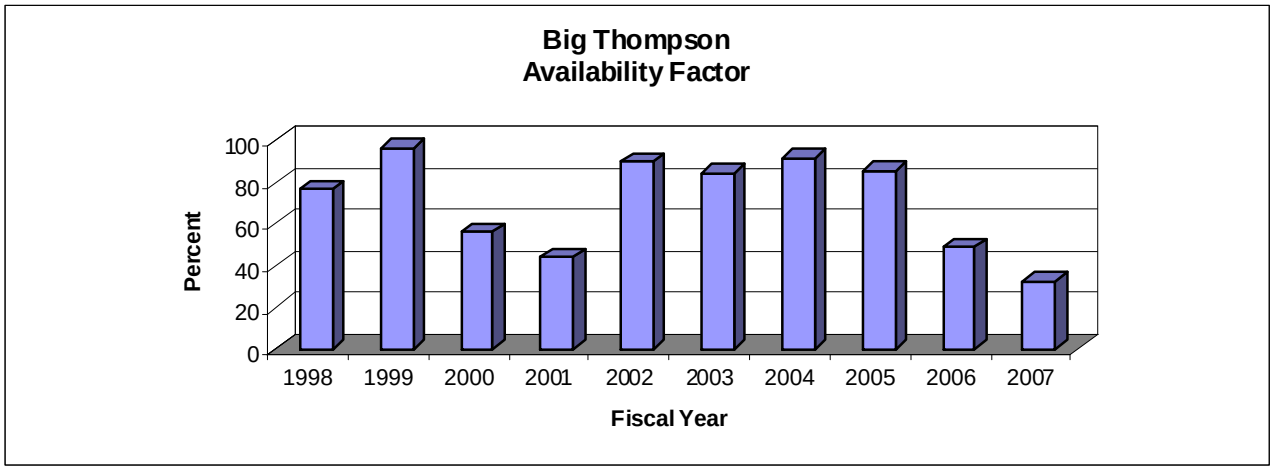


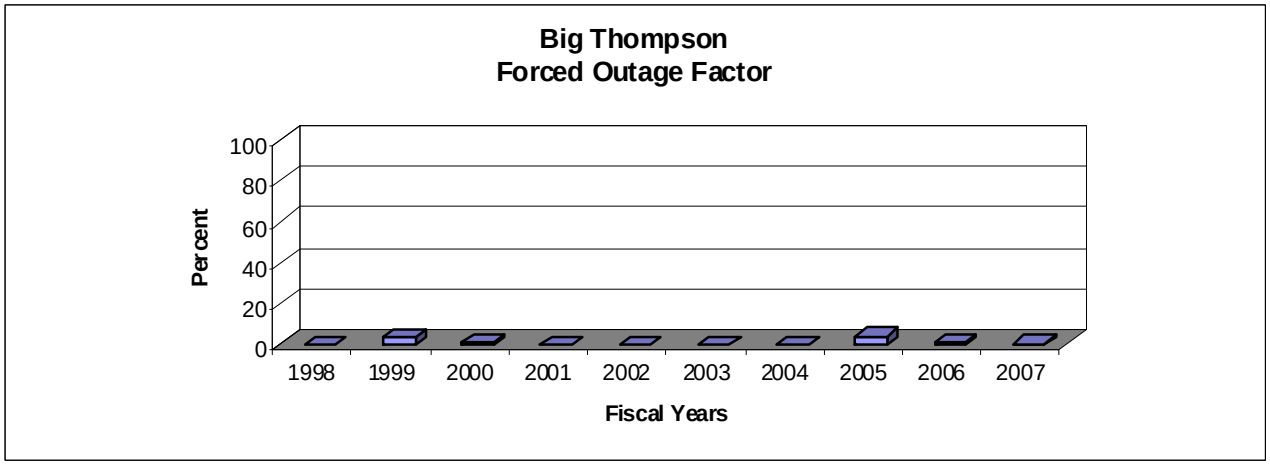



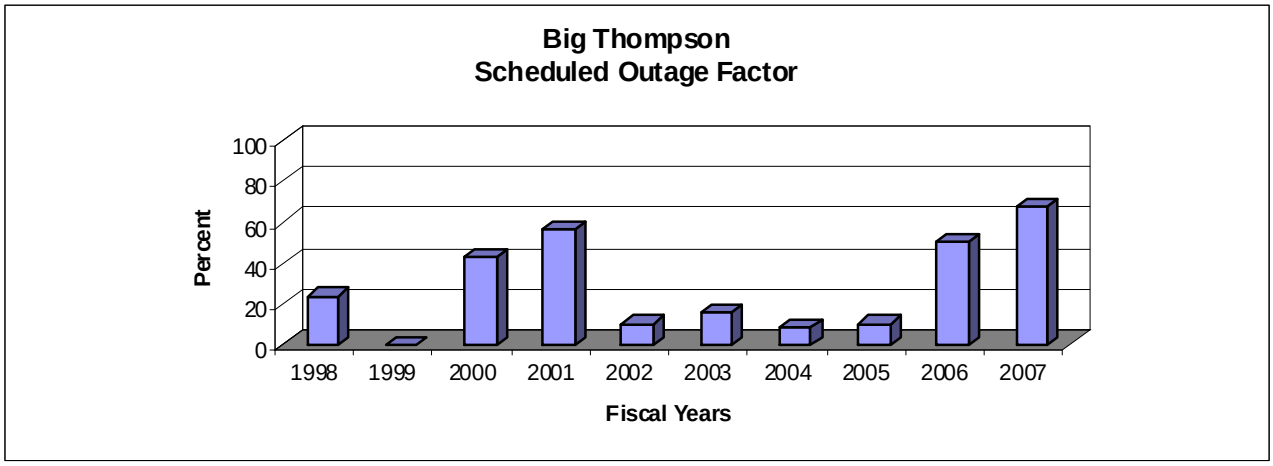
## Benchmark 5
## Plant Availability Factor



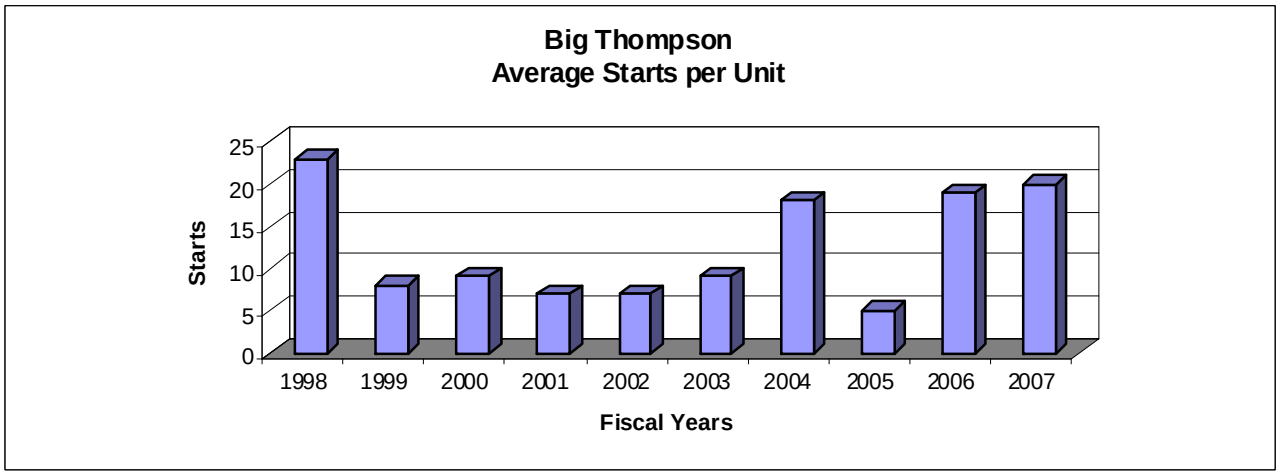

## Benchmark 6
## Plant Forced Outage Factor



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Big Thompson** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.62% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 153.57 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 60,739 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.35 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 32.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.3 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 67.3 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Boysen Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Boysen Powerplant
Thermopolis WY

**Telephone Numbers:**
Phone: (307) 261-5671
Fax: (307) 261-5683

**E-Mail Address:** jlawson@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The Congress authorized the Boysen Unit of the Pick Sloan Missouri Basin Project under the Flood Control Act of December 22, 1944, Public Law 534, which approved the general comprehensive plan set forth in Senate Document 191, as revised and coordinated by Senate Document 247, 78th Congress, 2d Session. |
| **Project Purposes:** | The Boysen Unit provides regulation of the stream flow for power generation, irrigation, flood control, sediment retention, fish propagation, and recreation development. |
| **Plant Location:** | Boysen Powerplant is located in Fremont County approximately 20 miles south of Thermopolis, Wyoming, on the Wind River. |
| **Plant Purpose:** | Power generated at the Boysen Powerplant is fed into the Western Division, Pick-Sloan Missouri Basin Program transmission facilities for use within that division. |

**Plant Facts:** An overflow, weir-type spillway controlled by radial gates is located on the right abutment and discharges immediately upstream and left of the Boysen Powerplant. The powerplant has an installed capacity of 15,000 kilowatts developed by two 7,500-kilowatt units operating under an average head of 99 feet. Each unit is served by a 10-foot-diameter steel penstock joined to a common 15-foot diameter steel penstock immediately upstream from the powerplant. The 15-foot-diameter penstock leading from the intake structure to the units was located to utilize the bore of an existing railroad tunnel made available through relocation of the CB&Q Railroad.

**Plant History:** Construction of the powerplant was authorized by the Flood Control Act of December 22, 1944. Construction began in 1947 and was completed in 1952.

**Present Activities:** Normal Operations.

**Future Planned Activities:** The $CO_2$ fire suppression systems for the two generating units will be installed in FY-2010. The wicket gate greasing systems for both generating units will be installed in FY-2009 and FY-2010. Unit one Cooler will be rebuilt in FY-2006 and Unit two's Cooler will be rebuilt in FY-2007.

**Special Issues:** None.

| | | | |
|---|---|---|---|
| **River:** | Wind River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 15,000 kW | **Installed Capacity:** | 15,000 kW |
| **Year of Initial Operation:** | 1952 | **Age:** | 55 years |
| **Net Generation (FY-2007):** | 37.9 GWh | **Rated Head:** | 96 feet |
| **Average Plant Factor (FY-2007):** | 29.7 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Boysen**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | Yes |

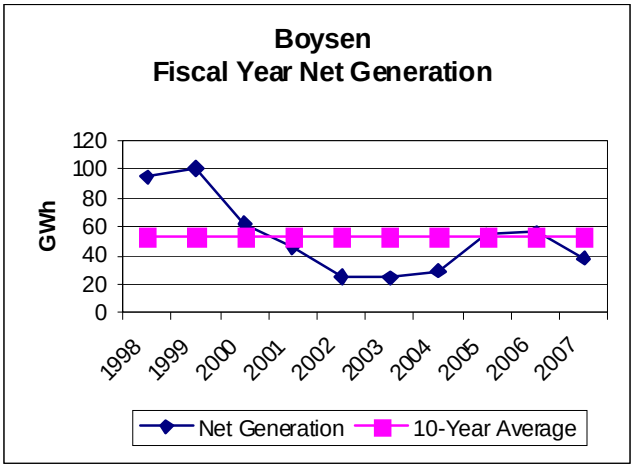
## Generators

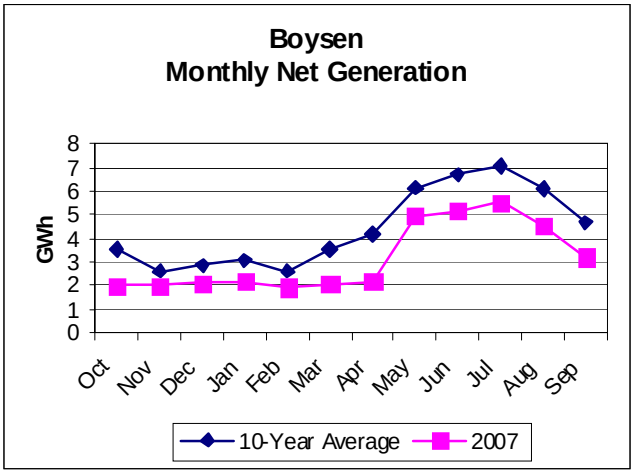
**Boysen Generators**

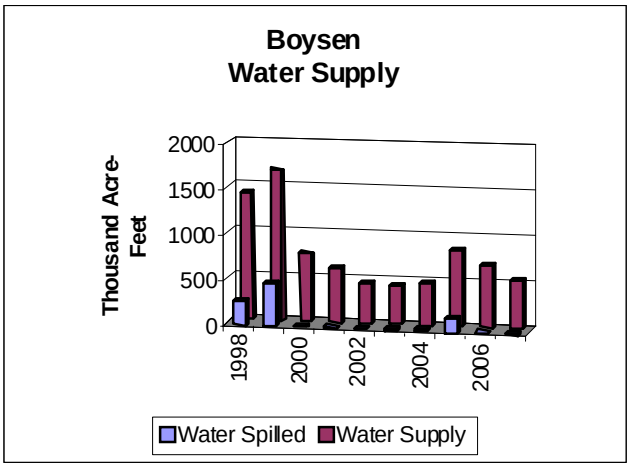
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 7,500 | - | 7,500 |
| 2 | 7,500 | - | 7,500 |
| 2 units | 15,000 | - | 15,000 |

## Generation

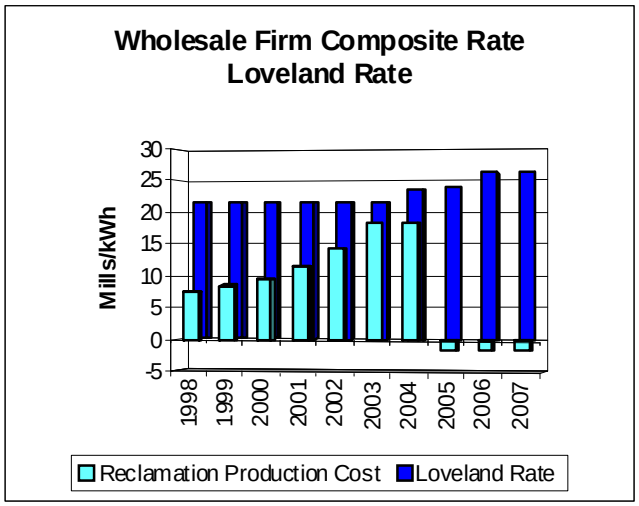

Boysen
Fiscal Year Net Generation
GWh
120
100
80
60
40
20
0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Net Generation
10-Year Average


Boysen
Monthly Net Generation
GWh
8
7
6
5
4
3
2
1
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
10-Year Average
2007

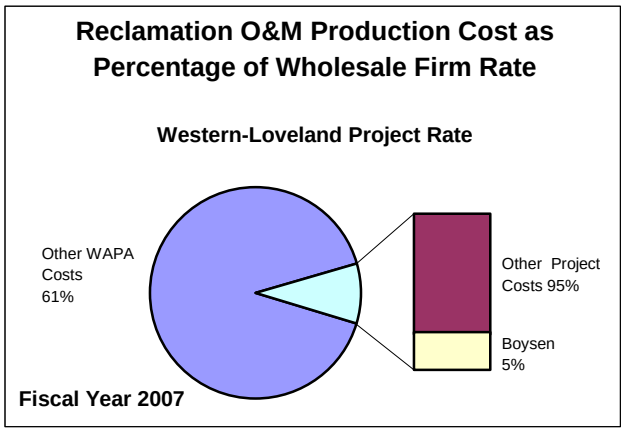

Boysen
Water Supply
Thousand Acre-Feet
2000
1500
1000
500
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

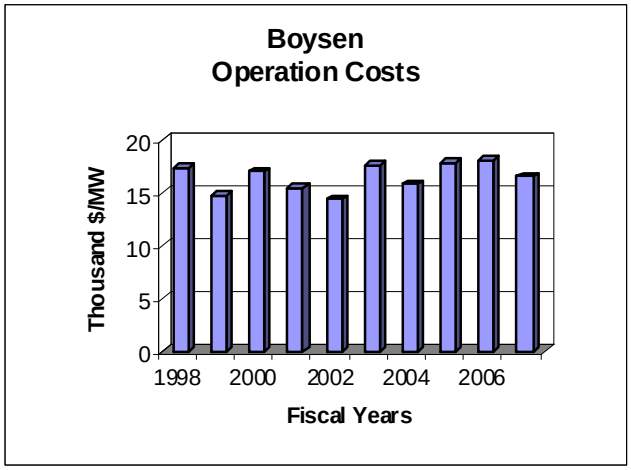
## Benchmark 1
## Wholesale Firm Rate

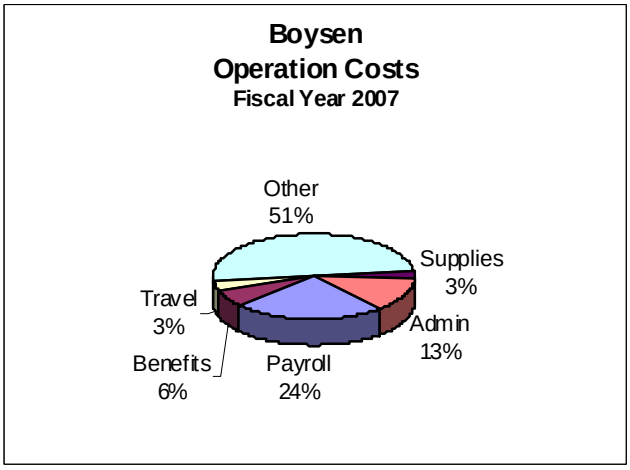


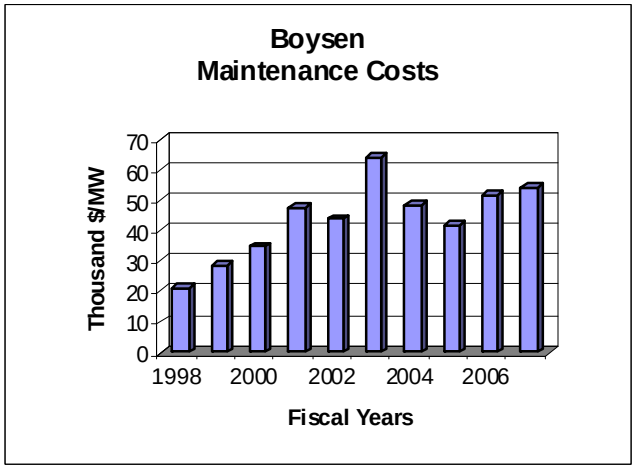

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

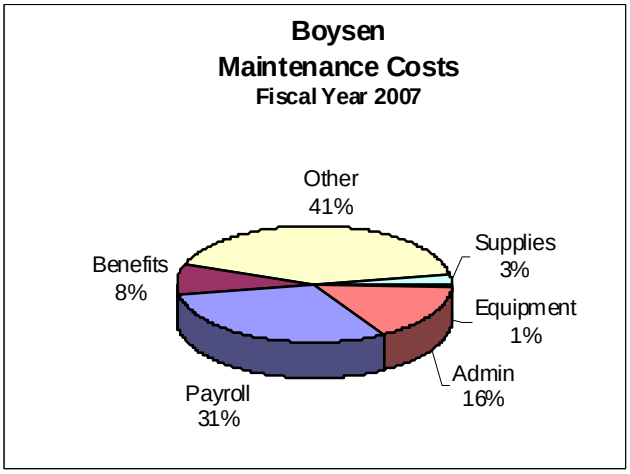


## Benchmark 3
## Production Costs



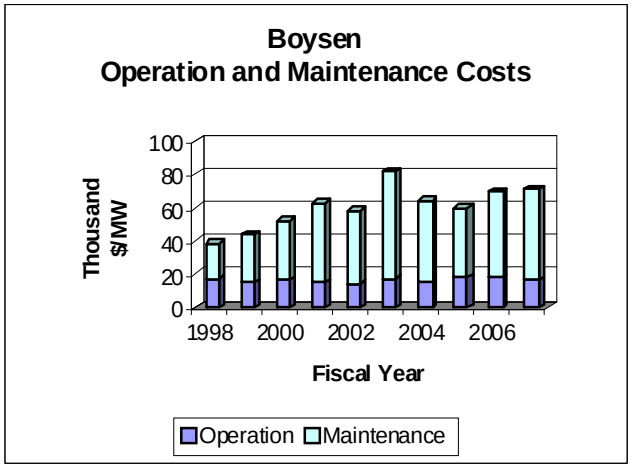



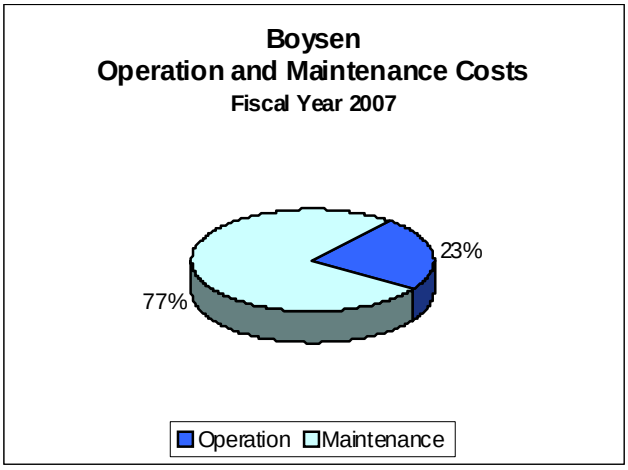



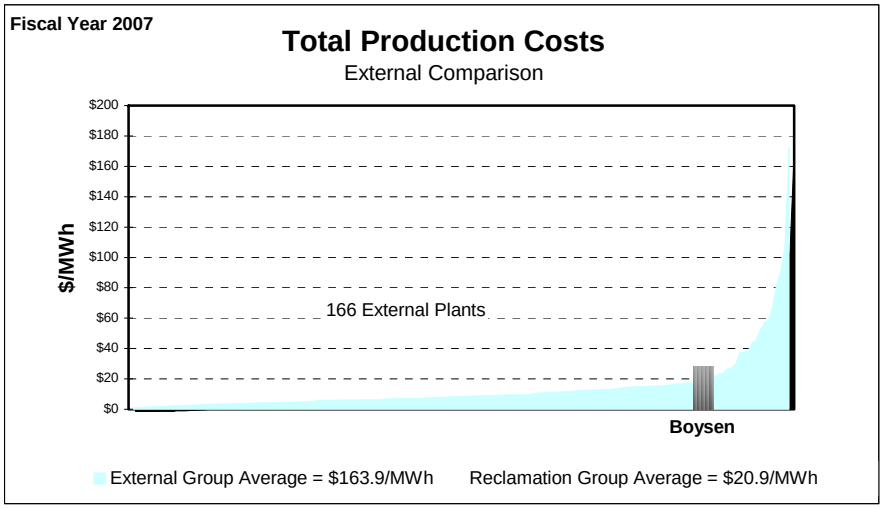



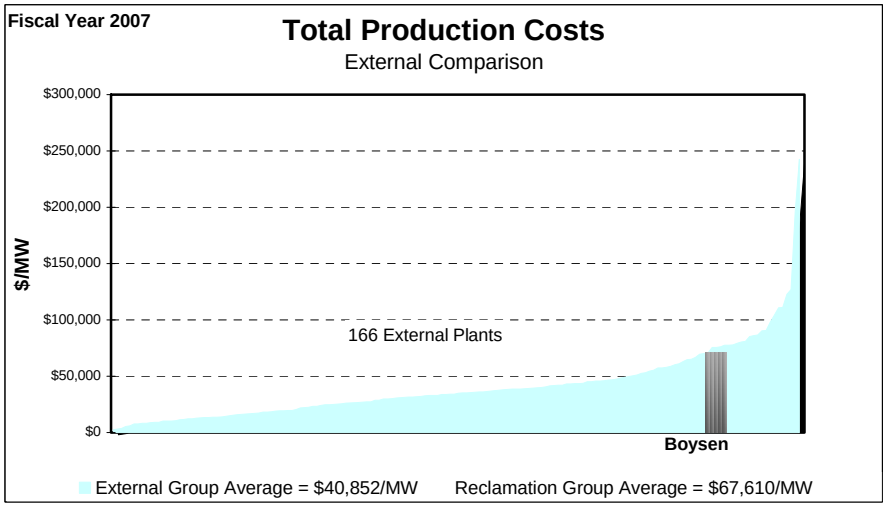

FY 2001 – Repair of Unit #2 wicket gates and re-packing of penstock expansion joints.
FY 2003 – Maintenance Costs include wicket gate greasing system repairs and transformer Doble testing.

## Benchmark 3
## Production Costs



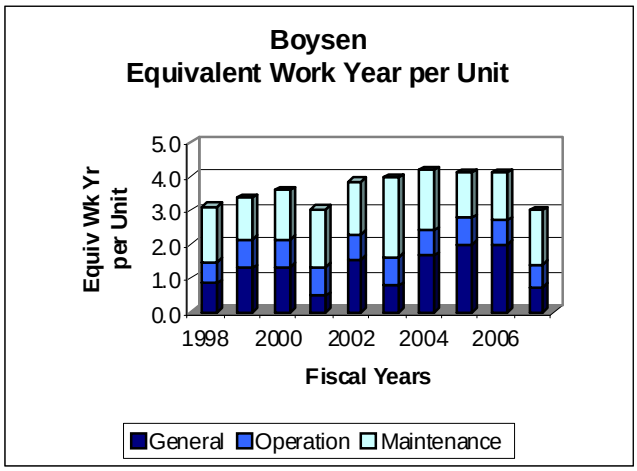



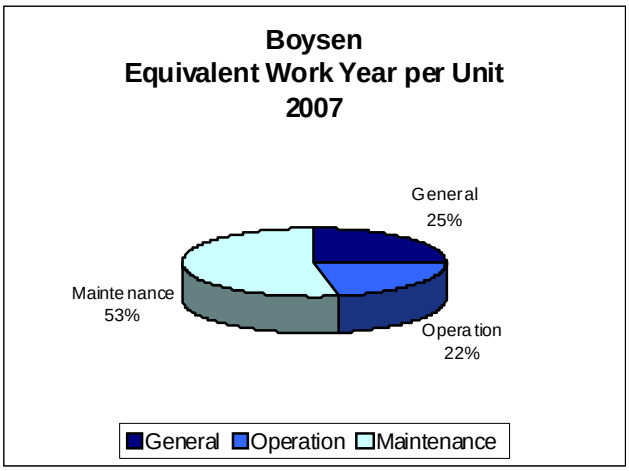



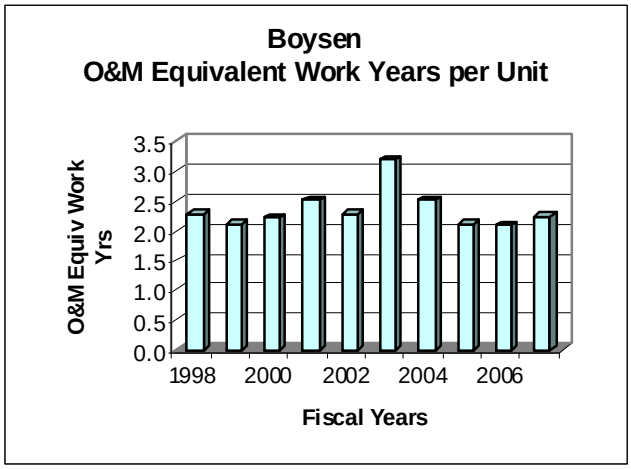



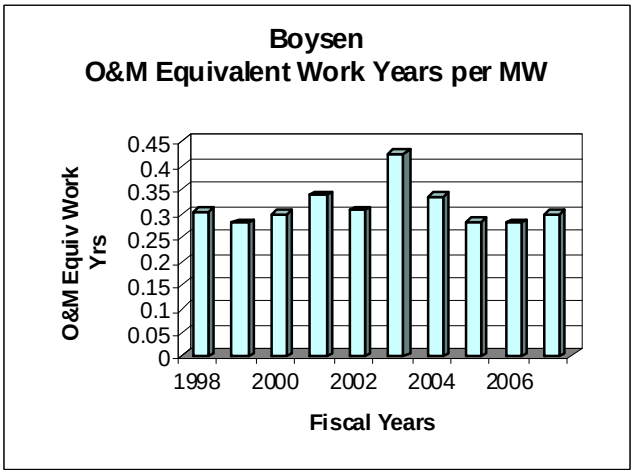
## Benchmark 4
## Workforce Deployment

| Boysen FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.30 | 0.15 | 0.04 | 1.49 | 0.74 | 0.10 |
| Operation | 1.18 | 0.13 | 0.00 | 1.31 | 0.66 | 0.09 |
| Maintenance | 2.83 | 0.32 | 0.00 | 3.15 | 1.58 | 0.21 |
| Total Staffing | 5.32 | 0.60 | 0.04 | 5.95 | 2.98 | 0.40 |

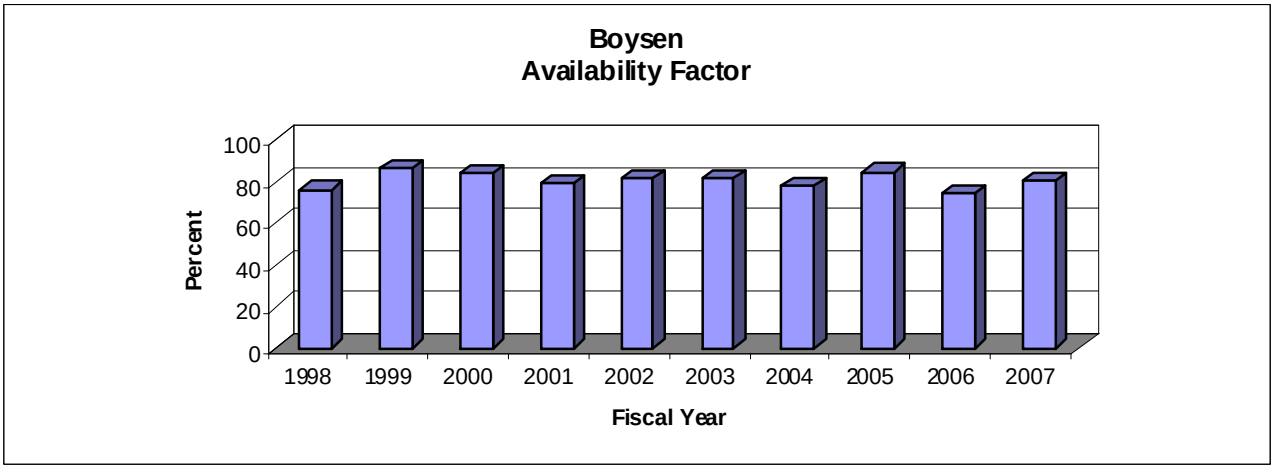


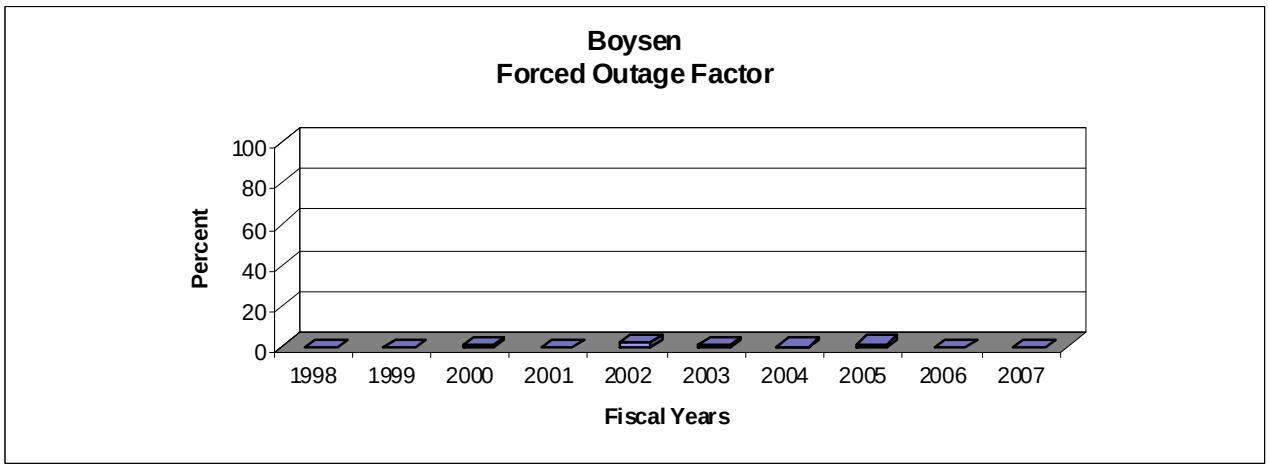



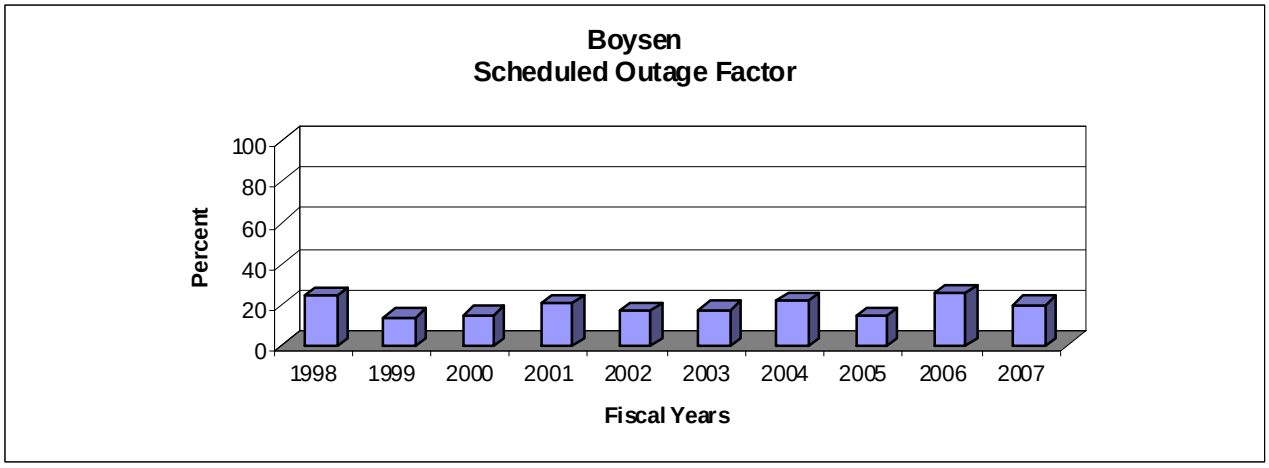
## Benchmark 5
## Plant Availability Factor




## Benchmark 6
## Plant Forced Outage Factor

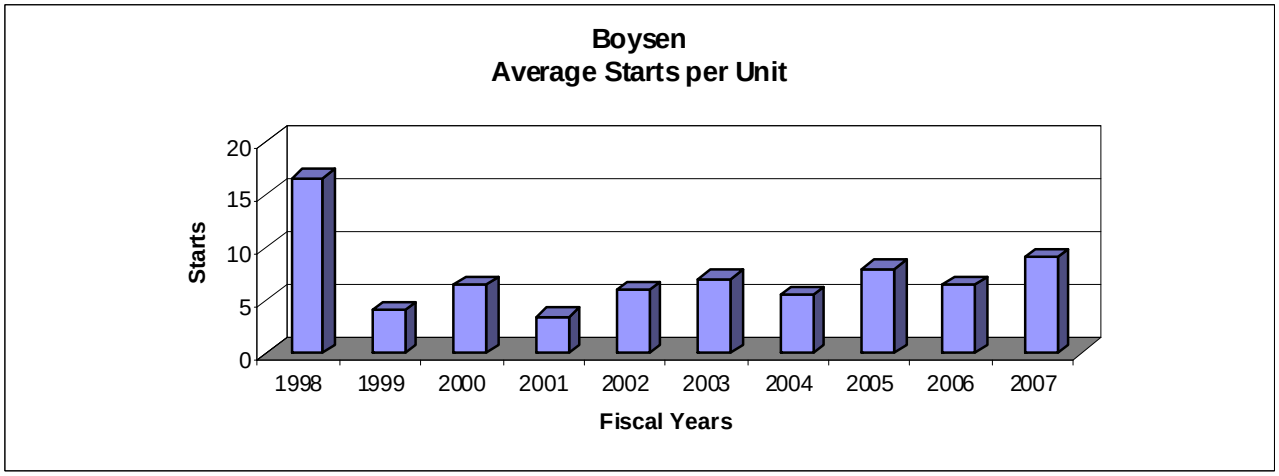


## Benchmark 7
## Plant Scheduled Outage Factor




FY-1997 – Unit 2 extended maintenance.
FY-1998 – Units 1 and 2 voltage regulator and exciter replacement.

## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Boysen Powerplant** | **Reclamation Average 10-30 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 2.42% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 28.18 | 16.40 | 2.76 | ***163.95 | 1.00 |
| **O&M Costs $/MW** | 71,112 | 62,731 | 7,847 | ***40,852 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.30 | 0.2 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 80.0 | 88.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.00 | 0.1 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 20.0 | 11.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Buffalo Bill Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Buffalo Bill Powerplant
Cody WY

**Telephone Numbers:**
Phone: (307) 261-5671
Fax: (307) 261-5683

**E-Mail Address:**
jlawson@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The Secretary of the Interior authorized the Shoshone Project on February 10, 1904, under authority of the Reclamation Act of June 17, 1902, and authorized Heart Mountain power development on June 19, 1945, under the provisions of the Reclamation Project Act of 1939, and authorized under authority of the Reclamation Reform Act of October 12, 1982, as the Buffalo Bill Dam Modifications as part of the Pick-Sloan Missouri Basin Program |
| **Project Purposes:** | Floodwaters of the Shoshone River are stored in Buffalo Bill Reservoir for later release for irrigation and power generation. Power is developed at the Buffalo Bill, Spirit Mountain, Shoshone, and Heart Mountain Powerplants. The system is interconnected with the West Division of the Pick-Sloan Missouri Basin Program. |
| **Plant Location:** | Buffalo Bill Powerplant is located in Park County approximately 4 miles southwest of Cody, Wyoming, on the Shoshone River. |
| **Plant Purpose:** | Power produced on the project is fed into a grid system, which serves an area extending into three States. |

| | | | |
|---|---|---|---|
| **Plant Facts:** | Buffalo Bill Dam began storing water in 1910. The dam and reservoir are located in a rugged scenic canyon adjacent to a main highway which leads into Yellowstone National Park. | | |
| **Plant History:** | In 1992 construction was completed on the dam modification (which raised the dam 25 feet), the new powerplant, and the visitor's center. | | |
| **Present Activities:** | Normal Operations. | | |
| **Future Planned Activities:** | None | | |
| **Special Issues:** | None | | |
| **River:** | Shoshone River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Underground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 18,000 kW | **Installed Capacity:** | 18,000 kW |
| **Year of Initial Operation:** | 1992 | **Age:** | 15 years |
| **Net Generation (FY-2007):** | 41.0 GWh | **Rated Head:** | 266 feet |
| **Average Plant Factor (FY-2007):** | 26.2 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Buffalo Bill**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | Yes |

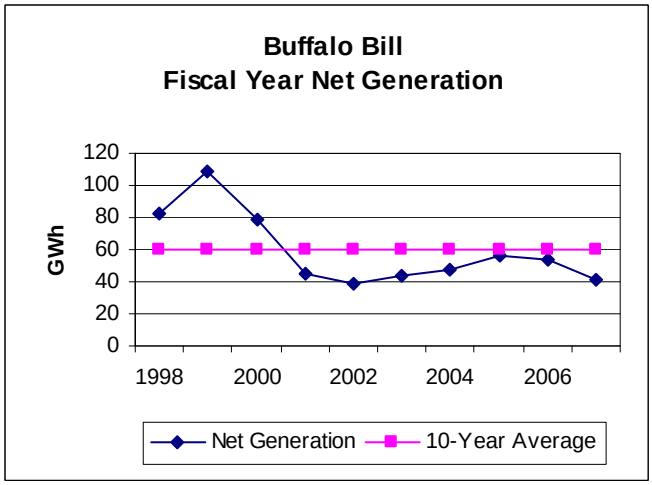
## Generators

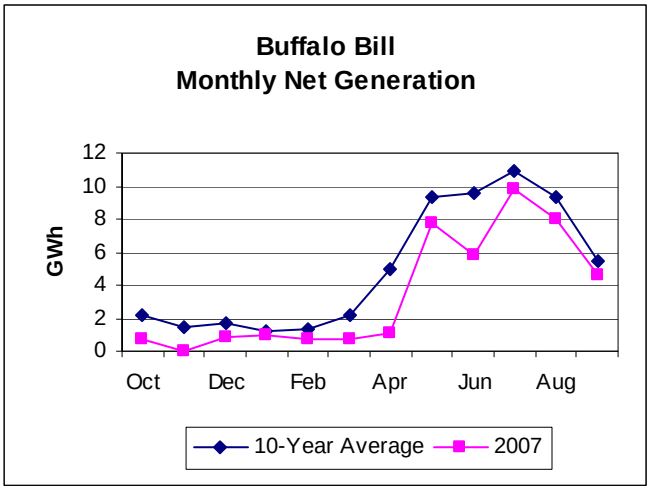
**Buffalo Bill Generators**

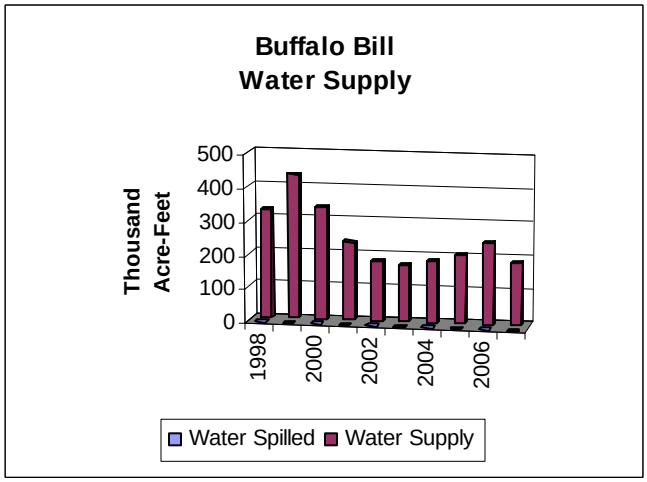
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 6,000 | - | 6,000 |
| 2 | 6,000 | - | 6,000 |
| 3 | 6,000 | - | 6,000 |
| 3 units | 18,000 | - | 18,000 |

## Generation

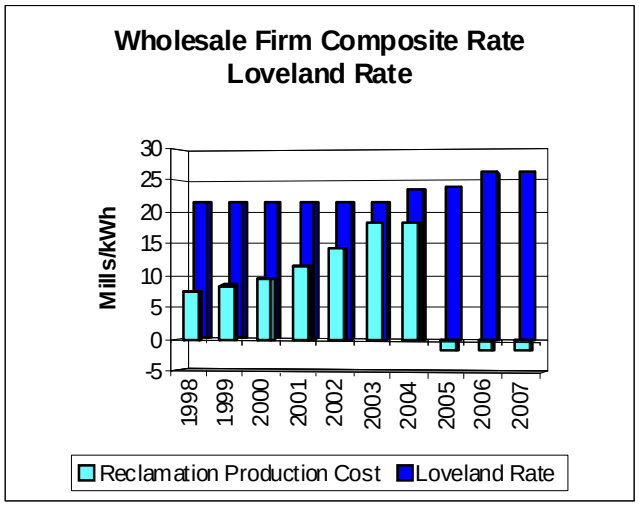

Buffalo Bill
Fiscal Year Net Generation
GWh
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Buffalo Bill
Monthly Net Generation
GWh
12
10
8
6
4
2
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

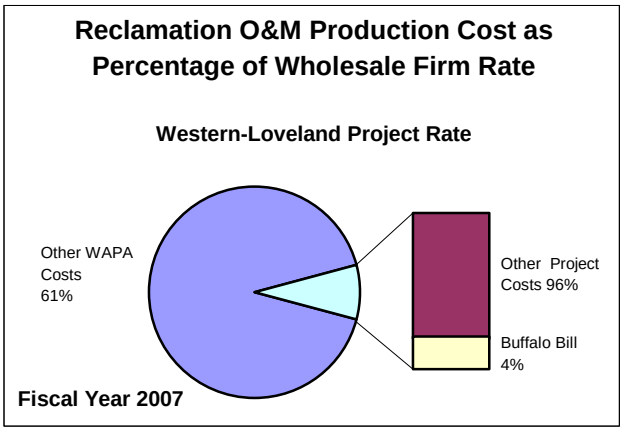

Buffalo Bill
Water Supply
Thousand Acre-Feet
500
400
300
200
100
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

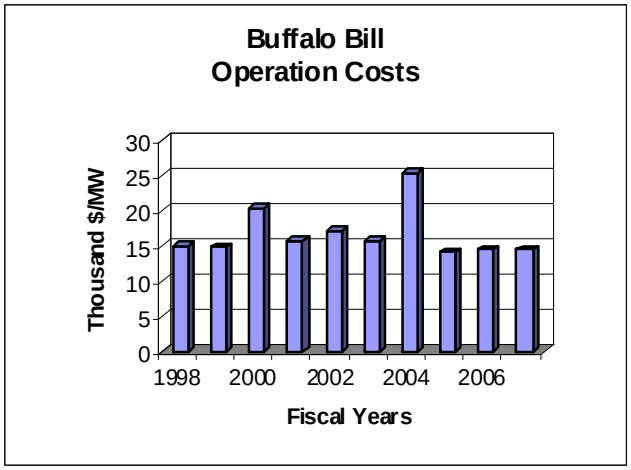
## Benchmark 1
## Wholesale Firm Rate

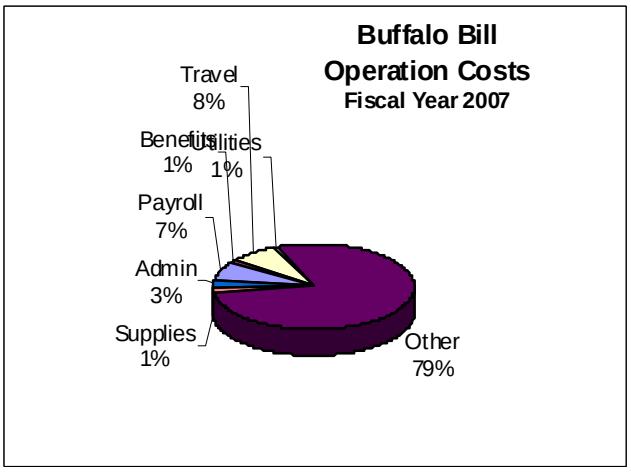


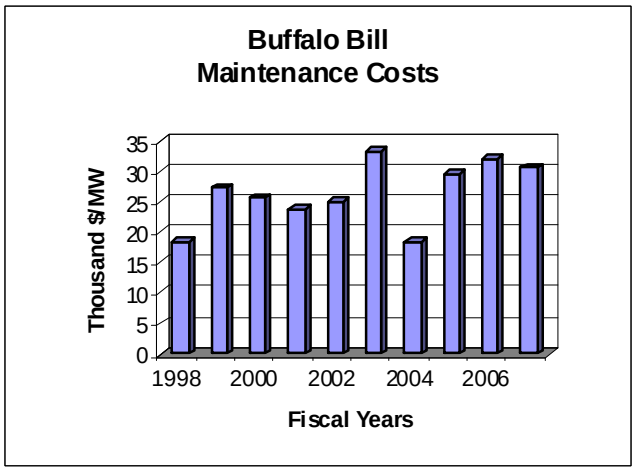

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

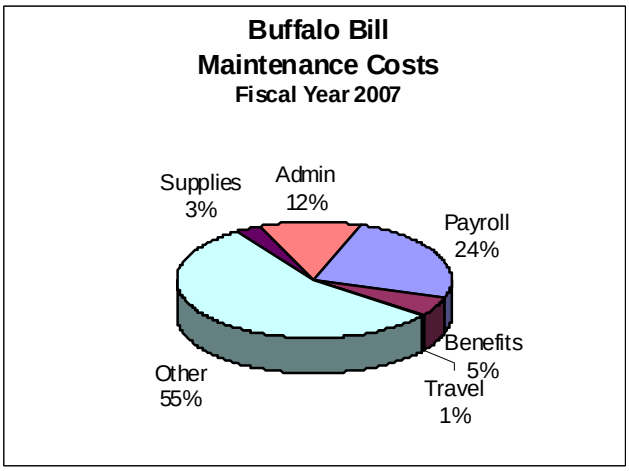


## Benchmark 3
## Production Costs

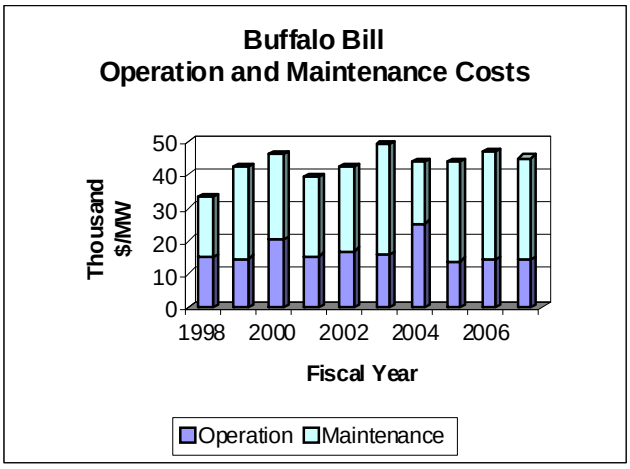


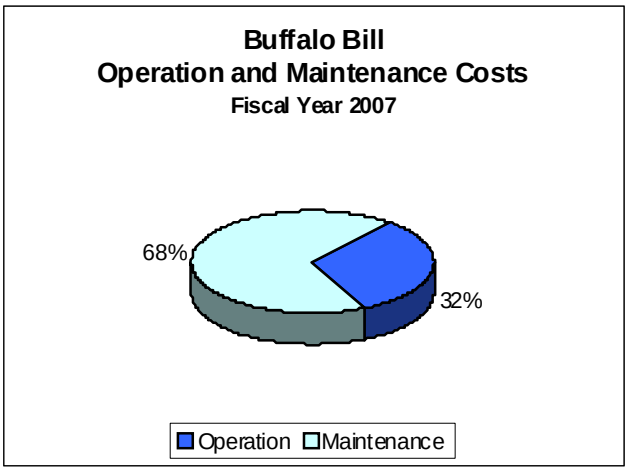



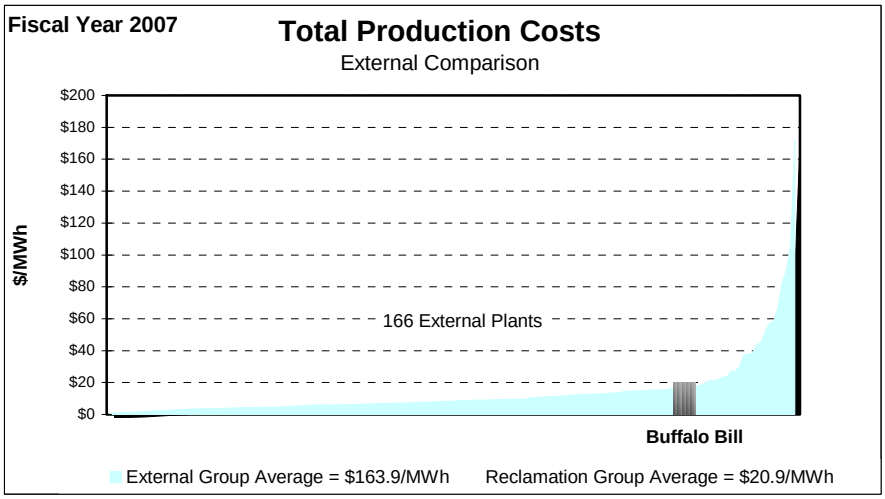



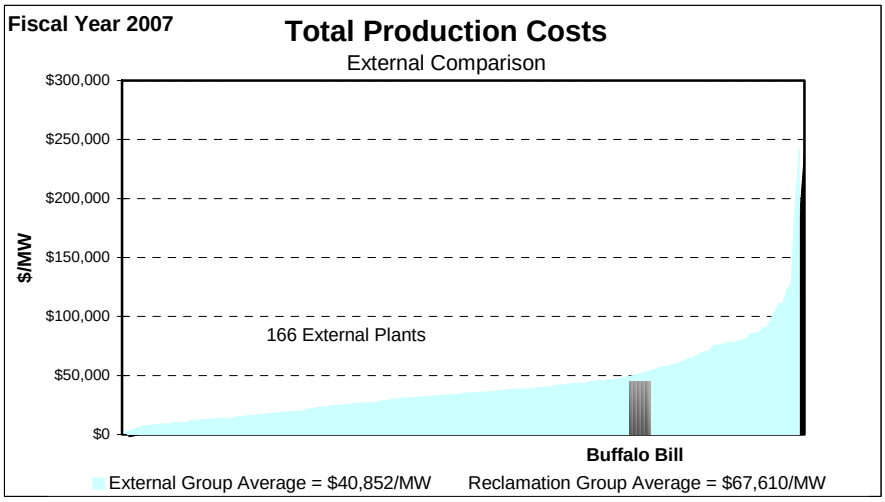



## Benchmark 3
## Production Costs



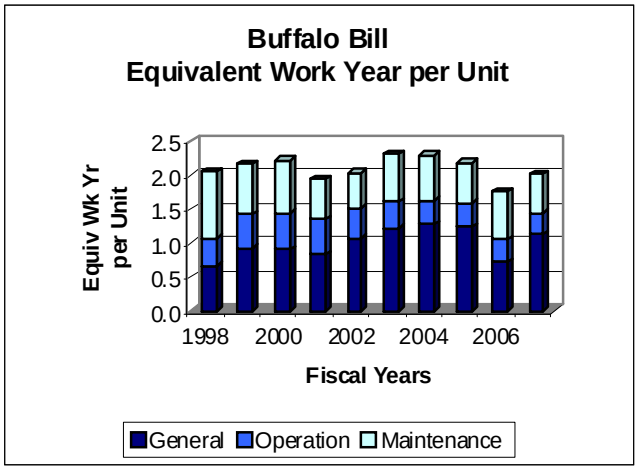



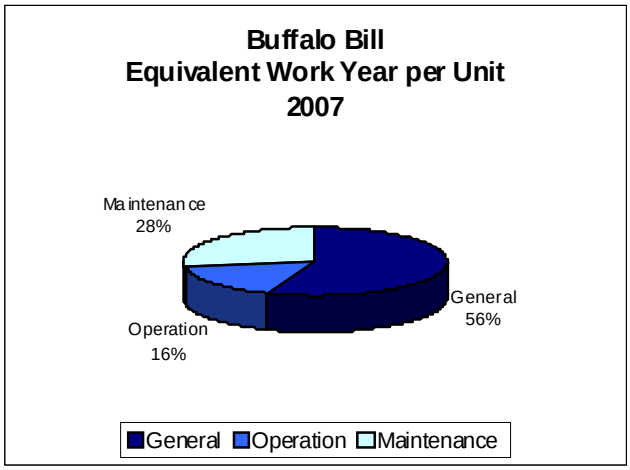



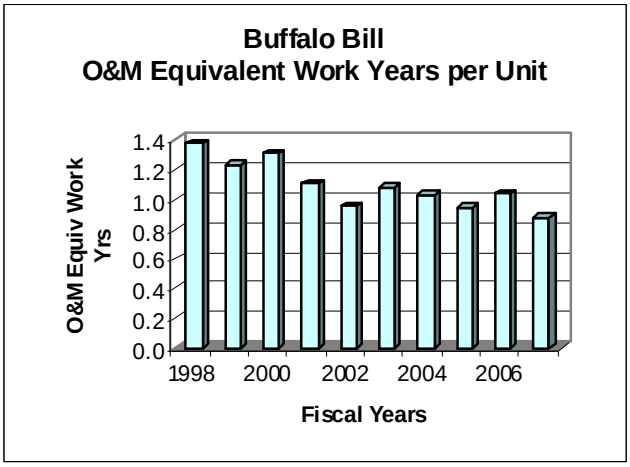



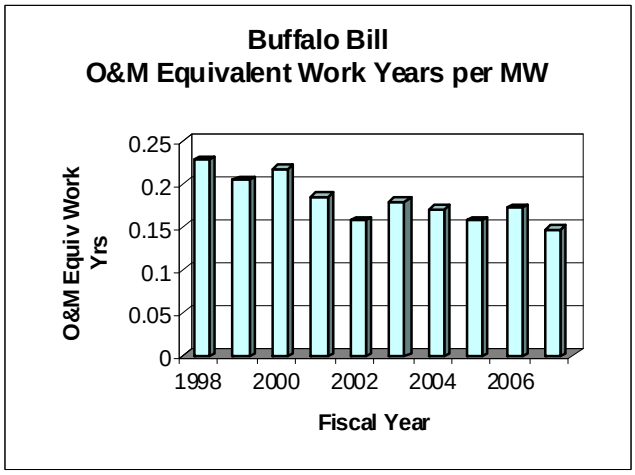
**Benchmark 4**
**Workforce Deployment**

| Buffalo Bill FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 2.98 | 0.34 | 0.05 | 3.37 | 1.12 | 0.19 |
| Operation | 0.86 | 0.10 | 0.00 | 0.96 | 0.32 | 0.05 |
| Maintenance | 1.52 | 0.17 | 0.00 | 1.69 | 0.56 | 0.09 |
| Total Staffing | 5.36 | 0.61 | 0.05 | 6.02 | 2.01 | 0.33 |

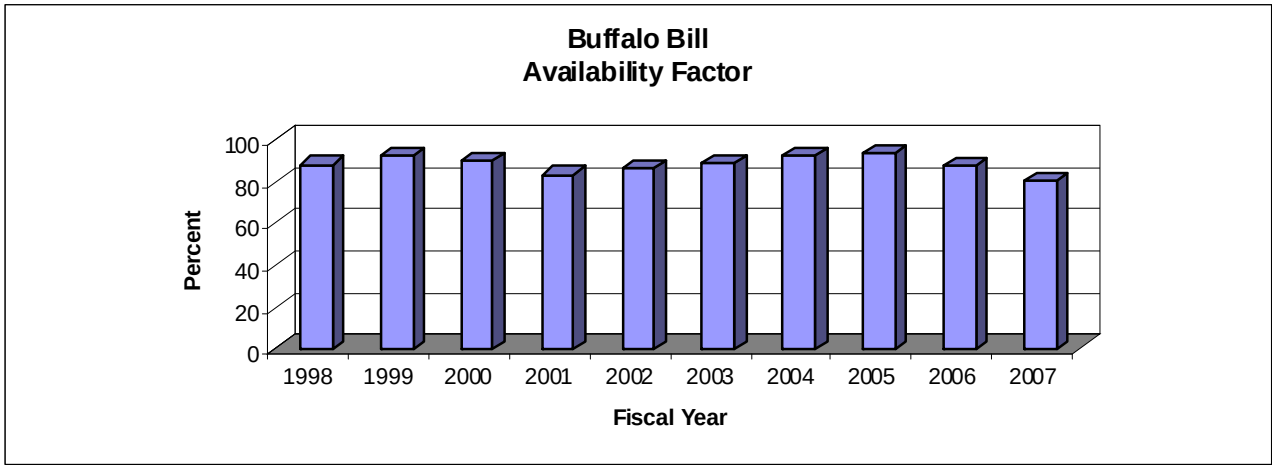


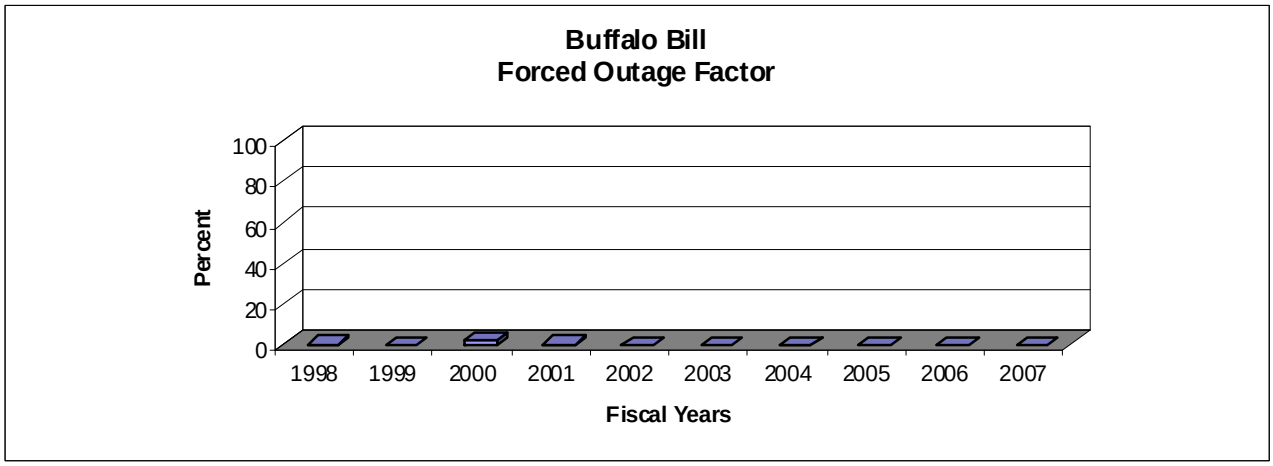



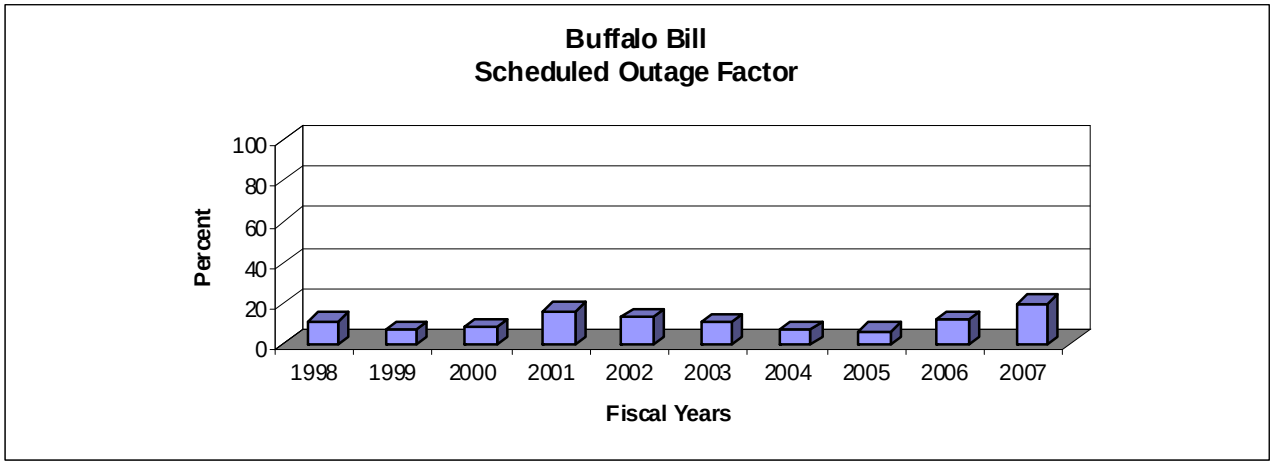
## Benchmark 5
## Plant Availability Factor




## Benchmark 6
## Plant Forced Outage Factor

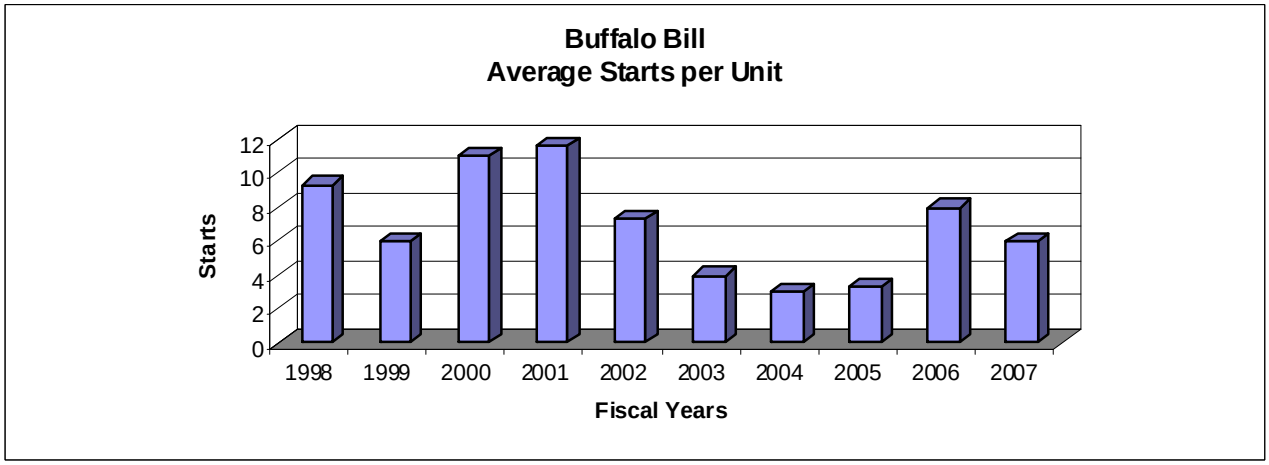


## Benchmark 7
## Plant Scheduled Outage Factor




FY-01 - Extended outage on all units for re-coating of power penstock.

## Unit Starts



## Benchmark Data Comparison

| Fiscal Year 2007 | Buffalo Bill Powerplant | Reclamation Average 10-30 MW Group | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|---|
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.84% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 19.77 | 16.40 | 2.76 | ***163.95 | 1.00 |
| **O&M Costs $/MW** | 45,071 | 62,731 | 7,847 | ***40,852 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.15 | 0.22 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 79.93 | 88.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.03 | 0.1 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 20.03 | 11.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Canyon Ferry Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
Paul Backlund
Facility Manager

**Plant Address:**
Canyon Ferry Field Office
7700 Canyon Ferry Road
Helena MT 59602

**Telephone Numbers:**
Phone: (406) 475-3923
Fax: (406) 475-9147

**E-Mail Address:**
pbacklund@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council

**PMA Service Area:** Western Area Power Administration, Upper Great Plains Region

**Project Authorization:** Construction of the Canyon Ferry Unit, part of the Pick-Sloan Missouri Basin Project Eastern Division, was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general comprehensive plan set forth in Senate document 191, as revised by Senate Document 247, 78th Congress.

**Project Purposes:** The Canyon Ferry Unit is a multi-purpose project, which provides low cost power generation and makes an important contribution to the flood control, irrigation, and power supply in the upper Missouri Basin. Canyon Ferry was constructed to provide regulation of runoff for low cost power and to permit increased irrigation diversions in the upper Missouri River Basin. With a total capacity of 2,051,000 acre-feet, Canyon Ferry Reservoir makes possible the irrigation of 155,600 acres of land and supplements irrigation of 82,000 acres in the upper Missouri area. The reservoir permits upstream irrigation development by reregulating residual flows of the river for downstream powerplants.

**Plant Location:** Canyon Ferry Powerplant is located on the main stem of the Missouri River in Lewis & Clark County, about 17 miles northeast of Helena, the capital of Montana.

**Plant Purpose:** Canyon Ferry Powerplant, with an installed capacity of 50,000 kilowatts, supplies expanding power needs for residential and commercial use in a wide surrounding area.

**Plant Facts:** The powerplant is located at the downstream toe of the dam on the right abutment. Three 13.5-foot diameter penstocks, embedded in the dam, supply water to three 23,500 horsepower, vertical-shaft, Francis-type hydraulic turbines each driving a 16,667-kilowatt generator. The Canyon Ferry 115-kilovolt switchyard is a steel structure mounted on the roof of the powerplant.

Canyon Ferry Dam is a concrete structure rising 225 feet above the rock foundation and impounds flows of the Missouri River for multi-purpose use. Canyon Ferry Reservoir is about 25 miles long with a total capacity of 2,051,000 acre-feet.

**Plant History:** Construction of Canyon Ferry Powerplant started in 1949 and was completed in 1954. Unit 1 began operation in December 1953, and Units 2 and 3 in March 1954. Canyon Ferry Powerplant is part of the Eastern Division of the Pick-Sloan Missouri Basin Program.

**Present Activities:** FY-2006 activities included: protective relay test set replacement; repair spillway guides; installed and tested a new prototype turbine air system for increasing low dissolved oxygen; oil purification system replacement; dam roadway expansion joint repair; installed underground power lines to all camp facilities; gantry crane repairs; fiber optic system installed to warehouse, visitor center, and office building; Unit 2 and transformer K2A testing and triennial maintenance; Crow Creek Pumping Plant OCB 412 and transformer KY1A testing and maintenance.

**Future Activities:** Major activities planned in the near future include: complete roadway and expansion joint repair; dam drain cleaning; remove possible PCB contaminated electrical equipment at Crow Creek pumping plant; field verification of powerplant electrical drawings; unbalanced closure testing of fixed wheel gates; coating of metal structures on and in the dam; replace generator, transformer, and switchyard lightning arresters; and reservoir dust abatement dike repair.

**Special Issues:** The Missouri River Basin experienced its seventh consecutive year of drought conditions, resulting in below average power generation in FY-2000 through FY-2006. Responsibilities, in addition to the 50,000-kilowatt powerplant, also include the operation and maintenance of the dam, reservoir, switchyard, a Government camp, two water and sewage systems, maintenance and support of Crow Creek Pumping Plant and Substation, and several miles of roads and fences.

| | | | |
|---|---|---|---|
| **River:** | Missouri River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 50,000 kW | **Installed Capacity:** | 50,000 kW |
| **Year of Initial Operation:** | 1953 | **Age:** | 54 years |
| **Net Generation (FY-2007):** | 291.8 GWh | **Rated Head:** | 125 feet |
| **Average Plant Factor (FY-2007):** | 67.2 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load | | |

## Ancillary Services

**Canyon Ferry**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | No |
| Black Start | Yes |
| Voltage Support | Yes |

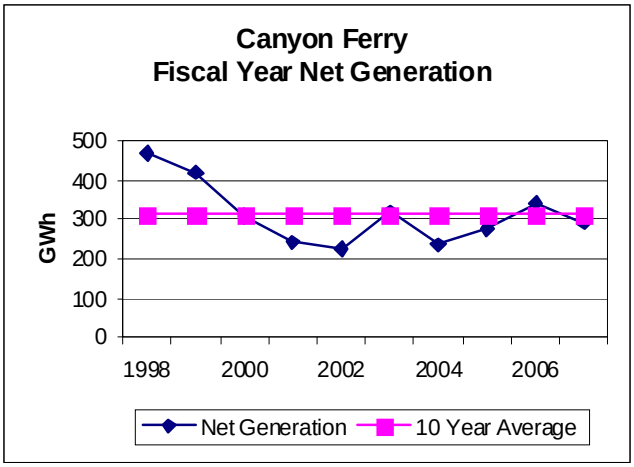
Canyon Ferry is not designated as an "official" blackstart plant, even though it has the capability.

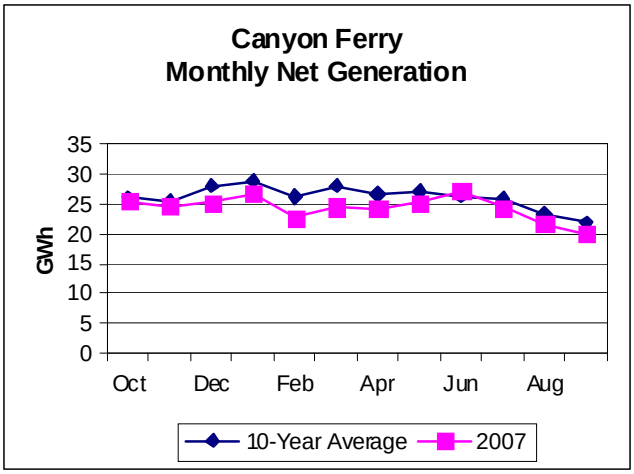
## Generators

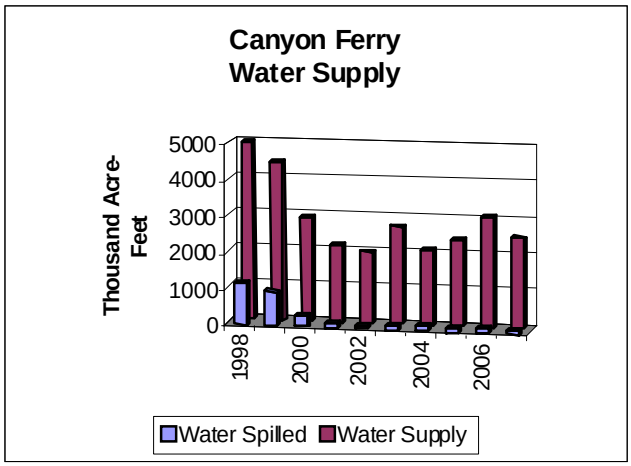
**Canyon Ferry Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 16,667 | - | 16,667 |
| 2 | 16,667 | - | 16,667 |
| 3 | 16,667 | - | 16,667 |
| 3 units | 50,000 | - | 50,000 |

## Generation



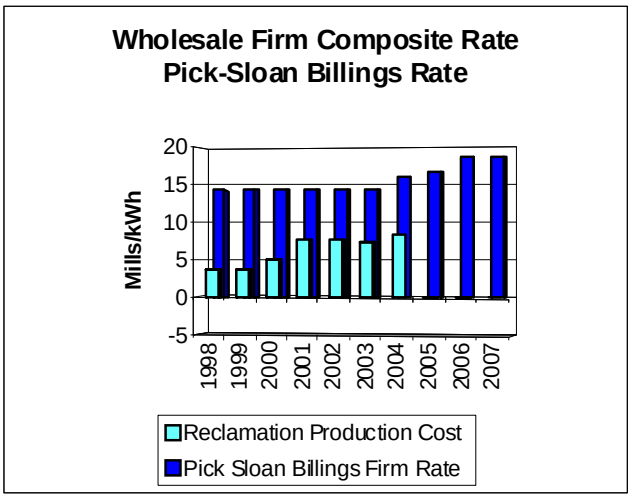



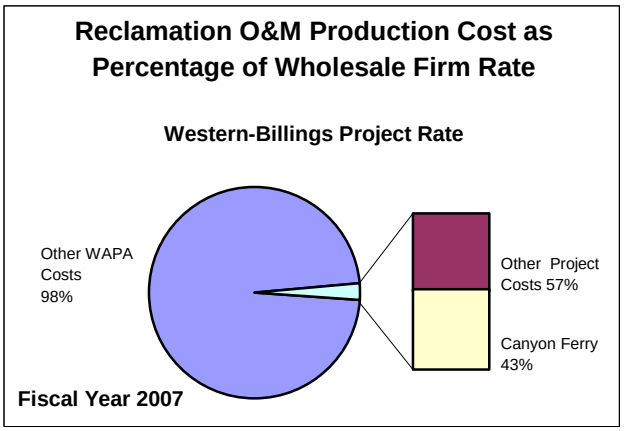

Drought conditions encountered for the sixth consecutive year.

# Prime Laboratory Benchmarks

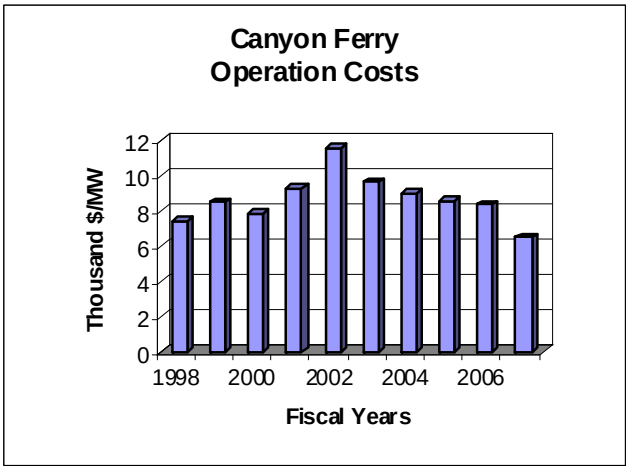
## Benchmark 1
## Wholesale Firm Rate

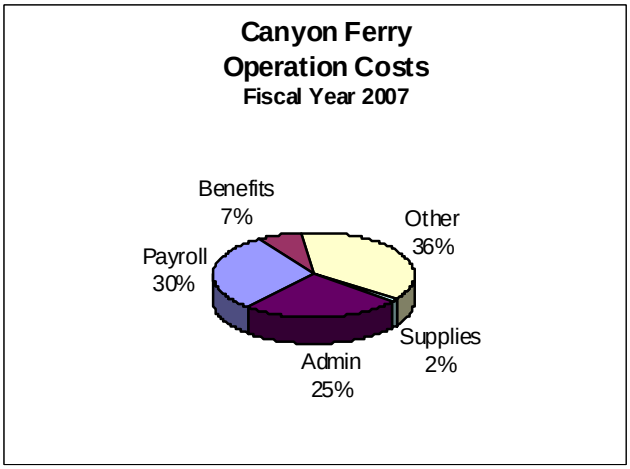


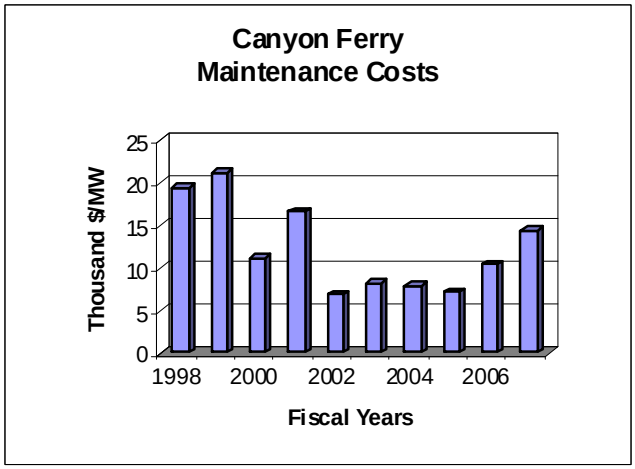

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

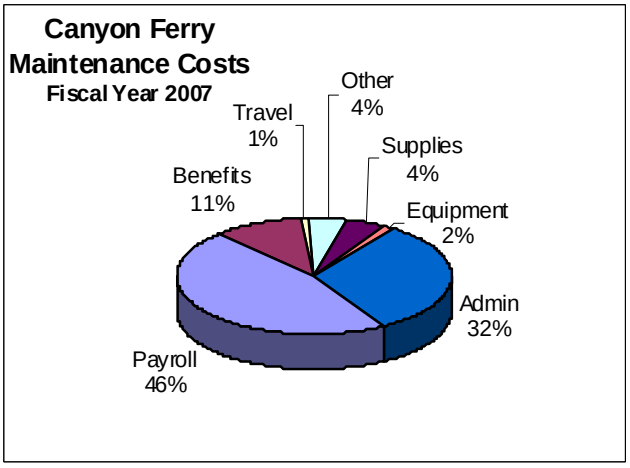


## Benchmark 3
## Production Costs



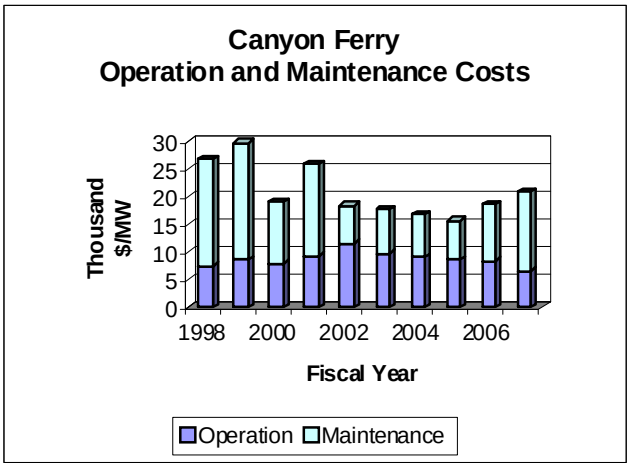



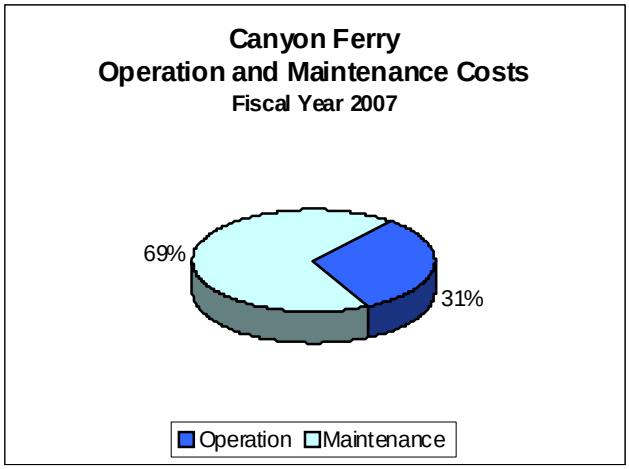



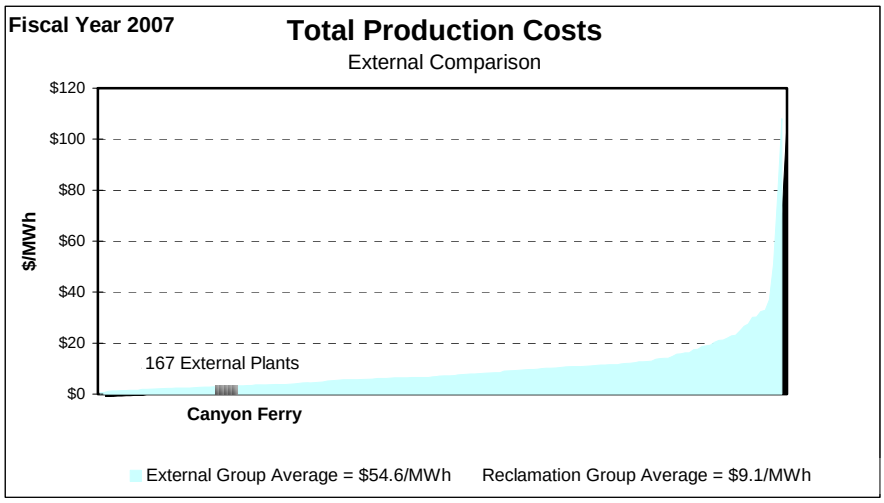



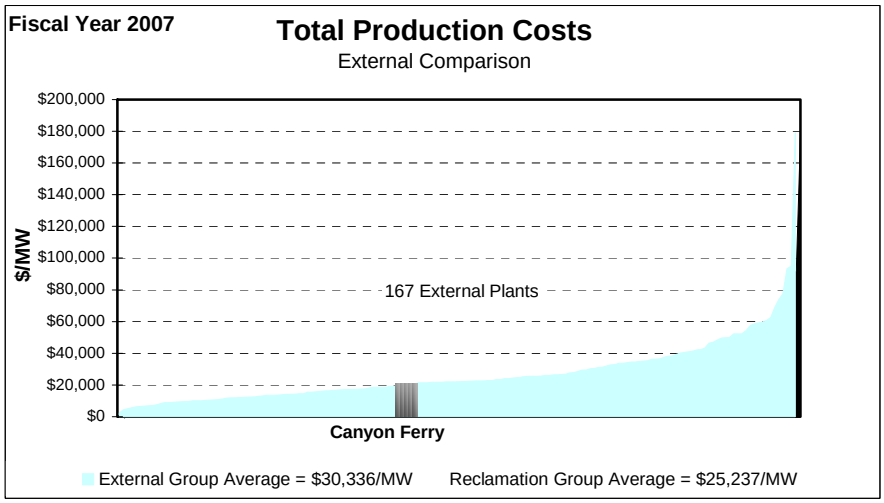

FY-1999 – FY-2001 maintenance costs include extraordinary maintenance costs for refurbishment of the powerplant penstock's fixed-wheel gates and hydraulic cylinders overhaul.

## Benchmark 3
## Production Costs



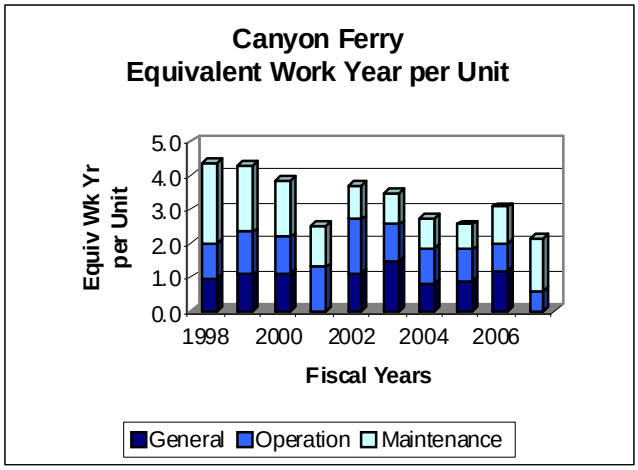



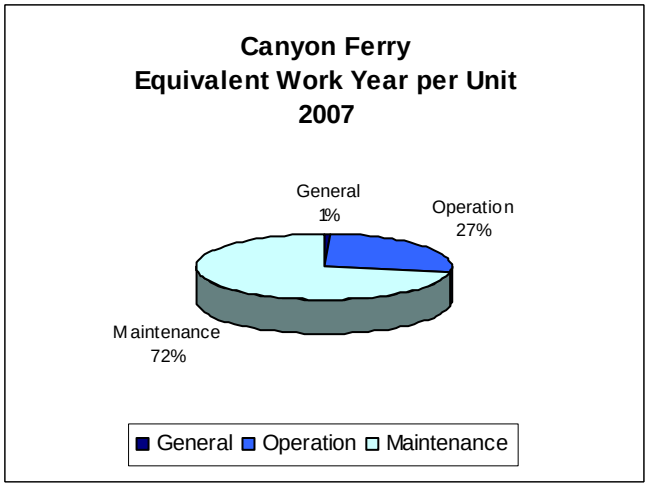



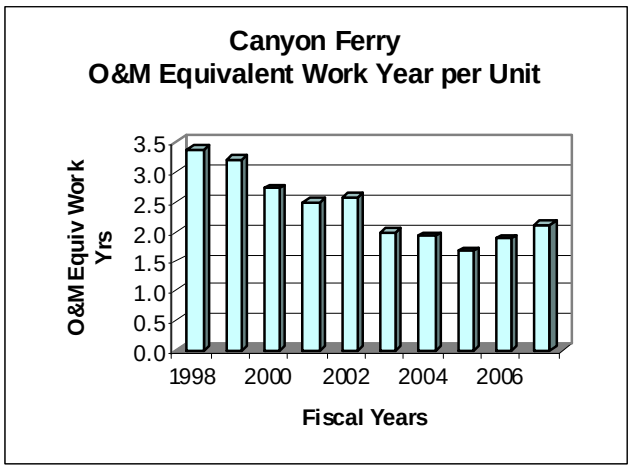



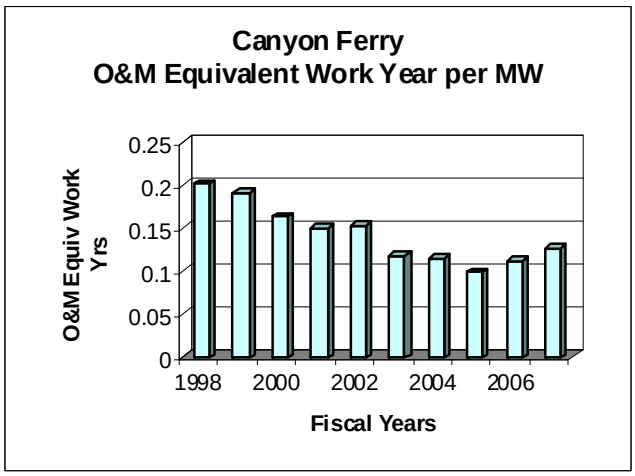
**Benchmark 4**
**Workforce Deployment**

| Canyon Ferry FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.00 | 0.00 | 0.05 | 0.05 | 0.02 | 0.00 |
| Operation | 1.55 | 0.17 | 0.00 | 1.72 | 0.57 | 0.03 |
| Maintenance | 4.16 | 0.47 | 0.00 | 4.63 | 1.54 | 0.09 |
| Total Staffing | 5.71 | 0.64 | 0.05 | 6.41 | 2.14 | 0.13 |

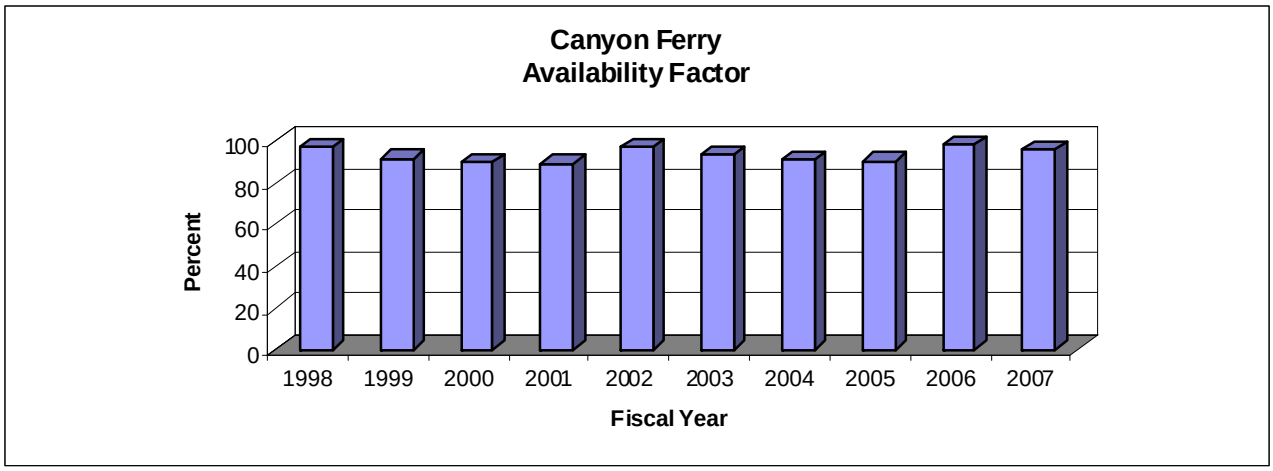


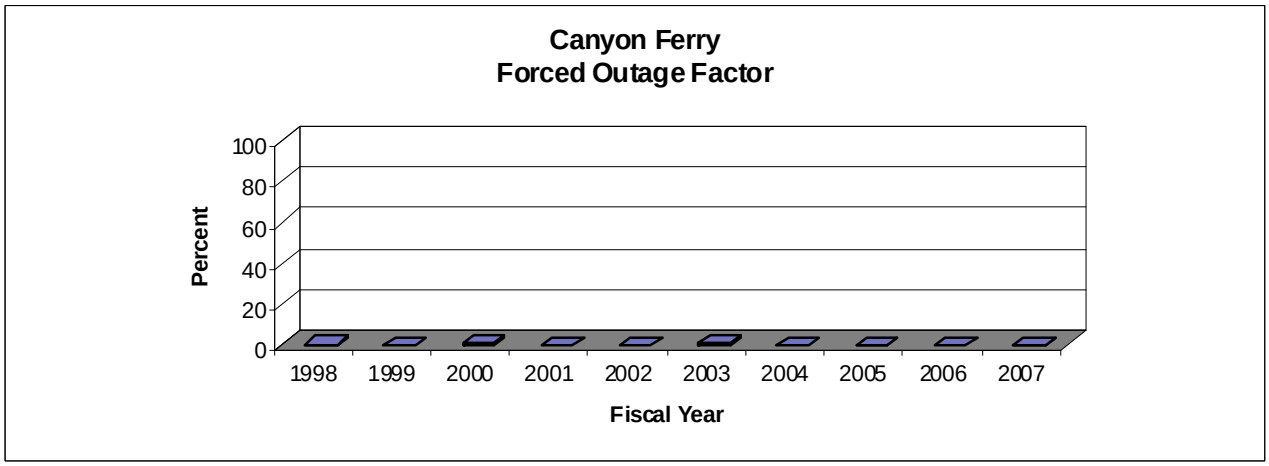



**Benchmark 5**
**Availability Factor**

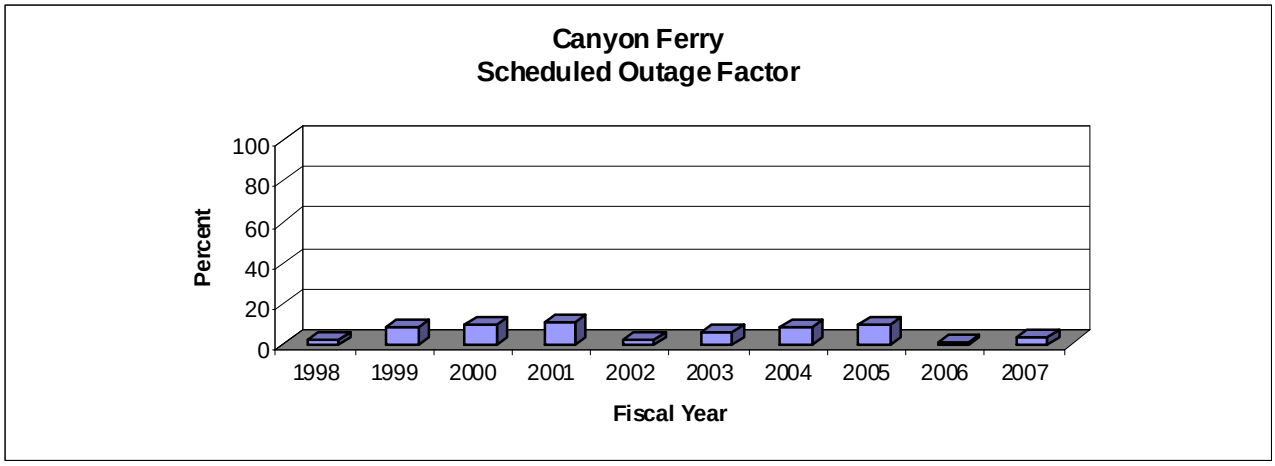



FY-1999, FY-2000, FY-2001 – Each included a 6-week extended outage for refurbishing the penstock's fixed-wheel gate and overhauling the hydraulic cylinders.
FY-2004 – Extended unit outages for low dissolved oxygen draft tube modifications and powerplant protective relaying replacement projects.

**Benchmark 6**
**Plant Forced Outage Factor**



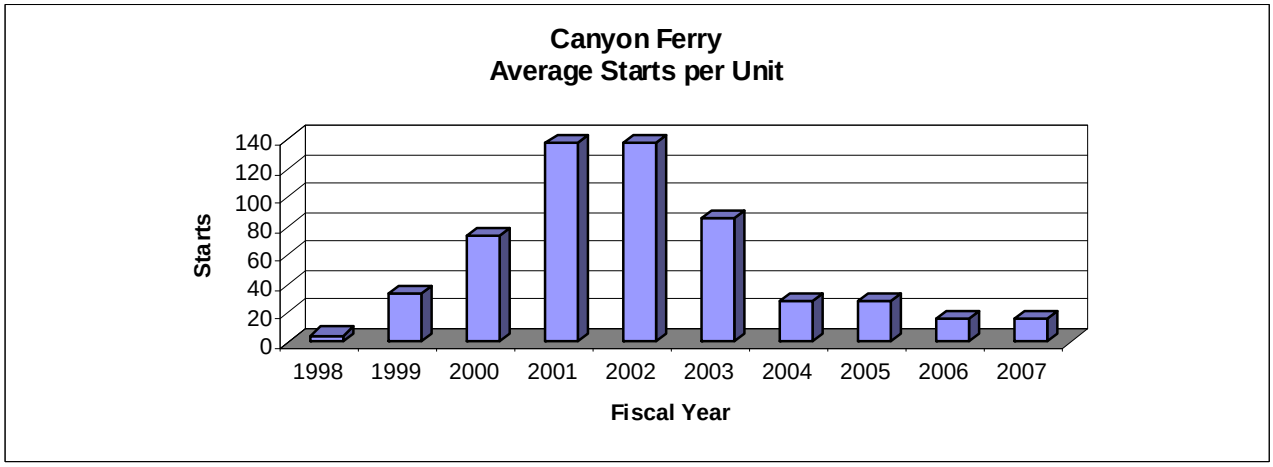
**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-1999, FY-2000, FY-2001 – Extended unit outages for penstock fixed-wheel gates refurbishment and hydraulic cylinders overhaul.

FY-2004 – Extended unit outages for low dissolved oxygen draft tube modifications and powerplant protective relaying replacement projects.

**Unit Starts**

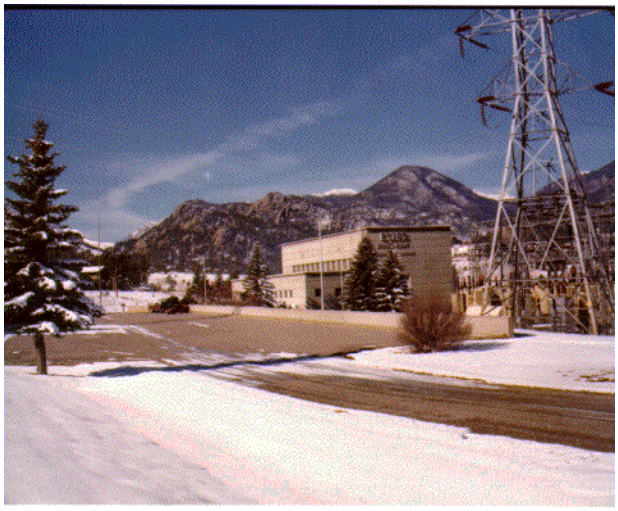


| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Canyon Ferry Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 16.5 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.09% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 3.56 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 20,802 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.13 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 96.0 | 81.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.2 | 0.2 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 3.8 | 18.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

The Missouri River Basin experienced its sixth consecutive year of drought conditions in FY-2005, which resulted in below average generation (MWh).

# Estes Powerplant
# Colorado-Big Thompson Project



**Plant Contact:**
Chuck Pedersen
O&M Chief

**Plant Address:**
Estes Powerplant
PO Box 960
Estes Park CO 80517-0960

**Telephone Numbers:**
Phone: (970) 962-4400
Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The President approved the Secretary of the Interior's finding of feasibility on December 21, 1937.

**Project Purposes:** The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities.

**Plant Location:** Estes Power plant is located in Larimer County, Colorado, near the town of Estes Park, Colorado.

**Plant Purpose:** The powerplant takes diversion water delivered from Marys Lake Powerplant and holds it in Lake Estes for the project. A side benefit is the generation of hydroelectric power for the project.

**Plant Facts:** Lake Estes, below Estes Powerplant, is formed by Olympus Dam constructed across the Big Thompson River. The afterbay storage in Lake Estes and the forebay storage in Marys Lake enable the Estes Powerplant to meet daily variations in energy demand.

**Plant History:** The water and power control center for Colorado Big Thompson Project's reservoirs, power plants, and transmission lines in Wyoming, Colorado, and western Nebraska is located at the project headquarters in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation power plants.

**Present Activities:** Recently completed projects include installation of a new fire alarm system, installation of a new $CO_2$ fire suppression system, rehabilitation of powerplant fire and cooling water piping systems, and installation of new unit excitation systems. Installation of an automatic trashrake and new trashracks are in progress and scheduled for FY2009 completion at the associated Olympus Dam site.

**Future Planned Activities:** Life safety modifications are planned for FY 2009. Unit 1 and 2 breaker replacement and fixed-wheel headgate repairs are planned for FY 2010. Plant remote control (RTU SCADA and fiber communication) upgrades are planned to be completed in FY 2010. Governor upgrades are planned for FY 2010. Online condition monitoring equipment installation is planned for FY 2013.

**Special Issues:** Estes Units 1, 2, and 3 are on AGC and provide VAR support, and occasionally are used for spinning reserve.

| | | | |
|---|---|---|---|
| **River:** | Big Thompson River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 45,000 kW | **Installed Capacity:** | 45,000 kW |
| **Year of Initial Operation:** | 1950 | **Age:** | 57 years |
| **Net Generation (FY-2007):** | 102.0 GWh | **Rated Head:** | 515 feet |
| **Average Plant Factor (FY-2007):** | 26.2 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Estes**
**Ancillary Services**

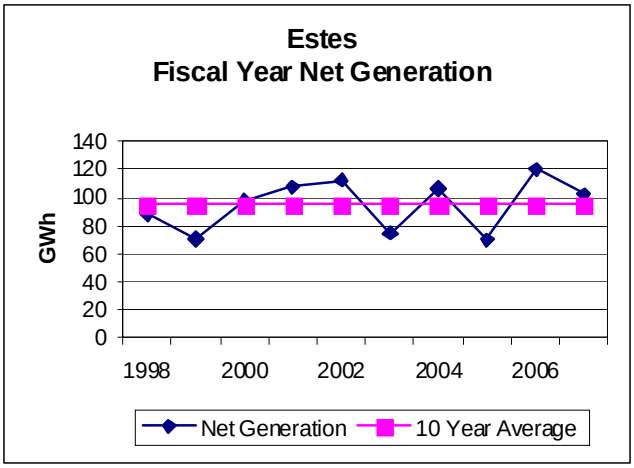
| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | No |
| Regulation/Load Following | Yes |
| Black Start | Yes |
| Voltage Support | Yes |

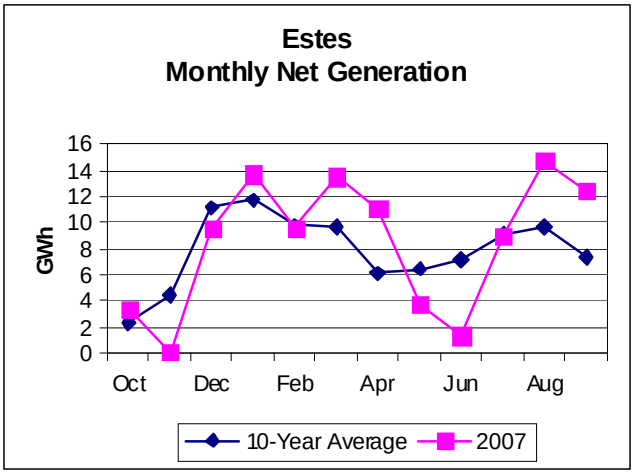
## Generators

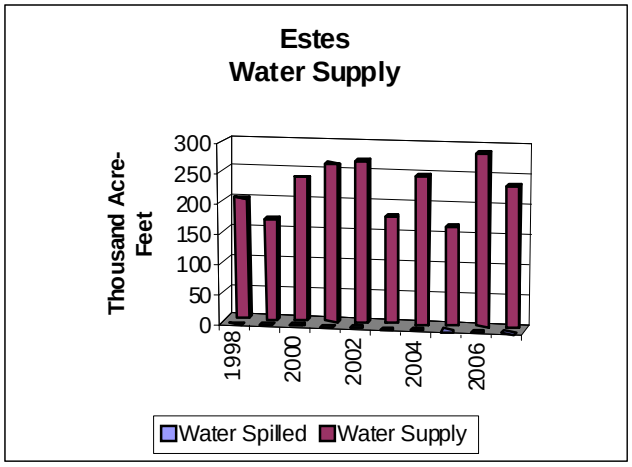
**Estes Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 15,000 | - | 15,000 |
| 2 | 15,000 | - | 15,000 |
| 3 | 15,000 | - | 15,000 |
| 3 units | 45,000 | - | 45,000 |

## Generation

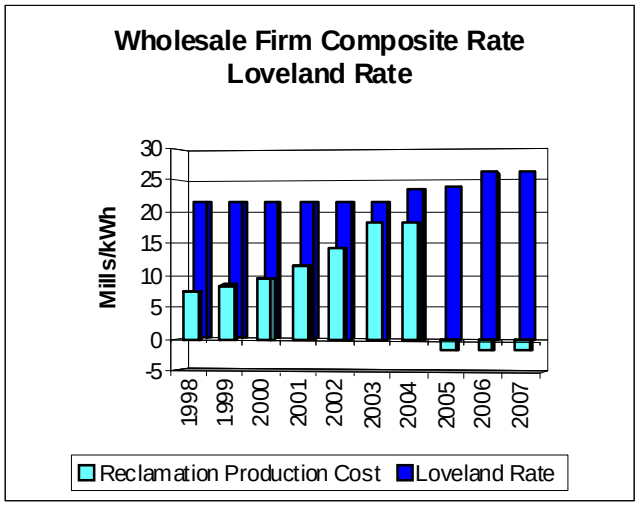

Estes
Fiscal Year Net Generation
GWh
140
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Estes
Monthly Net Generation
GWh
16
14
12
10
8
6
4
2
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

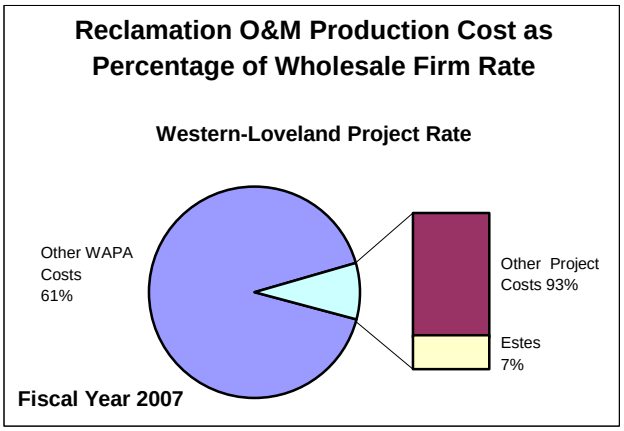

Estes
Water Supply
Thousand Acre-Feet
300
250
200
150
100
50
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

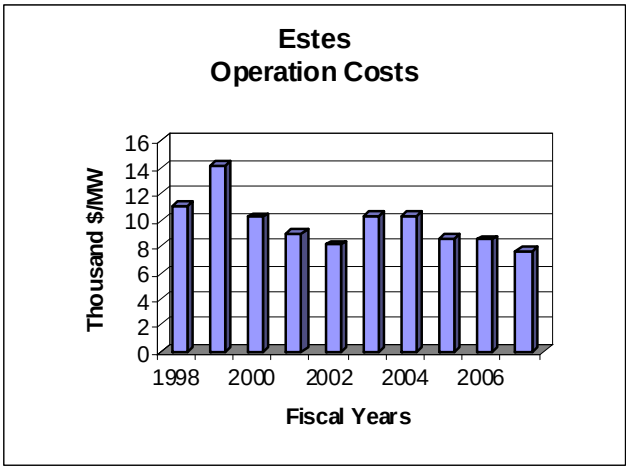
### Benchmark 1
### Wholesale Firm Rate

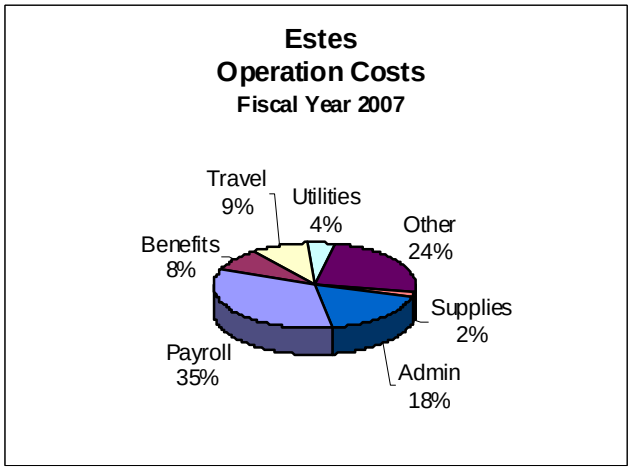


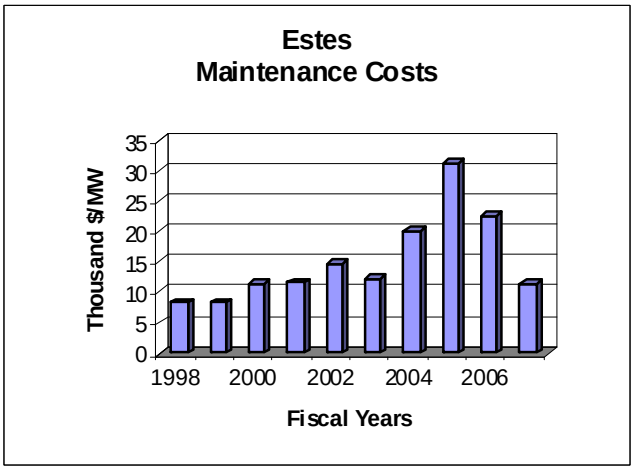

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

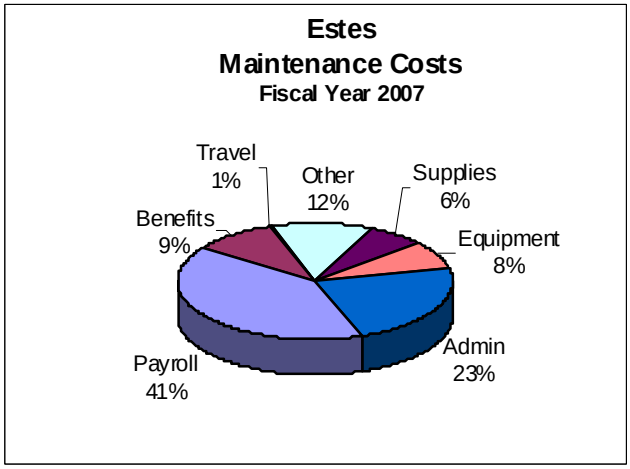


## Benchmark 3
## Production Costs

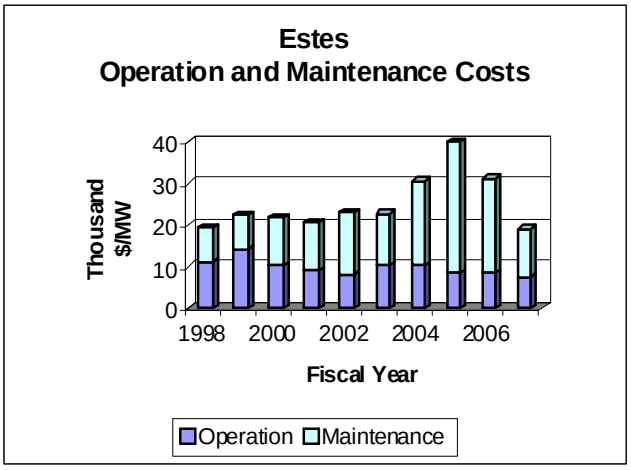


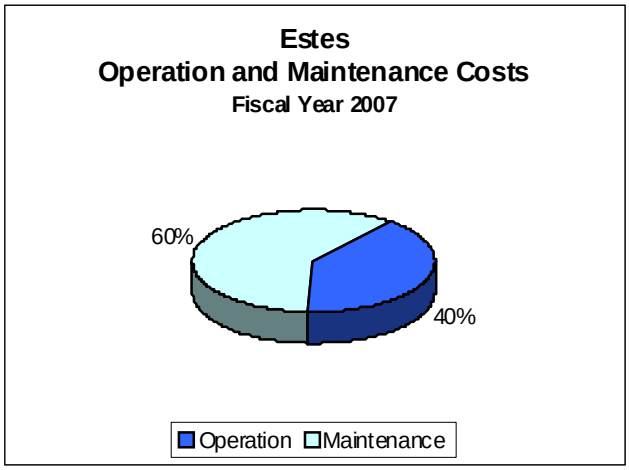



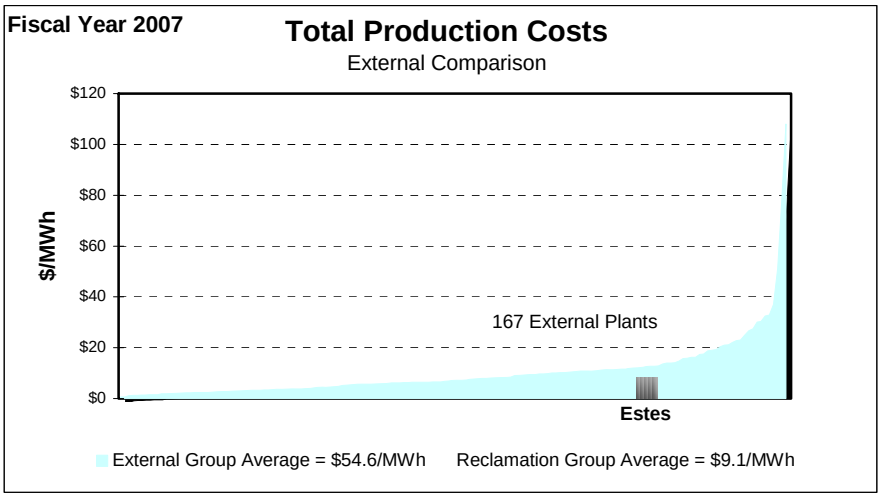



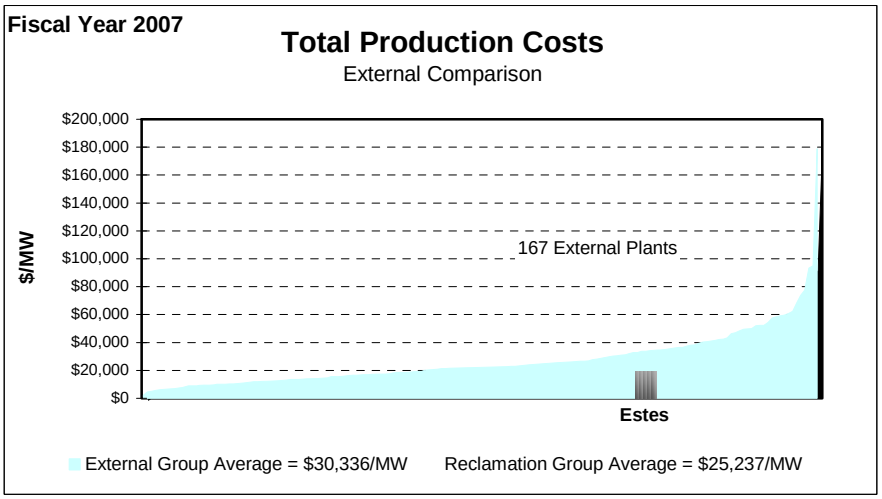



## Benchmark 3
## Production Costs



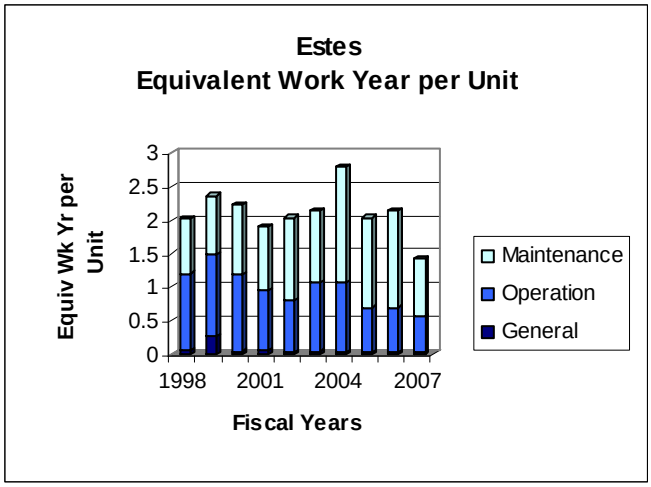



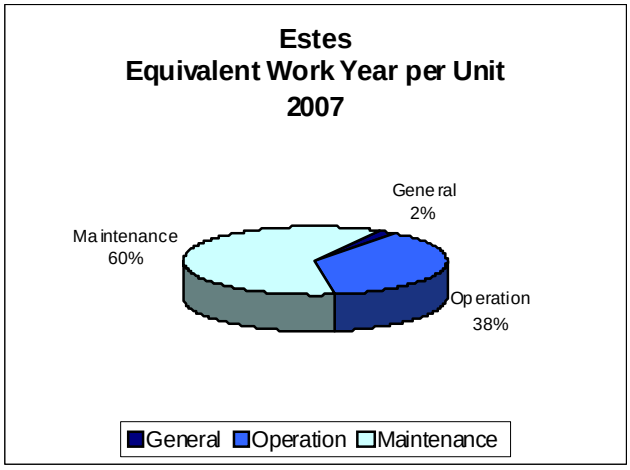



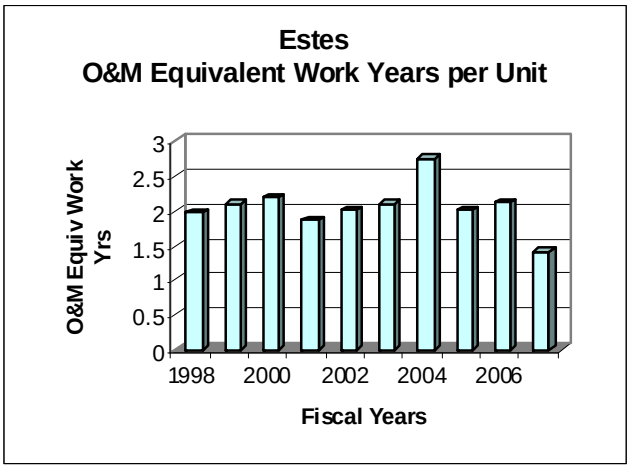



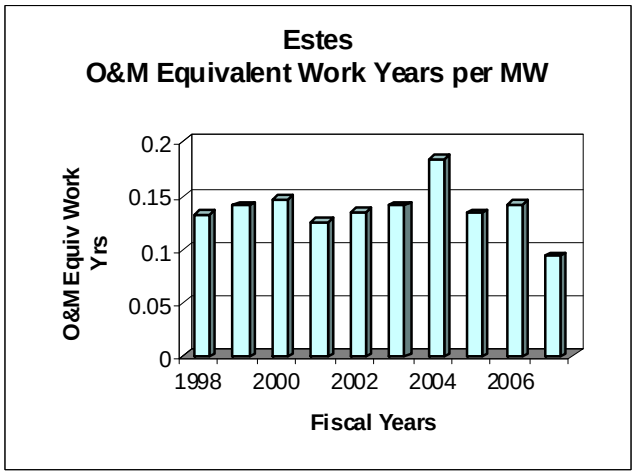
## Benchmark 4
## Workforce Deployment

| Estes FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.02 | 0.00 | 0.05 | 0.08 | 0.03 | 0.00 |
| Operation | 1.45 | 0.16 | 0.00 | 1.61 | 0.54 | 0.04 |
| Maintenance | 2.34 | 0.26 | 0.00 | 2.60 | 0.87 | 0.06 |
| Total Staffing | 3.81 | 0.43 | 0.05 | 4.29 | 1.43 | 0.10 |

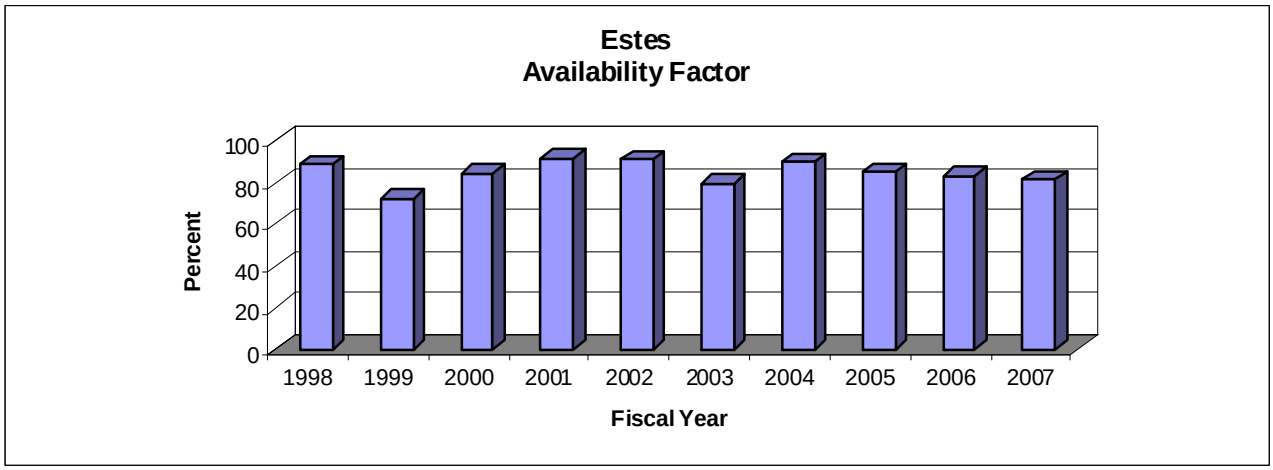


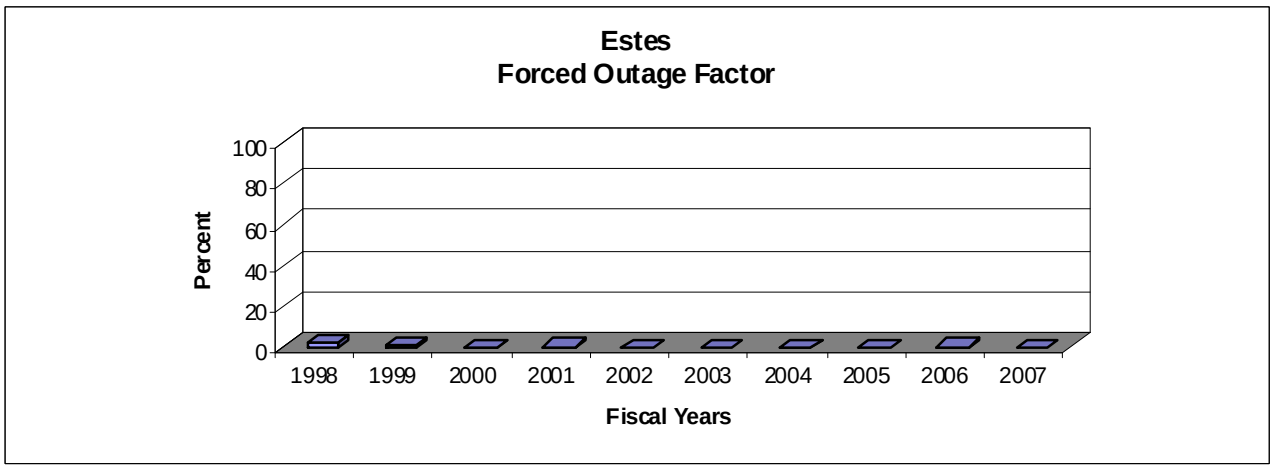



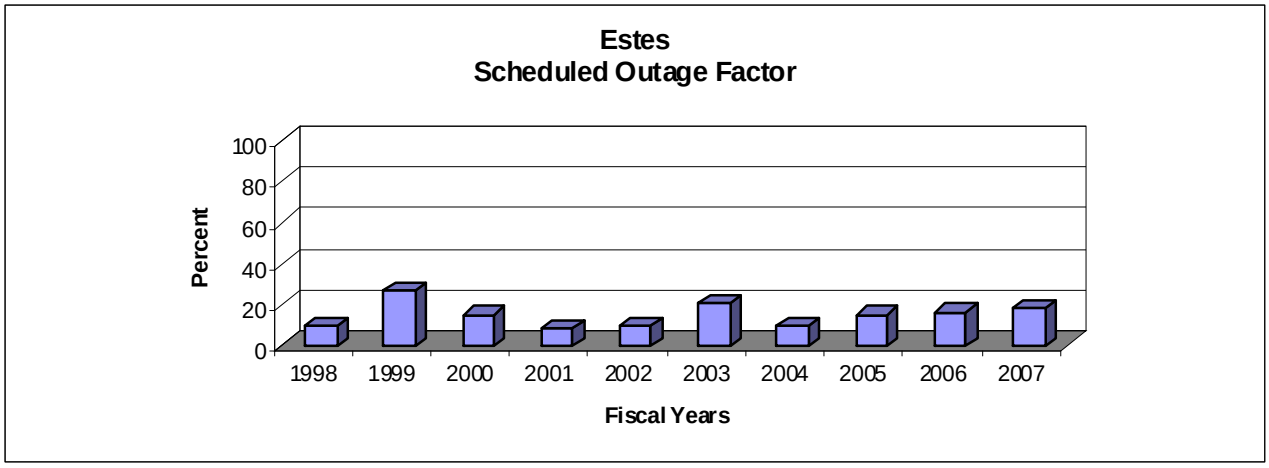
**Benchmark 5**
**Plant Availability Factor**



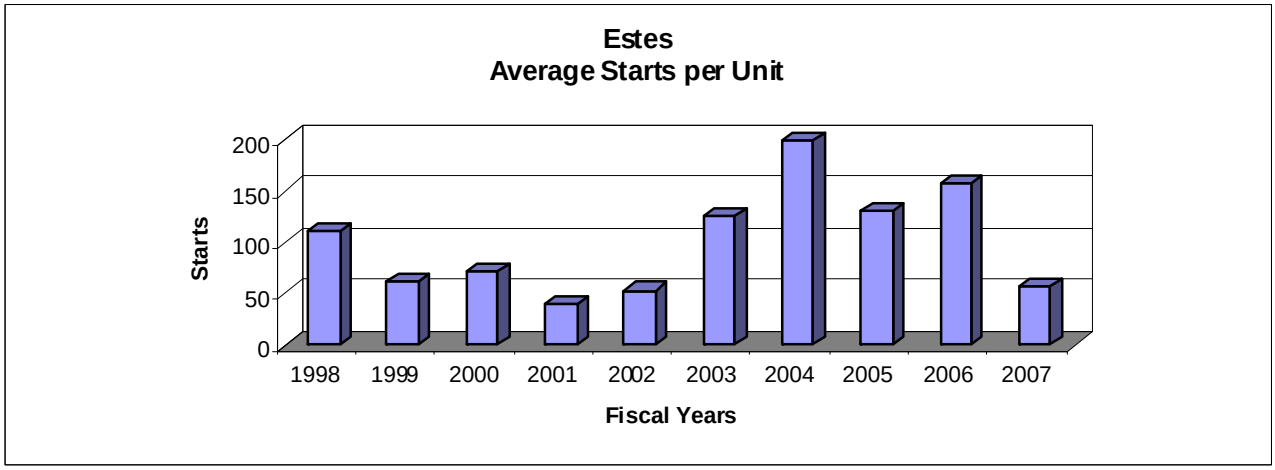

**Benchmark 6**
**Plant Forced Outage Factor**



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Estes Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.94% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 8.40 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 19,046 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.09 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 81.7 | 81.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.1 | 0.2 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 18.1 | 18.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Flatiron Powerplant
# Colorado-Big Thompson Project

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Chuck Pedersen
Chief, O&M

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11056 West County Road 18E
Loveland CO 80537-9711

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Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The President approved the Secretary of the Interior's finding of feasibility on December 21, 1937. |
| **Project Purposes:** | The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in the Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities. |
| **Plant Location:** | Flatiron Powerplant and Pumping Plant are located in Larimer County, near Carter Lake, 10 miles west of Loveland, Colorado. |
| **Plant Purpose:** | Generating hydroelectric power for the project and providing water to Carter Lake for delivery to other customers. |

**Plant Facts:** The Flatiron Powerplant discharges into Flatiron Reservoir, which regulates the water for release to the foothills storage and distribution system. The afterbay storage in Flatiron Reservoir and the forebay storage in Pinewood Lake enable Flatiron Powerplant to meet daily power loads. The Flatiron reversible pump unit lifts water from Flatiron Reservoir, a maximum of 297 feet, and delivers it through a pressure conduit and tunnel to Carter Lake. When the flow is reversed, the unit acts as a turbine-generator and produces electric energy.

**Plant History:** The water and power control center for Colorado-Big Thompson Project's reservoirs, powerplants, and transmission lines in Wyoming, Colorado, and western Nebraska is located at the project headquarters in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation powerplants.

**Present Activities:** Recently completed projects include $CO_2$ fire suppression system upgrade, fire detection and alarm system installation, and unit excitation system replacement. Flatiron Unit No. 1 shorted windings were repaired in September 2006, but shorted out again one year later. Flatiron Dam spillway repairs were completed in FY 2008.

**Future Planned Activities:** The windings for both Unit Nos. 1 and 2 will be replaced starting in FY 2008. Unit 3 bypass stilling basin concrete repairs are scheduled for FY 2010. Plant remote control (RTU SCADA and fiber communication) upgrades are planned to be completed in FY 2010. Governor upgrades are planned for FY2011. Penstocks interior lining and exterior coating replacements are planned to start in FY 2012.

**Special Issues:** Flatiron Units 1 and 2 are on AGC and provide VAR support.

| | | | |
|---|---|---|---|
| **River:** | Big Thompson River and Colorado River | **Plant Type:** | Conventional – Pump Generator |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 71,500 kW | **Installed Capacity:** | 94,500 kW |
| **Year of Initial Operation:** | 1954 | **Age:** | 54 years |
| **Net Generation (FY-2007)** | 240.3 GWh | **Rated Head:** | 1,055 feet |
| **Average Plant Factor (FY-2007):** | 29.2 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Flatiron**
**Ancillary Services**

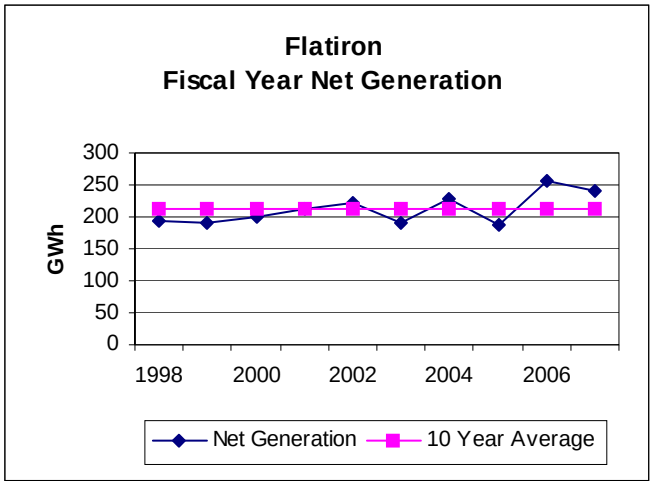
| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | Yes |
| Voltage Support | Yes |

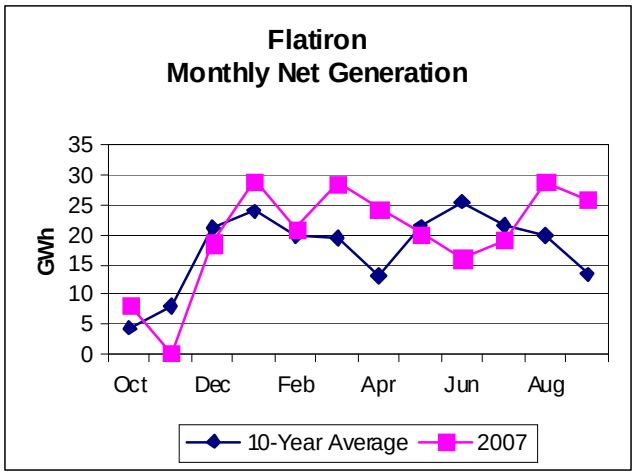
## Generators

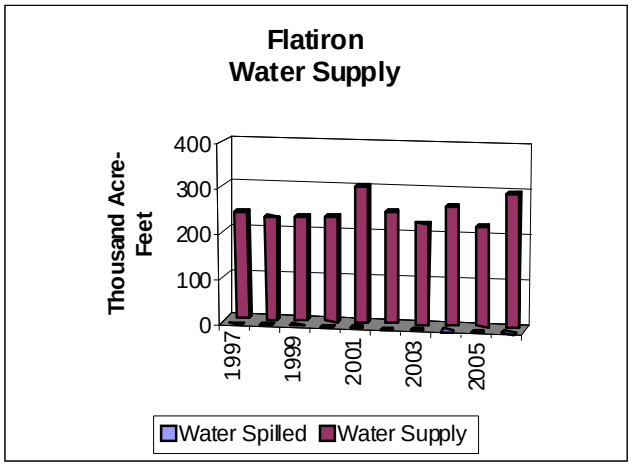
**Flatiron Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 31,500 | 11,500 | 43,000 |
| 2 | 31,500 | 11,500 | 43,000 |
| 3 | 8,500 | - | 8,500 |
| 3 units | 71,500 | 23,000 | 94,500 |

## Generation

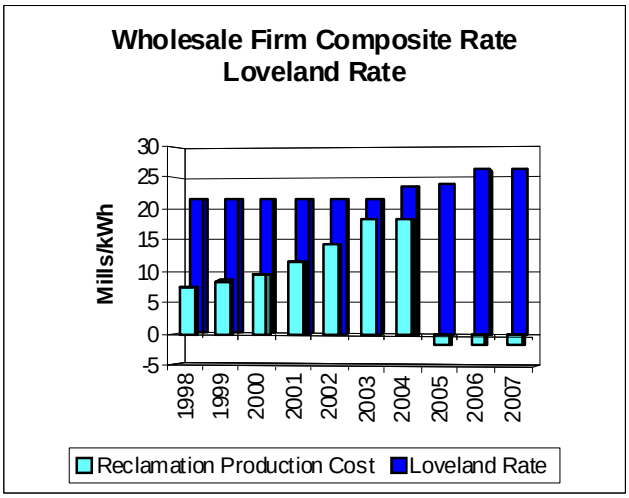

Flatiron
Fiscal Year Net Generation
GWh
300
250
200
150
100
50
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Flatiron
Monthly Net Generation
GWh
35
30
25
20
15
10
5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

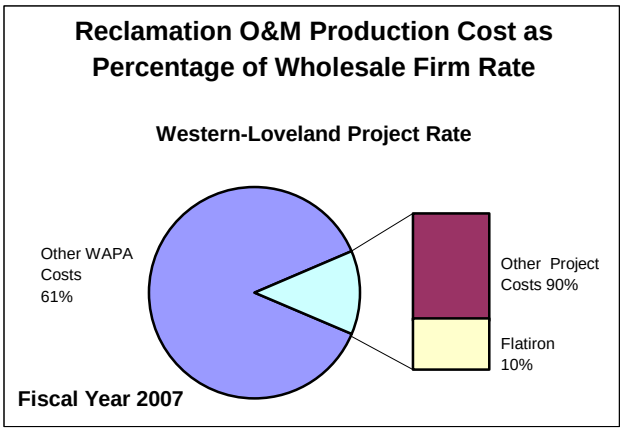

Flatiron
Water Supply
Thousand Acre-Feet
400
300
200
100
0
1997
1999
2001
2003
2005
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

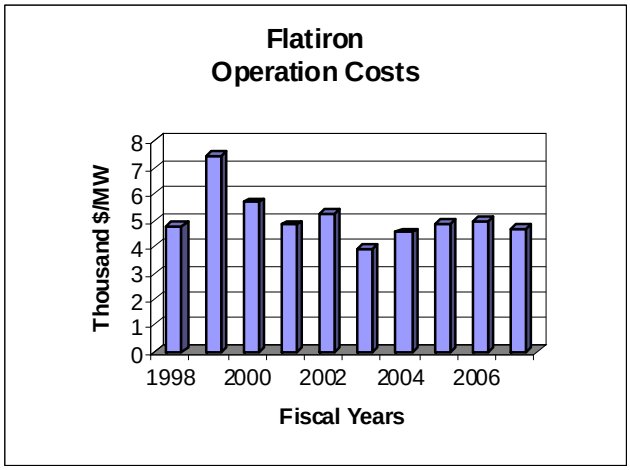
### Benchmark 1
### Wholesale Firm Rate

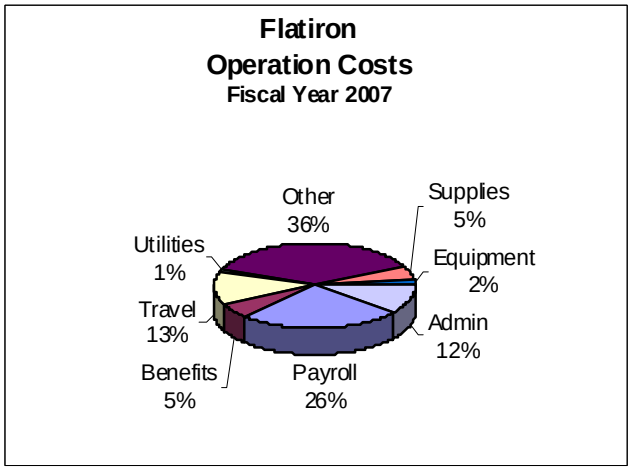


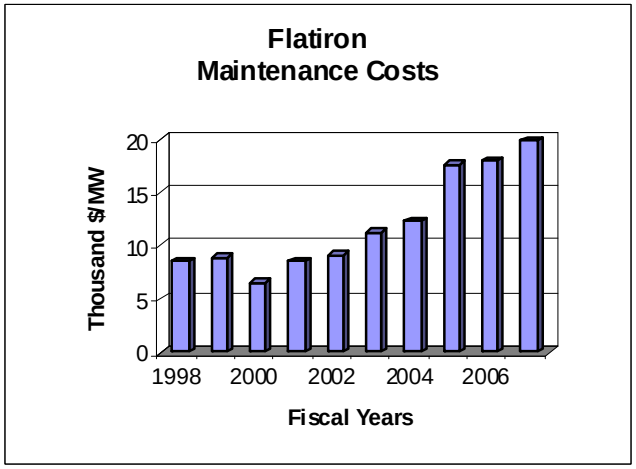

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

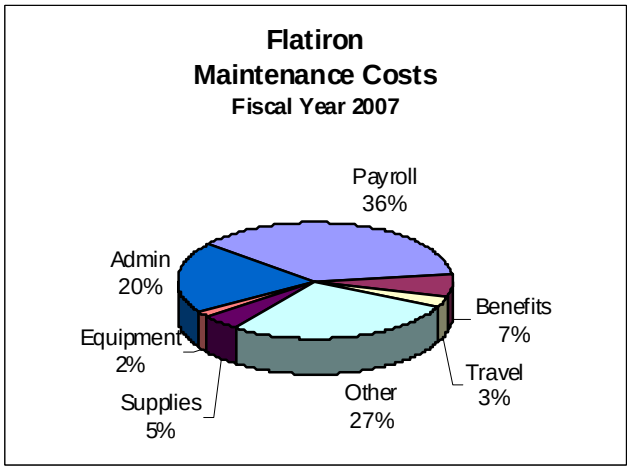


## Benchmark 3
## Production Costs

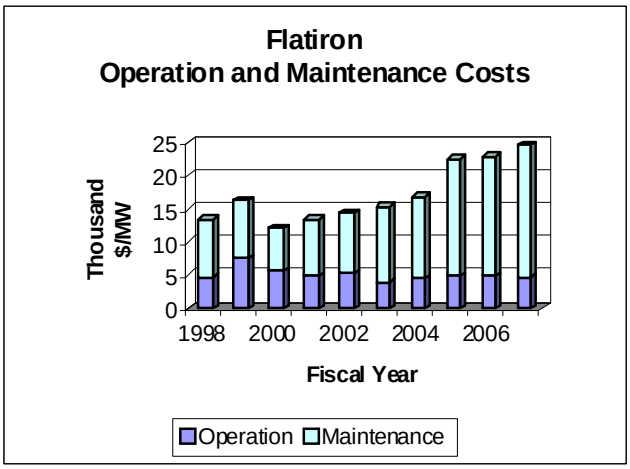


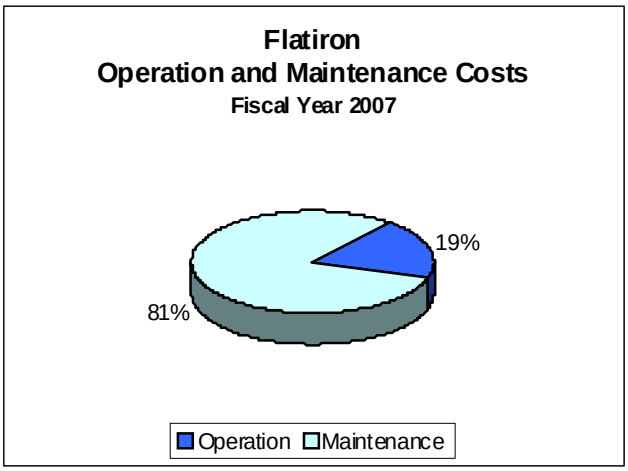



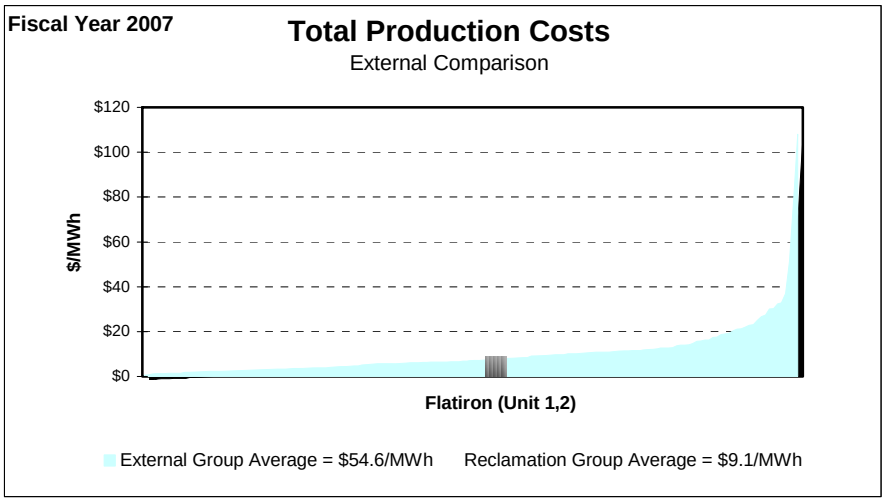



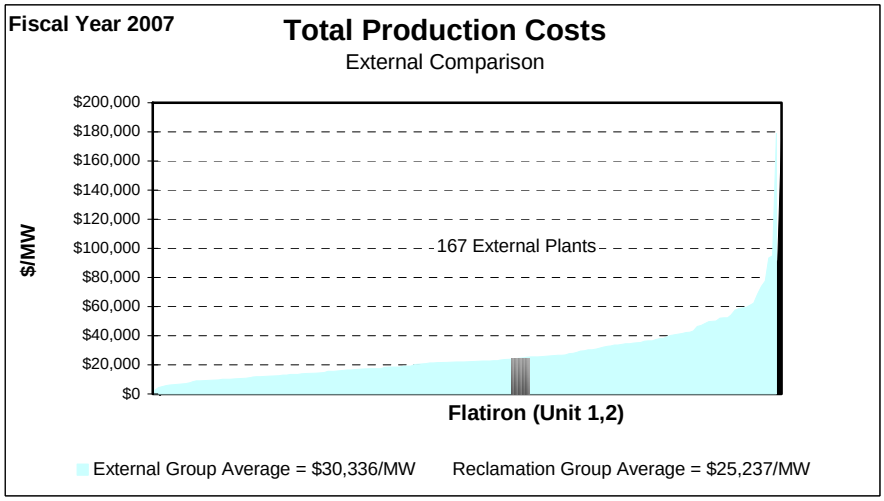



## Benchmark 3
## Production Costs



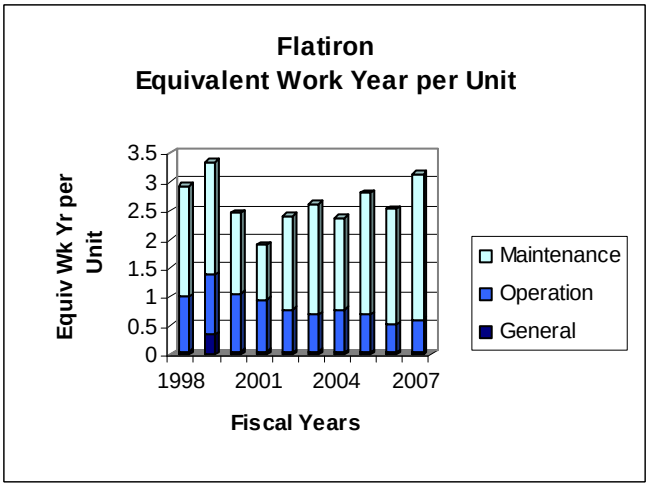



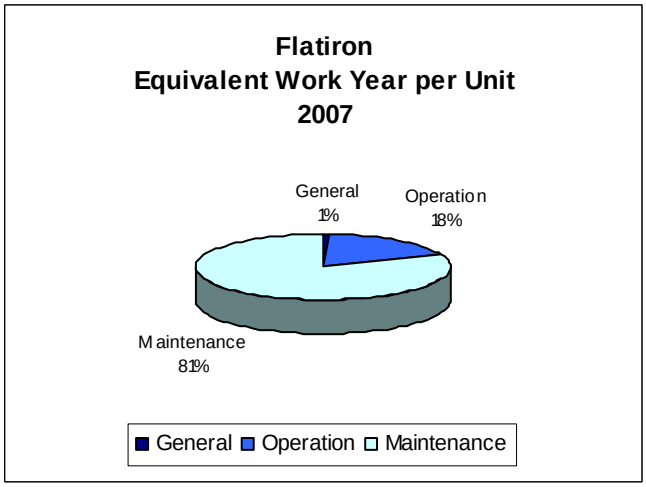



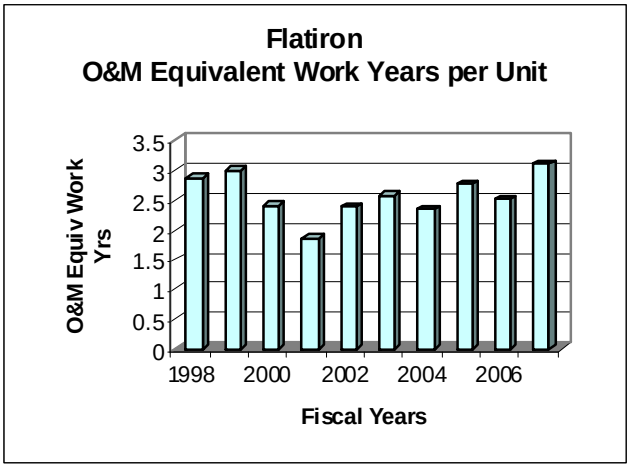



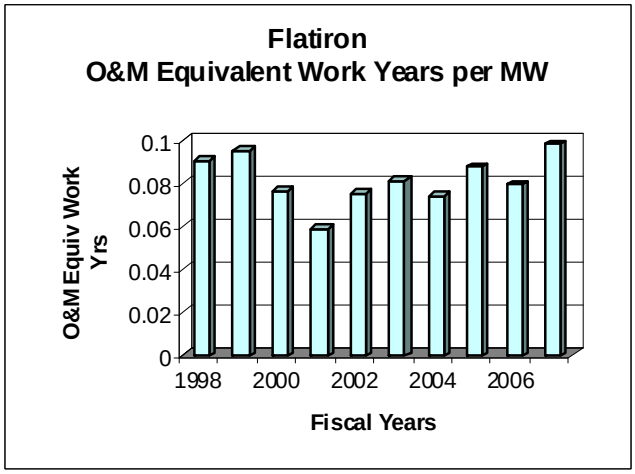
## Benchmark 4
## Workforce Deployment

| Flatiron FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.03 | 0.00 | 0.05 | 0.09 | 0.03 | 0.00 |
| Operation | 1.54 | 0.17 | 0.00 | 1.71 | 0.57 | 0.02 |
| Maintenance | 6.85 | 0.77 | 0.00 | 7.62 | 2.54 | 0.08 |
| Total Staffing | 8.42 | 0.95 | 0.05 | 9.43 | 3.14 | 0.10 |

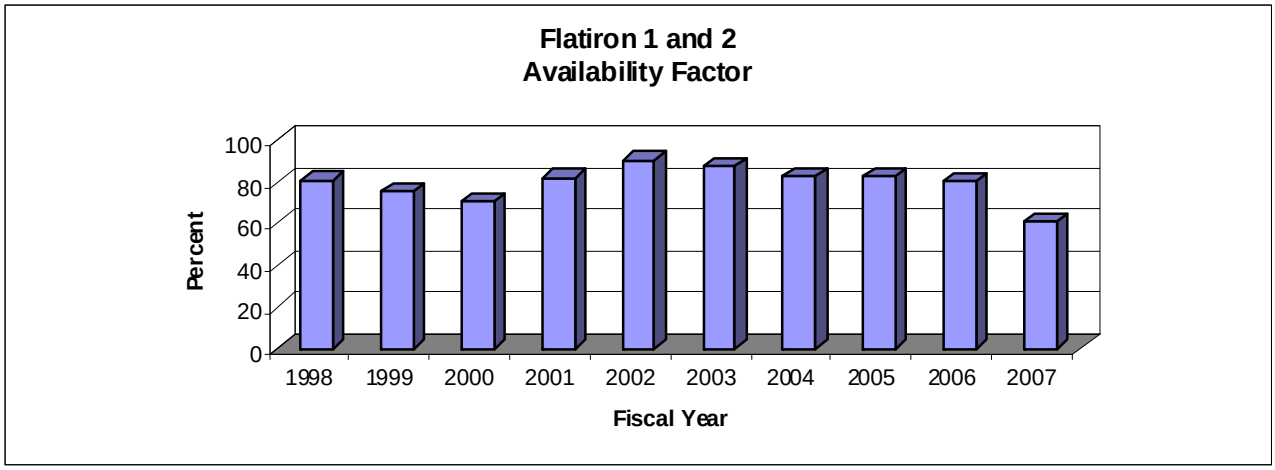


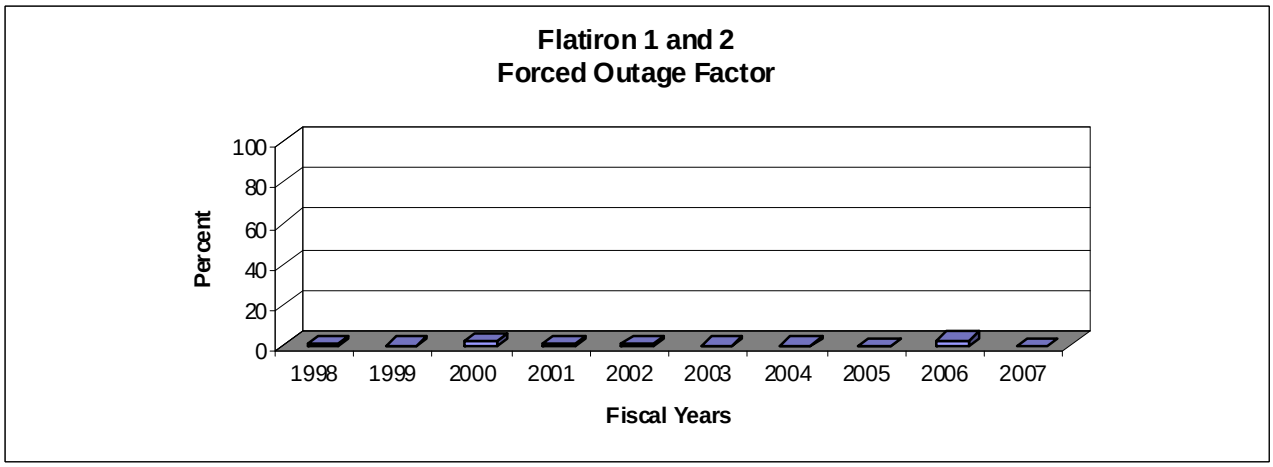



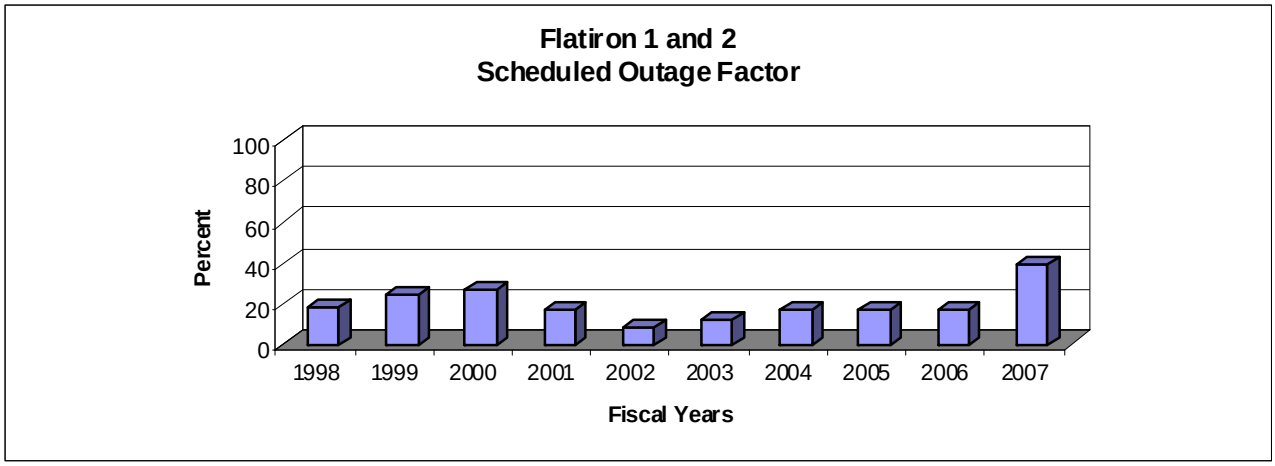
**Benchmark 5**
**Plant Availability Factor**



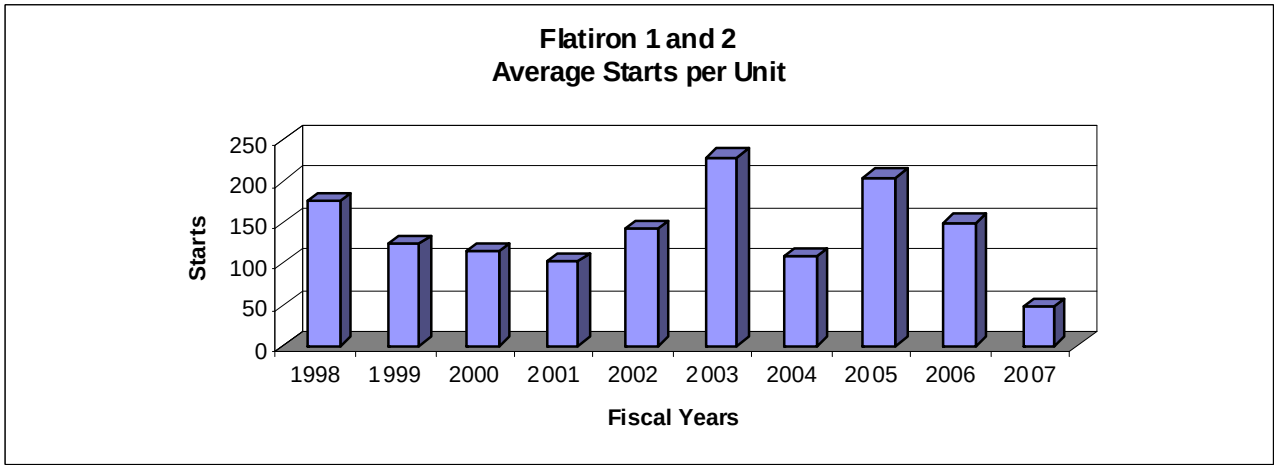

**Benchmark 6**
**Plant Forced Outage Factor**



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



## Benchmark Data Comparison

| Fiscal Year 2007 | Flatiron Powerplant | Reclamation Average 30-100 MW Group | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|---|
| Wholesale Firm Rate Mills/kWh | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| Production Cost as Percentage of Wholesale Firm Rate | 4.81% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| O&M Cost $/MWh | 8.82 | 7.85 | 2.76 | ***54.63 | 1.00 |
| O&M Costs $/MW | 24,628 | 24,132 | 7,847 | ***30,336 | 2,897 |
| O&M Equiv Work Year per MW | 0.10 | 0.10 | 0.03 | Not Available | 0.0 |
| Availability Factor | 61.0 | 81.3 | 82.3 | **88.64 | 98.5 |
| Forced Outage Factor | 0.1 | 0.2 | 2.6 | **2.61 | 0.0 |
| Scheduled Outage Factor | 38.9 | 18.5 | 15.1 | **8.74 | 0.0 |

## Benchmark Data Comparison

| Fiscal Year 2007 | Flatiron Powerplant | Reclamation Average 30-100 MW Group | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|---|
| Wholesale Firm Rate Mills/kWh | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| Production Cost as Percentage of Wholesale Firm Rate | 4.81% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| O&M Cost $/MWh | 8.82 | 7.85 | 2.76 | ***54.63 | 1.00 |
| O&M Costs $/MW | 24,628 | 24,132 | 7,847 | ***30,336 | 2,897 |
| O&M Equiv Work Year per MW | 0.10 | 0.10 | 0.03 | Not Available | 0.0 |
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| Scheduled Outage Factor | 38.9 | 18.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

Note: Performance data based on Units 1 and 2. Unit 3 is primarily used as a pump.

# Fremont Canyon Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Fremont Canyon Powerplant
Alcova WY

**Telephone Numbers:**
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**E-Mail Address:**
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**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Glendo Unit of the Pick-Sloan Missouri Basin Project was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general plan set forth in Senate Document 191, as revised and coordinated by Senate Document 247, 78th Congress, 2d Session. The project was reauthorized by Public Law 503, 83d Congress, on July 16, 1954.

**Project Purposes:** The Glendo Unit is a multi-purpose project. The unit furnishes a maximum of 40,000 acre-feet of water annually from Glendo Reservoir for irrigation in Wyoming and Nebraska. Glendo and Fremont Canyon Powerplants supply electrical power to Wyoming, Colorado, and Nebraska. The unit provides irrigation, power generation, flood control, fish and wildlife enhancement, recreation, sediment retention, and pollution abatement. It also improves the quality of municipal and industrial water supply in the North Platte River Valley between Gray Reef Dam and Glendo Reservoir.

**Plant Location:** Fremont Canyon Powerplant is located in Natrona County, Wyoming, approximately 3 miles downstream from Pathfinder Dam on the left bank of the North Platte River Canyon.

**Plant Purpose:** The powerplant generates power during releases of stored water from Pathfinder Reservoir of the North Platte Project.

**Plant Facts:** The Fremont Canyon Powerplant consists of two hydraulic turbine-driven generators, with a combined capacity of 66,800 kilowatts. Water for power generation is conveyed to the powerplant by a 3-mile-long 18-foot-diameter, concrete-lined pressure tunnel. The tunnel branches to two 10.75-foot-diameter penstocks upstream of the powerplant. This conduit is controlled by a 14- by 18-foot fixed-wheel gate located 243 feet downstream from the inlet.

**Plant History:** Construction of Fremont Canyon Powerplant and power conduit began in 1956 and was completed in 1961. The plant had an original installed capacity of 48,000 kilowatts, and was up rated between 1986 and 1990, through the installation of new generator windings and turbines, to its current installed rating of 66,800 kilowatts.

**Present Activities:** A contract for replacement of the $CO_2$ fire suppression system for the three generating units was awarded in FY-2004 and the new system was installed in FY-2005. Unit 2 power cables from the transformer to the unit breaker were replaced in FY-2004. The overhead tunnel door and operator that provides access to the powerplant was replaced in FY-2004.

**Future Planned Activities:** The wicket gate greasing systems for both generating units will be installed in FY-2007.

**Special Issues:** Because of low water conditions from FY-1991through FY-1994, extensive cavitation damage required lengthy annual welding repair. The availability factor low and the scheduled outage factor high in fiscal year 2002 were due to significant draft tube and runner cavitation repairs to Unit 2 plus interruption of annual maintenance to complete critical maintenance at other facilities.

A new, low flow outlet at Pathfinder Dam was completed in 1997. This new outlet works will allow restoration of year-round flows to 4 miles of river between the Dam and Fremont Canyon Powerplant when necessary river access and operation agreements have been established.

**Fremont Canyon Powerplant**
**30-100 MW**

| | | | |
|---|---|---|---|
| **River Name:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 48,000 kW | **Installed Capacity:** | 66,800 kW |
| **Year of Initial Operation:** | 1960 | **Age:** | 47 years |
| **Net Generation (FY-2007):** | 172.6 GWh | **Rated Head:** | 300 feet |
| **Annual Plant Factor (FY-2007):** | 29.7 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Fremont Canyon**
**Ancillary Services**

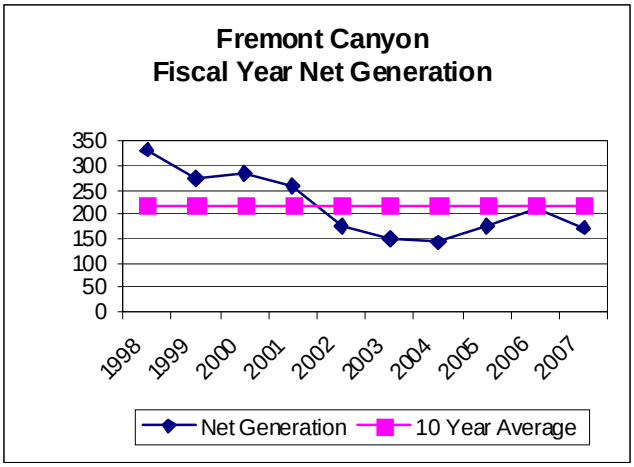
| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | No |
| Voltage Support | Yes |

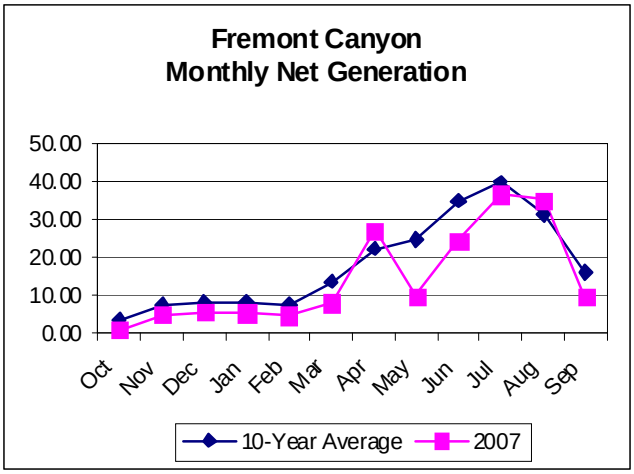
## Generators

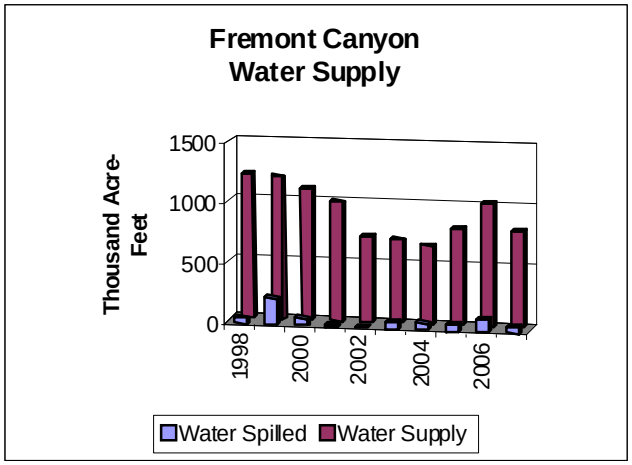
**Fremont Canyon Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 24,000 | 9,400 | 33,400 |
| 2 | 24,000 | 9,400 | 33,400 |
| 2 units | 48,000 | 18,800 | 66,800 |

## Generation

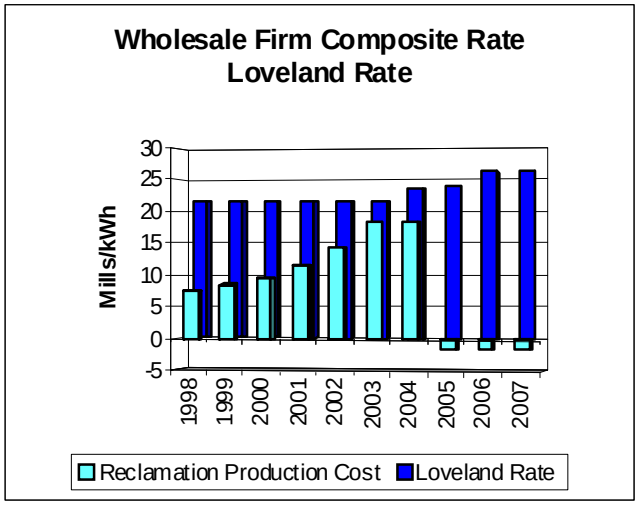

Fremont Canyon
Fiscal Year Net Generation
350
300
250
200
150
100
50
0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Net Generation
10 Year Average


Fremont Canyon
Monthly Net Generation
50.00
40.00
30.00
20.00
10.00
0.00
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
10-Year Average
2007

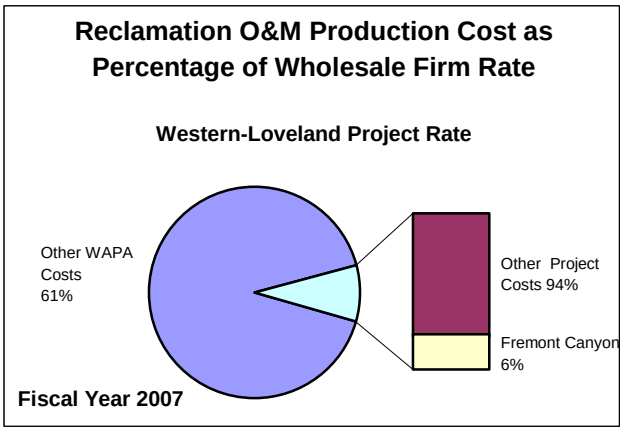

Fremont Canyon
Water Supply
Thousand Acre-Feet
1500
1000
500
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

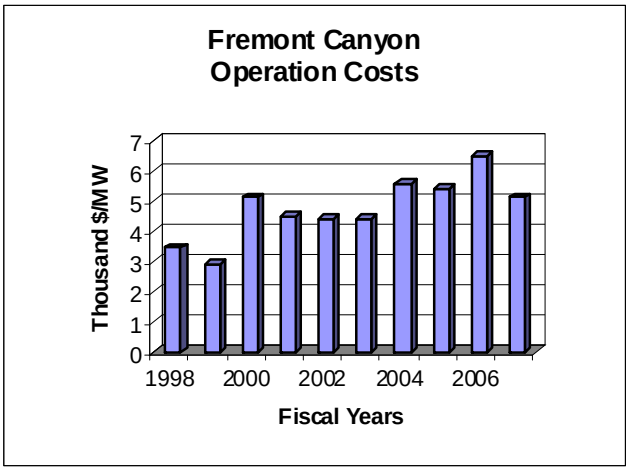
### Benchmark 1
### Wholesale Firm Rate

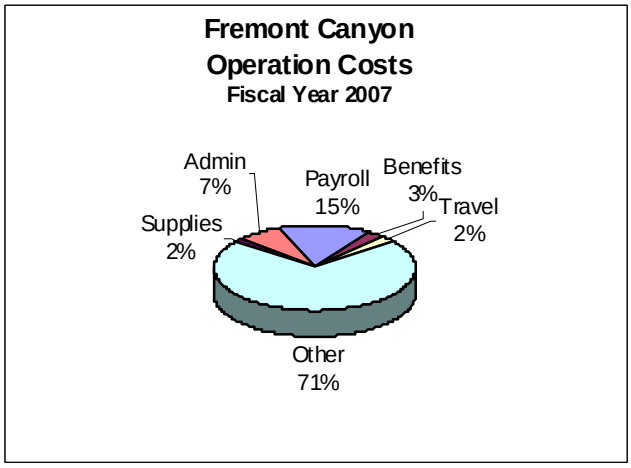


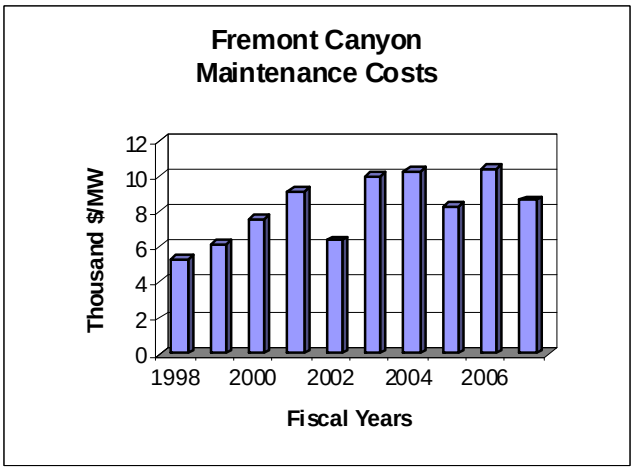

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

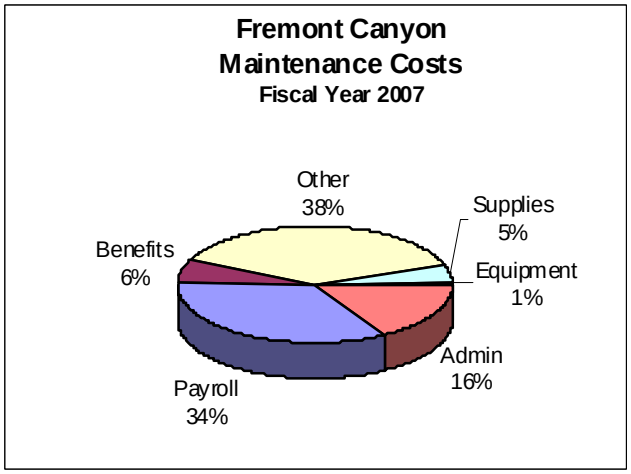


## Benchmark 3
## Production Costs



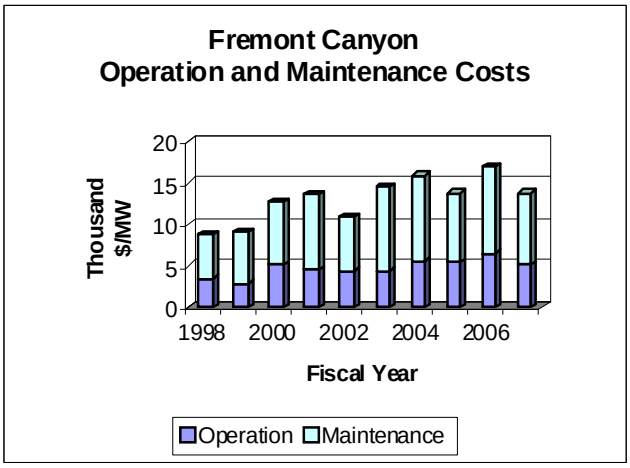



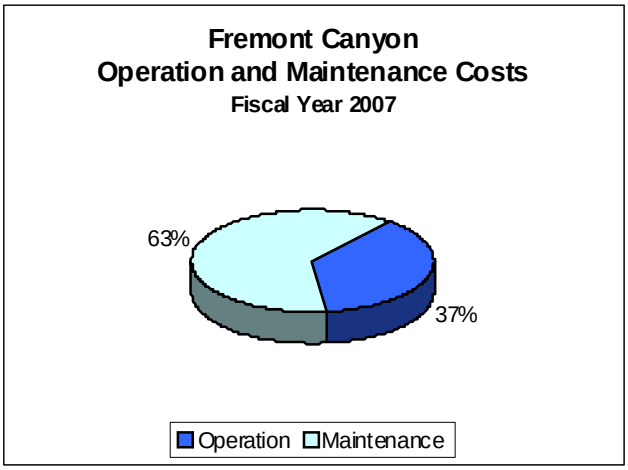



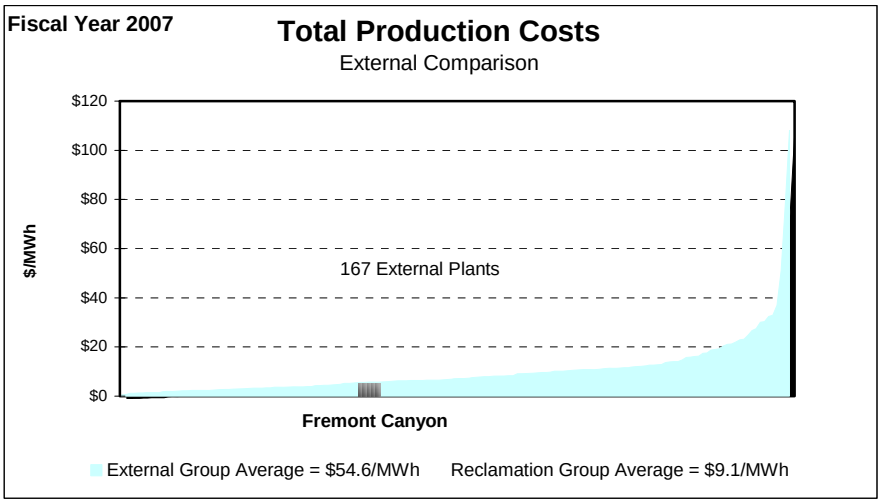



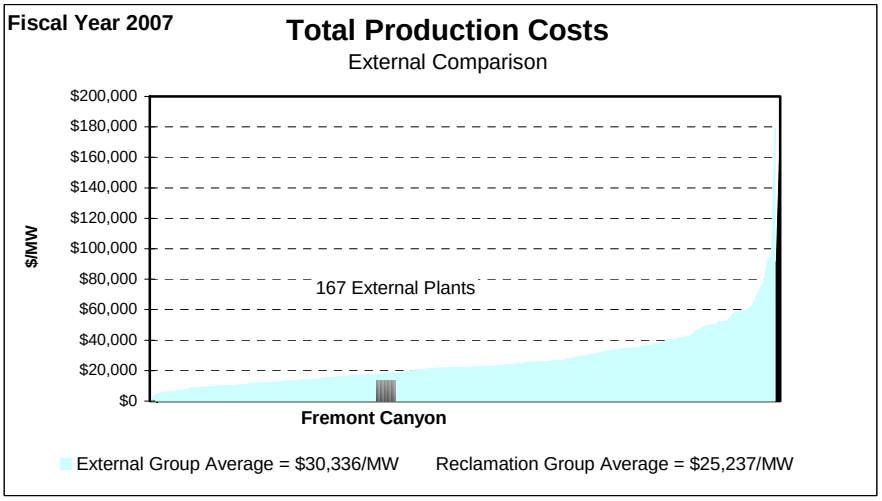

FY-2003 – Maintenance costs include replacement of Unit 1 power cables.

## Benchmark 3
## Production Costs



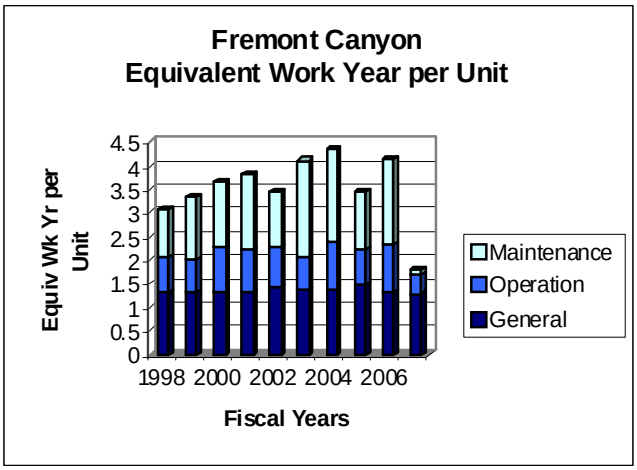



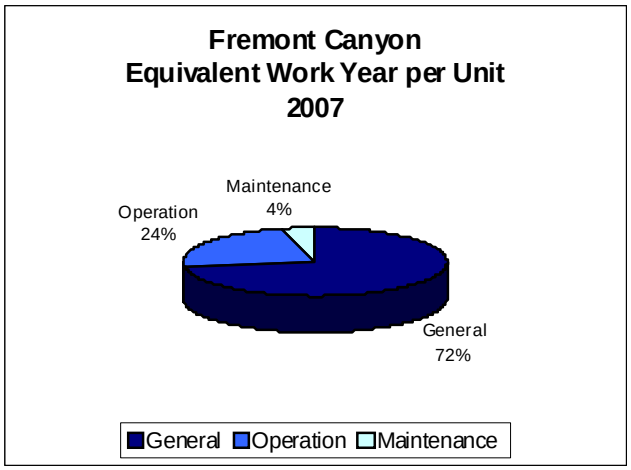



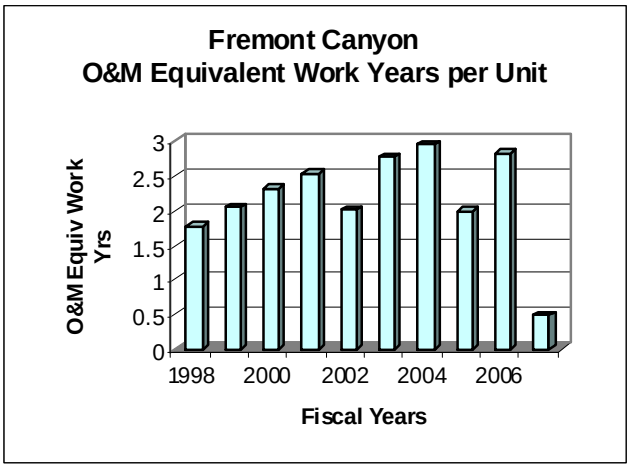



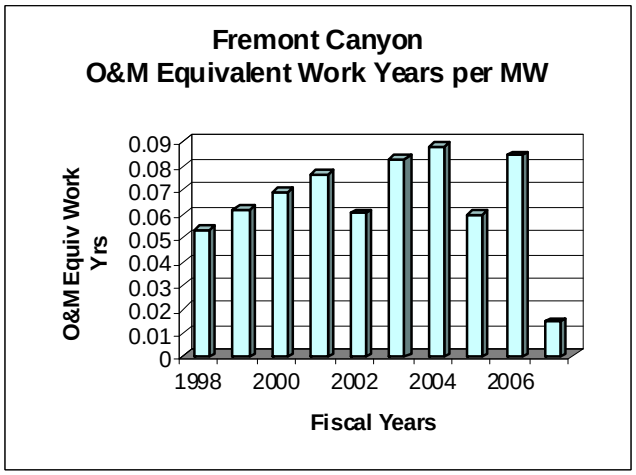
## Benchmark 4
## Workforce Deployment

| Fremont Canyon FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 2.28 | 0.26 | 0.04 | 2.58 | 1.29 | 0.04 |
| Operation | 0.75 | 0.09 | 0.00 | 0.84 | 0.42 | 0.01 |
| Maintenance | 0.12 | 0.01 | 0.00 | 0.14 | 0.07 | 0.00 |
| Total Staffing | 3.16 | 0.36 | 0.04 | 3.55 | 1.78 | 0.05 |

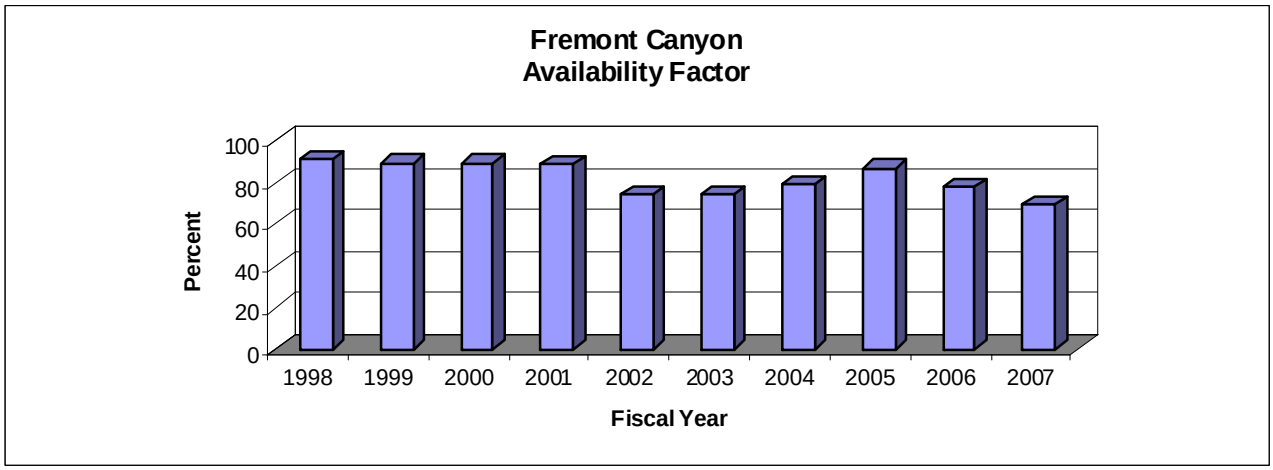


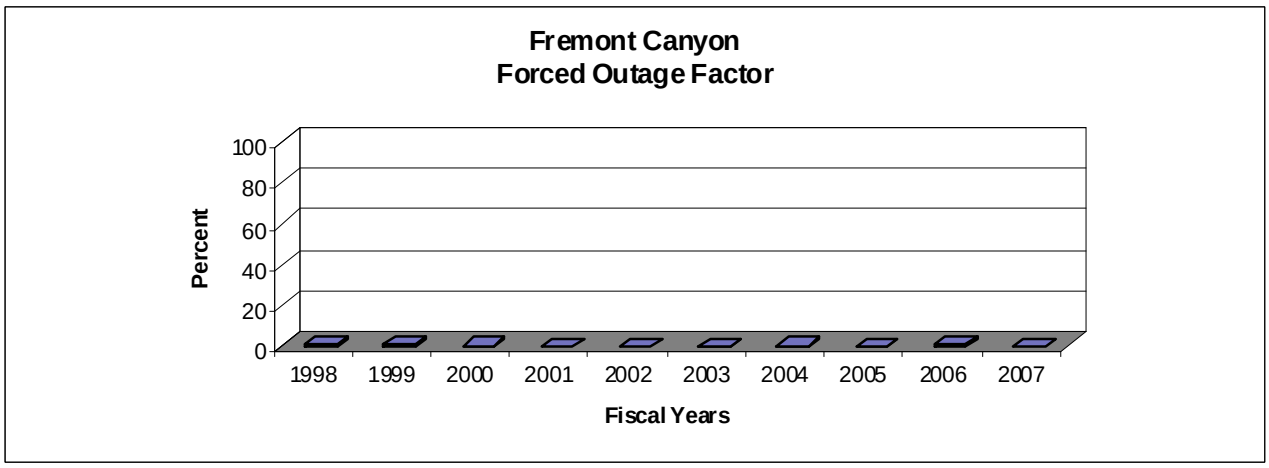



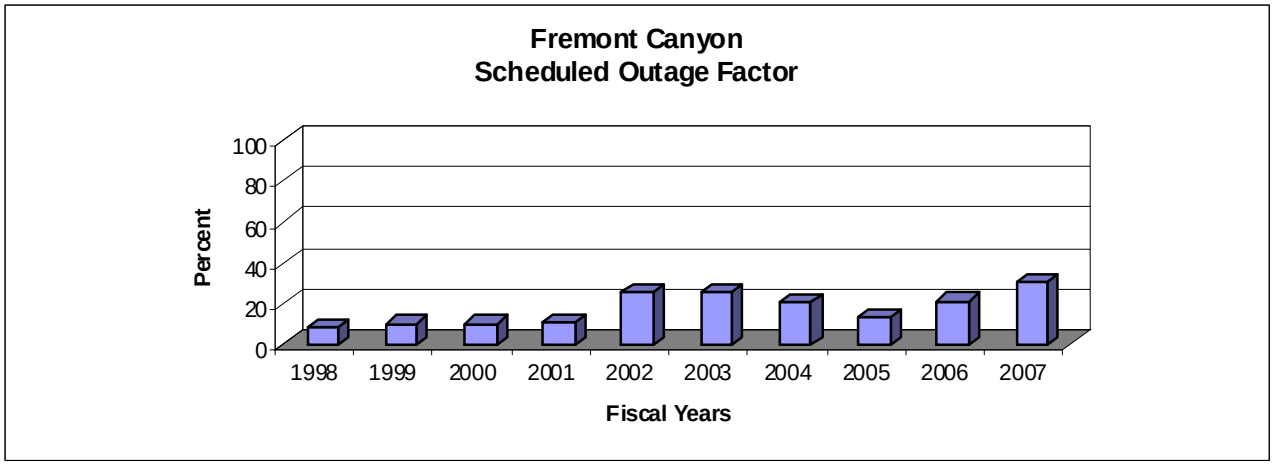
**Benchmark 5**
**Plant Availability Factor**




**Benchmark 6**
**Plant Forced Outage Factor**



**Benchmark 7**
**Plant Scheduled Outage Factor**

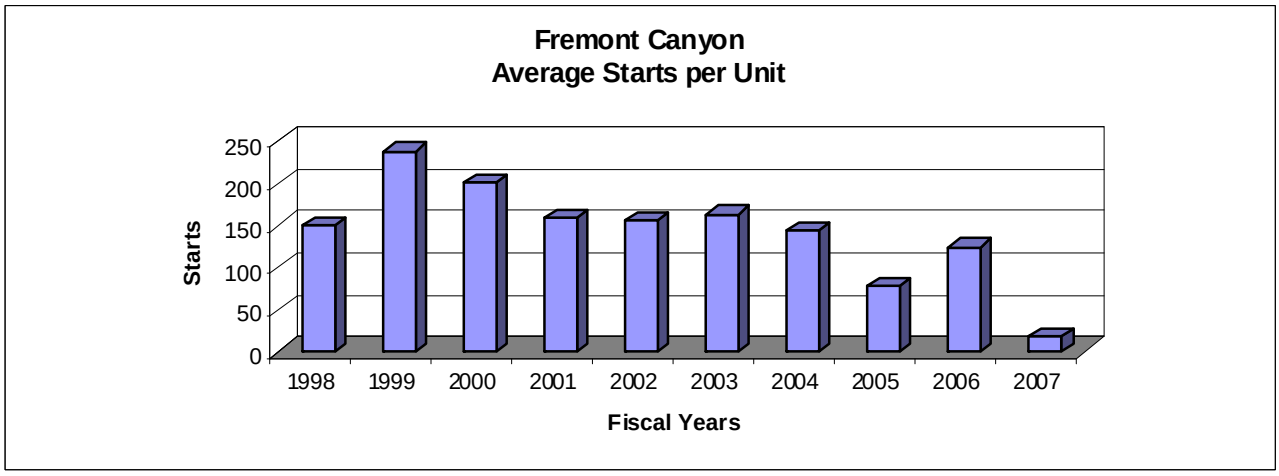



FY-1996 to FY-1997 – Extended maintenance.

FY-2002 – Extended outage for significant draft tube and runner cavitation repairs to Unit 2 plus interruption of annual maintenance to complete critical maintenance at other facilities.

FY-2003 – Extended outage for significant re-contouring of Units 1 and 2 turbine runner buckets.
FY-2004 – Unit 2 power cable replacement and $CO_2$ system replacement.

**Unit Starts**



## Benchmark Data Comparison

| Fiscal Year 2007 | Fremont Canyon Powerplant | Reclamation Average 30-100 MW Group | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|---|
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 2.10% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 5.35 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 13,832 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.01 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 69.2 | 84.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.0 | 0.5 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 30.8 | 15.3 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Glendo Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

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Glendo WY

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Fax: (307) 261-5683

**E-Mail Address:**
jlawson@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Glendo Unit of the Pick-Sloan Missouri Basin Project was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general plan set forth in Senate Document 191, as revised and coordinated by Senate Document 247, 78th Congress, 2d Session. The project was reauthorized by Public Law 503, 83d Congress, on July 16, 1954.

**Project Purposes:** The Glendo Unit is a multi-purpose project. The unit furnishes a maximum of 40,000 acre-feet of water annually from Glendo Reservoir for irrigation in Wyoming and Nebraska. Glendo and Fremont Canyon Powerplants supply electrical power to Wyoming, Colorado, and Nebraska. The unit provides irrigation, power generation, flood control, fish and wildlife enhancement, recreation, sediment retention, and pollution abatement. It also improves the quality of municipal and industrial water supply in the North Platte River Valley between Gray Reef Dam and Glendo Reservoir.

**Plant Location:** Glendo Powerplant is located in Platte County approximately 4.5 miles southeast of Glendo, Wyoming, on the North Platte River.

**Plant Purpose:** Addition of Glendo Unit power generation facilities increases available power in the North Platte River Basin by about 500 million kilowatt-hours annually. This increase comes principally from the Glendo and Fremont Canyon Powerplants, however, some of the gain is due to the conversion of the Alcova Powerplant from seasonal to year-round operation made possible by the regulation afforded by Glendo Reservoir.

**Plant Facts:** Glendo Dam is a zoned earth fill structure on the North Platte River. The embankment 190 feet high and 2,096 feet long along the crest. An uncontrolled concrete spillway 45 feet wide is located about 450 feet north of the right abutment of the dam. The Glendo Powerplant is joined to the Glendo Reservoir by a diversion tunnel 21 feet in diameter and 2,100 feet long.

Glendo Powerplant is operated on a seasonal basis during the release of irrigation flows to satisfy downstream demands on the North Platte River in Wyoming and Nebraska.

**Plant History:** Construction of Glendo Dam and Powerplant began in 1954 and was completed in 1958. The plant had an original installed capacity of 24,000 kilowatts and was up rated between 1980-84 to its present installed capacity of 38,000 kilowatts by replacing turbines and windings.

**Present Activities:** The unit governors were rebuilt, water service piping was replaced, and new digital generator temperature recorders were installed in FY-2004.

**Future Planned Activities:** Materials will be purchased in FY-2006 for replacement of the wicket gate greasing system. The new system is planned for installation by Reclamation forces in FY-2011.

**Special Issues:** In 1993, a low-flow bypass at Glendo Dam was made operational to restore year-round flows to 22 miles of downstream river. Main power transformer KY1A was replaced in 1998.

| | | | |
|---|---|---|---|
| **River:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 24,000 kW | **Installed Capacity:** | 38,000 kW |
| **Year of Initial Operation:** | 1958 | **Age:** | 49 years |
| **Net Generation (FY-2007):** | 57.8 GWh | **Rated Head:** | 100 feet |
| **Average Plant Factor (FY-2007):** | 17.6 percent (seasonal) | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate (seasonal) | | |

## Ancillary Services

**Glendo**
**Ancillary Services**

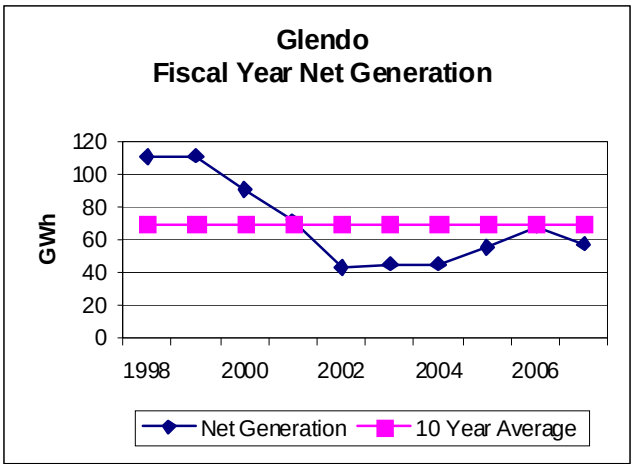
| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | Yes |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | Yes |

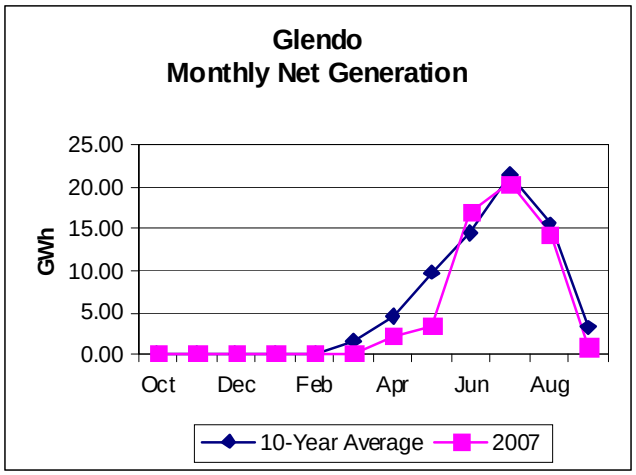
## Generators

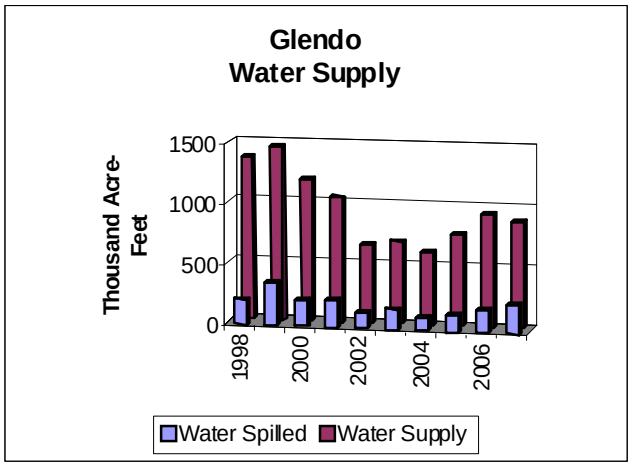
**Glendo Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 12,000 | 7,000 | 19,000 |
| 2 | 12,000 | 7,000 | 19,000 |
| 2 units | 24,000 | 14,000 | 38,000 |

## Generation

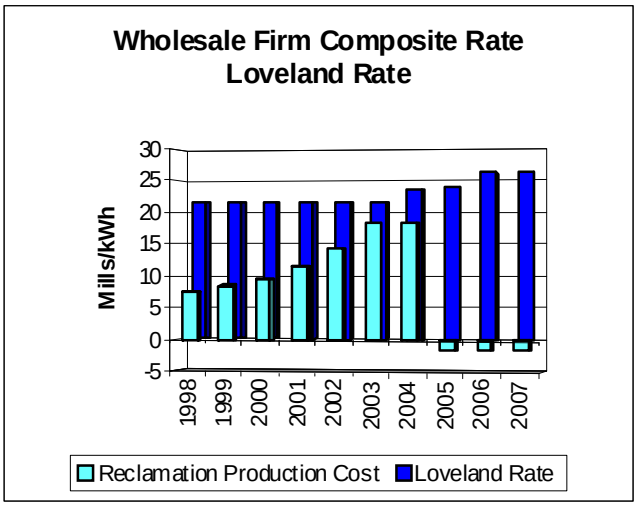

Glendo
Fiscal Year Net Generation
GWh
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Glendo
Monthly Net Generation
GWh
25.00
20.00
15.00
10.00
5.00
0.00
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

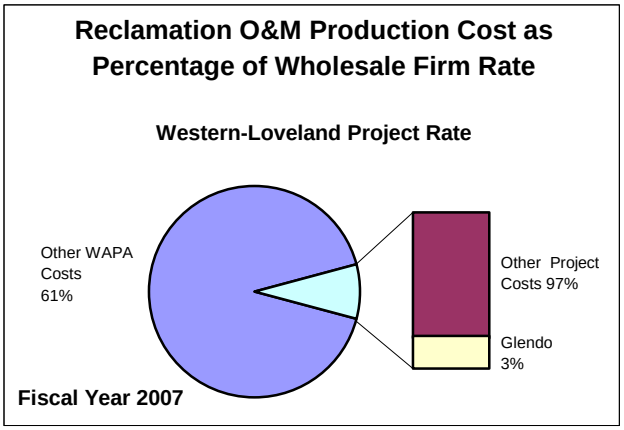

Glendo
Water Supply
Thousand Acre-Feet
1500
1000
500
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

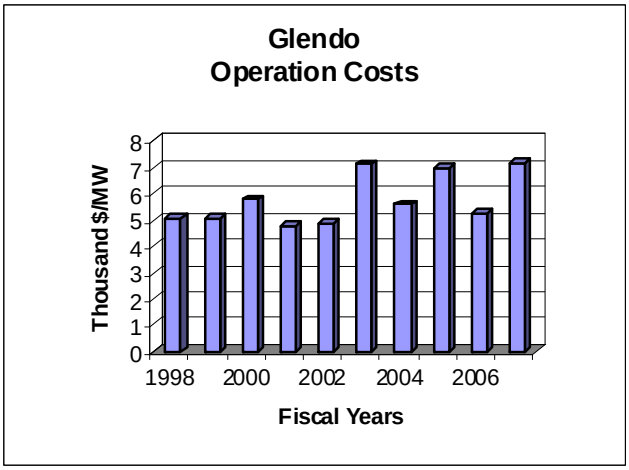
## Benchmark 1
## Wholesale Firm Rate

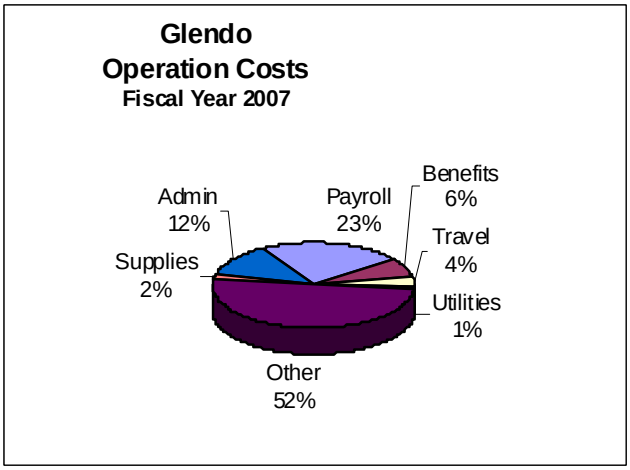


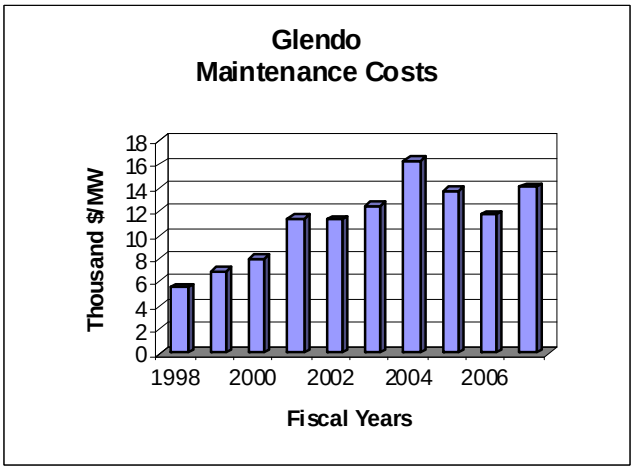

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

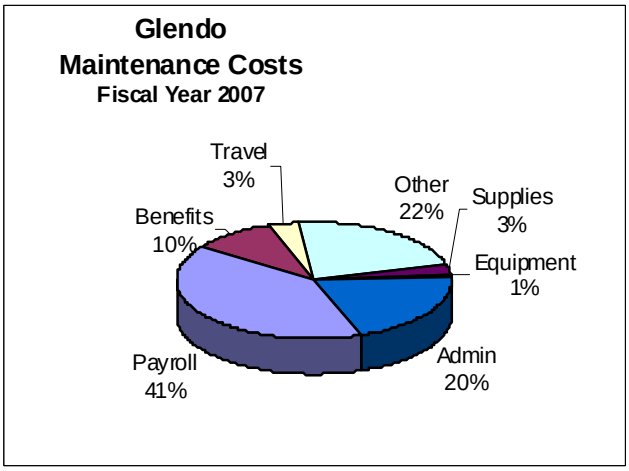


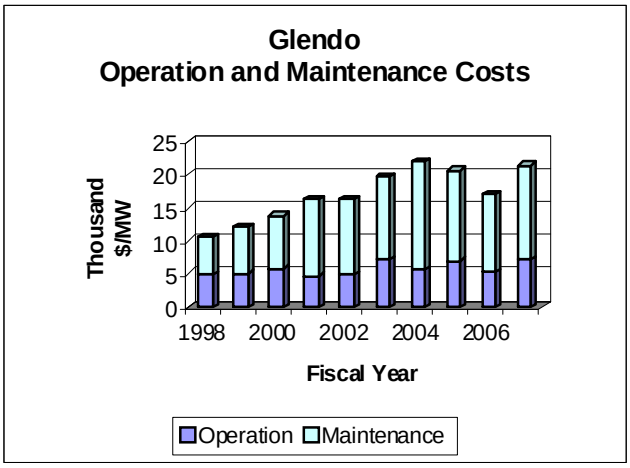
## Benchmark 3
## Production Costs

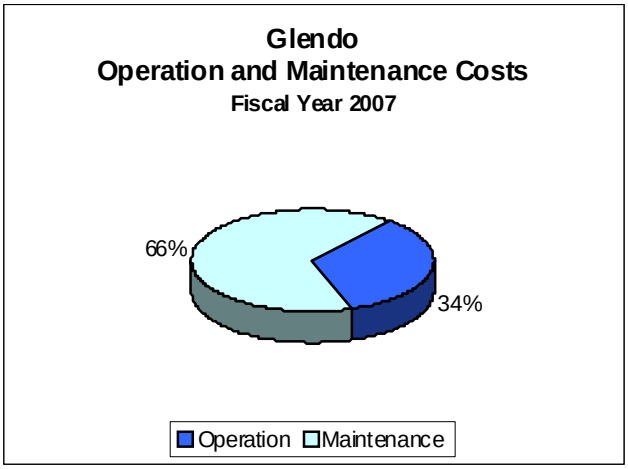


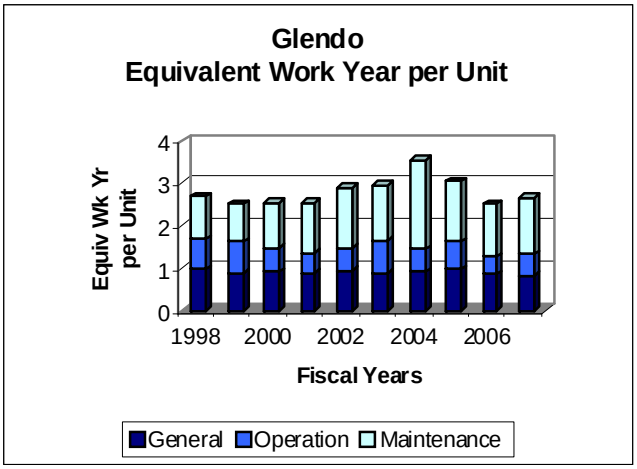



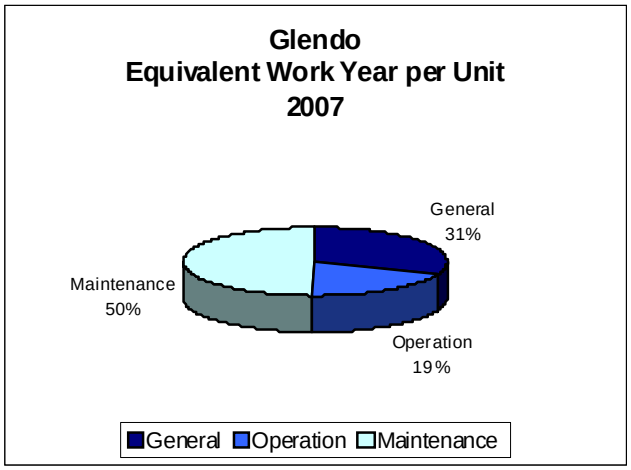



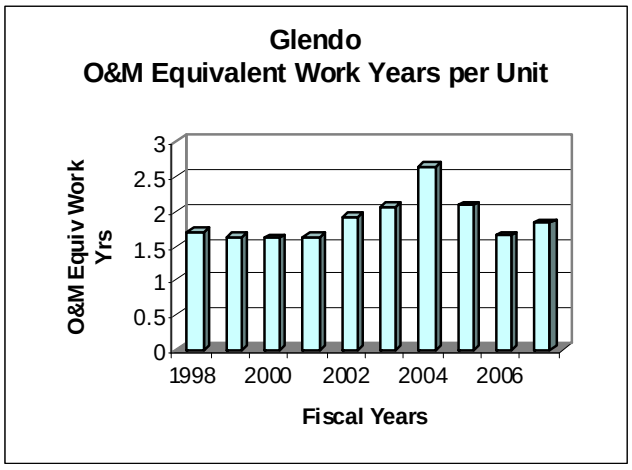



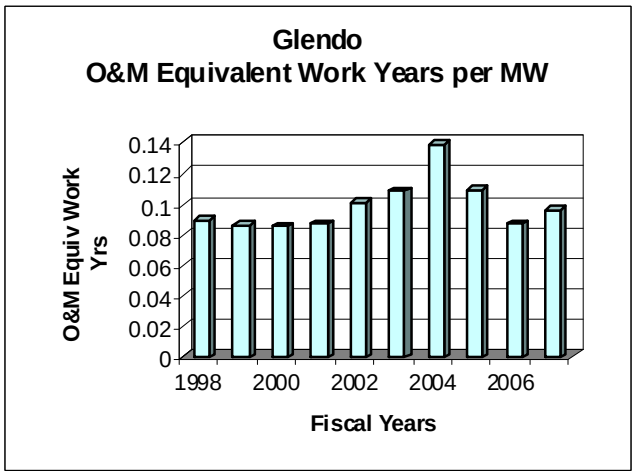
## Benchmark 4
## Workforce Deployment

| Glendo FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.47 | 0.17 | 0.04 | 1.68 | 0.84 | 0.04 |
| Operation | 0.90 | 0.10 | 0.00 | 1.00 | 0.50 | 0.03 |
| Maintenance | 2.38 | 0.27 | 0.00 | 2.65 | 1.33 | 0.07 |
| Total Staffing | 4.76 | 0.54 | 0.04 | 5.33 | 2.66 | 0.14 |

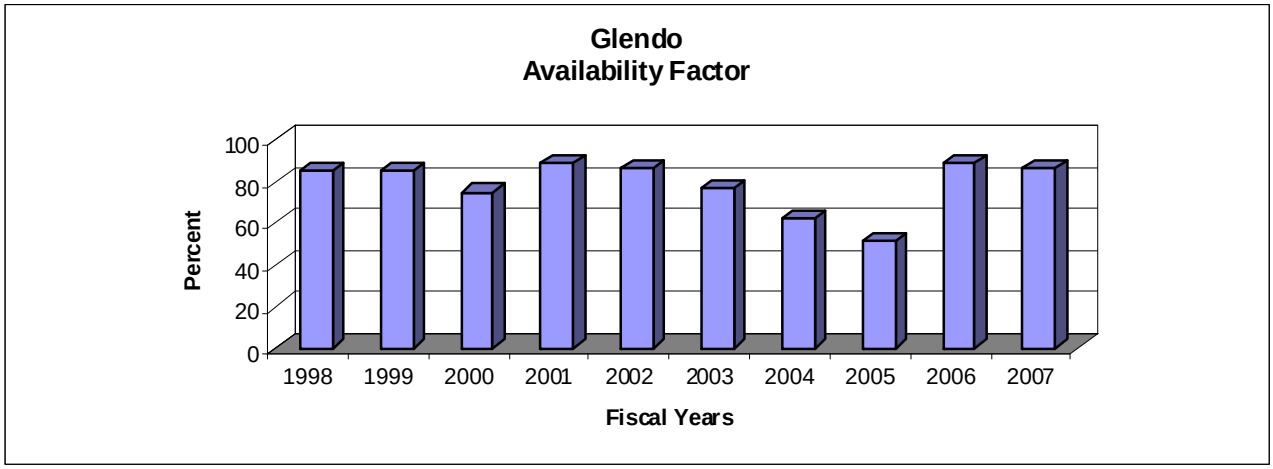


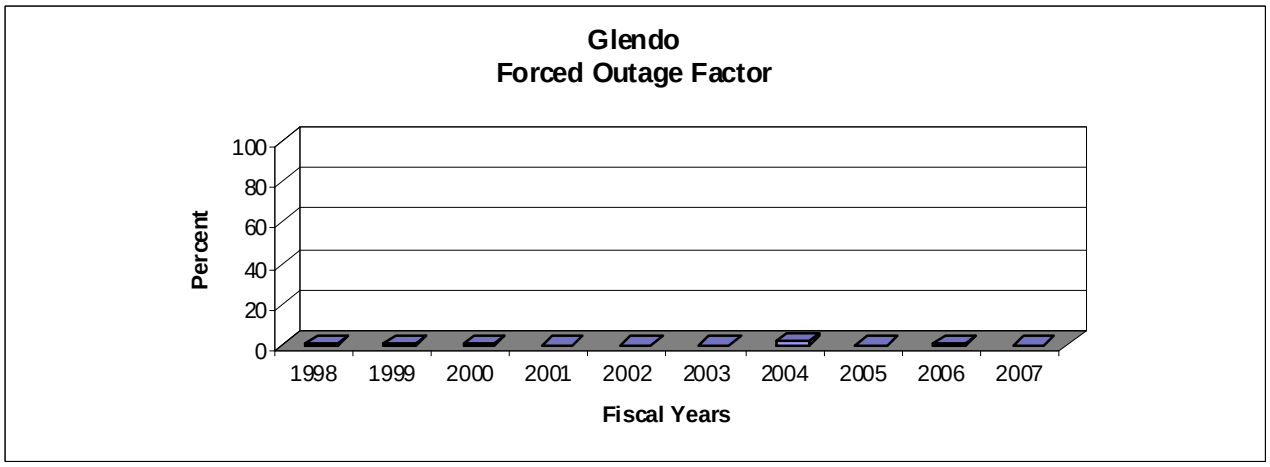



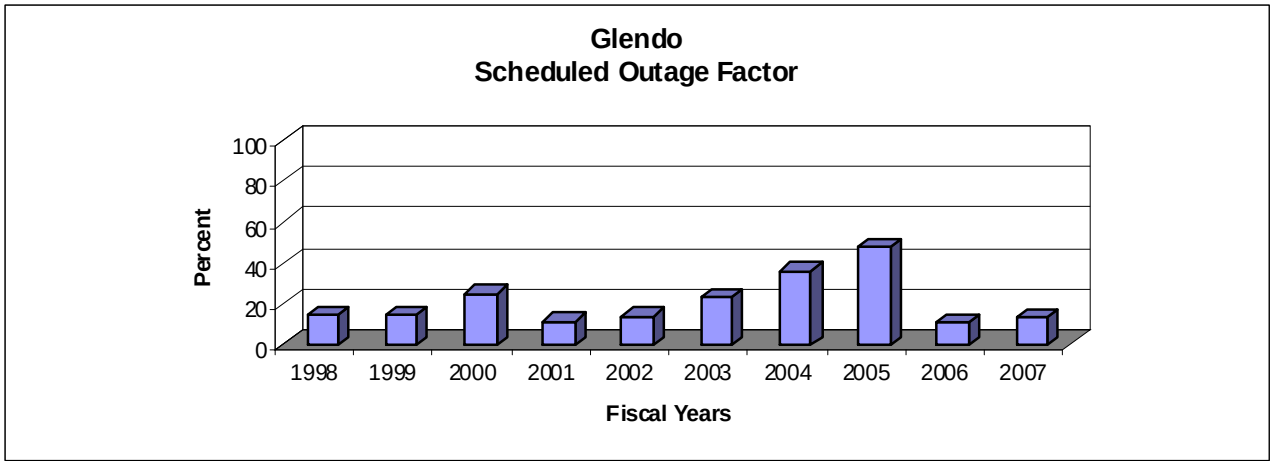
**Benchmark 5**
**Plant Availability Factor**




**Benchmark 6**
**Plant Forced Outage Factor**



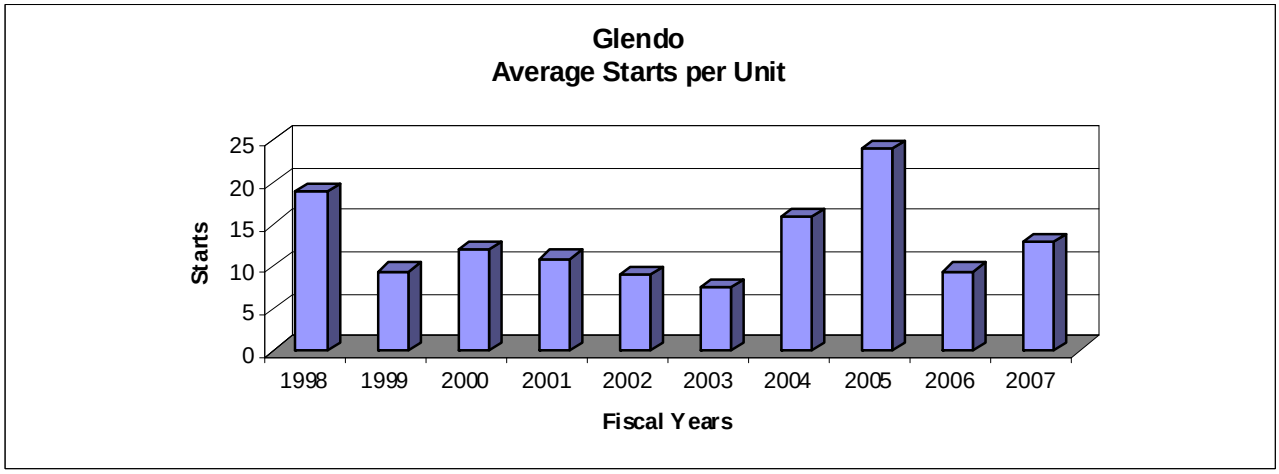
**Benchmark 7**
**Plant Scheduled Outage Factor**




Extended maintenance done during winter shutdown.

FY-2003 – Unit 1 schedule outage extended for replacement of water service piping.
FY-2004 – Both unit governors were rebuilt; water service piping was replaced; and new digital generator temperature recorders were installed.

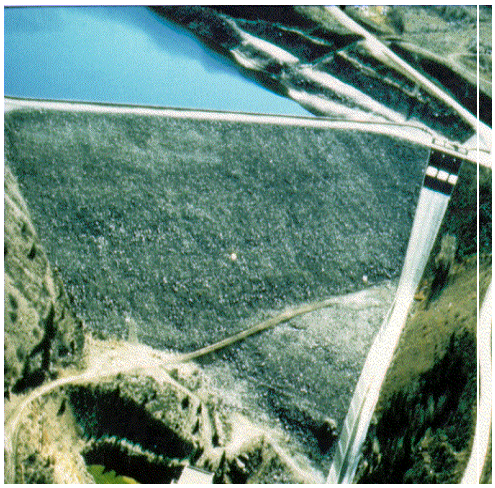
**Unit Starts**



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Glendo** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.84% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 13.98 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 21,285 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 86.4 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.10 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 13.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Green Mountain Powerplant
# Colorado-Big Thompson Project



**Plant Contact:**
Chuck Pederson
O&M Chief

**Plant Address:**
Green Mountain Powerplant
Building 17, 170
County Road 1813
Silverthorne CO 80498

**Telephone Numbers:**
Phone: (970) 962-4400
Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The President approved the Secretary of the Interior's finding of feasibility on December 21, 1937.

**Project Purposes:** The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in the State of Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities.

**Plant Location:** Green Mountain Powerplant is located in Summit County, approximately 13 miles southeast of the town of Kremmling, Colorado on the Blue River, a tributary of the Colorado.

**Plant Purpose:** Provides project water storage and maintains minimum water flows in the Blue River.

**Plant Facts:** This dam provides replacement storage for water diverted by the project to the eastern slope. The dam is an earth fill structure, 309 feet high, with a crest length of 1,150 feet and volume of 4,360, 211 cubic yards. The powerplant has two units with a total installed generating capacity of 26,000 kilowatts.

**Plant History:** The water and power control center for Colorado-Big Thompson Project's reservoirs, powerplants, and transmission lines in Wyoming, Colorado, and western Nebraska is located at the project headquarters in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation powerplants.

**Present Activities:** Recently completed projects include ring seal gate removal and restoration; $CO_2$ fire suppression system replacement; fire detection and alarm system installation; Unit 1 overhaul; and powerplant lead cleanup.

**Future Planned Activities:** Excitation system replacement, headgate hydraulic motor replacement, spillway concrete repairs, and transformer KZ1A repairs are planned for FY 2009. Plant remote control (RTU SCADA and digital microwave/fiber) upgrades are planned to be completed in FY 2010. Access road repairs and building roof and concrete repairs are planned to be completed in FY 2010. Penstock relining is planned for FY 2011; governor upgrades are planned for FY 2012. Online condition monitoring system addition is planned for FY 2013.

**Special Issues:** None.

| | | | |
|---|---|---|---|
| **River:** | Blue River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 21,600 kW | **Installed Capacity:** | 26,000 kW |
| **Year of Initial Operation:** | 1943 | **Age:** | 64 years |
| **Net Generation (FY-2007):** | 60.2 GWh | **Rated Head:** | 210 feet |
| **Average Plant Factor (FY-2007):** | 26.7 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Green Mountain**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | Yes |
| Voltage Support | Yes |

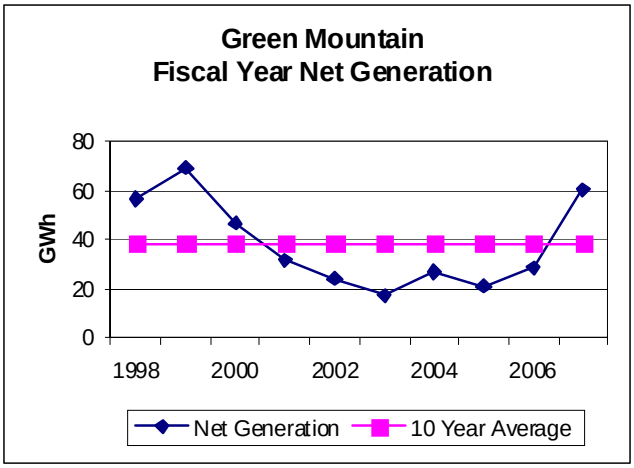
## Generators

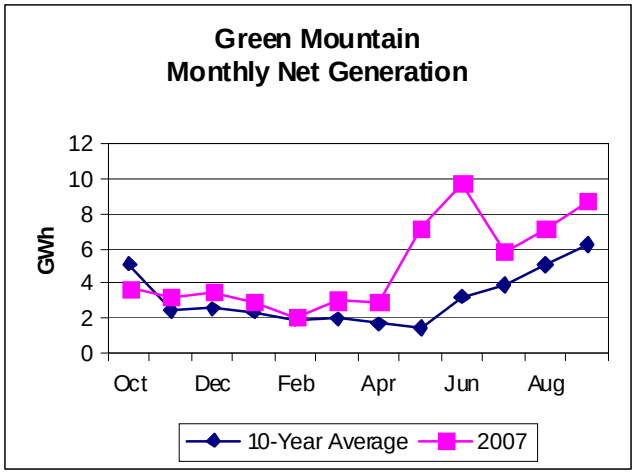
**Green Mountain Generators**

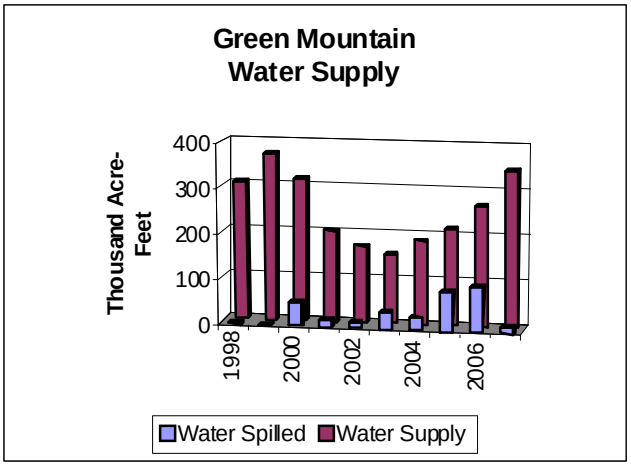
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 10,800 | 2,200 | 13,000 |
| 2 | 10,800 | 2,200 | 13,000 |
| 2 units | 21,600 | 4,400 | 26,000 |

## Generation

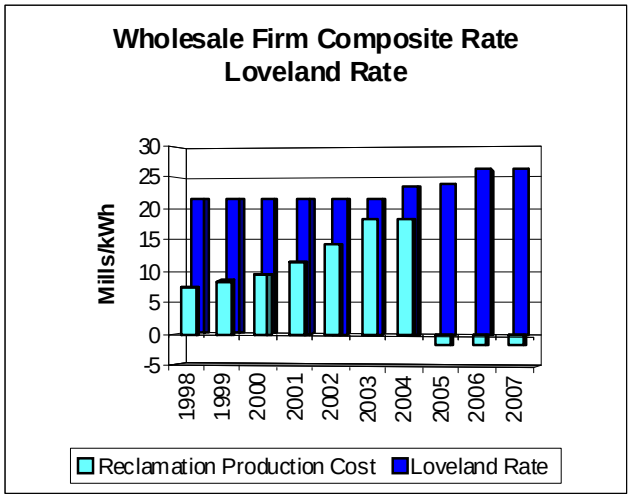

Green Mountain
Fiscal Year Net Generation
GWh
80
60
40
20
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Green Mountain
Monthly Net Generation
GWh
12
10
8
6
4
2
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

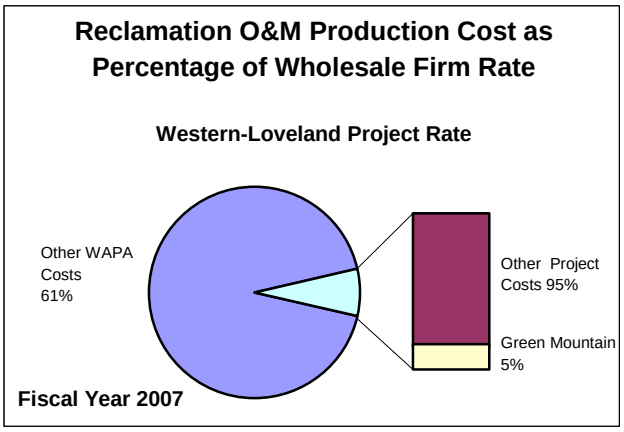

Green Mountain
Water Supply
Thousand Acre-Feet
400
300
200
100
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

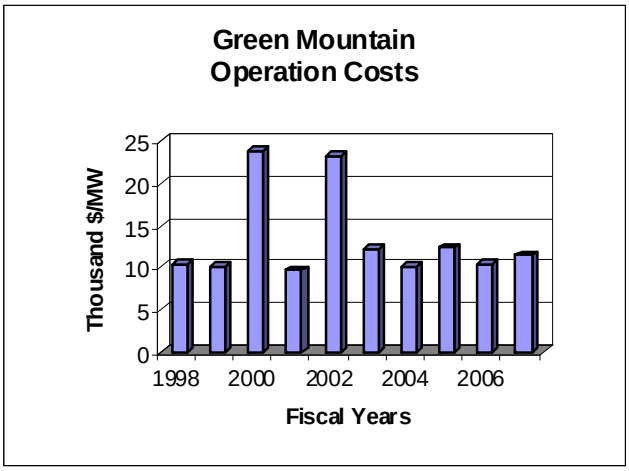
### Benchmark 1
### Wholesale Firm Rate

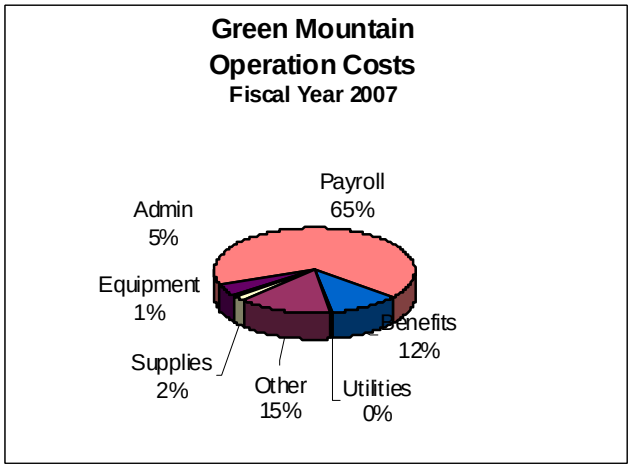


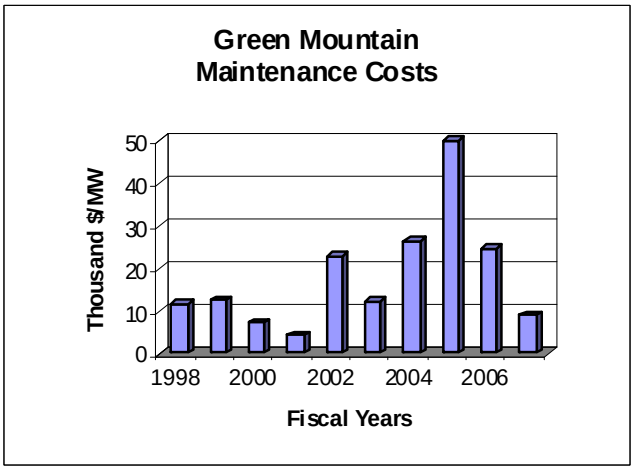

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

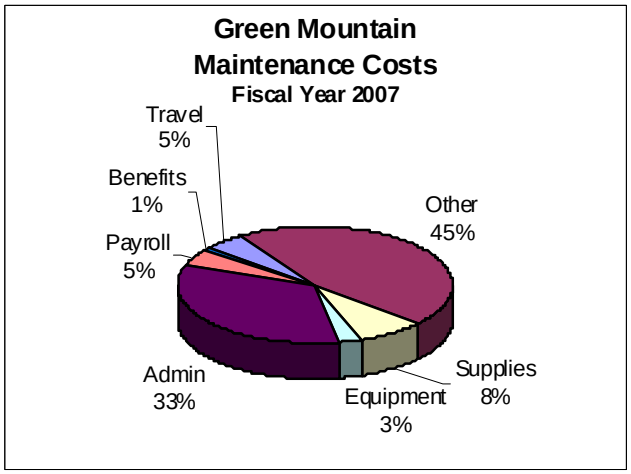


## Benchmark 3
## Production Costs

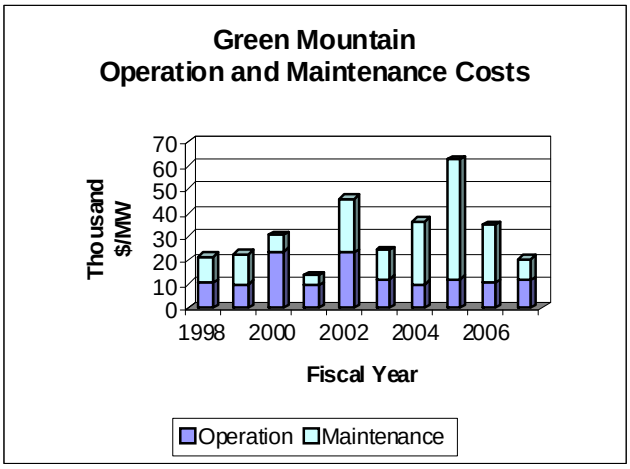


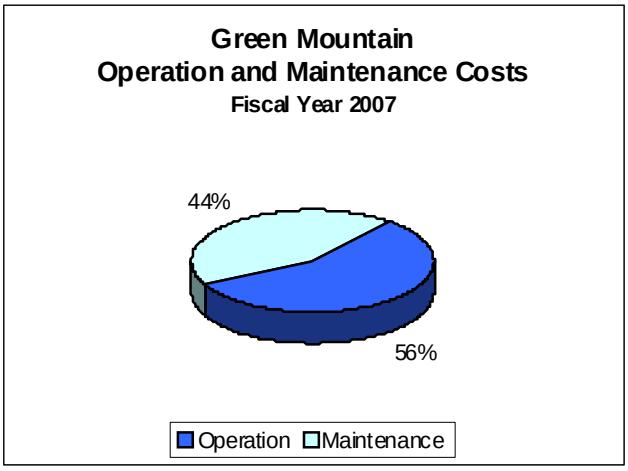



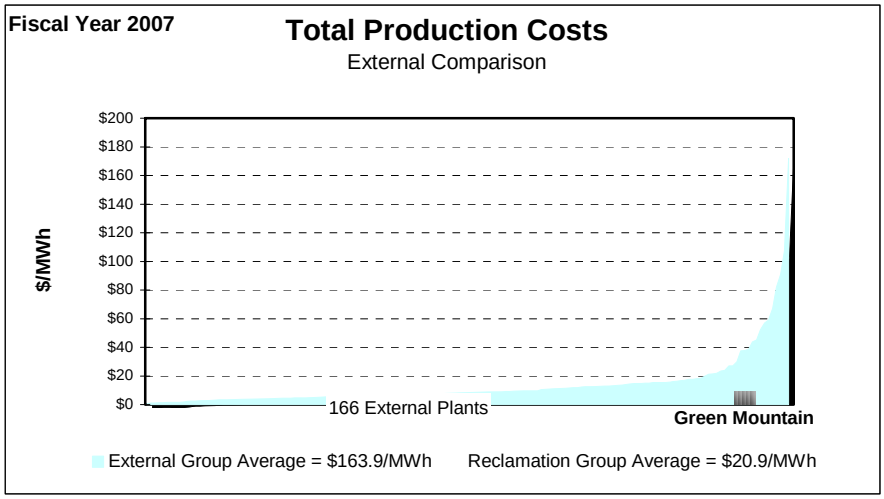



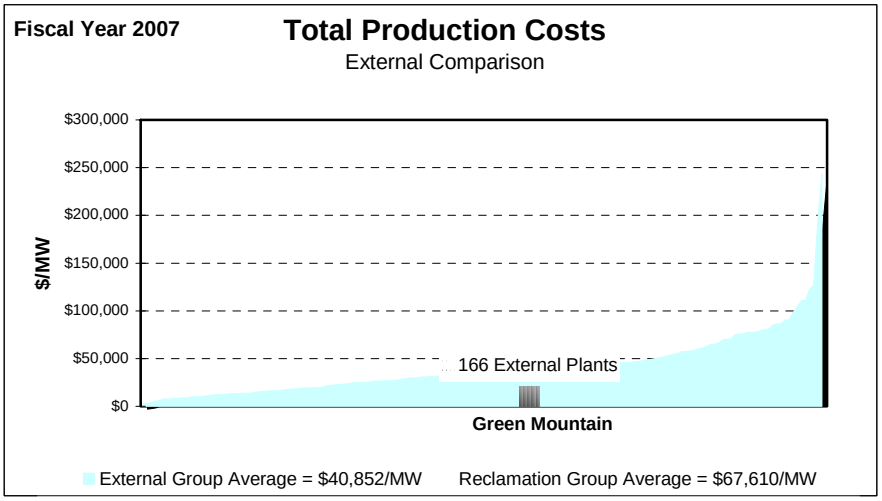



## Benchmark 3
## Production Costs



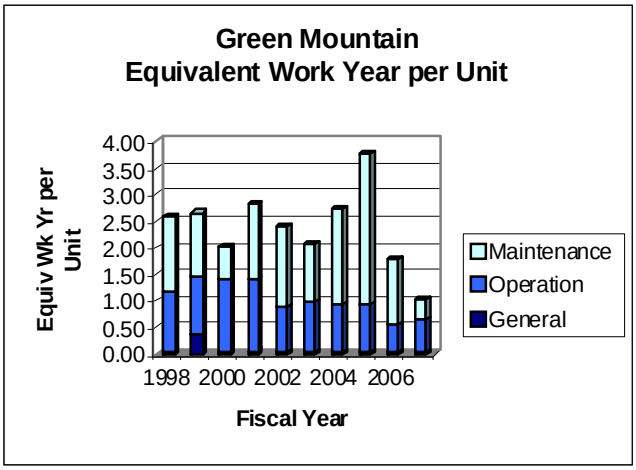



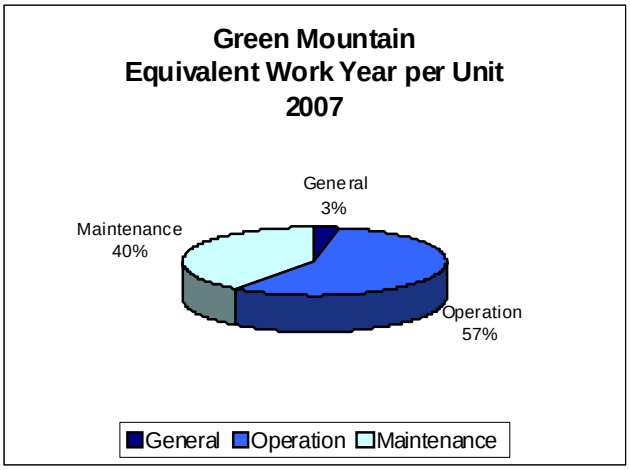



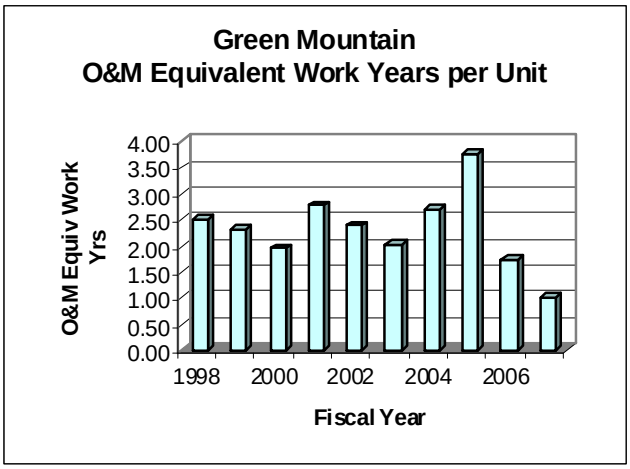



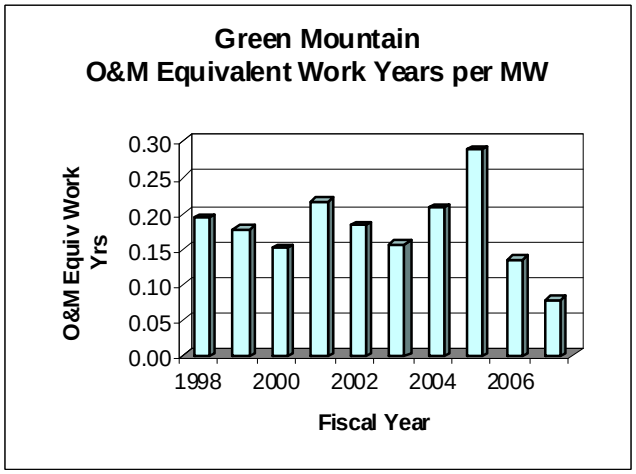
**Benchmark 4**
**Workforce Deployment**

| Green Mountain FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.03 | 0.00 | 0.04 | 0.07 | 0.03 | 0.00 |
| Operation | 0.97 | 0.10 | 0.00 | 1.07 | 0.53 | 0.04 |
| Maintenance | 2.20 | 0.23 | 0.00 | 2.43 | 1.22 | 0.09 |
| Total Staffing | 3.19 | 0.34 | 0.04 | 3.57 | 1.78 | 0.14 |

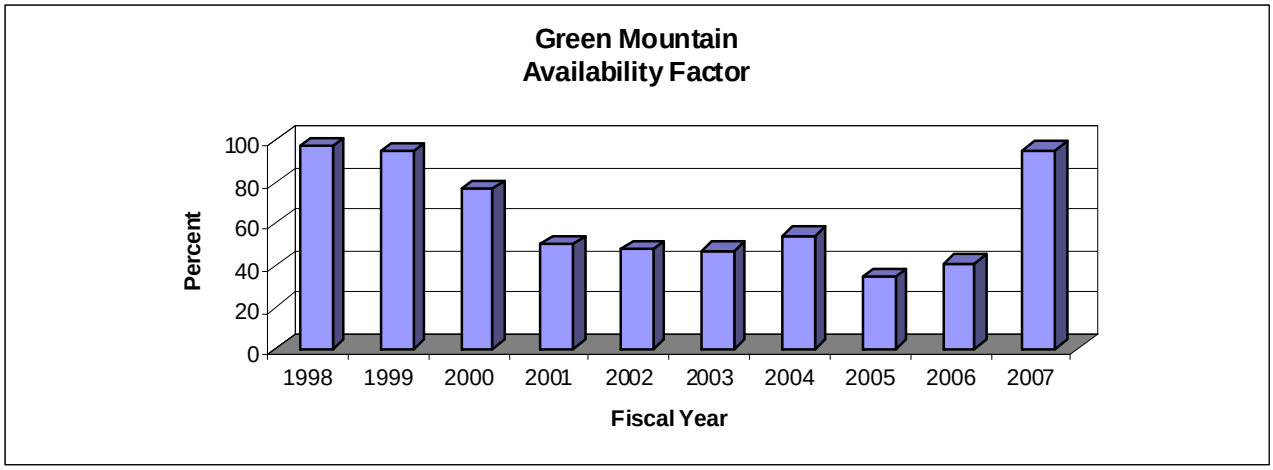


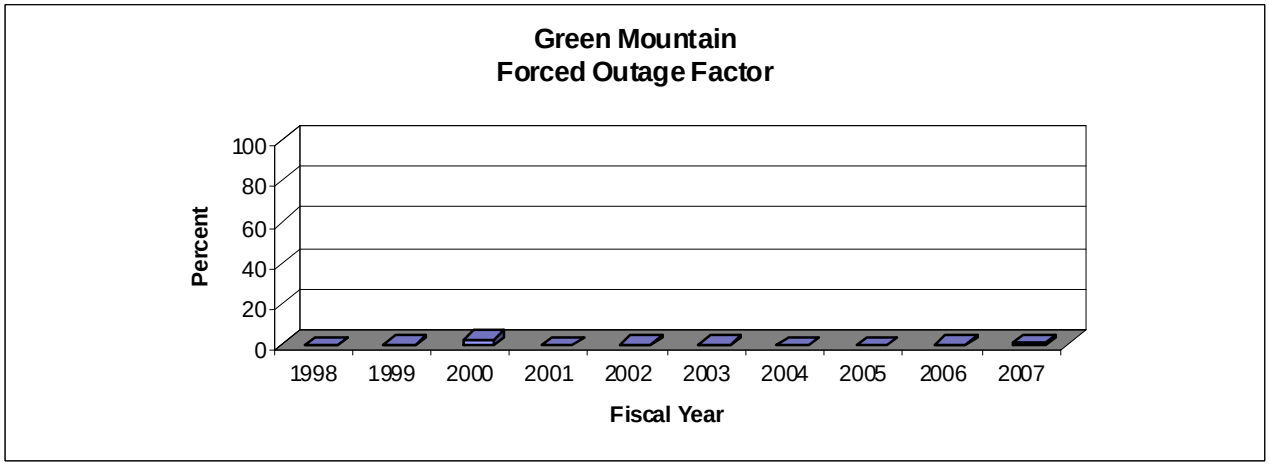



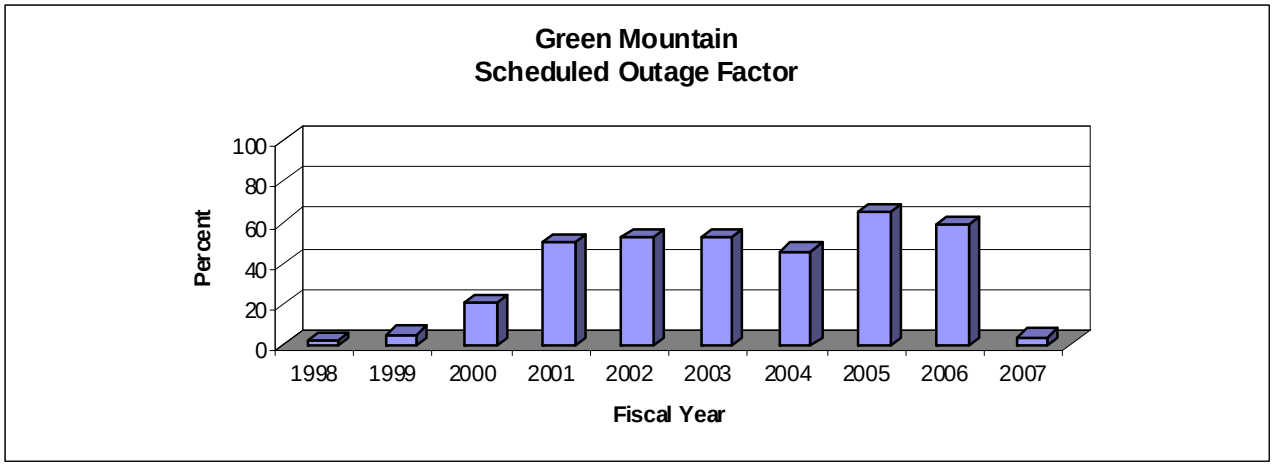
**Benchmark 5**
**Plant Availability Factor**



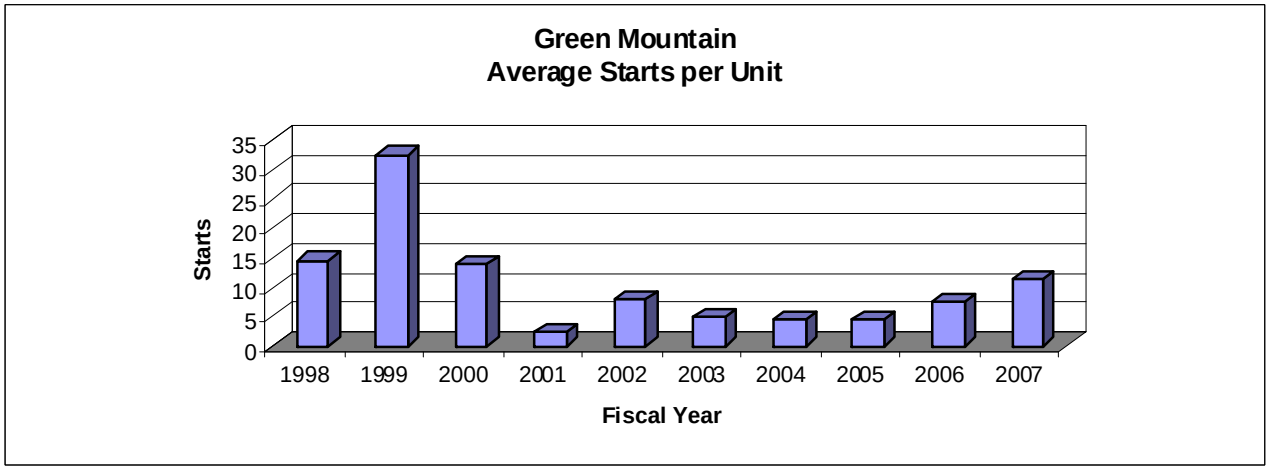

**Benchmark 6**
**Plant Forced Outage Factor**



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Green Mountain Powerplant** | **Reclamation Average 10-30 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 26.1 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.94% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 8.86 | 16.40 | 2.76 | ***163.95 | 1.00 |
| **O&M Costs $/MW** | 20,517 | 62,731 | 7,847 | ***40,852 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.13 | 0.23 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 95.4 | 88.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.5 | 0.1 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 4.1 | 11.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Guernsey Powerplant
# North Platte Project

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**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Secretary of the Interior authorized the project on March 14, 1903. The President approved the Guernsey Dam and Powerplant on April 30, 1925. The project was originally called the Sweetwater Project.

**Project Purposes:** The North Platte Project provides full service irrigation for about 226,000 acres. The North Platte River, fed by many mountain streams rising in the Rocky Mountains of Colorado and Wyoming, is the most important river in southeastern Wyoming and western Nebraska. Its waters are stored and used for irrigation and power development.

**Plant Location:** Guernsey Powerplant is located in Platte County, Wyoming, approximately 2 miles upstream of Guernsey, Wyoming, on the North Platte River about 180 miles below Alcova Dam and 25 miles below Glendo Dam.

**Plant Purpose:** The Guernsey Dam controls river flow. Water released from Pathfinder Reservoir can be stored at this dam and released to fit varying irrigation demands. Water is released through Guernsey Powerplant.

**Plant Facts:** The powerplant is on the right bank below the dam and has two 3,200-kilowatt generators. Power is transmitted to towns and industries down the valley over transmission lines. The electric power generated at Guernsey Powerplant is supplied to the project area by four substations and about 160 miles of transmission lines.

Guernsey Powerplant is operated on a seasonal basis during the release of irrigation flows to satisfy downstream demands on the North Platte River in Wyoming and Nebraska.

**Plant History:** Construction of Guernsey Powerplant began in 1925 and was completed in 1928. The original installed capacity of the plant was 4,800 kilowatts. The plant was up rated between 1992 and 1994 through replacement of the generator windings to its current installed capacity of 6,400 kilowatts.

**Present Activities:** Normal operations.

**Future Planned Activities:** Materials will be purchased in FY-2006 for replacement of the wicket gate greasing system. The new system is planned for installation by Reclamation forces in FY-2007.

**Special Issues:** Units were rewound, new excitation equipment was installed, and major overhaul of both turbines occurred in calendar years 1993 and 1994, which accounts for high production costs in FY-1994.

The Guernsey Switchyard was removed and replaced by Western Limestone substation in 1980 and 1981.

| | | | |
|---|---|---|---|
| **River:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 4,800 kW | **Installed Capacity:** | 6,400 kW |
| **Year of Initial Operation:** | 1927 | **Age:** | 80 years |
| **Net Generation (FY-2007):** | 14.4 GWh | **Rated Head:** | 70 feet |
| **Average Plant Factor (FY-2007):** | 26.1 percent (seasonal) | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate (seasonal) | | |

## Ancillary Services

**Guernsey**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | Yes |

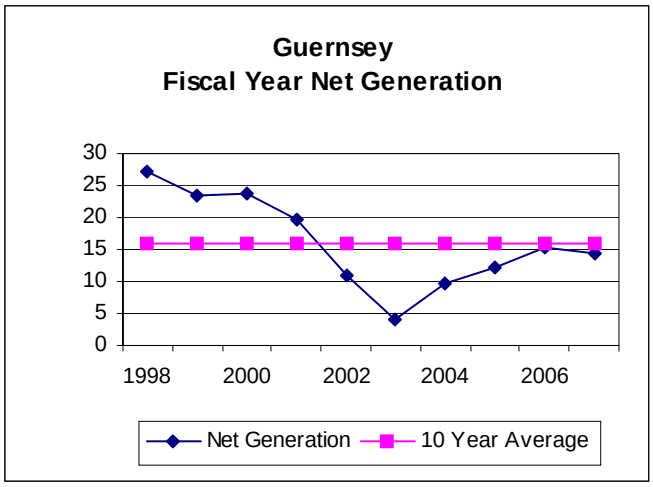
## Generators

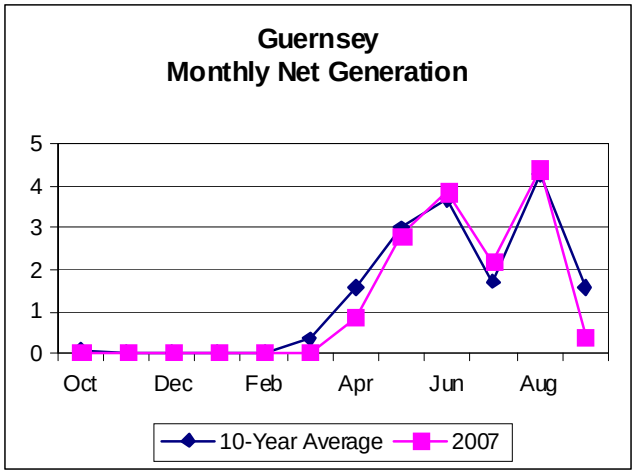
**Guernsey Generators**

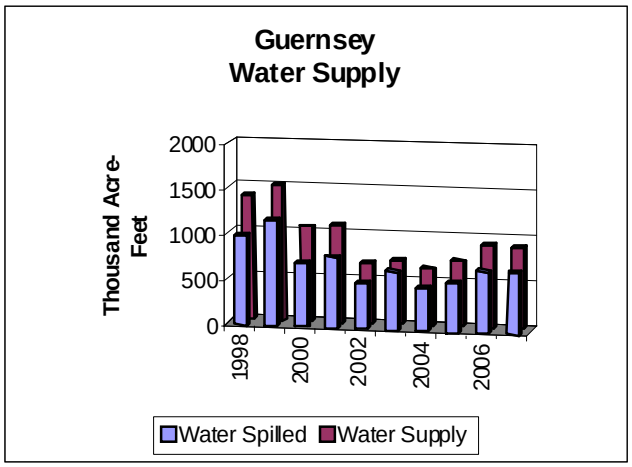
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 2,400 | 800 | 3,200 |
| 2 | 2,400 | 800 | 3,200 |
| 2 units | 4,800 | 1,600 | 6,400 |

## Generation

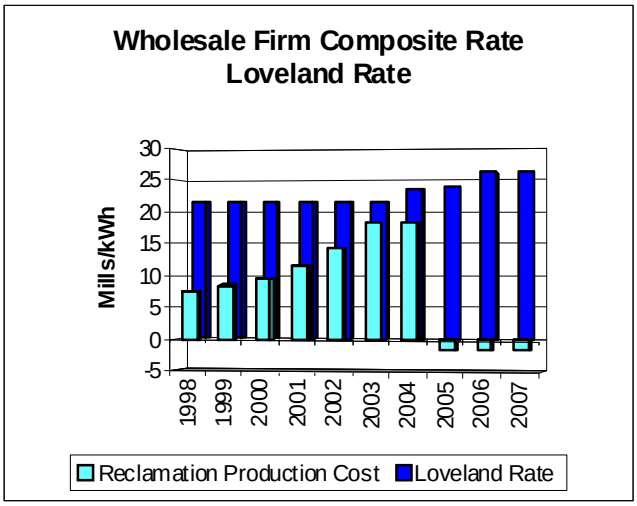

Guernsey
Fiscal Year Net Generation
30
25
20
15
10
5
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Guernsey
Monthly Net Generation
5
4
3
2
1
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

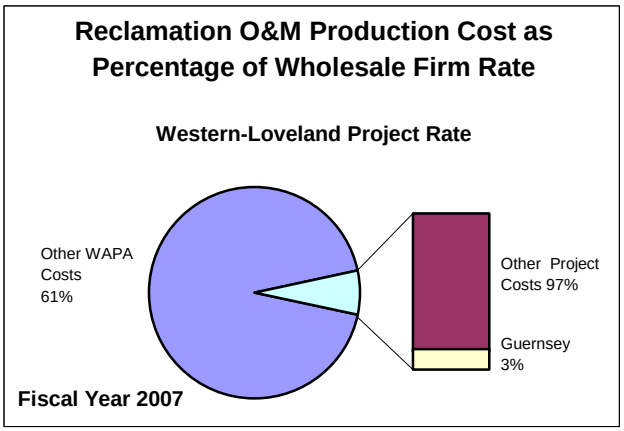

Guernsey
Water Supply
Thousand Acre-Feet
2000
1500
1000
500
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

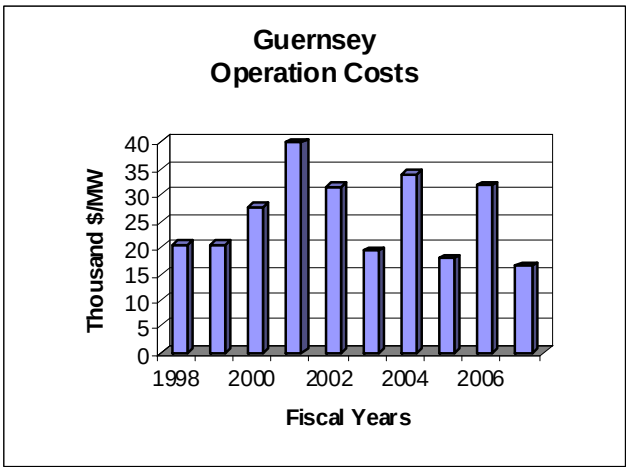
## Benchmark 1
## Wholesale Firm Rate

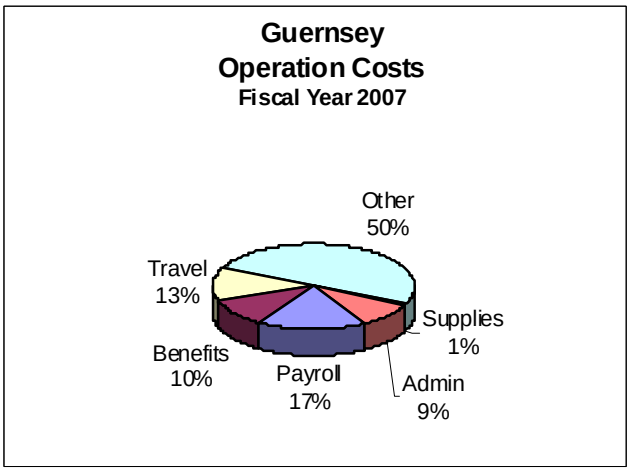


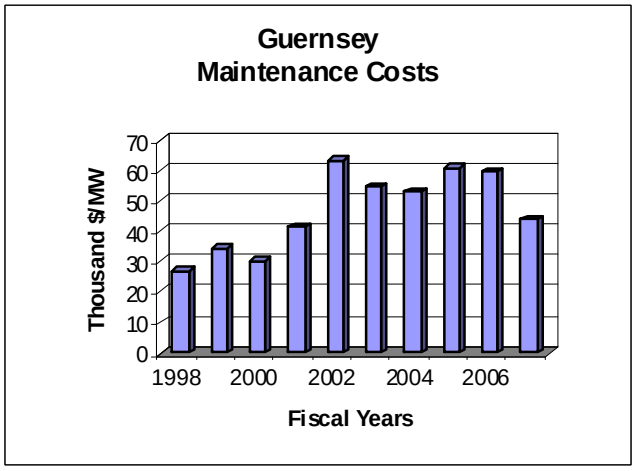

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

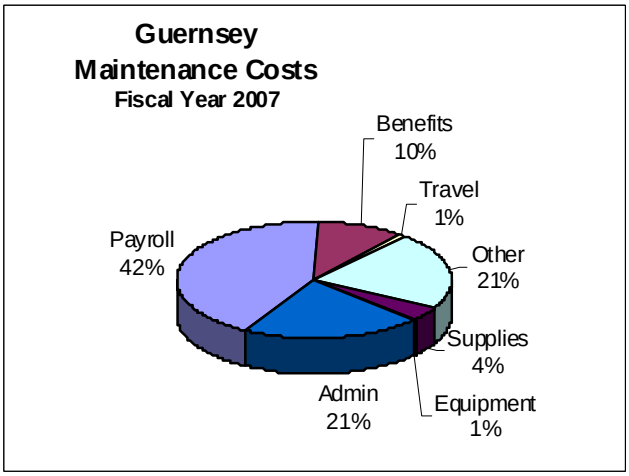


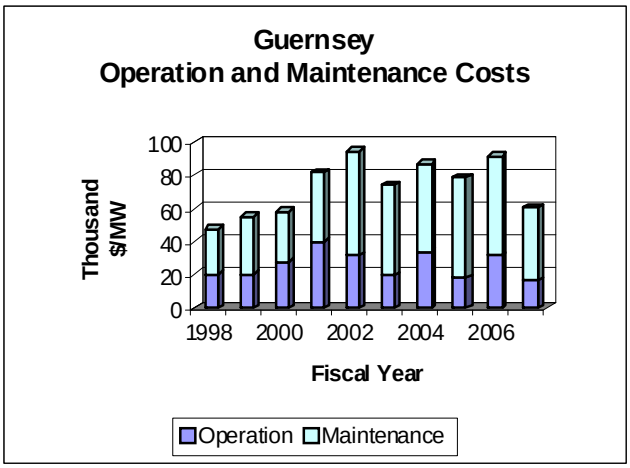
## Benchmark 3
## Production Costs

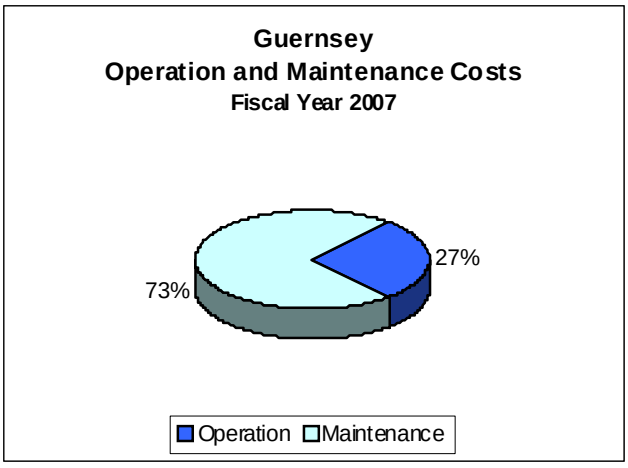


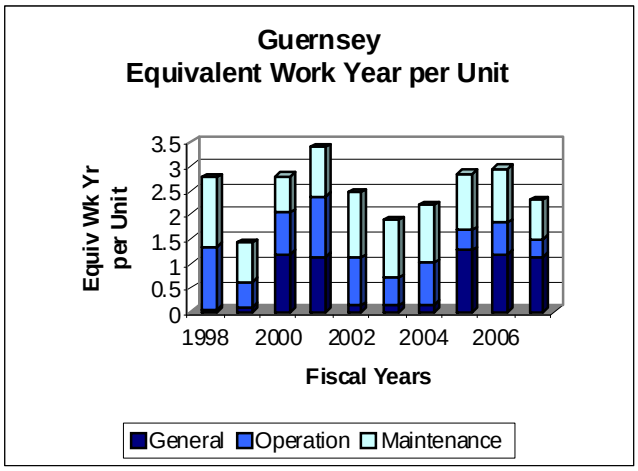



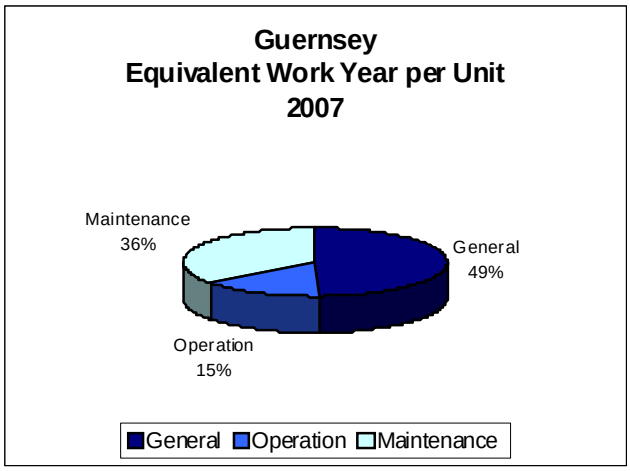



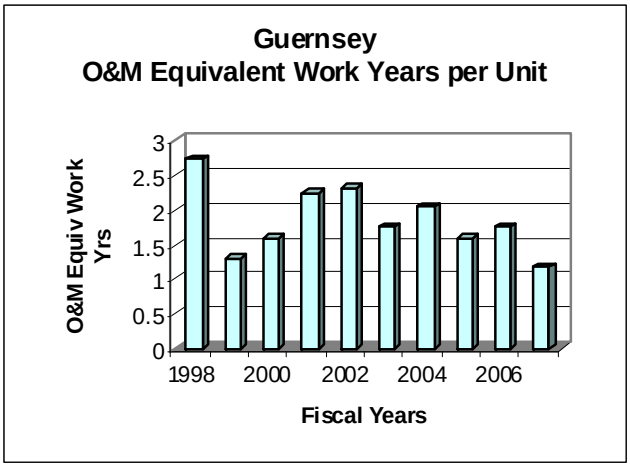



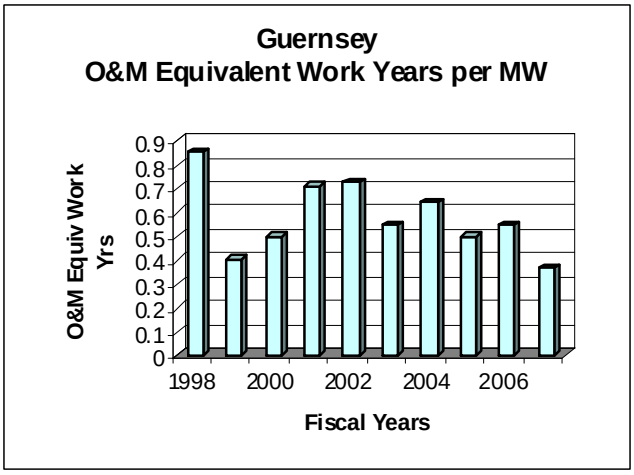
**Benchmark 4**
**Workforce Deployment**

| Guernsey FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 2.03 | 0.23 | 0.04 | 2.29 | 1.15 | 0.36 |
| Operation | 0.62 | 0.07 | 0.00 | 0.69 | 0.35 | 0.11 |
| Maintenance | 1.48 | 0.17 | 0.00 | 1.65 | 0.83 | 0.26 |
| Total Staffing | 4.13 | 0.47 | 0.04 | 4.64 | 2.32 | 0.72 |

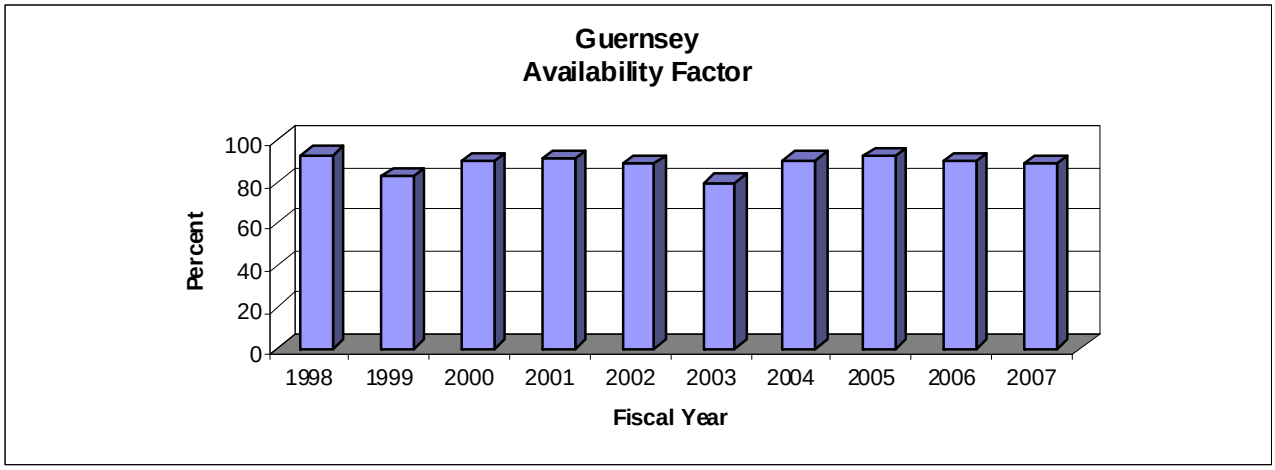


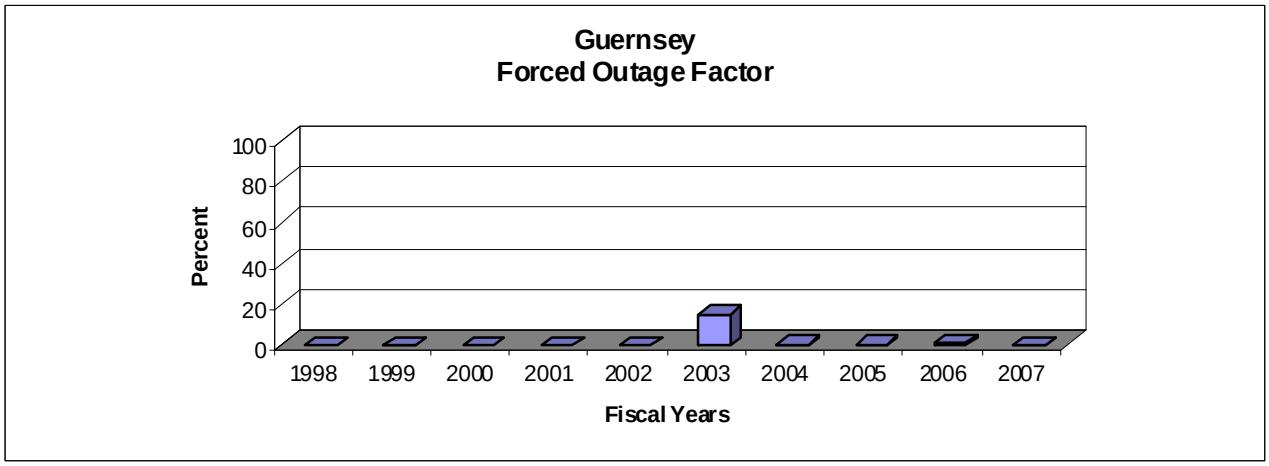



**Benchmark 5**
**Plant Availability Factor**

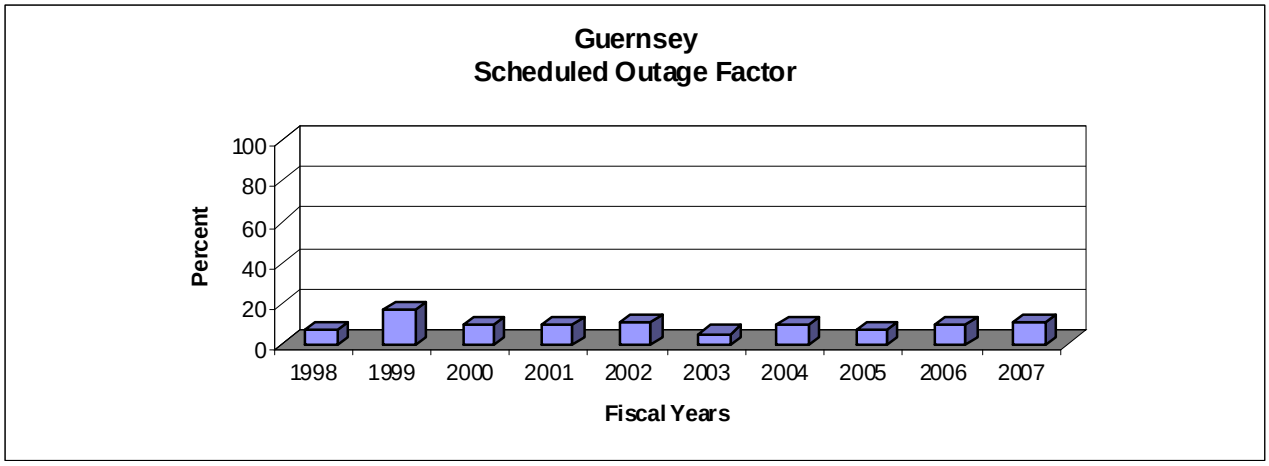



**Benchmark 6**
**Plant Forced Outage Factor**



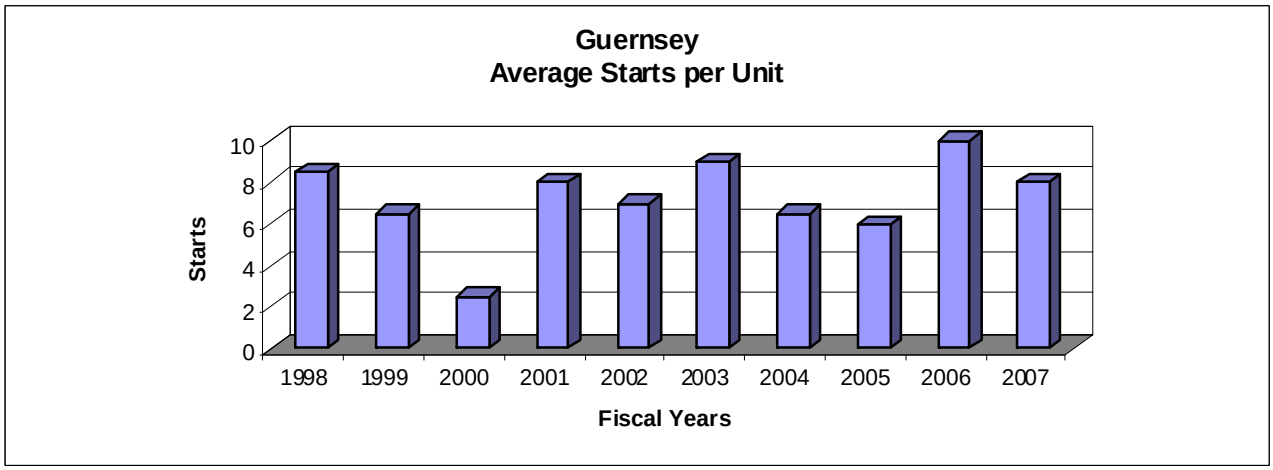

FY-2003 – Extended outage for rock fall clean up and hillside stabilization efforts above transformers and plant.

**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-1999 – Units 1 and 2 water service piping rehabilitation.

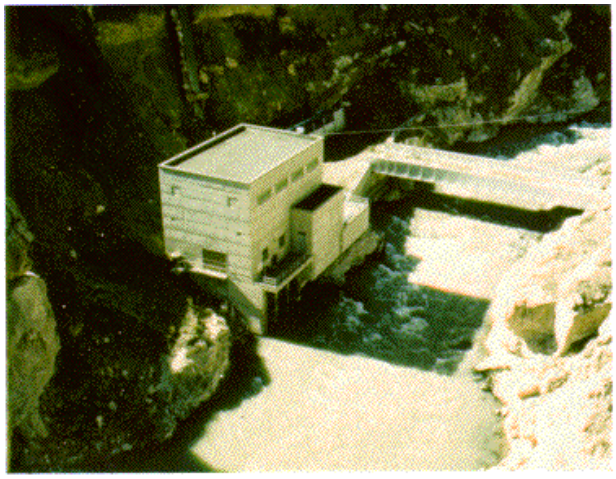
**Unit Starts**



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Guernsey Powerplant** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.9% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 26.92 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 60,458 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.37 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 89.0 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.15 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 10.8 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Heart Mountain Powerplant
# Shoshone Project



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Fax: (307) 261-5683

**E-Mail Address:** jlawson@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The Secretary of the Interior authorized the project on February 10, 1904, under authority of the Reclamation Act of June 17, 1902. The Secretary authorized Heart Mountain power development on June 19, 1945, under the provisions of the Reclamation Project Act of 1939. |
| **Project Purposes:** | Floodwaters of the Shoshone River are stored in Buffalo Bill Reservoir for later release for irrigation and power generation. Power is developed at the Shoshone and Heart Mountain Powerplants. The system is interconnected with the West Division of the Pick-Sloan Missouri Basin Program. |
| **Plant Location:** | Heart Mountain Powerplant is located in Park County, Wyoming, approximately 4 miles southwest of Cody, Wyoming, on the Shoshone River. |
| **Plant Purpose:** | Power produced at the Heart Mountain Powerplant is fed into a power grid system, which serves an area extending into three States. |

**Plant Facts:**

The Heart Mountain Powerplant is at the outlet of Shoshone Canyon Conduit about 4 miles southwest of Cody, Wyoming. The capacity of the plant is 5,000 kilowatts.

As a result of the modification of Buffalo Bill Dam, Buffalo Bill and Shoshone Powerplants were completed in 1992. Due to the Revised Instream Flow Agreement associated with the reconstruction of the dam, winter releases previously discharged from Heart Mountain Powerplant are now made through these two upstream powerplants. As a result, Heart Mountain Powerplant has been operated on a seasonal basis since 1992.

**Plant History:**

Construction of the powerplant was completed in 1947.The plant, which was originally built to be a temporary plant, was rewound in 1992.

**Present Activities:**

A contract was awarded in FY-2003 for installation of a new 3-phase power transformer, modification of existing bus work, and installation of new power cables. The contract was completed in FY-2004.

Preparation of designs and specifications for a contract to replace the generating unit voltage regulator was initiated in FY-2002. The contract was issued and awarded in FY-2003 and installation was completed in FY-2005.

Preparation of designs and specifications for a contract to replace the powerplant switchgear was initiated in FY-2002. The contract was awarded in FY-2004 and completed in FY-2004.

**Future Planned Activities:**

The wicket gate greasing system for the generating unit will be installed in FY-2009.

**Special Issues:**

Shoshone Canyon Conduit water restrictions, coupled with chronic oil leak and thrust bearing problems after the rewind reassembly, accounted for high production costs for FY-1994.

The fractured and soluble nature of the rocks which form the free flow section of the Shoshone Canyon Conduit has resulted in significant maintenance expenses which are assigned to Heart Mountain Powerplant.

A congressional budget write-in during FY-1996 resulted in a $600,000 obligation during that fiscal year for Reclamation's share of the costs associated with repairs to the conduit. Expenditure of these funds was accomplished over a 5-year period.

| | | | |
|---|---|---|---|
| **River:** | Shoshone River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 5,000 kW | **Installed Capacity:** | 5,000 kW |
| **Year of Initial Operation:** | 1948 | **Age:** | 59 years |
| **Net Generation (FY-2007):** | 13.9 GWh | **Rated Head:** | 265 feet |
| **Average Plant Factor (FY-2007):** | 32.4 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate/Seasonal | | |

## Ancillary Services

**Heart Mountain**
**Ancillary Services**

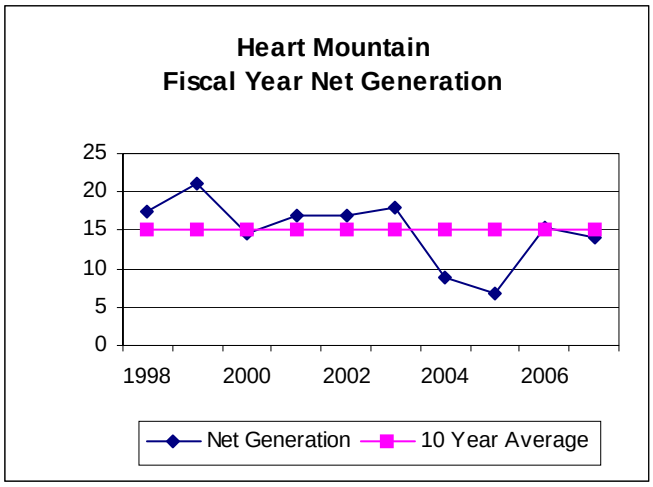
| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | Yes |

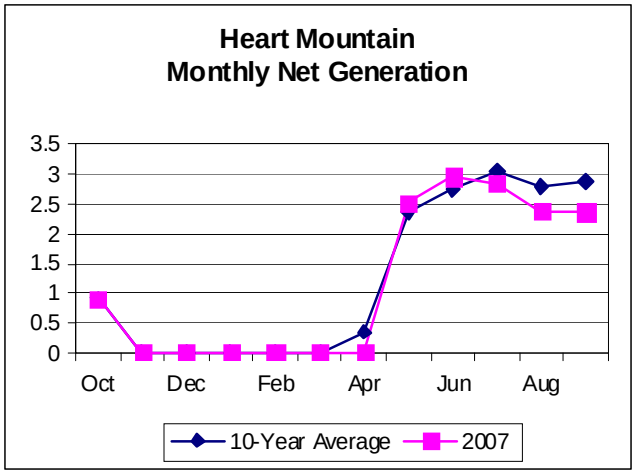
## Generators

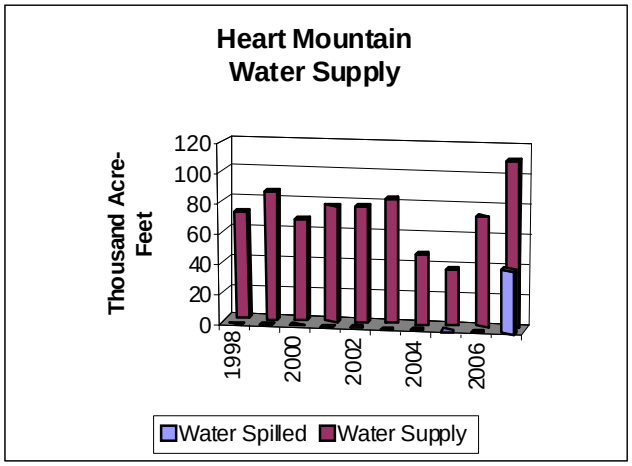
**Heart Mountain Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 5,000 | - | 5,000 |
| 1 Unit | 5,000 | - | 5,000 |

## Generation

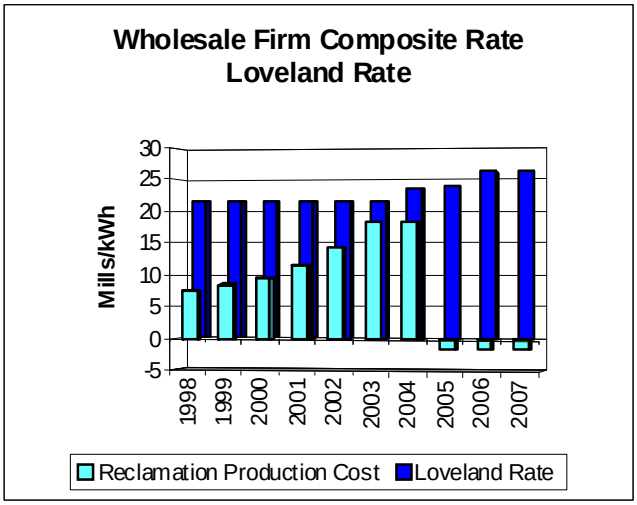

Heart Mountain
Fiscal Year Net Generation
25
20
15
10
5
0
1998
2000
2002
2004
2006
Net Generation
10 Year Average


Heart Mountain
Monthly Net Generation
3.5
3
2.5
2
1.5
1
0.5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

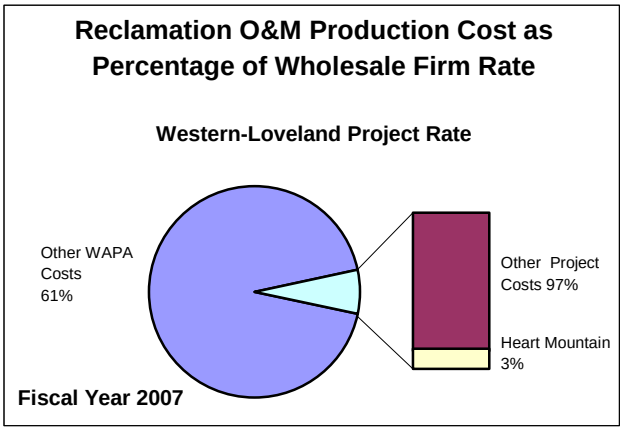

Heart Mountain
Water Supply
Thousand Acre-Feet
120
100
80
60
40
20
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

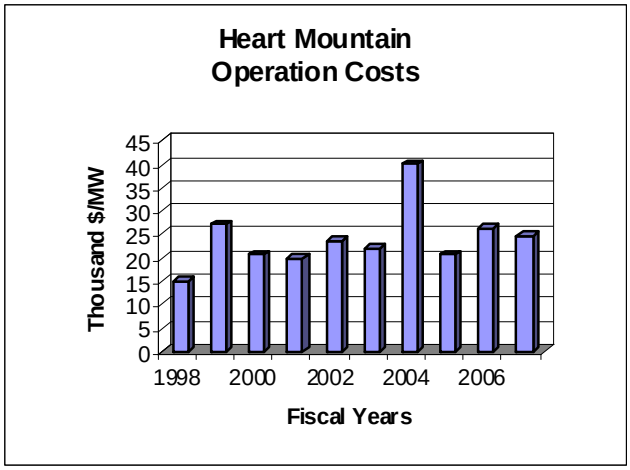
## Benchmark 1
## Wholesale Firm Rate

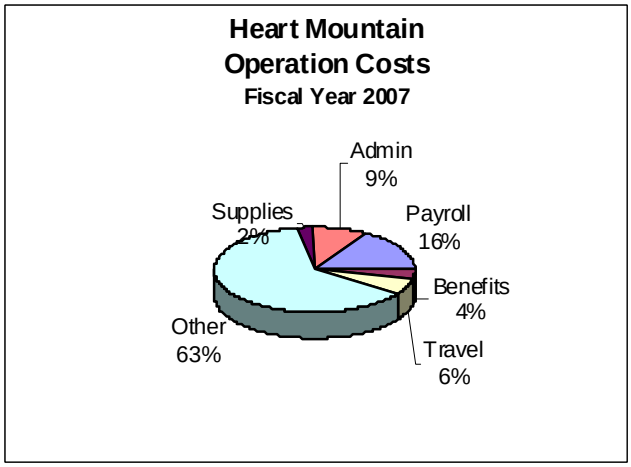


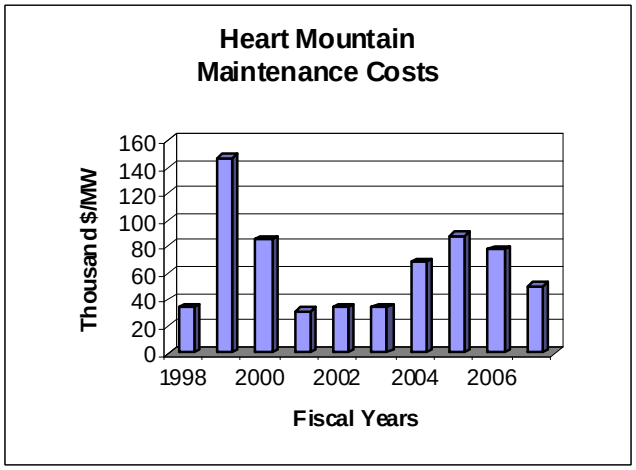

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

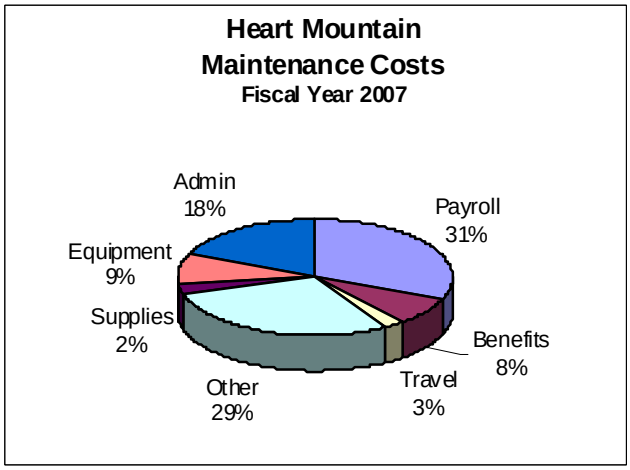


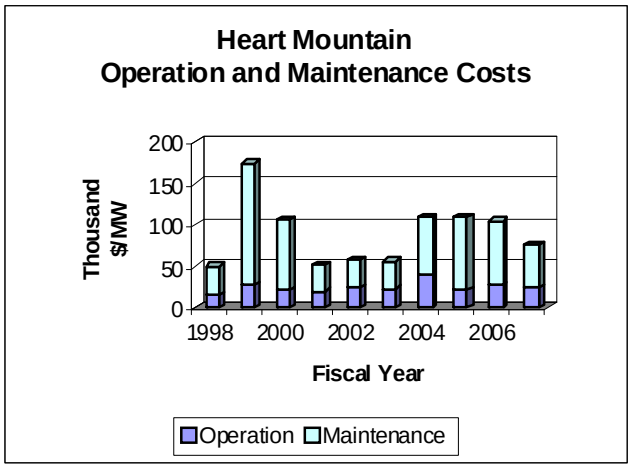
## Benchmark 3
## Production Costs

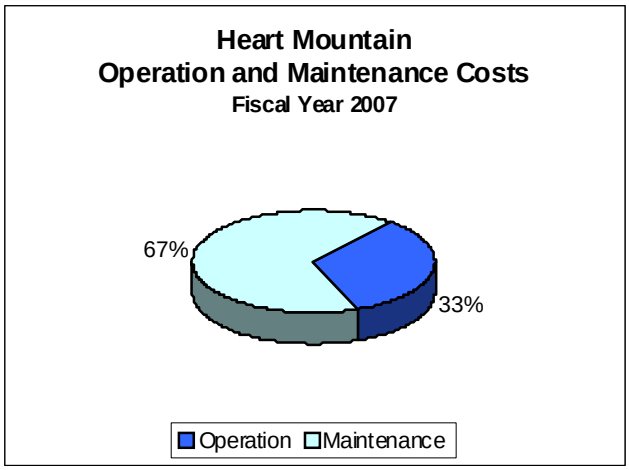


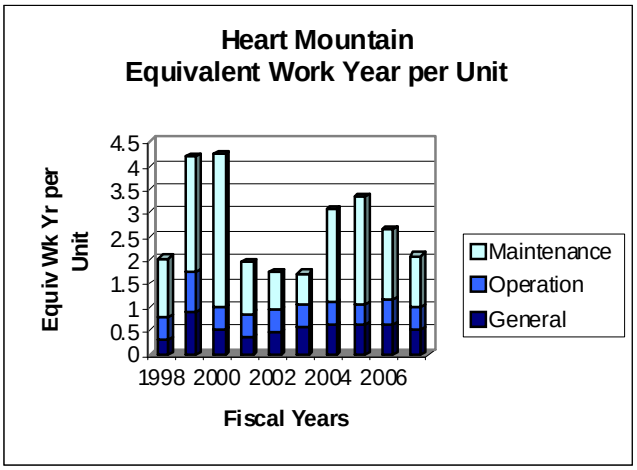



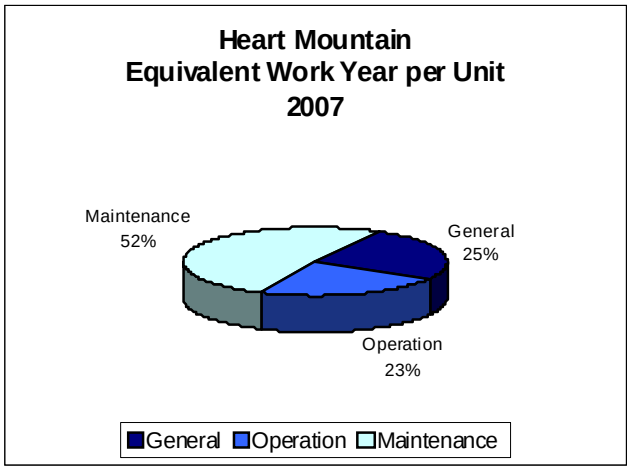



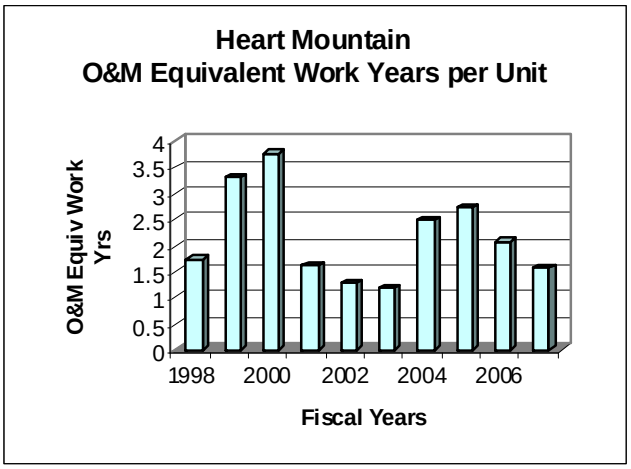

FY-1999 – Penstock repairs and slope stabilization.
FY-2000 – Wicket gate repairs accomplished.

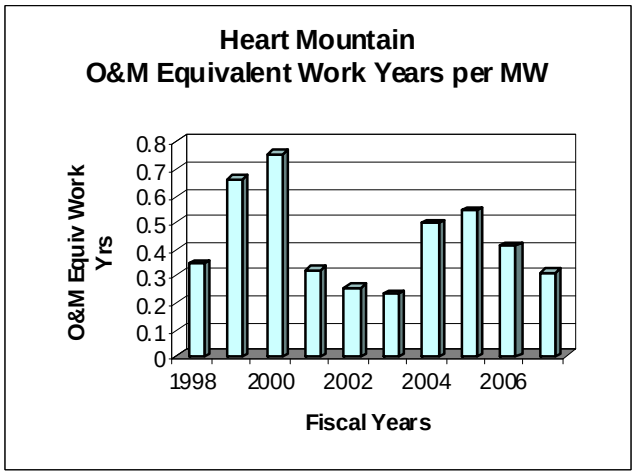
**Benchmark 4**
**Workforce Deployment**

| Heart Mountain FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.45 | 0.05 | 0.02 | 0.52 | 0.52 | 0.10 |
| Operation | 0.44 | 0.05 | 0.00 | 0.49 | 0.49 | 0.10 |
| Maintenance | 0.97 | 0.11 | 0.00 | 1.08 | 1.08 | 0.22 |
| Total Staffing | 1.86 | 0.21 | 0.02 | 2.09 | 2.09 | 0.42 |

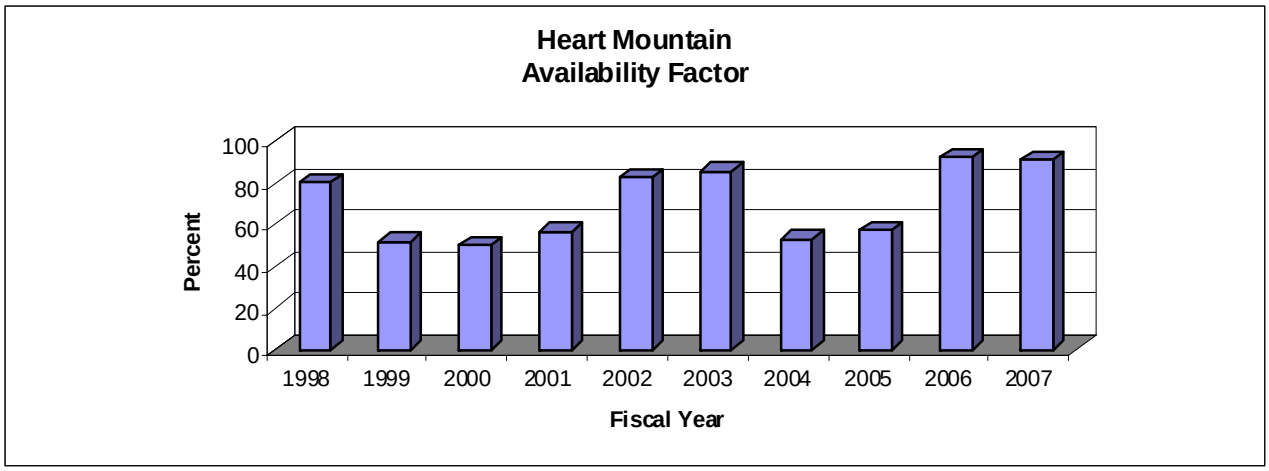


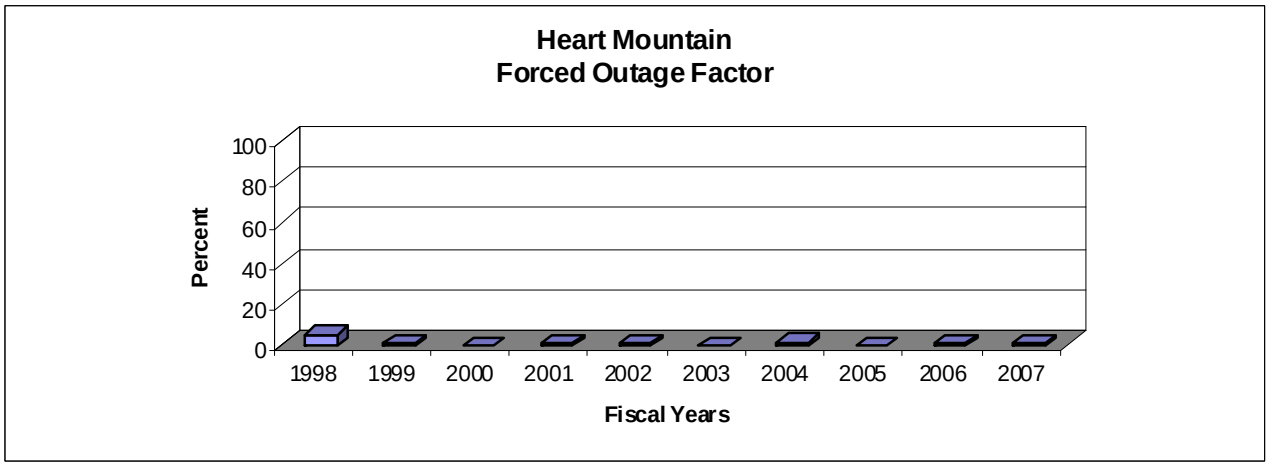



**Benchmark 5**
**Plant Availability Factor**

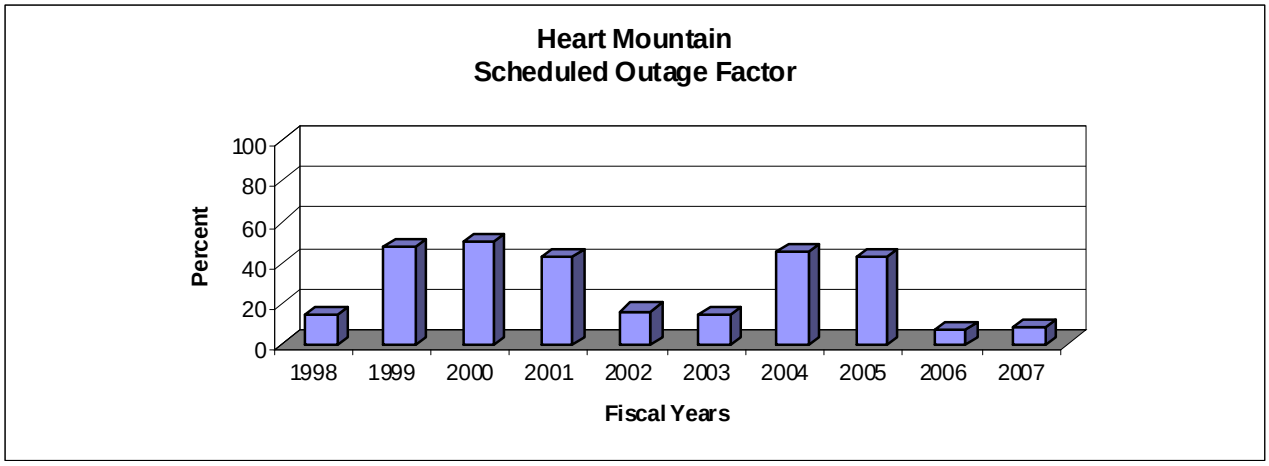



FY-1997 – Governor and wicket gate repairs.
FY-1998 – Penstock and wicket gate repairs.
FY-1999 – Penstock repairs and slope stabilization.
FY-2000 – Wicket gate repairs.
FY-2001 – Buffalo Bill Powerplant penstock and Spirit Mountain sleeve valve re-coating resulted in an extended outage at this plant.
FY-2004 – Transformer and switchgear replacements.

**Benchmark 6**
**Plant Forced Outage Factor**

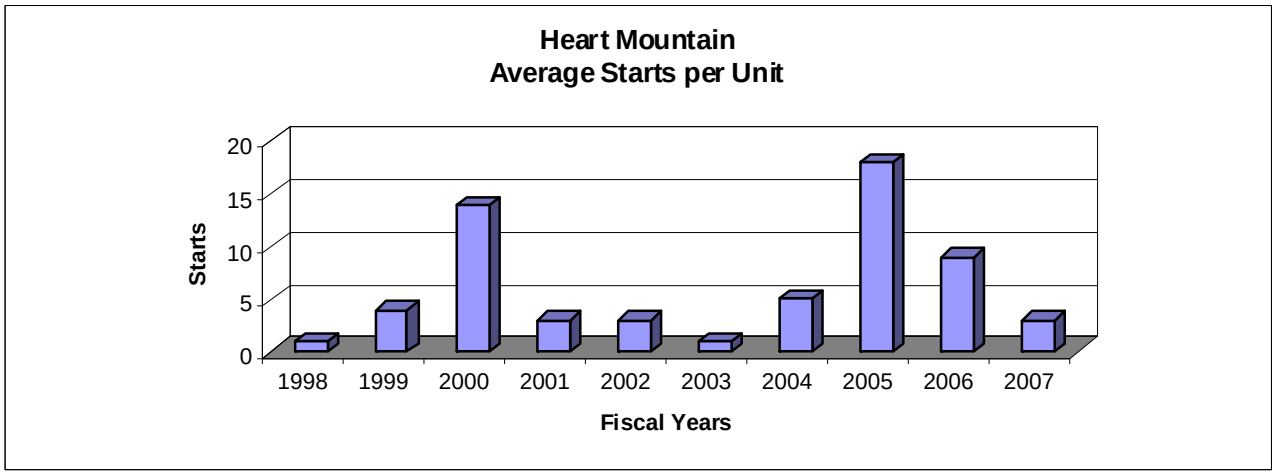


**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-97 - Governor and wicket gate repairs
FY-98 - Penstock and wicket gate repairs
FY-99 - Penstock repairs and slope stabilization
FY-00 - Wicket gate repairs.
FY-01- Buffalo Bill Powerplant penstock and Spirit Mountain sleeve valve re-coating resulted in an extended outage at this plant

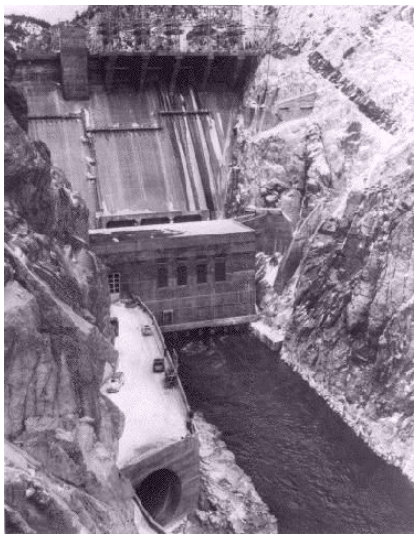
**Unit Starts**



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Heart Mountain Powerplant** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.9% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 26.95 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 75,126 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.31 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 91.0 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.81 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 8.2 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Kortes Powerplant
# Pick-Sloan Missouri Basin Program



**Plant Contact:**
John Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Kortes Powerplant
Sinclair WY

**Telephone Numbers:**
Phone: (307) 261-5671
Fax: (307) 261-5683

**E-Mail Address:** jlawson@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Kortes power development, Pick-Sloan Missouri Basin Prgram was found feasible by the Secretary of the Interior as a supplement to the Kendrick Project on November 26, 1941. However, it was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general plan set forth in Senate Document 191, as revised and coordinated by Senate Document 247, 78th Congress, 2d Session.

**Project Purposes:** Maximum benefits are obtained when Kortes Reservoir remains full and the power releases are coordinated with those from the Seminoe plant. The Seminoe and Kortes facilities are controlled from the Casper Control Center.

**Plant Location:** Kortes Powerplant is located in Carbon County, Wyoming, approximately 2 miles below Seminoe Dam on the North Platte River and about 60 miles southwest of Casper, Wyoming.

**Plant Purpose:** Because of the enormous increase in power demands in the area and power sales commitments, an accelerated power program was developed which consisted of erecting generating equipment and machinery concurrently with Kortes dam and powerhouse construction.

**Plant Facts:** The reinforced-concrete powerhouse at Kortes Powerplant occupies the entire width of the canyon at the toe of the dam. The plant has three 18,500-horsepower Francis-type turbines and three 12,000-kilowatt generators with a combined capacity of 36,000 kilowatts.

**Plant History:** Unit 2 was rewound in 1973. Units 1 and 3 were rewound in 1985. The three unit power transformers were replaced under a single contract in 1999, 2000, and 2001.

**Present Activities:** The second runner was installed in FY-2005 maintenance season. The 12” diameter water supply line was rehabilitated by contract in the FY-2005 maintenance season.

**Future Planned Activities:** Designs and specifications were initiated in FY-2004 for a contract to rehabilitate the three unit Ring Follower Gates. The gates will be rehabilitated under a three-year contract beginning in FY-2006.

**Special Issues:** Kortes is used as a peaking plant except when low water years restrict outflow.

Kortes Reservoir surface elevation is maintained in the range of 6,138 to 6,142 feet above sea level to maximize the plant's efficiency for hydropower production. In 1972, a minimum flow of 500 cubic feet per second was established in the Miracle Mile to support the blue ribbon trout fishery below Kortes Dam.

Access to the Kortes Powerplant is affected by periodic rock fall from the steep canyon walls necessitating continual operation and maintenance expenditures.

Significant cavitation damage has occurred in the turbine runners for all three units over the past several years requiring extended outages for extensive welding repairs.

Black start procedures have been developed and tested at the upper North Platte facilities to address re-start capabilities under a severe transmission system disturbance. If necessary, Kortes Powerplant could be used as the first step in starting Seminoe, Fremont Canyon, and Alcova Powerplants. These plants would then collectively be used to start PacifiCorp’s Dave Johnson Powerplant in the event of a power system emergency.

| | | | |
|---|---|---|---|
| **River:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 36,000 kW | **Installed Capacity:** | 36,000 kW |
| **Year of Initial Operation:** | 1950 | **Age:** | 57 years |
| **Net Generation (FY 2007):** | 122.4 GWh | **Rated Head:** | 200 feet |
| **Average Plant Factor (FY 2007):** | 39.1 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Peaking/Intermediate | | |

## Ancillary Services

**Kortes**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | Yes |
| Voltage Support | Yes |

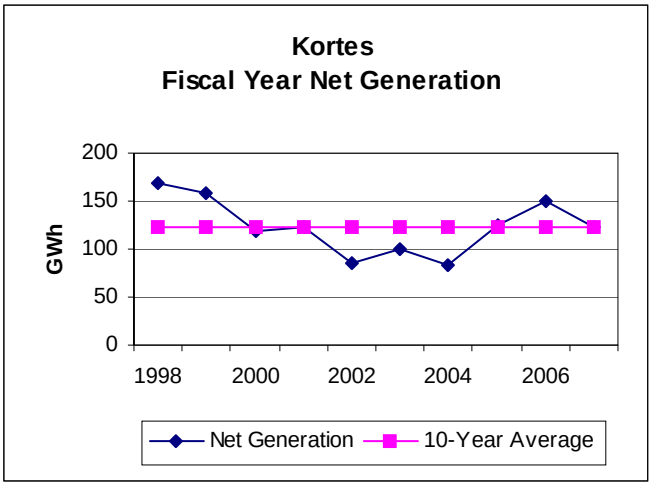
## Generators

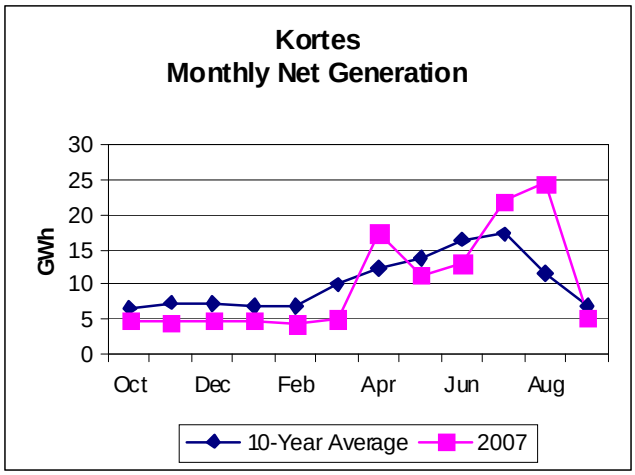
**Kortes Generators**

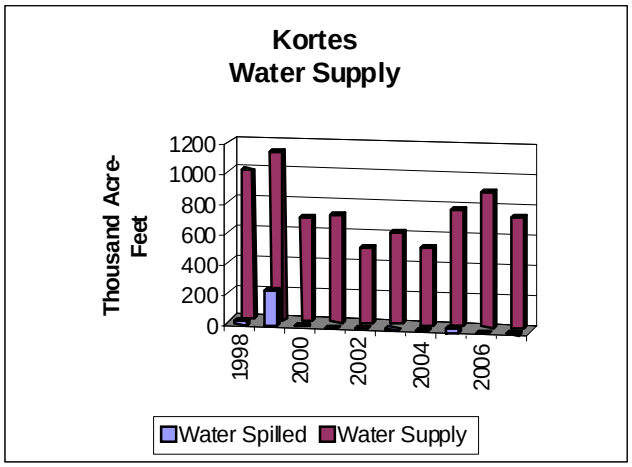
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 12,000 | - | 12,000 |
| 2 | 12,000 | - | 12,000 |
| 3 | 12,000 | - | 12,000 |
| 3 units | 36,000 | - | 36,000 |

## Generation

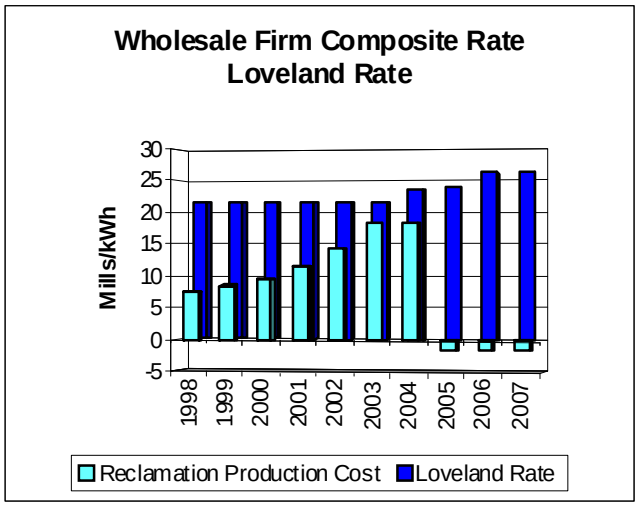

Kortes
Fiscal Year Net Generation
GWh
200
150
100
50
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Kortes
Monthly Net Generation
GWh
30
25
20
15
10
5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

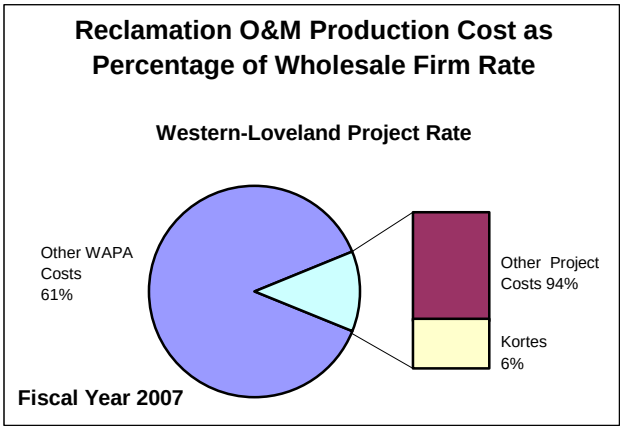

Kortes
Water Supply
Thousand Acre-Feet
1200
1000
800
600
400
200
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

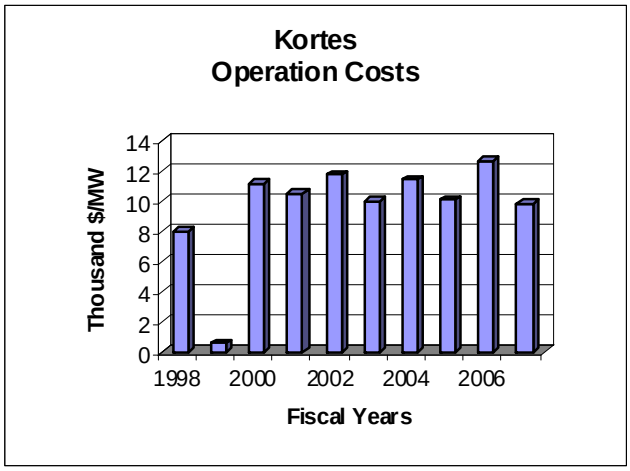
## Benchmark 1
## Wholesale Firm Rate

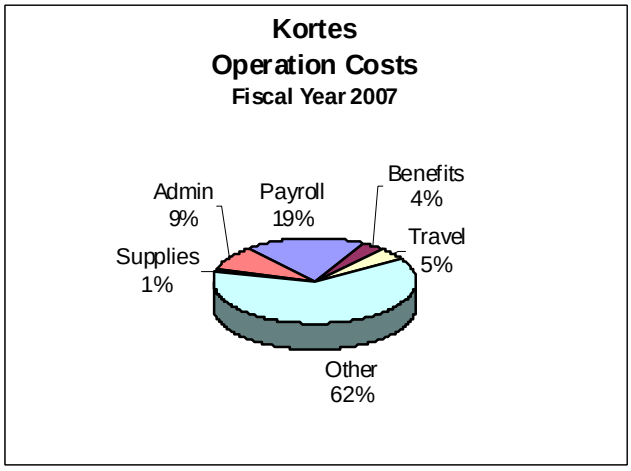


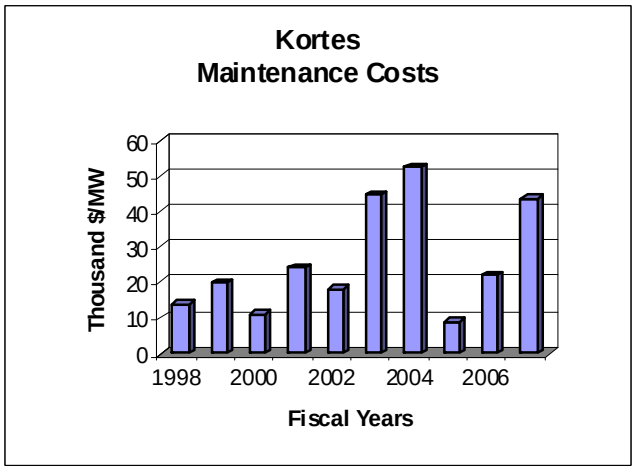

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

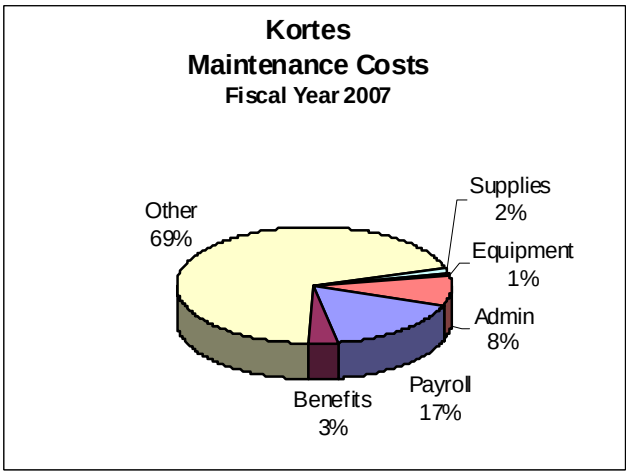


## Benchmark 3
## Production Costs



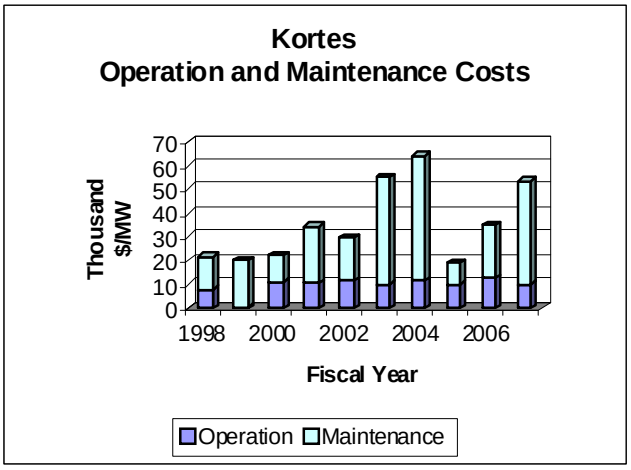



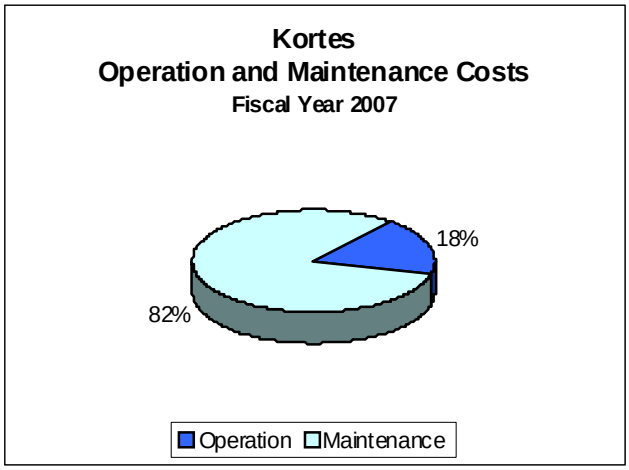



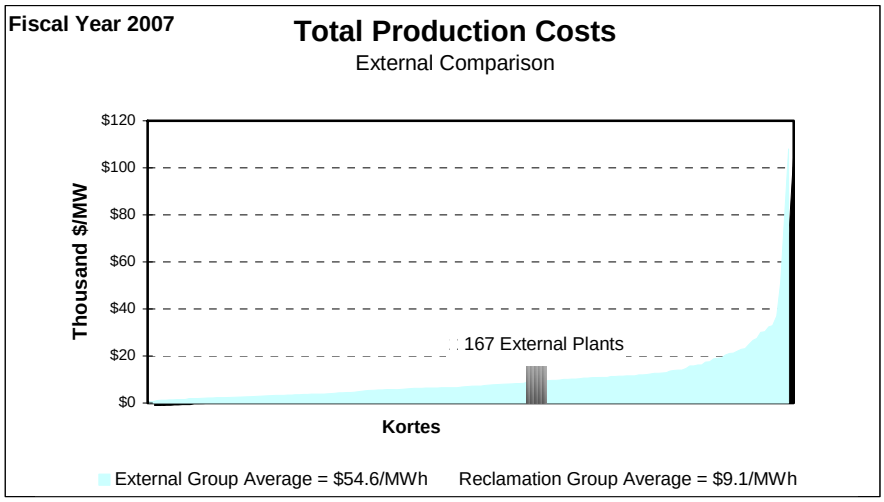



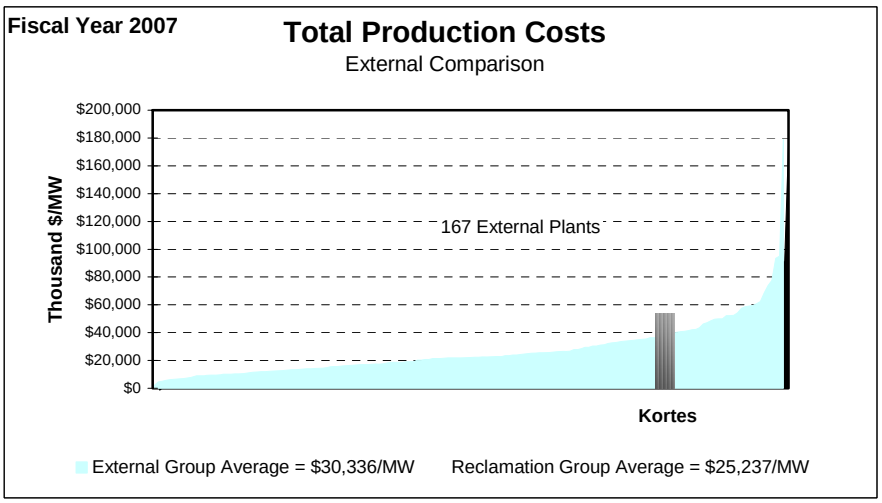

FY-2003 Maintenance Costs include a $900,000 RAX expense on the Kortes Tunnel Repair.

## Benchmark 3
## Production Cost



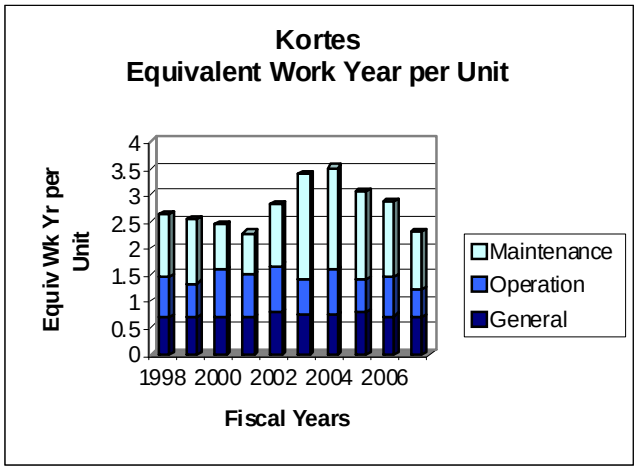



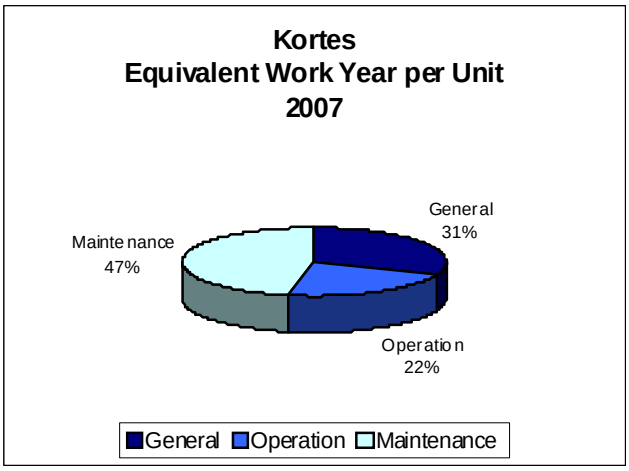



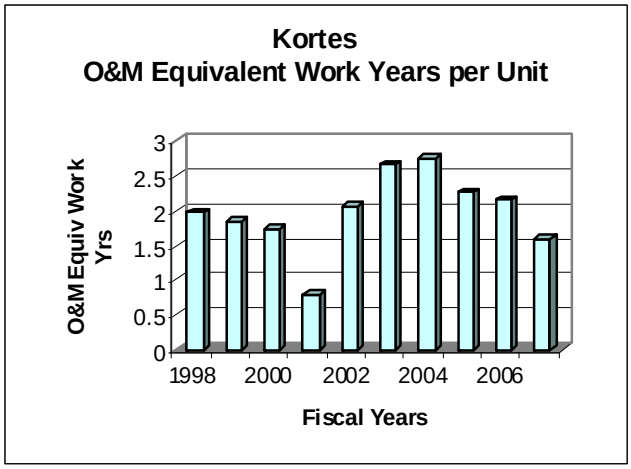



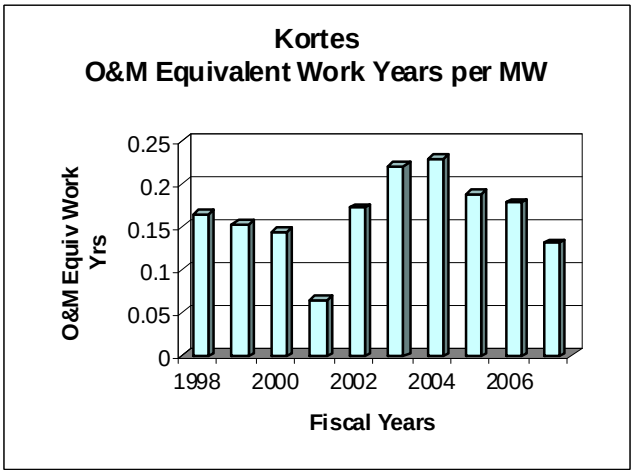
## Benchmark 4
## Workforce Deployment

| Kortes FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.86 | 0.21 | 0.05 | 2.12 | 0.71 | 0.06 |
| Operation | 1.38 | 0.16 | 0.00 | 1.54 | 0.51 | 0.04 |
| Maintenance | 2.90 | 0.33 | 0.00 | 3.23 | 1.08 | 0.09 |
| Total Staffing | 6.14 | 0.69 | 0.05 | 6.88 | 2.29 | 0.19 |

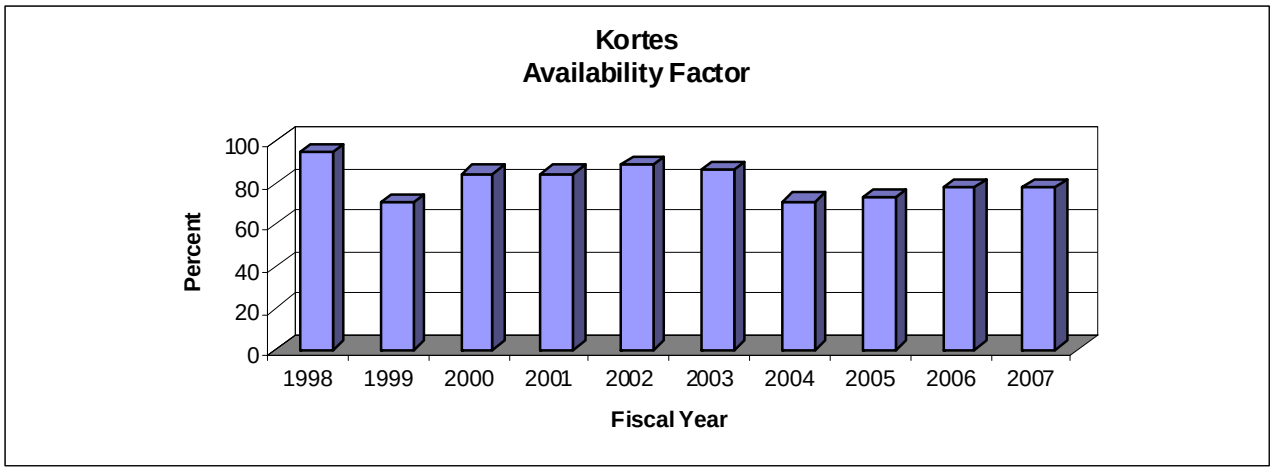


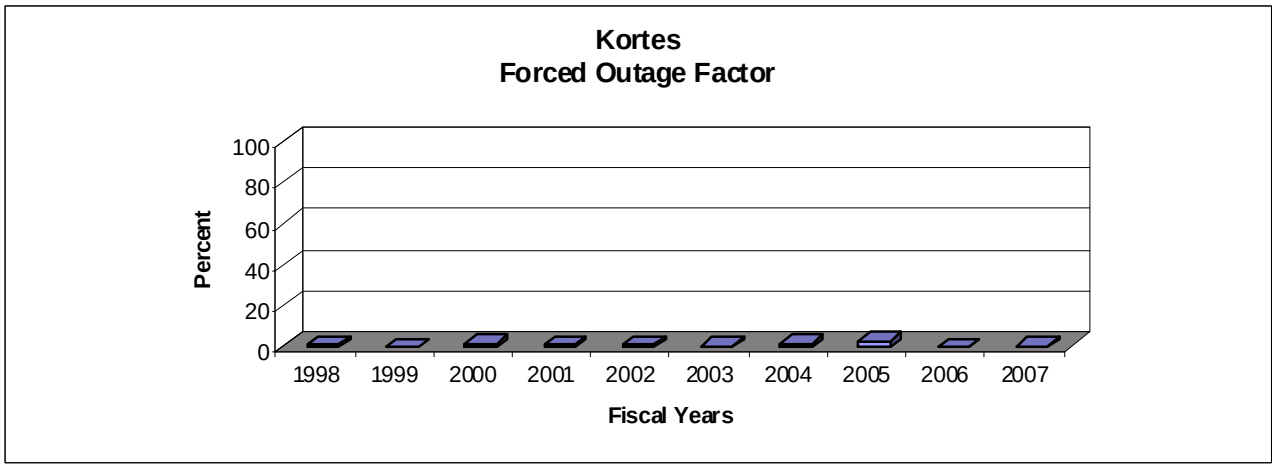



**Benchmark 5**
**Plant Availability Factor**

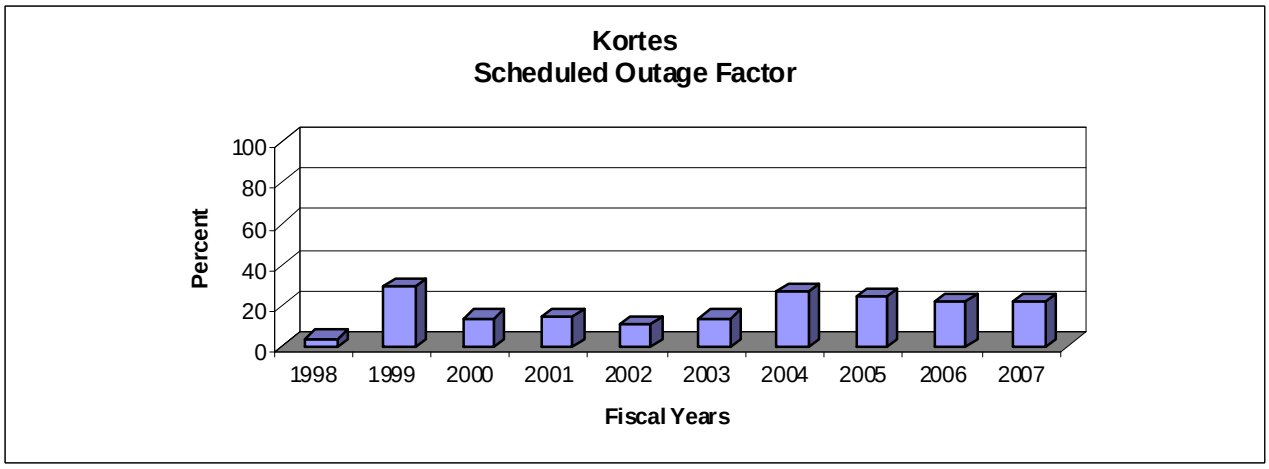



FY-1999 – Unit 2 transformer failure in September 1998 and replacement in June 1999.
FY-2000 – Replacement of Unit 3 transformer in March 2000.
FY-2001 – Replacement of Unit 1 transformer in February 2001.

**Benchmark 6**
**Plant Forced Outage Factor**

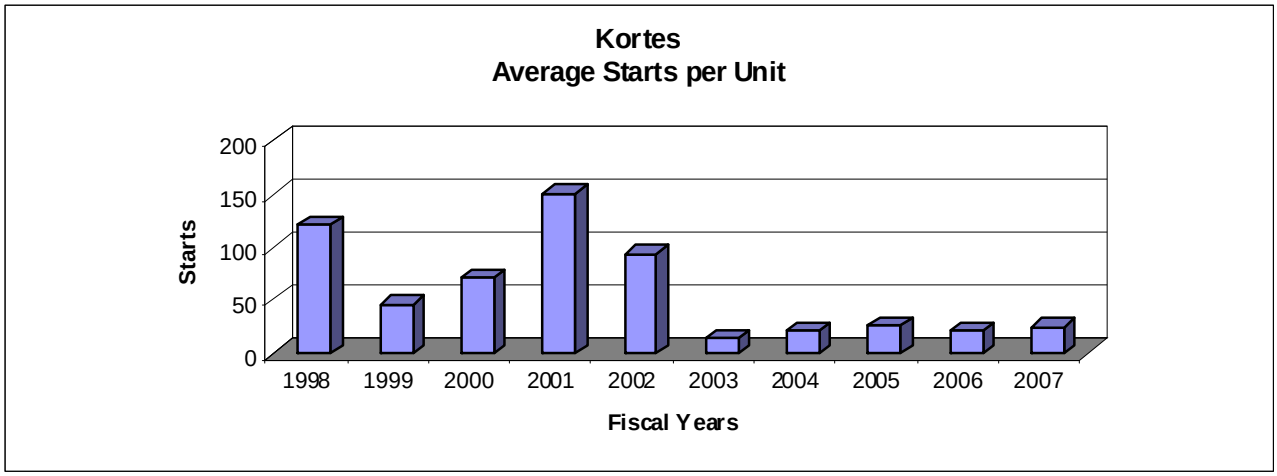


## Benchmark 7
## Plant Scheduled Outage Factor




FY-1999 - Unit 2 transformer replaced.
FY-2001 – Unit 1 transformer replaced.

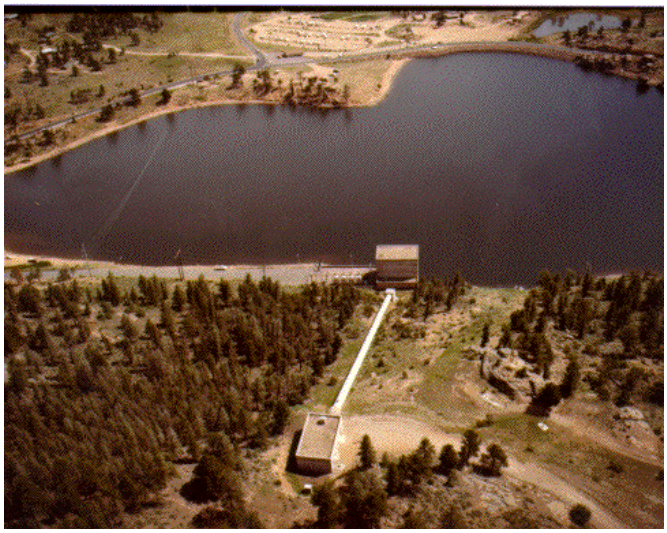
## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Kortes Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 4.38% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 15.75 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 53,564 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.13 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 77.8 | 84.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.3 | 0.5 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 21.8 | 15.3 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Marys Lake Powerplant
# Colorado-Big Thompson Project



**Plant Contact:**
Chuck Pedersen
O&M Chief

**Plant Address:**
Marys Lake Powerplant
PO Box 960
Estes Park CO 80517-0960

**Telephone Numbers:**
Phone: (970) 586-4400
Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Secretary's finding of feasibility was approved by the President on December 21, 1937.

**Project Purposes:** The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in the State of Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities.

**Plant Location:** Marys Lake Powerplant is located in Larimer County, Colorado, on the western shore of Marys Lake, 2.5 miles southwest of Estes Park, Colorado.

**Plant Purpose:** Marys Lake provides afterbay and forebay capacity for reregulating water flow. Marys Lake Power plant provides generation of hydroelectric power for the project.

**Plant Facts:** Marys Lake discharges into Estes Powerplant. There is limited after bay storage, therefore, operation of Marys Lake Powerplant must be coordinated with the Estes Powerplant.

**Plant History:** The water and power control center for Colorado-Big Thompson Project's reservoirs, powerplants, and transmission lines in Wyoming, Colorado, and western Nebraska is at the project headquarters in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation powerplants.

**Present Activities:** Recently completed projects include fire alarm system upgrades; $CO_2$ fire suppression system replacement; power and control panel replacement/reconfiguration; and powerplant roof repairs. Unit excitation system replacement is in progress.

**Future Planned Activities:** Plant remote control (RTU SCADA and fiber communication) upgrades are planned to be completed in FY 2010. Governor upgrading is planned for FY 2013 as is the addition of online condition monitoring.

**Special Issues:** None.

| | | | |
|---|---|---|---|
| **River:** | Colorado River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 8,100 kW | **Installed Capacity:** | 8,100 kW |
| **Year of Initial Operation:** | 1951 | **Age:** | 56 years |
| **Net Generation (FY-2007):** | 40.8 GWh | **Rated Head:** | 212 feet |
| **Average Plant Factor (FY-2007):** | 58.0 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load | | |

## Ancillary Services

**Marys Lake**
**Ancillary Services**

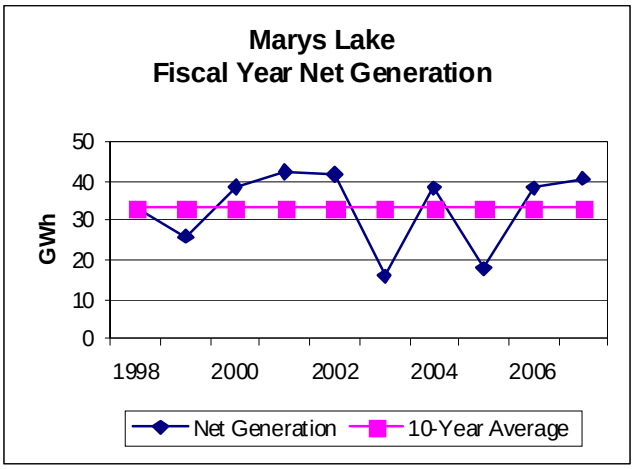
| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | Yes |
| Voltage Support | Yes |

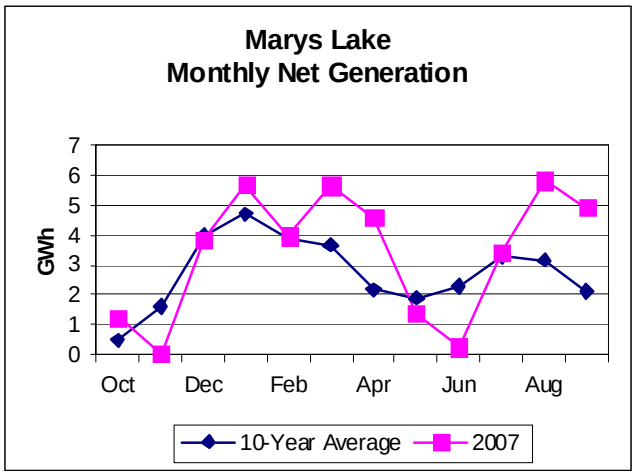
## Generators

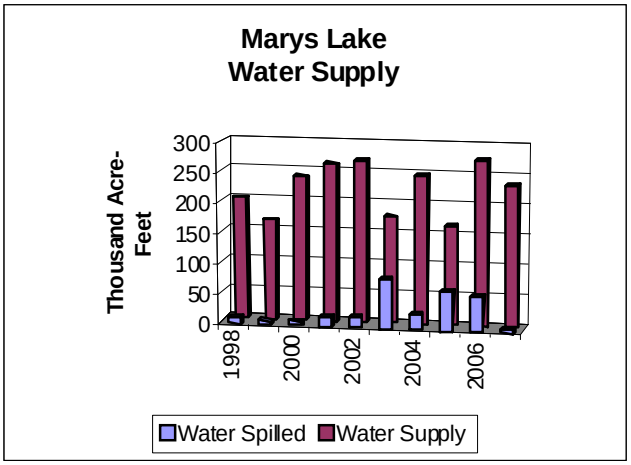
**Marys Lake Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 8,100 | - | 8,100 |
| 1 Unit | 8,100 | - | 8,100 |

## Generation

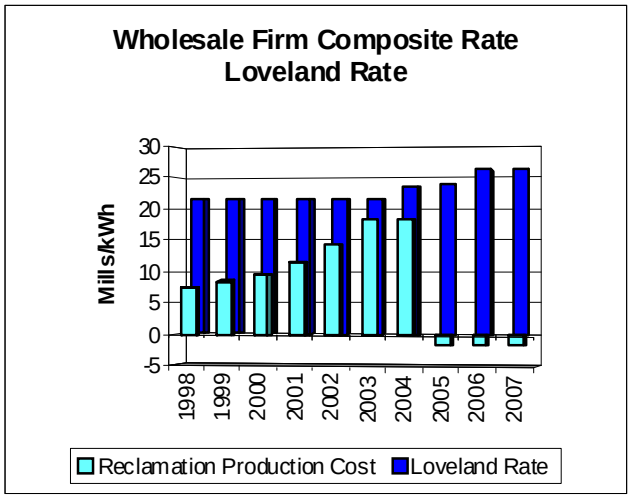

Marys Lake
Fiscal Year Net Generation
GWh
50
40
30
20
10
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Marys Lake
Monthly Net Generation
GWh
7
6
5
4
3
2
1
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

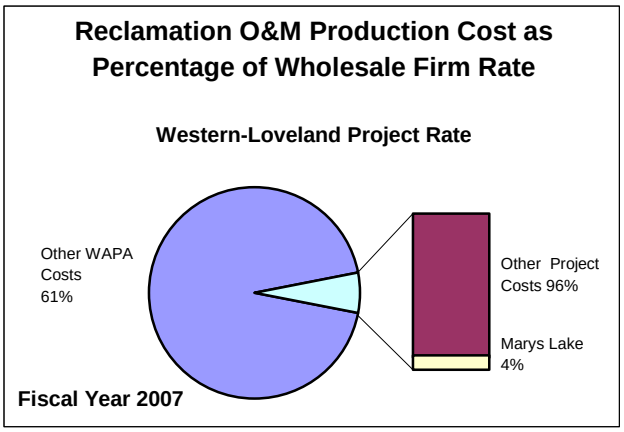

Marys Lake
Water Supply
Thousand Acre-Feet
300
250
200
150
100
50
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

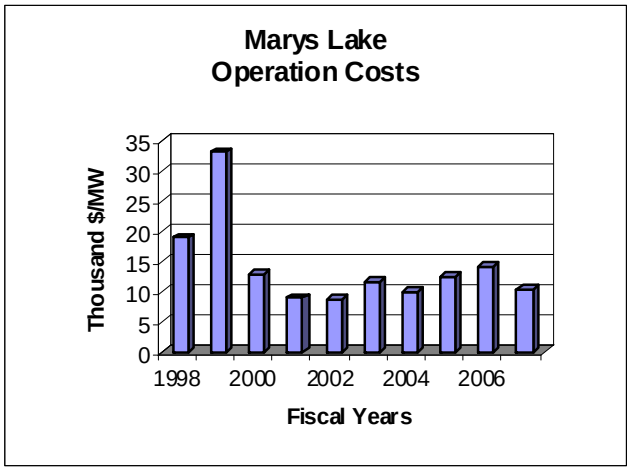
### Benchmark 1
### Wholesale Firm Rate

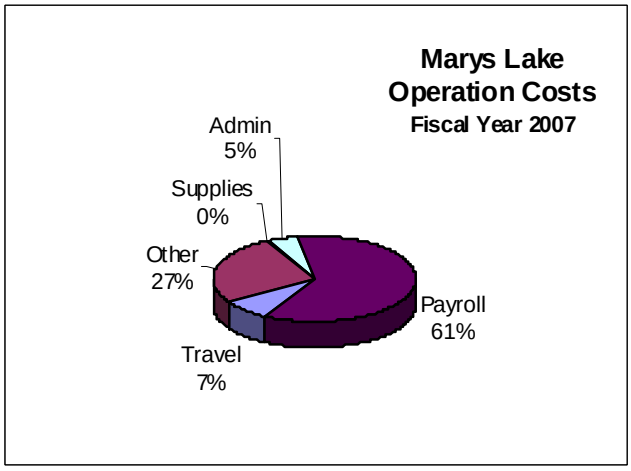


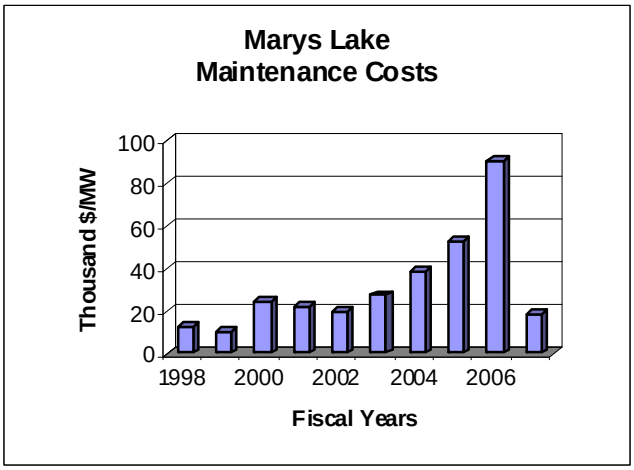

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

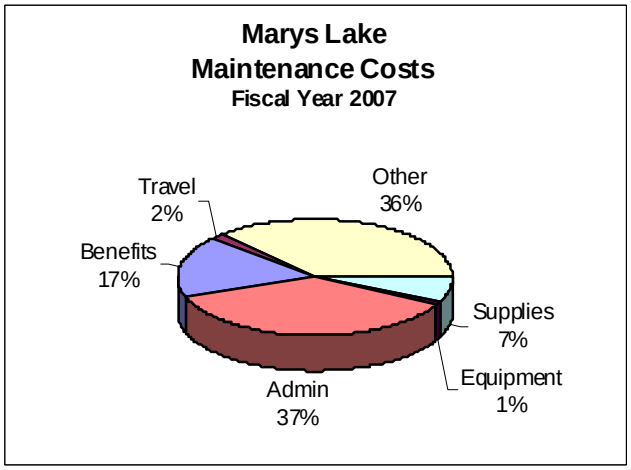


## Benchmark 3
## Production Costs

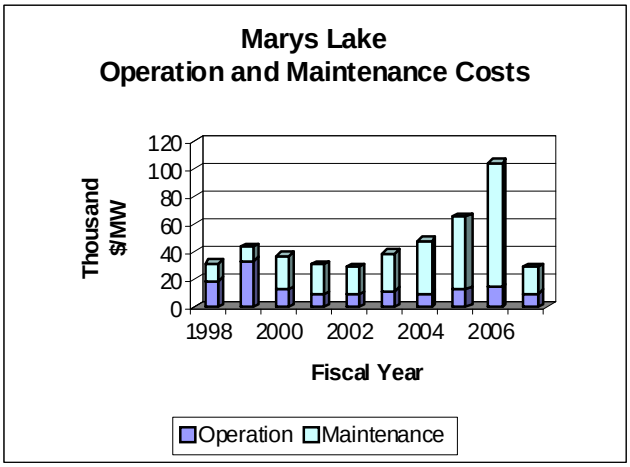


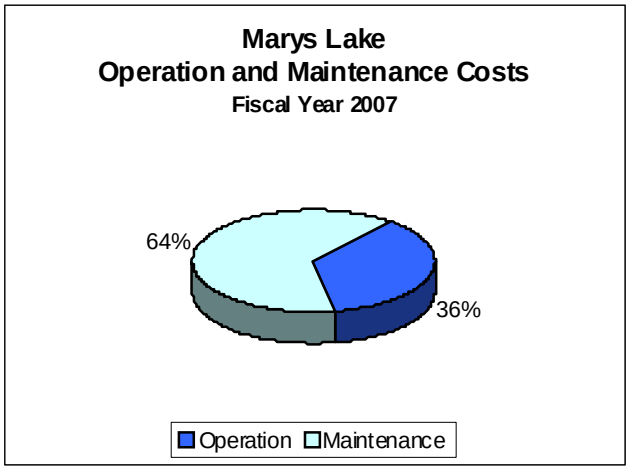



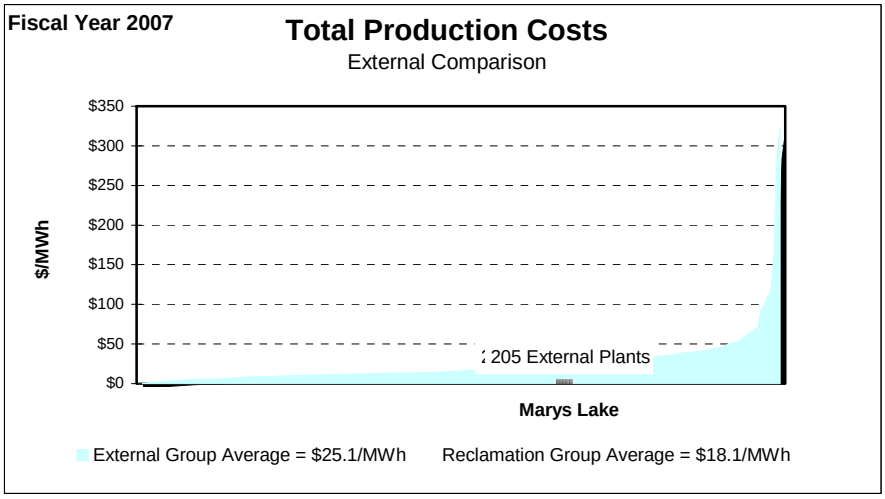



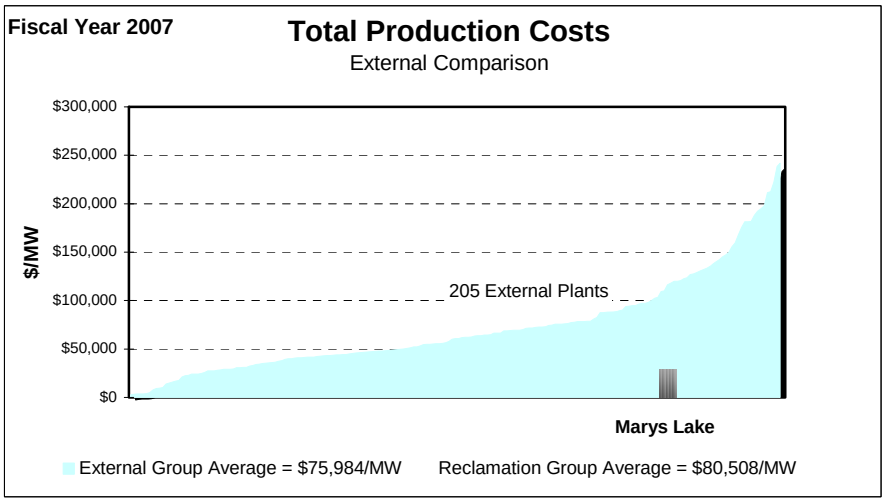



## Benchmark 3
## Production Costs



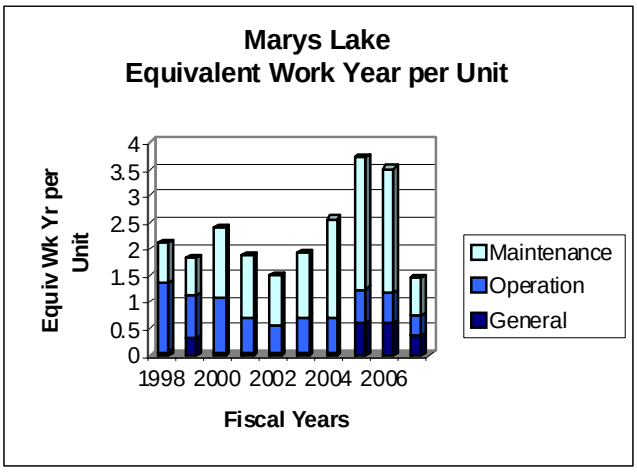



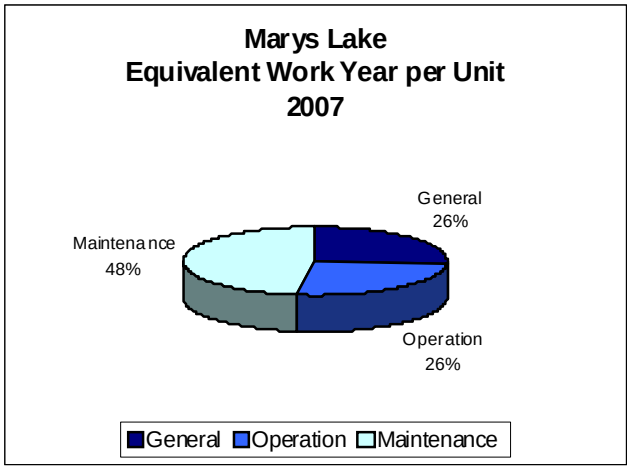



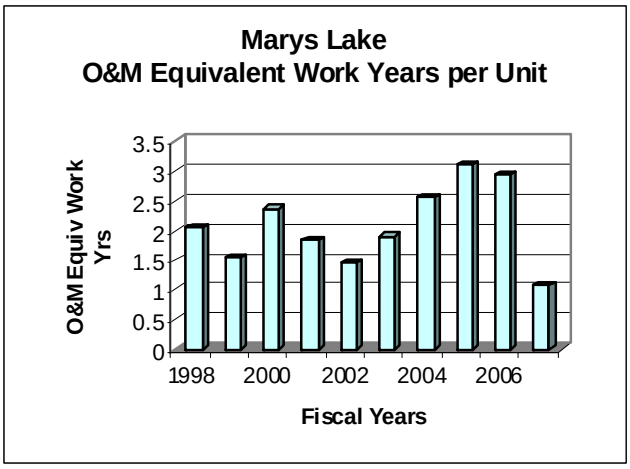



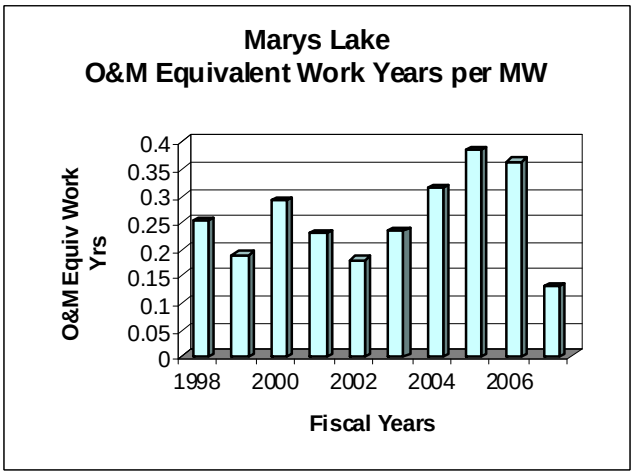
## Benchmark 4
## Workforce Deployment

| Marys Lake FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.01 | 0.00 | 0.02 | 0.03 | 0.03 | 0.00 |
| Operation | 0.52 | 0.06 | 0.00 | 0.58 | 0.58 | 0.07 |
| Maintenance | 2.13 | 0.22 | 0.00 | 2.36 | 2.36 | 0.29 |
| Total Staffing | 2.67 | 0.28 | 0.02 | 2.97 | 2.97 | 0.37 |

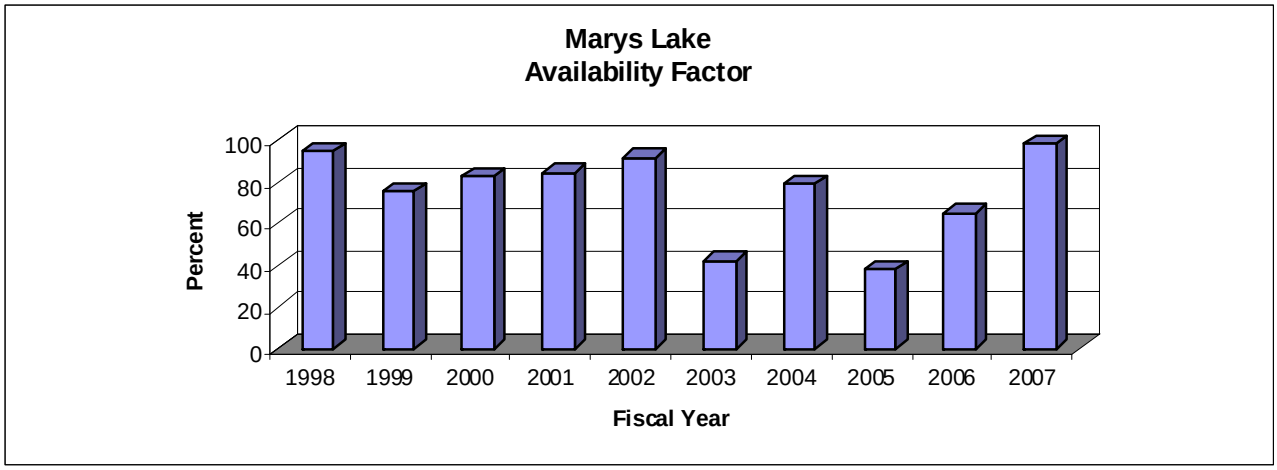


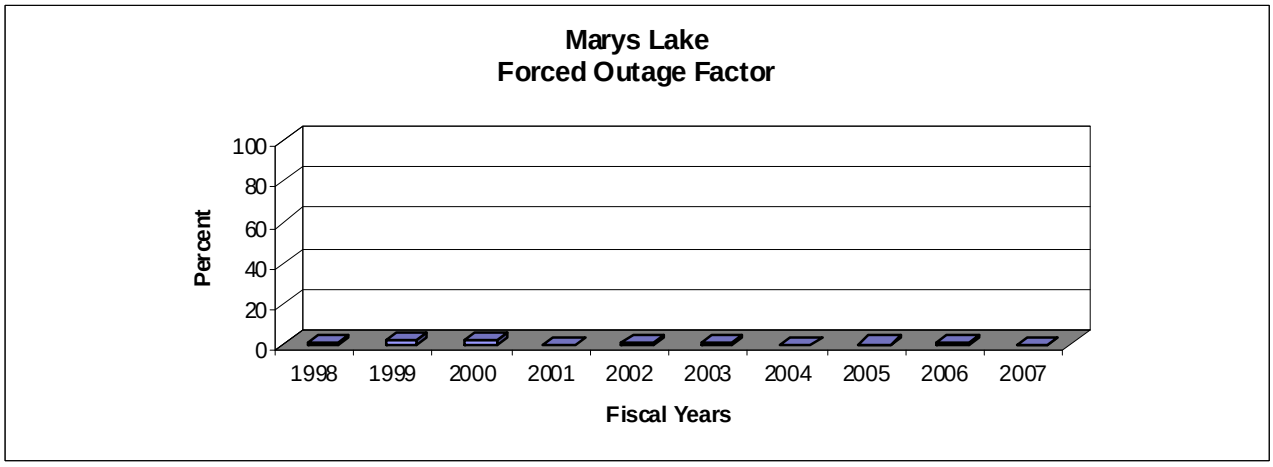



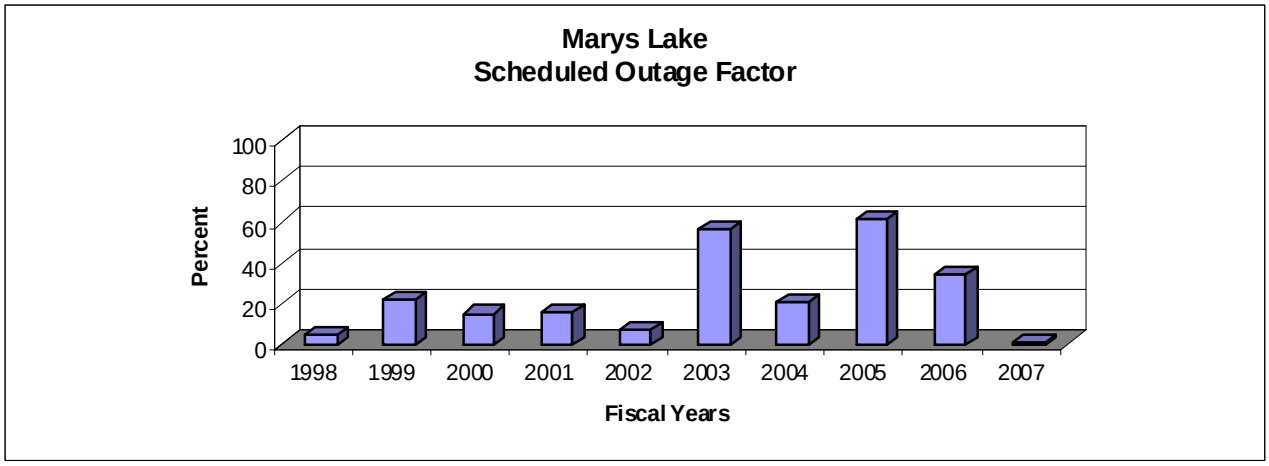
**Benchmark 5**
**Plant Availability Factor**



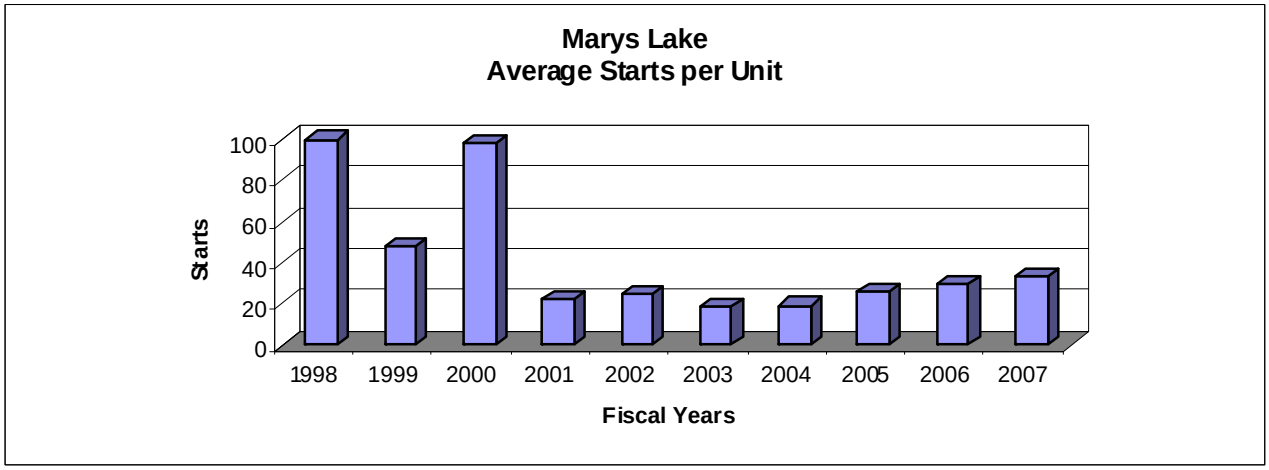

**Benchmark 6**
**Plant Forced Outage Factor**



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Marys Lake Powerplant** | **Reclamation Average 0-10 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 26.1 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.4% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 5.71 | 14.71 | 2.76 | ***25.9 | 1.00 |
| **O&M Costs $/MW** | 28,728 | 60,518 | 7,847 | ***75,984 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.00 | 0.42 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 98.5 | 88.7 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.2 | 0.9 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 1.3 | 10.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Mt. Elbert Pumped-Storage Powerplant
# Fryingpan-Arkansas Project

**Plant Contact:**
Chuck Pedersen
O&M Chief

**Plant Address:**
Mt. Elbert Powerplant
Twin Lake Field Office
Granite Star Route
Granite CO 81228

**Telephone Numbers:**
Phone: (970) 962-4400
Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Congress authorized the Fryingpan-Arkansas Project under Public Law 87-590 (77 Stat. 393), signed by the President on August 16, 1962.

**Project Purposes:** The Fryingpan-Arkansas Project is a multi-purpose transmountain diversion development in southeastern Colorado. It makes possible an average annual diversion of 69,200 acre-feet of surplus water from the Fryingpan River and other tributaries of the Roaring Fork River on the western slope of the Rocky Mountains to the Arkansas River on the eastern slope.

**Plant Location:** Mt. Elbert Pumped-Storage Powerplant is located in Lake County, on the north shore of Twin Lakes, 20 miles southwest of Leadville, Colorado. It is at the foot of Mt. Elbert, Colorado's highest peak.

**Plant Purpose:** Generation of hydroelectric power for the project and supports peak capacity needs and power support of the interconnected power system.

**Plant Facts:** The powerplant was designed with modern architectural lines and is an all-concrete structure equivalent to a 14-story building, although most of the structure is below ground on the edge of Twin Lakes. The power generated at Mt. Elbert derives from water originally pumped from Twin Lakes, which acts as the Mt. Elbert afterbay, and also from supplemental water delivered from Turquoise Lake to the forebay. The generators are designed to operate as a 170,000-horsepower electric motor which drives the turbines in reverse, and pumps water back up to refill the forebay. This pumping mode normally will be used during the very early morning hours, when power demands are low and surplus low-rate power is received from other generating stations. This pump-back storage principle is advantageous since the generating units can be started quickly and adjustments of power output can be made rapidly to respond to varying patterns of daily and seasonal power demands.

**Plant History:** Normal operations.

**Present Activities:** Recently completed projects include plant compressor replacement, governor replacement, cooling water piping replacement, afterbay bulkhead gate cranes installation and protective relaying replacement. Unit $CO_2$ fire suppression and plant fire alarm upgrades in progress are scheduled to be completed in FY 2008. Communication (RTU SCADA) and digital microwave upgrades under progress are planned to be completed in FY 2009. A condition assessment by a private contractor that may recommend future repairs or upgrades (including, but not limited to cracked runner replacement) will be completed in FY2009.

**Future Planned Activities:** Unit 1 and 2 penstock guard cylinder and guard gate shaft repairs are planned for FY 2009. Online condition monitoring addition is planned for FY 2013.

**Special Issues:** None.

| | | | |
|---|---|---|---|
| **River:** | Trans Mountain Division | **Plant Type:** | Pump Storage |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 200,000 kW | **Installed Capacity:** | 200,000 kW |
| **Year of Initial Operation:** | 1981 | **Age:** | 26 years |
| **Net Generation (FY-2007):** | 313.4 GWh | **Rated Head:** | 448 feet |
| **Average Plant Factor (FY-2007):** | 18.1 percent | **Remotely Operated:** | No |
| **Production Mode:** | Peaking | | |

## Ancillary Services

**Mt. Elbert**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | Yes |
| Voltage Support | Yes |

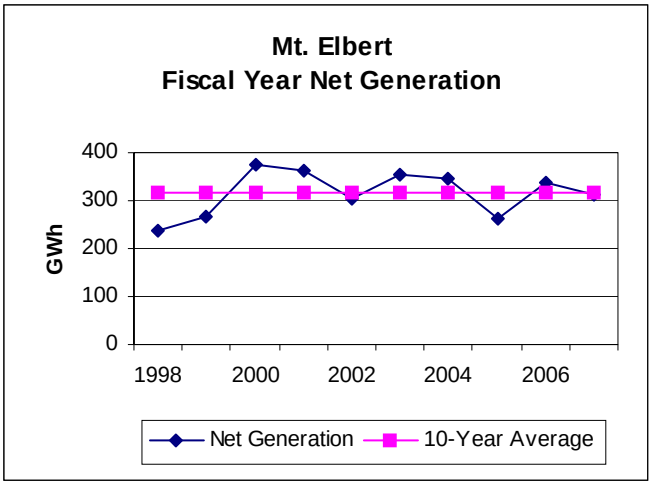
## Generators

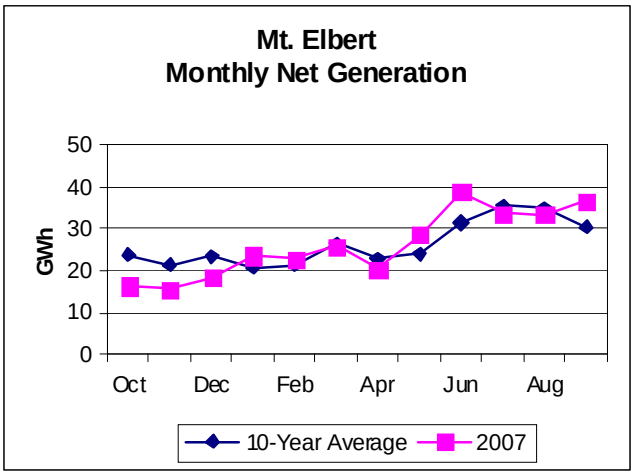
**Mt. Elbert PS Generators**

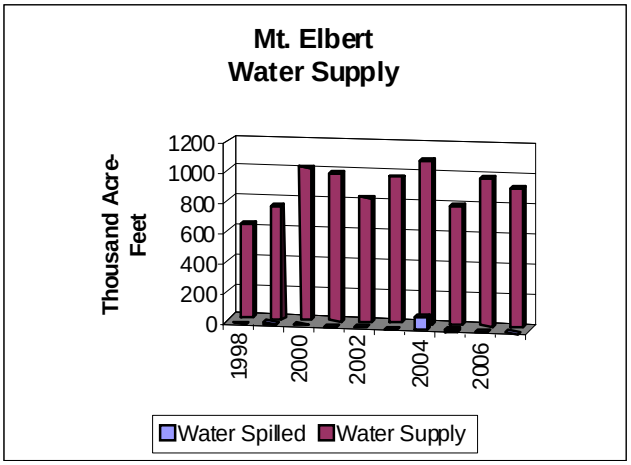
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 100,000 | - | 100,000 |
| 2 | 100,000 | - | 100,000 |
| 2 units | 200,000 | - | 200,000 |

## Generation

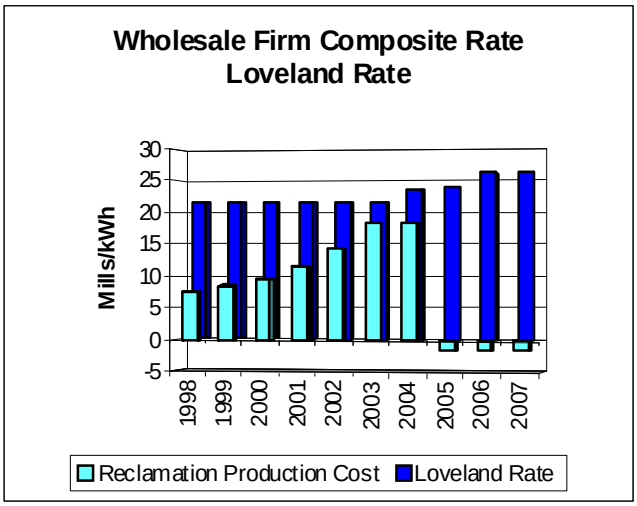

Mt. Elbert
Fiscal Year Net Generation
GWh
400
300
200
100
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Mt. Elbert
Monthly Net Generation
GWh
50
40
30
20
10
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

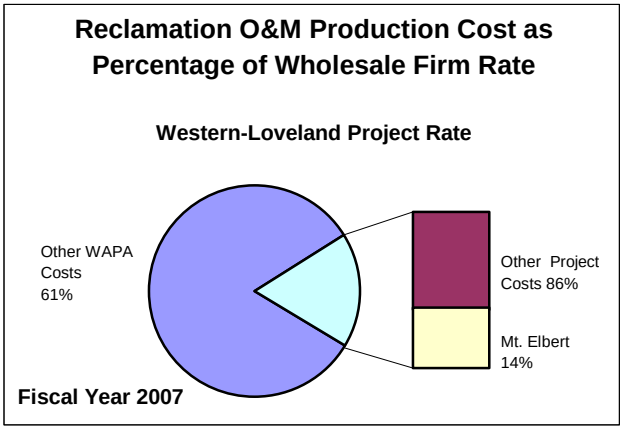

Mt. Elbert
Water Supply
Thousand Acre-Feet
1200
1000
800
600
400
200
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

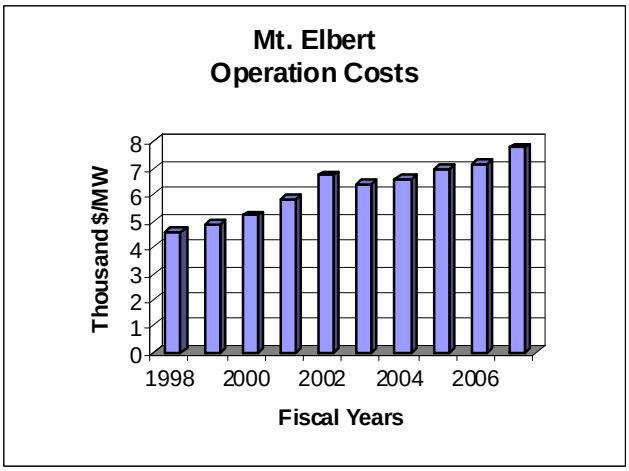
### Benchmark 1
### Wholesale Firm Rate

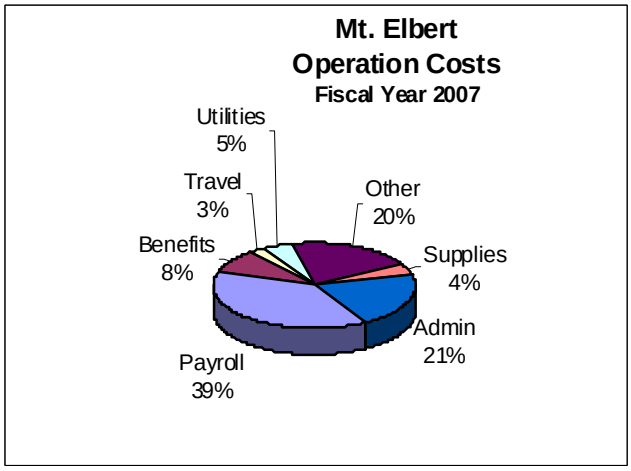


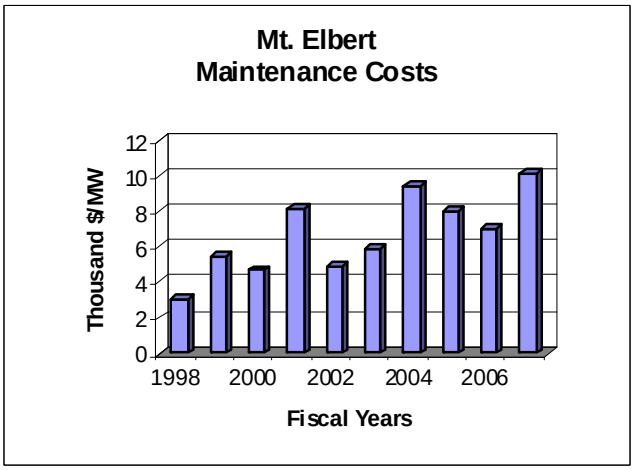

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

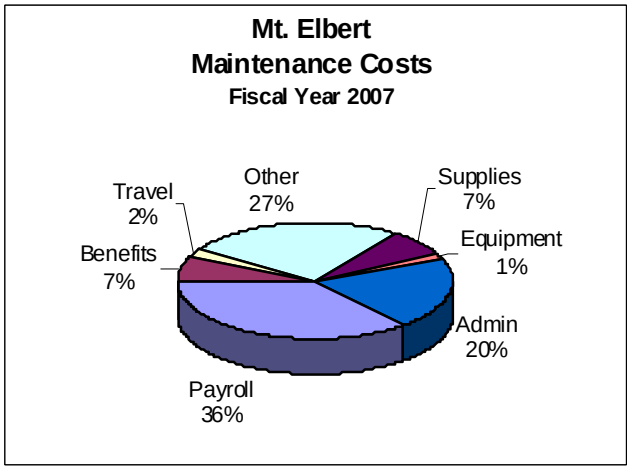


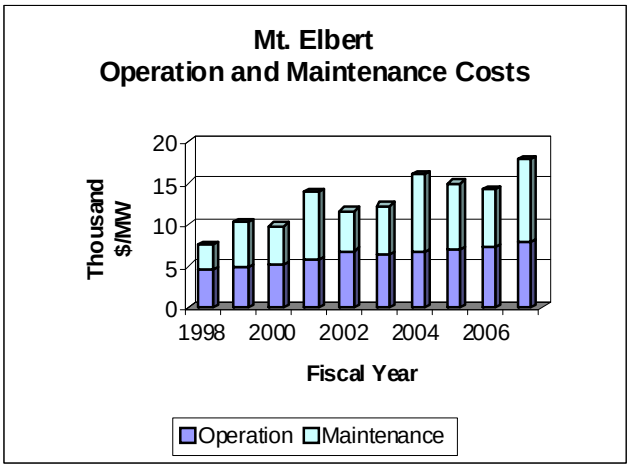
## Benchmark 3
## Production Costs

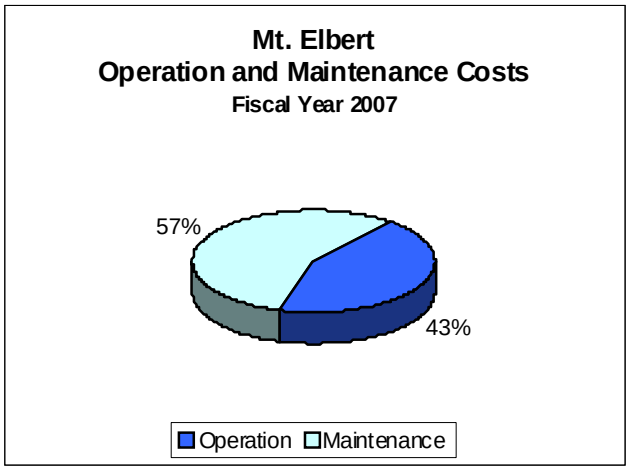


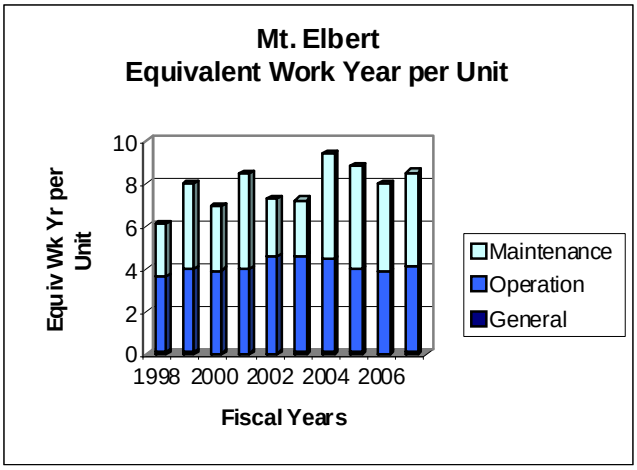



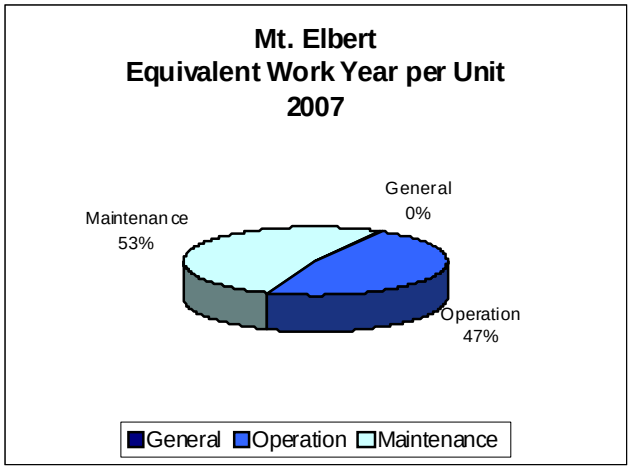



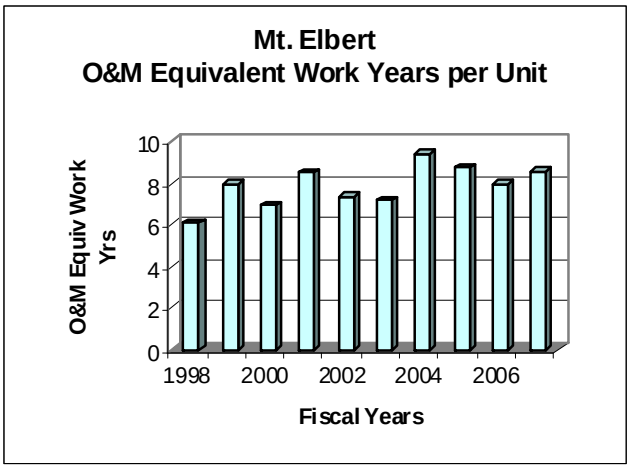



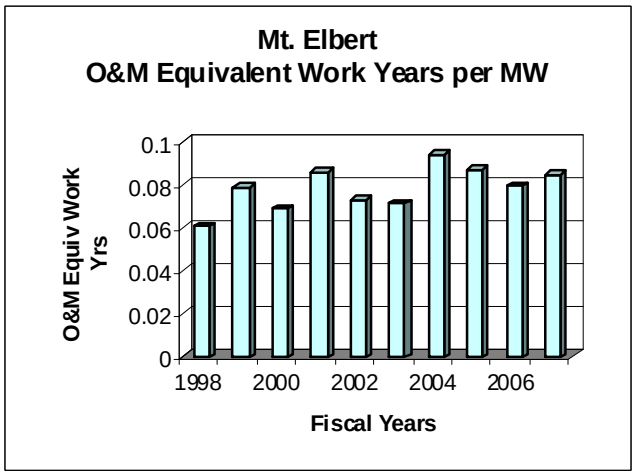
## Benchmark 4
## Workforce Deployment

| Mt. Elbert FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.02 | 0.00 | 0.04 | 0.06 | 0.03 | 0.00 |
| Operation | 7.26 | 0.82 | 0.00 | 8.08 | 4.04 | 0.04 |
| Maintenance | 8.08 | 0.91 | 0.00 | 8.99 | 4.49 | 0.04 |
| Total Staffing | 15.36 | 1.73 | 0.04 | 17.13 | 8.56 | 0.09 |

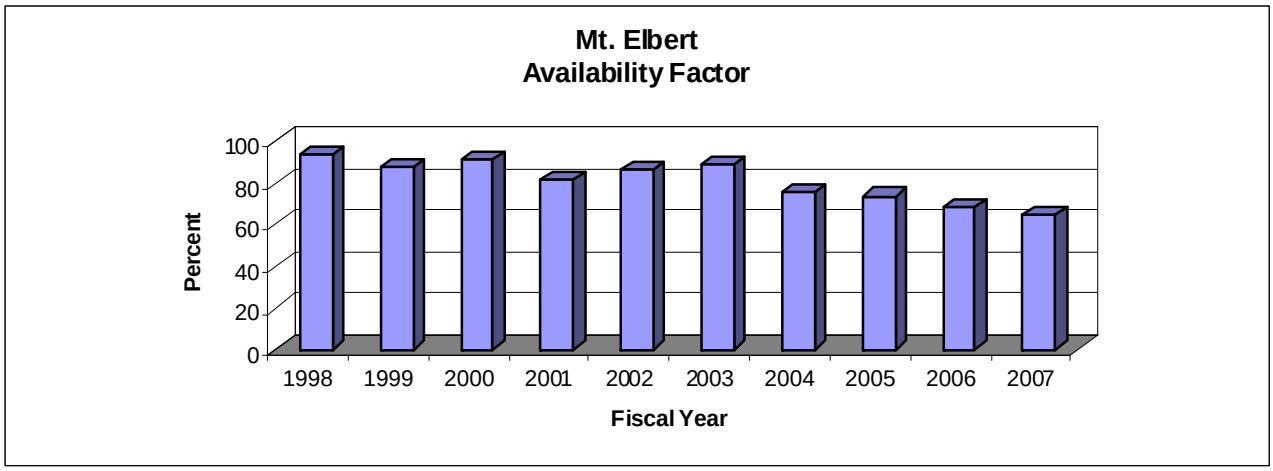


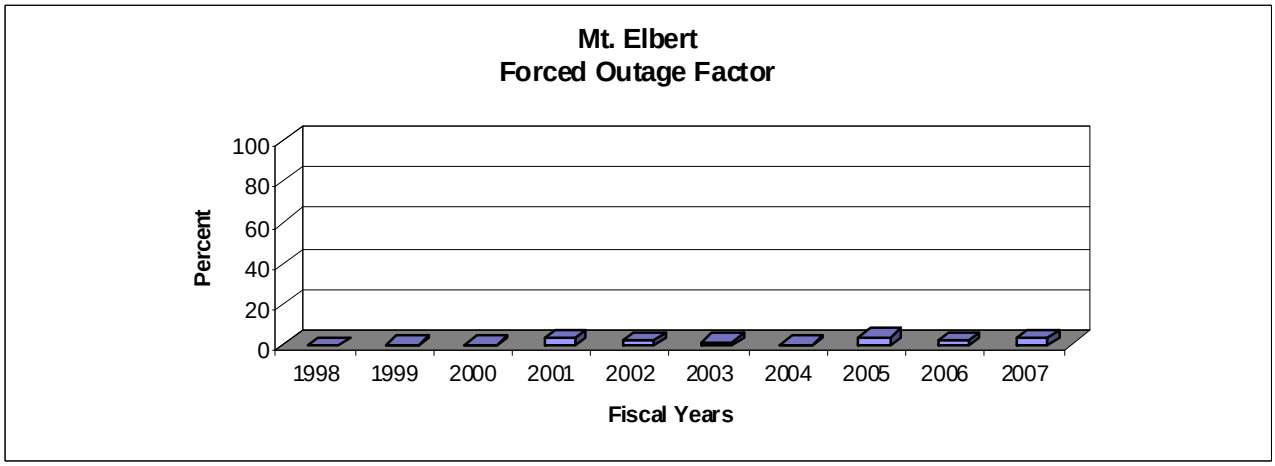



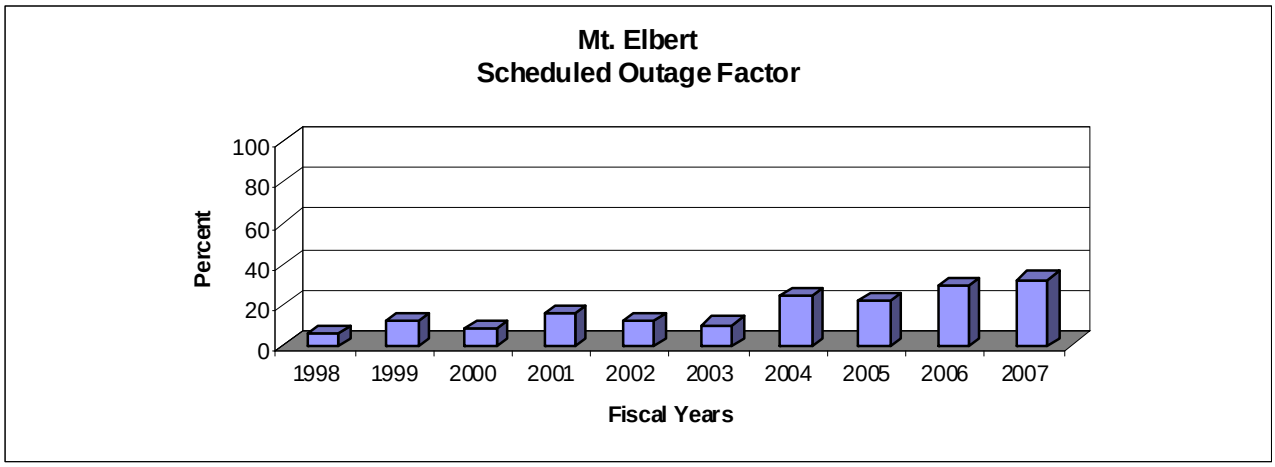
**Benchmark 5**
**Plant Availability Factor**



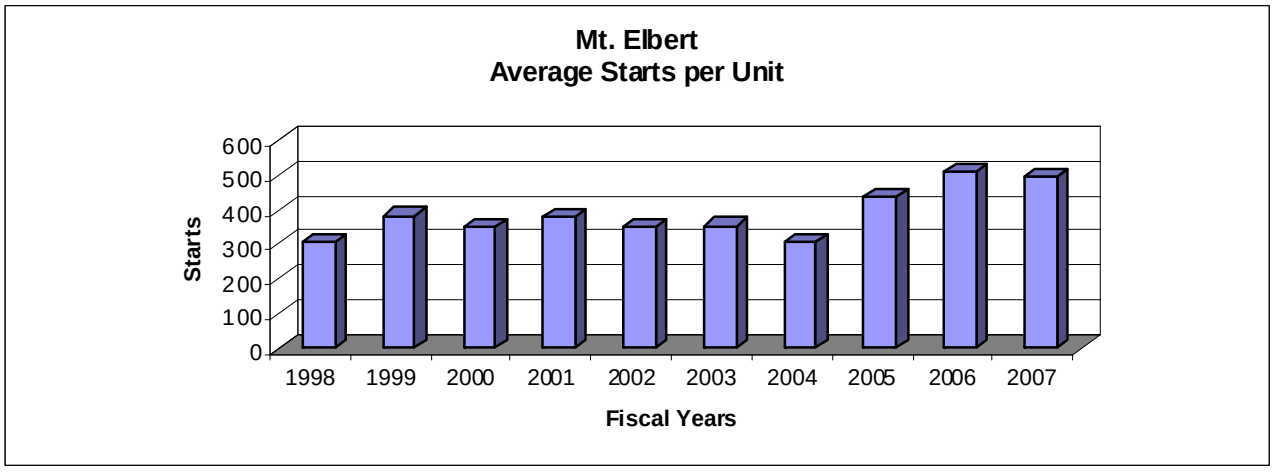

**Benchmark 6**
**Plant Forced Outage Factor**



## Benchmark 7
## Plant Scheduled Outage Factor




## Unit Starts



## Benchmark Data Comparison

| Fiscal Year 2007 | Mt. Elbert Powerplant | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 8.14% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 11.44 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 17,932 | 7,846.6 | Not Applicable | 2,897.3 |
| **O&M Equiv Work Year per MW** | 0.09 | 0.03 | Not Available | 0 |
| **Availability Factor** | 64.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 3.0 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 32.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

Note: Mt. Elbert is the only Reclamation facility that is operated in a pump-storage mode. This means that the plant purchases off peak energy to pump water to an upper storage reservoir. The water is then released to a lower reservoir when needed to meet system peak demands and for system stability. It is important to note the unique demands and usages on the Mt. Elbert facility, when comparing to other Reclamation and Industry plants.

# Pilot Butte Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Pilot Butte Powerplant
Morton WY

**Telephone Numbers:**
Phone: (307) 261-5671
Fax: (307) 261-5683

**E-Mail Address:**
jlawson@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The project was authorized for construction by the Secretary of the Interior on June 19, 1918, under the terms of the Indian Appropriation Act for fiscal year 1919, and approved by the Congress on May 25, 1918. By the act of June 5, 1920, the project was placed under Reclamation's jurisdiction. On September 25, 1970, Public Law 91-409 reauthorized the project as the Riverton Unit of the Pick-Sloan Missouri Basin Program. |
| **Project Purposes:** | Pilot Canal flows in a generally easterly direction from Pilot Butte Reservoir, servicing lands south of those supplied by the Wyoming Canal. |
| **Plant Location:** | The Riverton Unit is in central Wyoming on the Wind River Indian Reservation. Pilot Butte Powerplant is located in Fremont County, approximately 22 miles northwest of Riverton, Wyoming, at the drop from the Wyoming Canal to Pilot Butte Reservoir. |
| **Plant Purpose:** | Pilot Butte Powerplant was built to supply power to the project. |

| | | | |
|---|---|---|---|
| **Plant Facts:** | The plant has two generating units, which operate under a maximum head of 105 feet with a total capacity of 1,600 kilowatts. Power is distributed over 76 miles of transmission lines.<br><br>Pilot Butte Powerplant is operated on a seasonal basis during the diversion of irrigation flows to Pilot Butte Reservoir. | | |
| **Plant History:** | The Pilot Butte Powerplant, located at the drop from the Wyoming Canal to Pilot Butte Reservoir was out of service in June 1973. A new penstock was installed and units were placed in service in June 1990. | | |
| **Present Activities:** | Normal Operations. | | |
| **Future Planned Activities:** | None | | |
| **Special Issues:** | None | | |
| **River:** | Wind River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 1,600 kW | **Installed Capacity:** | 1,600 kW |
| **Year of Initial Operation:** | 1925 | **Age:** | 83 years |
| **Net Generation (FY 2007):** | 3.1 GWh | **Rated Head:** | 100 feet |
| **Average Plant Factor (FY 2007):** | 22.9 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load (seasonal) | | |

## Ancillary Services

**Pilot Butte**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | No |

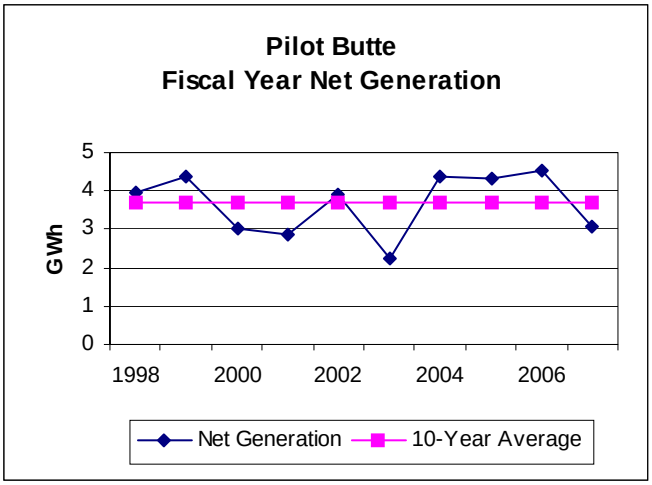
## Generators

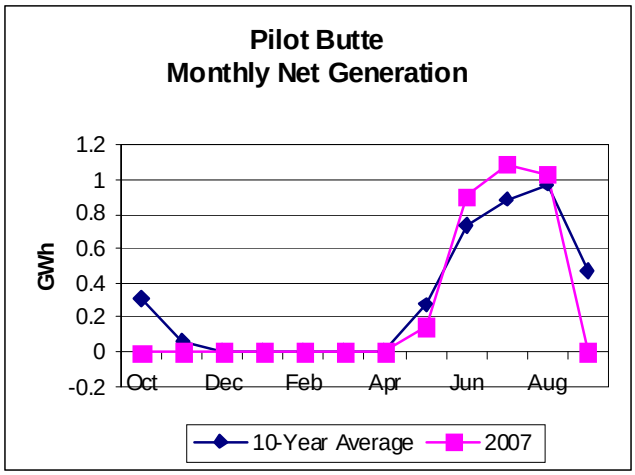
**Pilot Butte Generators**

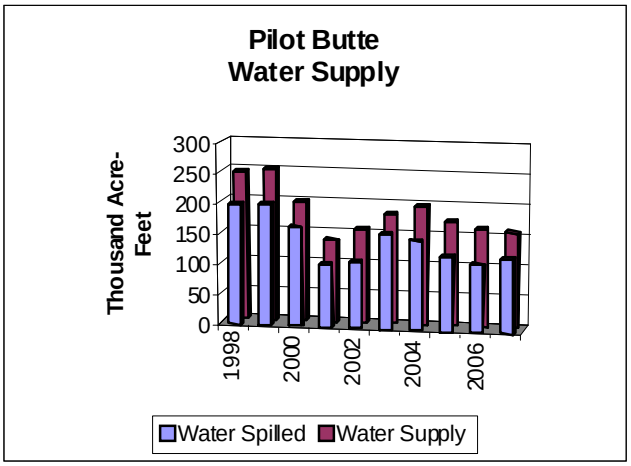
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 800 | - | 800 |
| 2 | 800 | - | 800 |
| 2 units | 1,600 | - | 1,600 |

## Generation

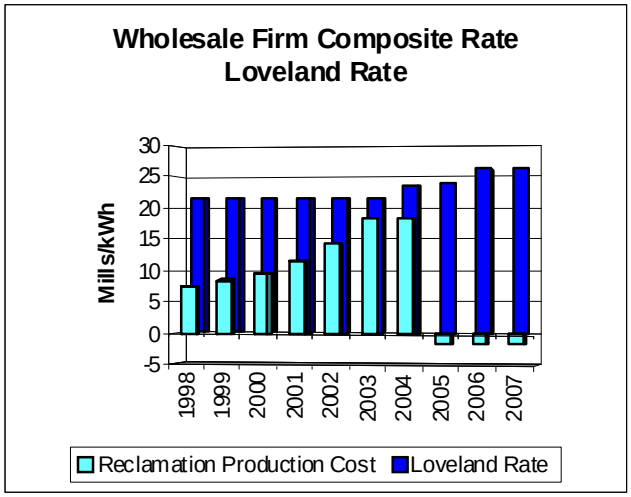

Pilot Butte
Fiscal Year Net Generation
GWh
5
4
3
2
1
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Pilot Butte
Monthly Net Generation
GWh
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

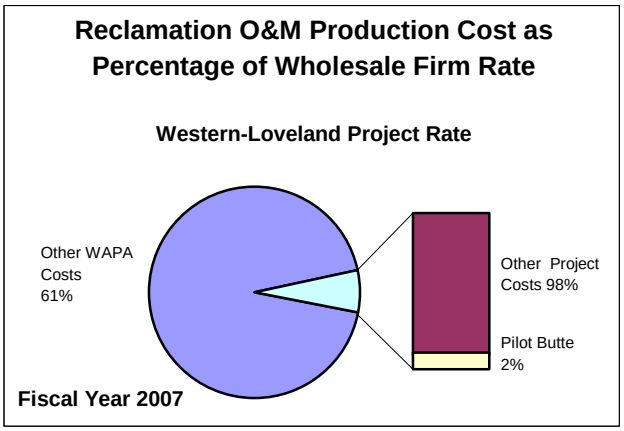

Pilot Butte
Water Supply
Thousand Acre-Feet
300
250
200
150
100
50
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

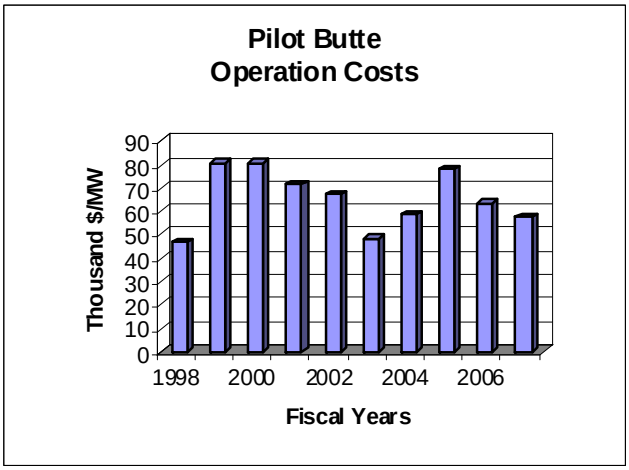
## Benchmark 1
## Wholesale Firm Rate

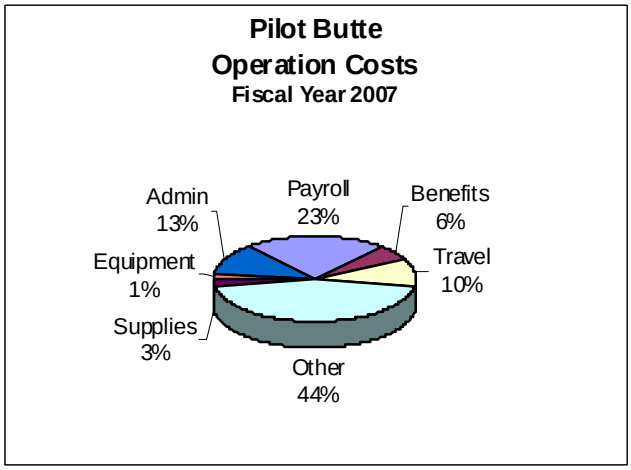


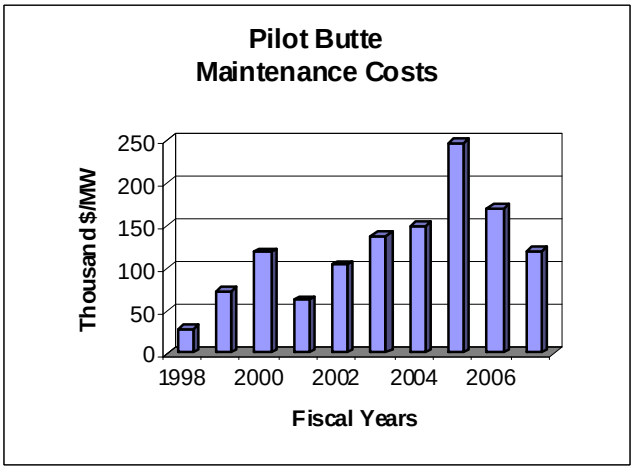

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

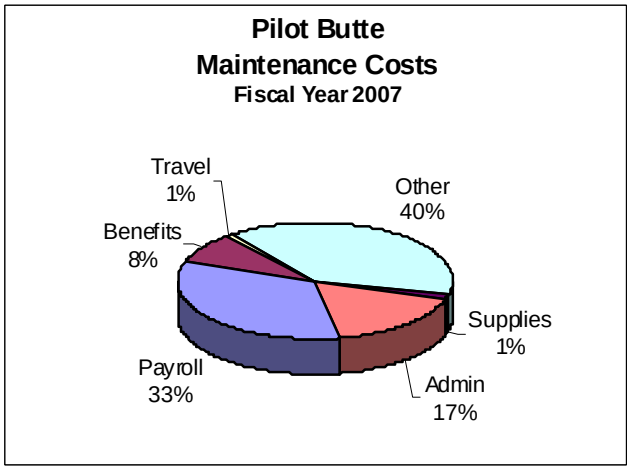


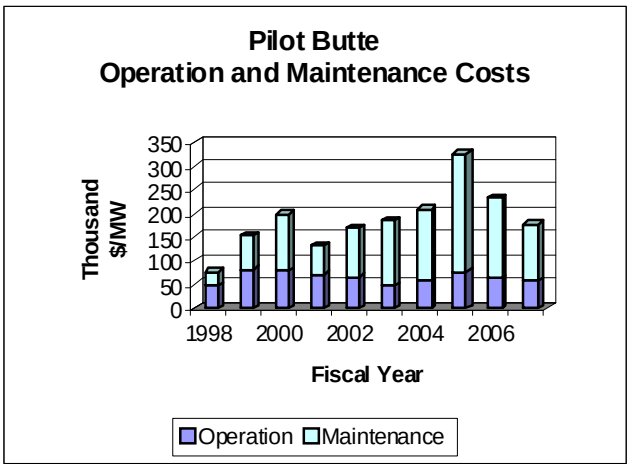
## Benchmark 3
## Production Cost

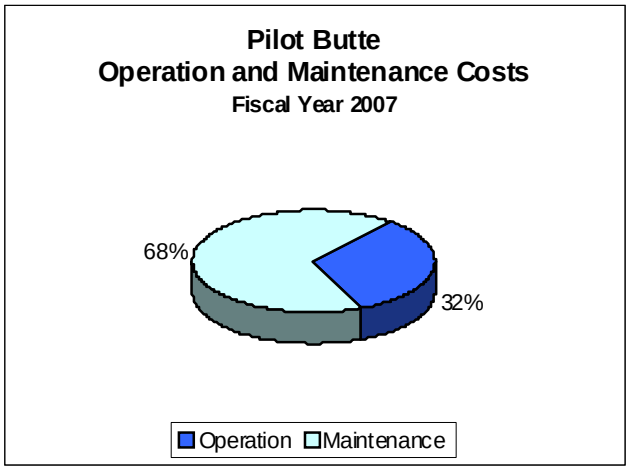


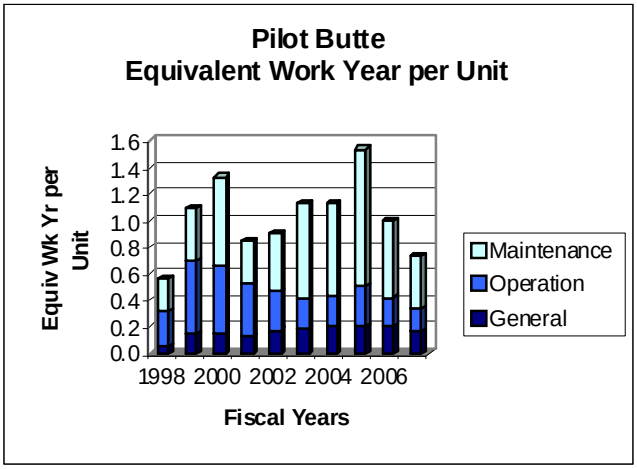



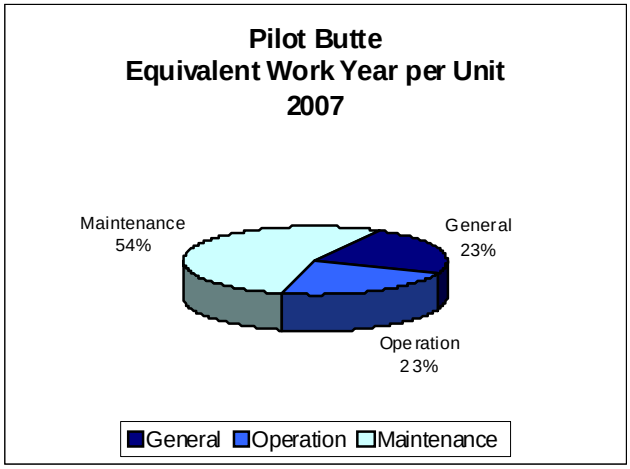



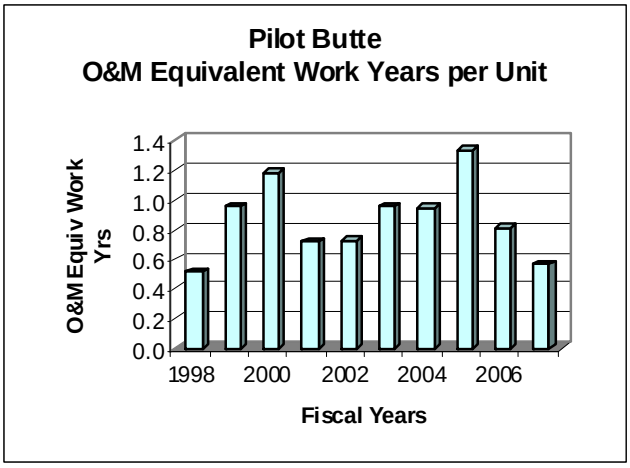

FY2003- Includes costs for significant repair of the stator winding for Unit 2.

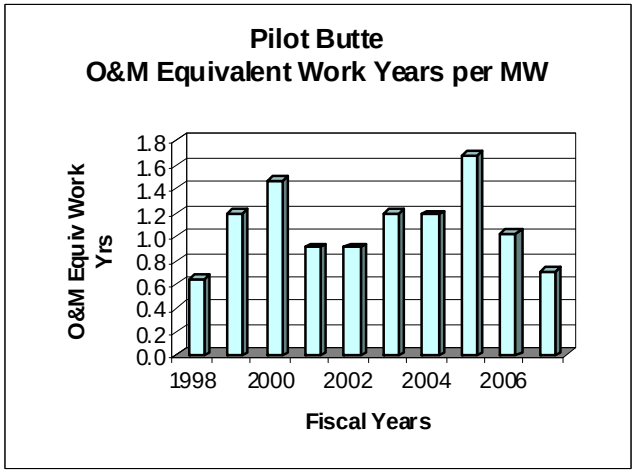
## Benchmark 4
## Workforce Deployment

| Pilot Butte FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.27 | 0.03 | 0.04 | 0.34 | 0.17 | 0.21 |
| Operation | 0.30 | 0.03 | 0.00 | 0.34 | 0.17 | 0.21 |
| Maintenance | 0.72 | 0.08 | 0.00 | 0.80 | 0.40 | 0.50 |
| Total Staffing | 1.29 | 0.15 | 0.04 | 1.47 | 0.74 | 0.92 |

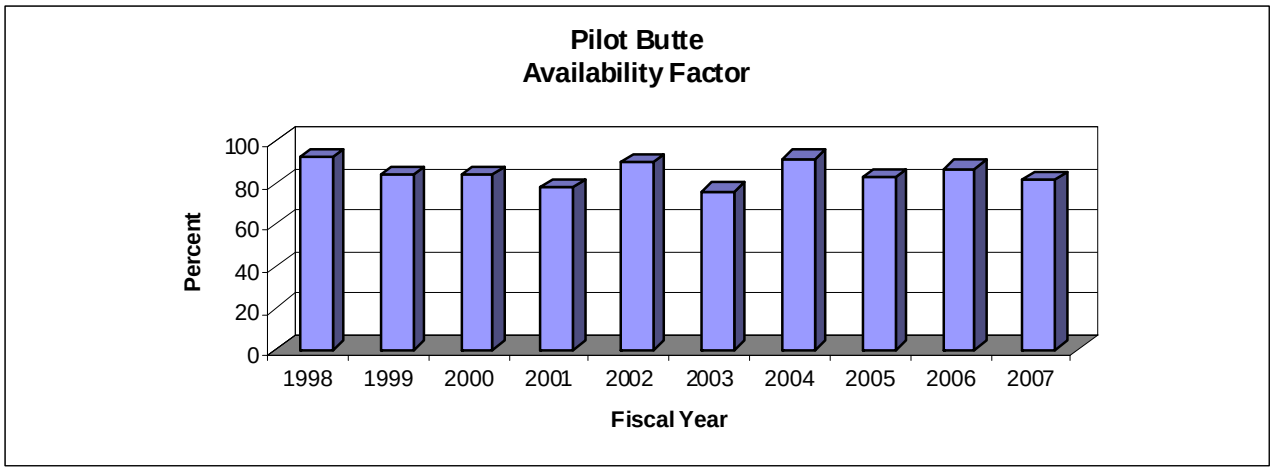


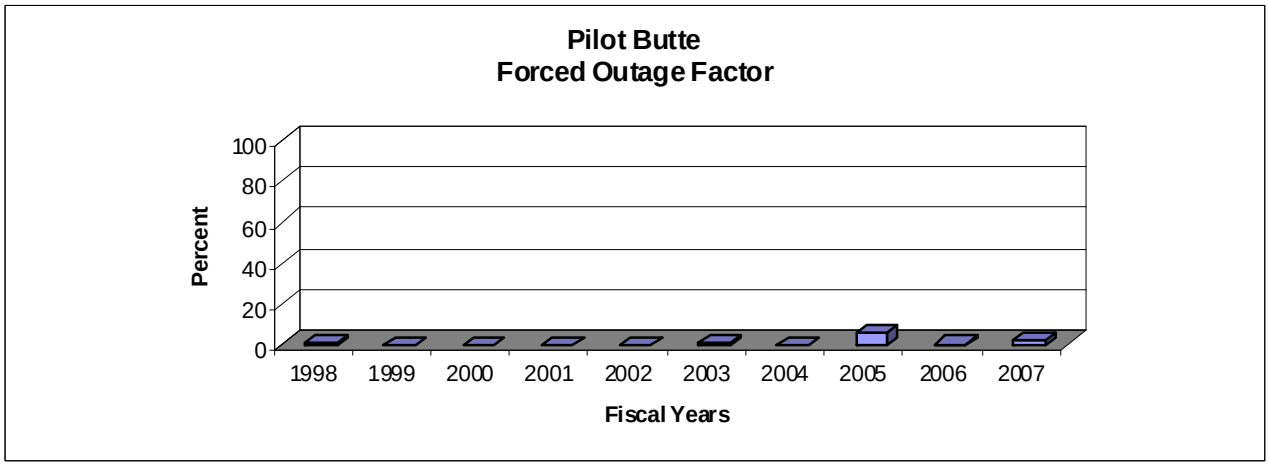



**Benchmark 5**
**Plant Availability Factor**

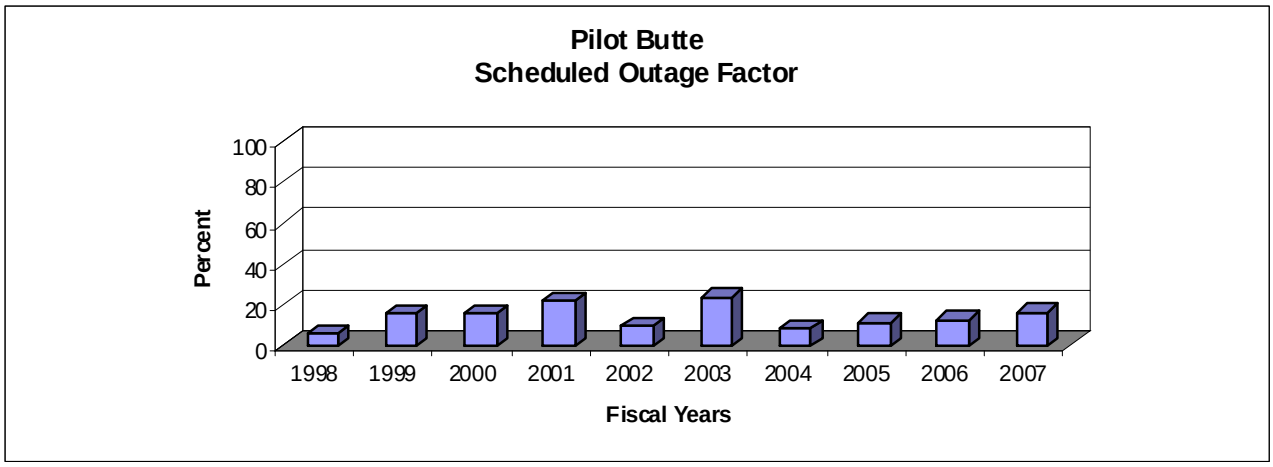



FY-2003 – Extended outage for significant repair of the stator winding for Unit 2.

**Benchmark 6**
**Plant Forced Outage Factor**

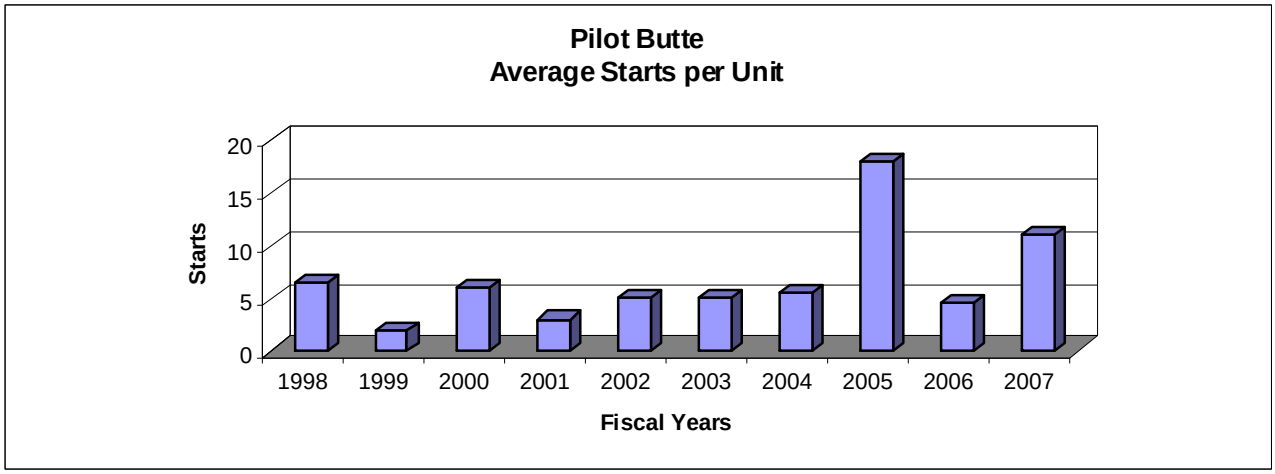


**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-2003 - Extended outage for significant repair of the stator winding for Unit 2.

**Unit Starts**



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Pilot Butte Powerplant** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.6% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 92.06 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 176,449 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.71 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 81.2 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 2.55 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 16.3 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Pole Hill Powerplant
# Colorado-Big Thompson Project

**Plant Contact:**
Chuck Pedersen
O&M Chief

**Plant Address:**
Pole Hill Powerplant
11056 West County Road 18E
Loveland CO 80537-9711

**Telephone Numbers:**
Phone: (970) 962-4400
Fax: (970) 663-3212

**E-Mail Address:**
cpedersen@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Systems Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** First construction funds were provided by the Interior Department Appropriation Act of August 9, 1937 (50 Stat. 595). The President approved Secretary of the Interior's finding of feasibility on December 21, 1937.

**Project Purposes:** The Colorado-Big Thompson Project is one of the largest and most complex natural resource developments undertaken by Reclamation. It consists of over 100 structures integrated into a transmountain water diversion system through which multiple benefits are provided to the people. The project spreads over approximately 250 miles in the State of Colorado. It stores, regulates, and diverts water from the Colorado River on the western slope of the Continental Divide to the eastern slope of the Rocky Mountains. It provides supplemental water for irrigation of about 720,000 acres of land, municipal and industrial use, hydroelectric power, and water-oriented recreation opportunities.

**Plant Location:** Pole Hill Powerplant is located in Larimer County, Colorado, in Little Hell Canyon, 10 miles east of Estes Park, Colorado.

**Plant Purpose:** Generation of hydroelectric power and water storage is for the Colorado-Big Thompson Project.

| | |
|---|---|
| **Plant Facts:** | Olympus Siphon and Tunnel and Pole Hill Tunnel and Canal convey project water from Lake Estes and some Big Thompson River floodwaters to a penstock, through which the water drops 815 feet to Pole Hill Powerplant. Water is then routed through Pole Hill Powerplant Afterbay, Rattlesnake Tunnel, Pinewood Lake, and Bald Mountain Pressure Tunnel and dropped to Flatiron Powerplant. |
| **Plant History:** | The water and power control center for Colorado-Big Thompson Project's reservoirs, powerplants, and transmission lines in Wyoming, Colorado, and western Nebraska is located in Loveland, Colorado. This Western Division of the Missouri River Basin is an interconnected system of 15 Reclamation powerplants. |
| **Present Activities:** | Generator $CO_2$ fire suppression replacement, new plant fire alarm system installation, 125 Vdc distribution board replacement, and excitation system replacement projects are currently in progress. |
| **Future Planned Activities:** | Continuation with excitation system replacement and 125 Vdc distribution board replacement, repairs to Rattlesnake Dam spillway and turbine pit scaffolding procurement will be completed in FY 2008. Plant remote control (RTU SCADA and fiber communication) upgrades are planned to be completed in FY 2010. |
| **Special Issues:** | None |

| | | | |
|---|---|---|---|
| **River:** | Colorado River and Big Thompson River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 33,250 kW | **Installed Capacity:** | 38,238 kW |
| **Year of Initial Operation:** | 1954 | **Age:** | 54 years |
| **Net Generation (FY-2007):** | 183.7 GWh | **Rated Head:** | 825 feet |
| **Average Plant Factor (FY-2007):** | 55.0 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load | | |

## Ancillary Services

**Pole Hill**
**Ancillary Services**

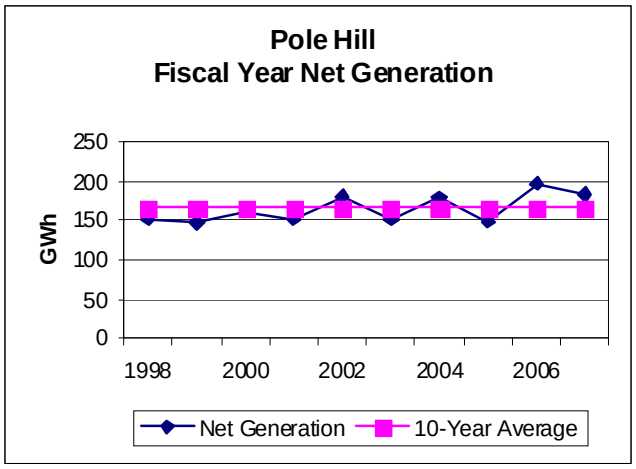
| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | Yes |
| Voltage Support | Yes |

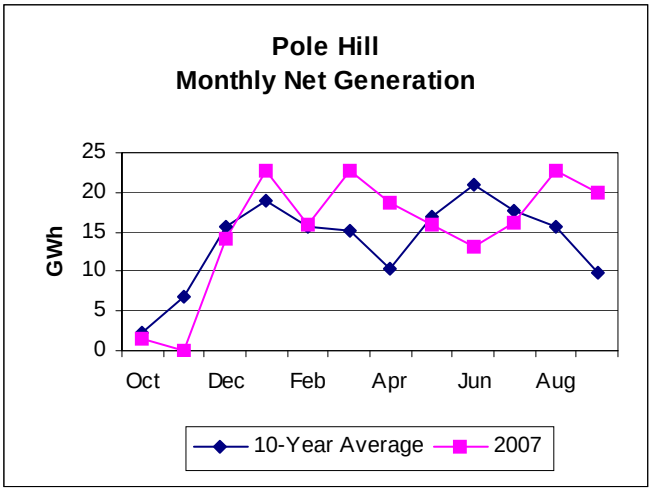
## Generators

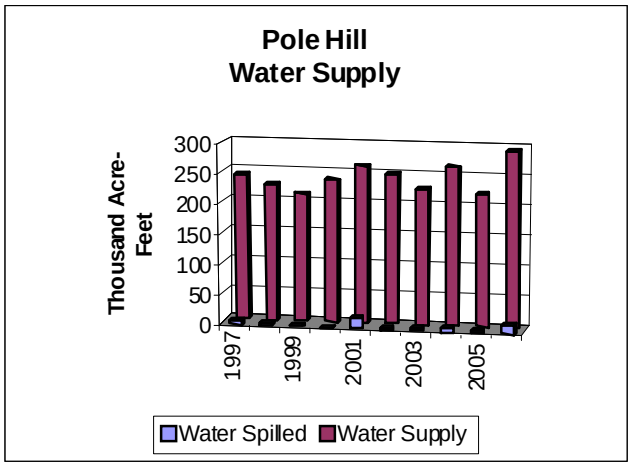
**Pole Hill Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 33,250 | 4,988 | 38,238 |
| 1 Unit | 33,250 | 4,988 | 38,238 |

## Generation

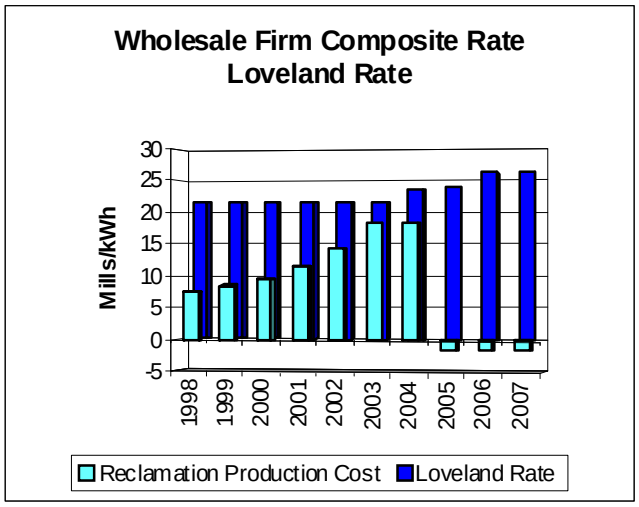

Pole Hill
Fiscal Year Net Generation
GWh
250
200
150
100
50
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Pole Hill
Monthly Net Generation
GWh
25
20
15
10
5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

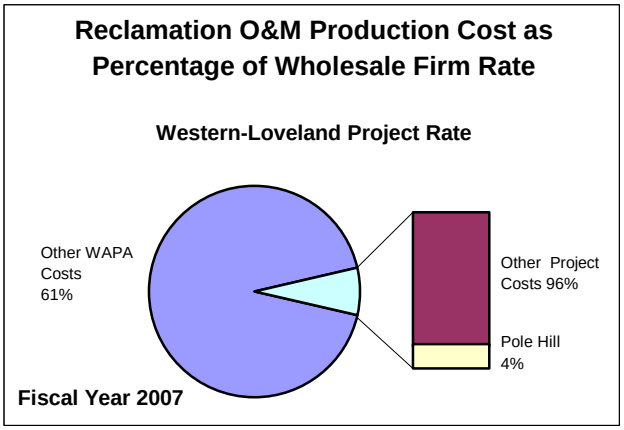

Pole Hill
Water Supply
Thousand Acre-Feet
300
250
200
150
100
50
0
1997
1999
2001
2003
2005
Water Spilled
Water Supply

## Prime Laboratory Benchmarks

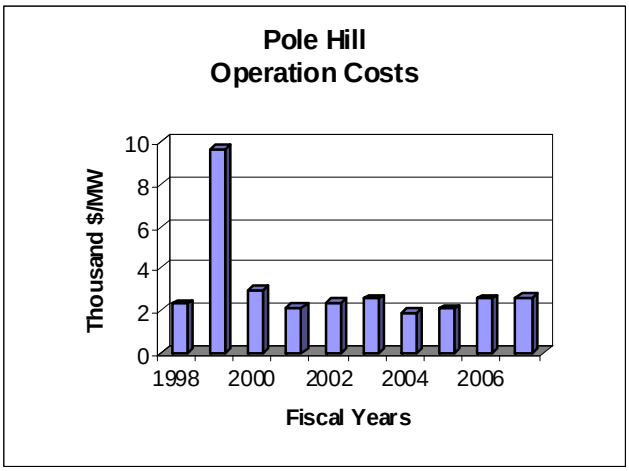
### Benchmark 1
### Wholesale Firm Rate

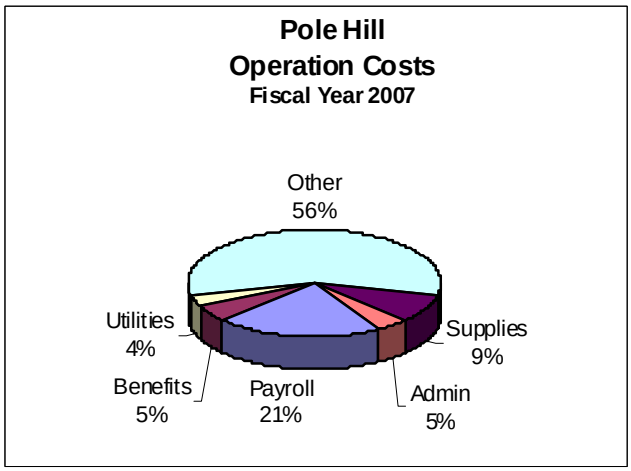


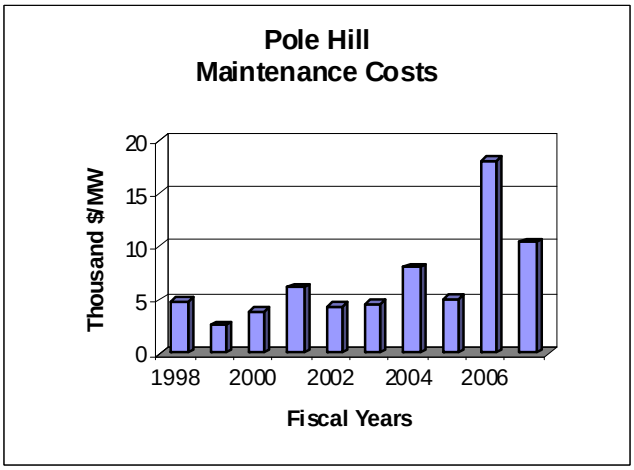

### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

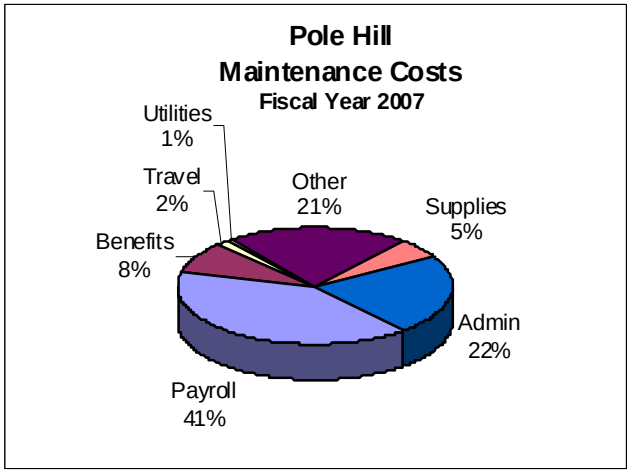


## Benchmark 3
## Production Costs

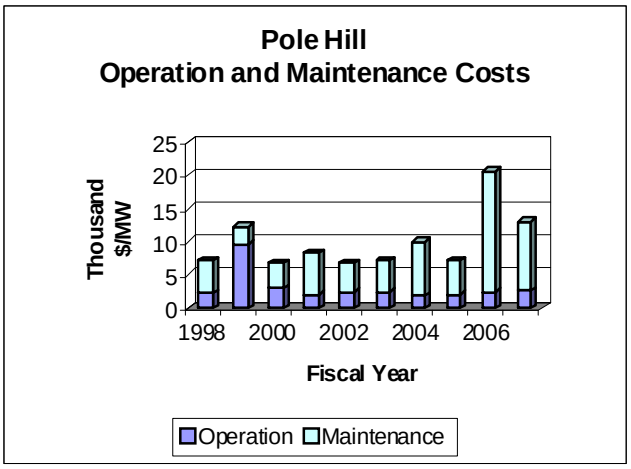


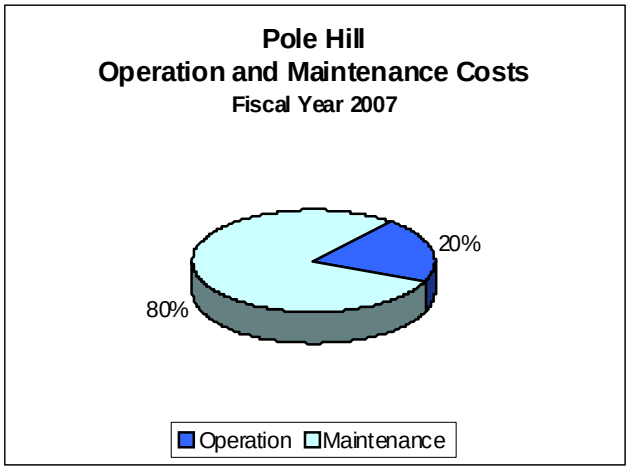



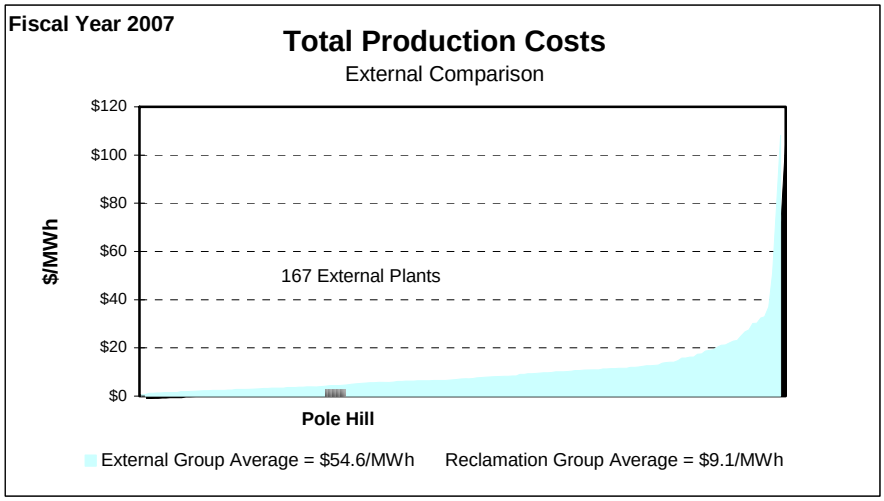



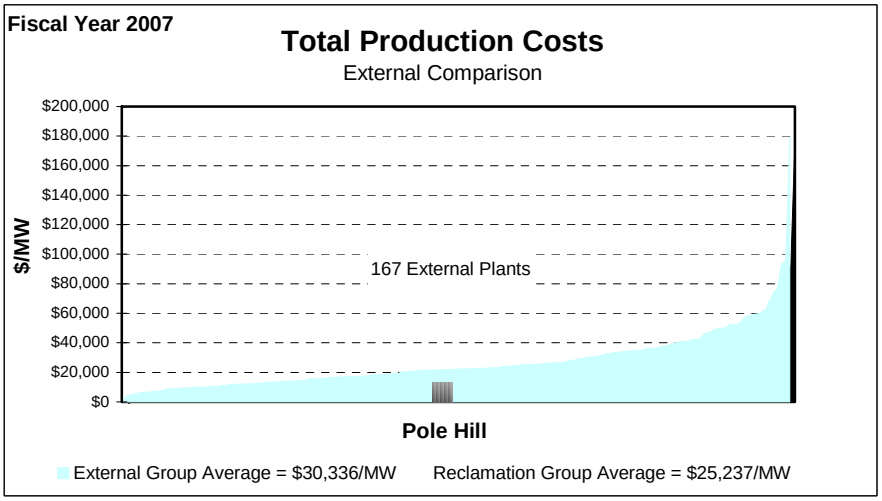



## Benchmark 3
## Production Costs



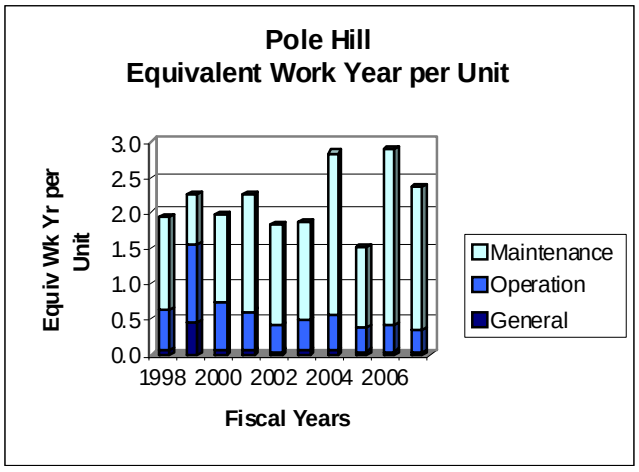



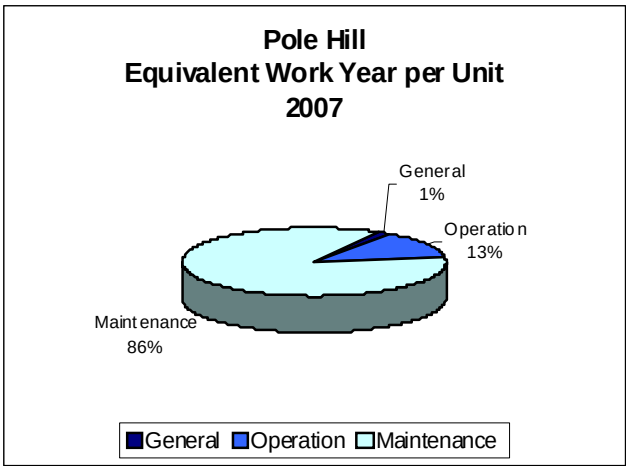



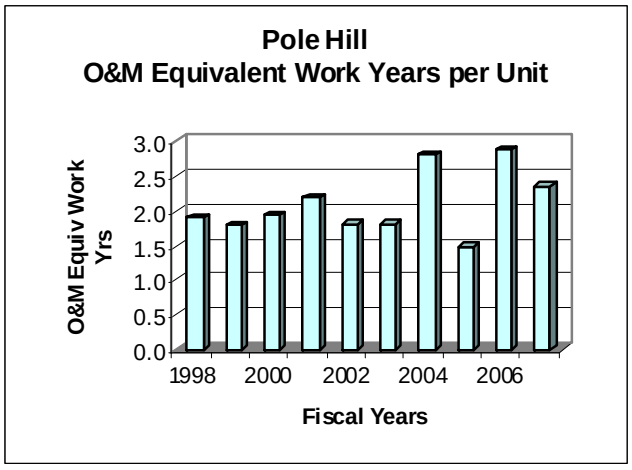



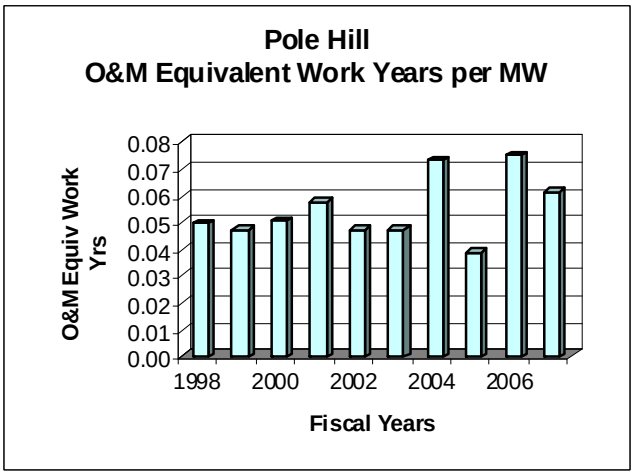
## Benchmark 4
## Workforce Deployment

| Pole Hill FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 0.02 | 0.00 | 0.02 | 0.03 | 0.03 | 0.00 |
| Operation | 0.28 | 0.03 | 0.00 | 0.31 | 0.31 | 0.01 |
| Maintenance | 1.83 | 0.21 | 0.00 | 2.04 | 2.04 | 0.05 |
| Total Staffing | 2.13 | 0.24 | 0.02 | 2.38 | 2.38 | 0.06 |

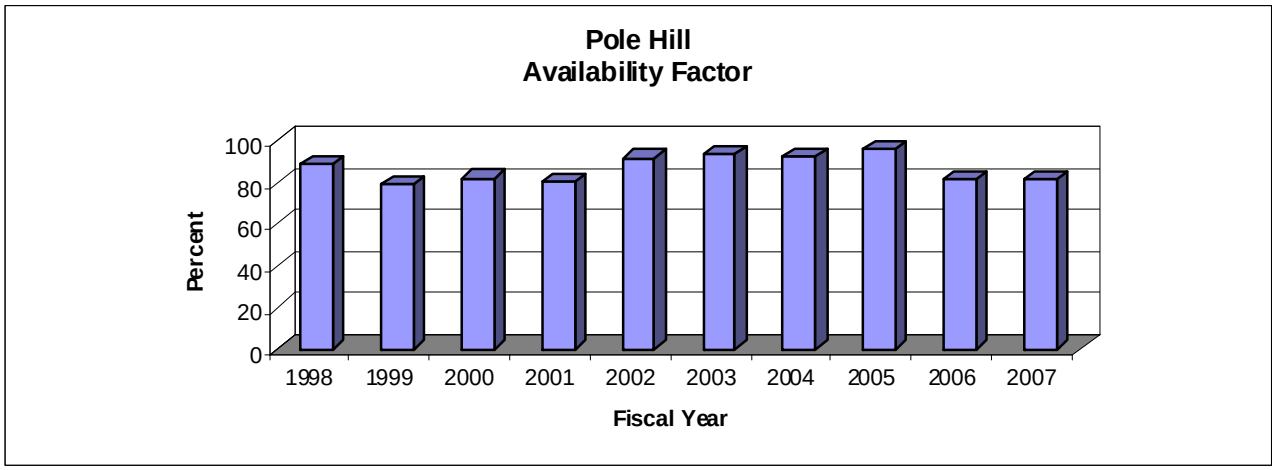


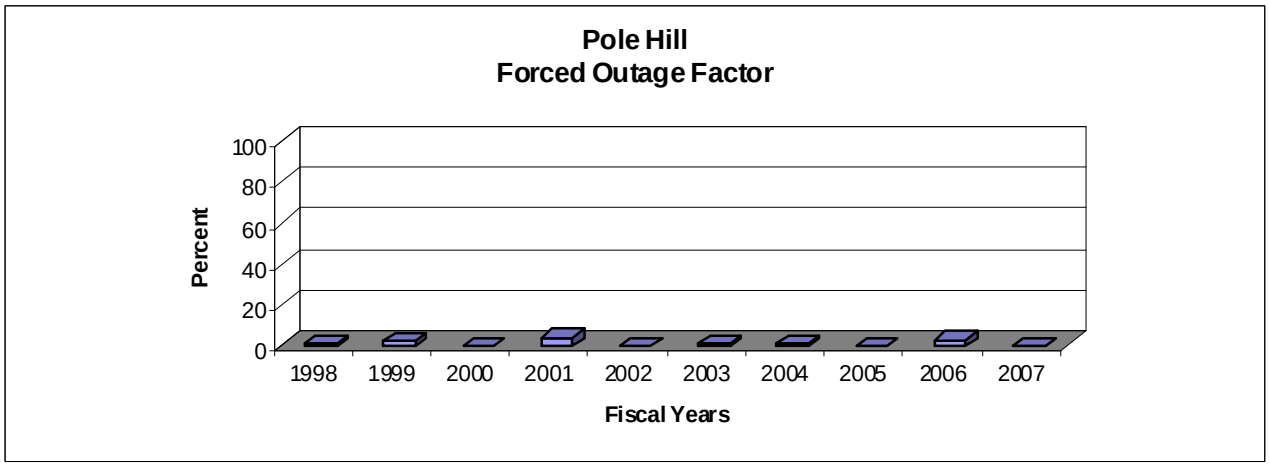



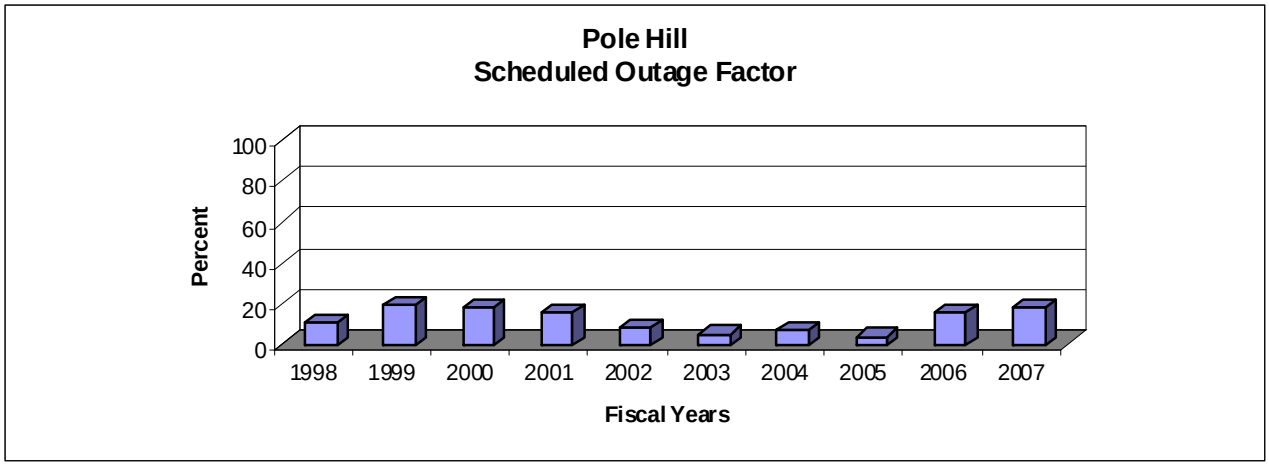
## Benchmark 5
## Plant Availability Factor



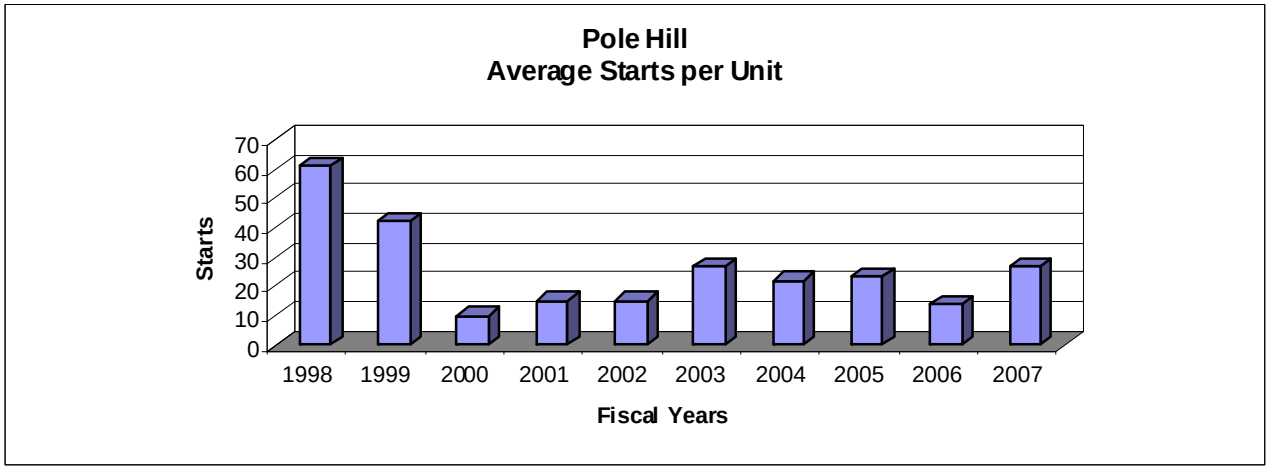

## Benchmark 6
## Plant Forced Outage Factor



## Benchmark 7
## Plant Scheduled Outage Factor



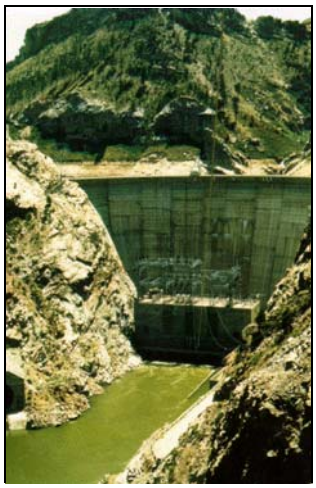

## Unit Starts



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Pole Hill Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.13% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 2.71 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 13,037 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.06 | 0.10 | 0.03 | Not Available | 0.00 |
| **Availability Factor** | 81.3 | 81.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.2 | 0.2 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 18.5 | 18.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Seminoe Powerplant
# Kendrick Project



**Plant Contact:**
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**Plant Address:**
Seminoe Powerplant
Sinclair WY

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Fax: (307) 261-5683

**E-Mail Address:**
jlawson@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The President approved the Kendrick Project on August 30, 1935. Originally known as Casper-Alcova, the project was renamed Kendrick in 1937.

**Project Purposes:** The Kendrick Project conserves the waters of the North Platte River for irrigation and electric power generation. The project is a multi-purpose development with storage at Seminoe Reservoir and diversion at Alcova Dam to project lands. Operation of the reservoirs and powerplants is integrated with other river basin developments. Seminoe Reservoir, with a total capacity of 1,017,279 acre-feet, provides storage capacity for the water to irrigate the project lands. The powerplant generates electric power as the water is released for irrigation or stored in Pathfinder Reservoir for later release as required.

**Plant Location:** Seminoe Powerplant is located in Carbon County, Wyoming, on the North Platte River and about 72 miles southwest of Casper, Wyoming.

**Plant Purpose:** Electric energy generated at the Seminoe Powerplant is marketed through the Pick-Sloan Missouri Basin Program's integrated system.

**Plant Facts:** The dam is a concrete-arch structure containing 210,000 cubic yards of concrete and rising 295 feet above the rock foundation. Water is released from the reservoir through penstocks at the Seminoe Powerplant or over a controlled spillway and outlet tunnel. The power plant is located at the base of the dam and has a rated head of 166 feet. The plant contains three units, each composed of a 15,000-kilowatt generator driven by a 20,800-horsepower turbine.

**Plant History:** Seminoe Dam and Powerplant construction began in 1936 and was completed in 1939. The original installed capacity of the plant was 32,400 but the plant was up rated in the mid-1970 to its current installed capacity of 45,000 kilowatts. The three-phase unit power transformer was replaced in 2001.

**Present Activities:** A contract was completed for supplying new controls and a new trolley for the powerplant 50-ton bridge crane. Reclamation forces installed the new crane in FY-2004.

Replacement of the three powerplant single-phase unit power transformers with a new 3-phase transformer along with modification to the associated bus work was completed in FY-2004.

**Future Planned Activities:** The three unit Ring Seal Gates will be rehabilitated under a three-year contract beginning in FY-2006.

**Special Issues:** Access to Seminoe Powerplant is affected by periodic rock falls from the steep canyon walls necessitating continual operation and maintenance expenditures.

| | | | |
|---|---|---|---|
| **River:** | North Platte River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 32,400 kW | **Installed Capacity:** | 51,750 kW |
| **Year of Initial Operation:** | 1939 | **Age:** | 68 years |
| **Net Generation (FY-2007):** | 96.4 GWh | **Rated Head:** | 166 feet |
| **Average Plant Factor (FY-2007):** | 21.3 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Intermediate | | |

## Ancillary Services

**Seminoe**
**Ancillary Services**

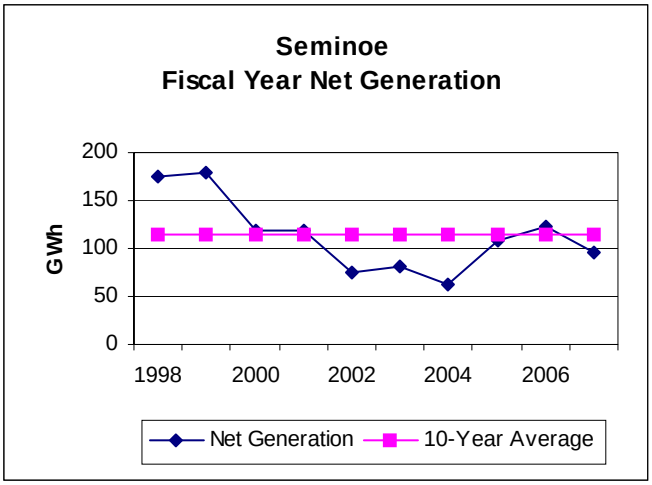
| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | No |
| Voltage Support | Yes |

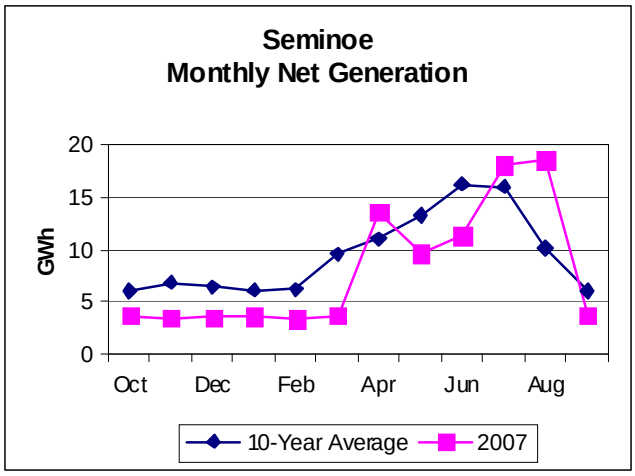
## Generators

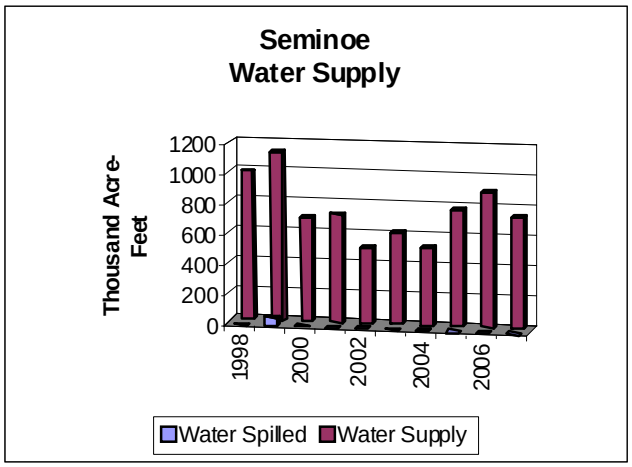
**Seminoe Generators**
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 10,800 | 6,450 | 17,250 |
| 2 | 10,800 | 6,450 | 17,250 |
| 3 | 10,800 | 6,450 | 17,250 |
| 3 units | 32,400 | 19,350 | 51,750 |

## Generation

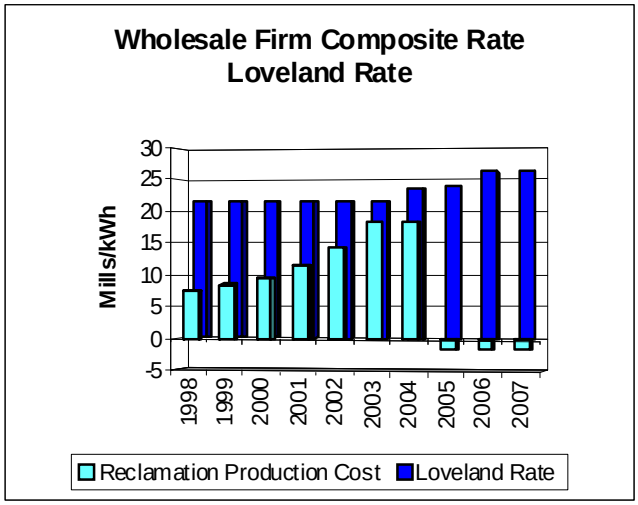

Seminoe
Fiscal Year Net Generation
GWh
200
150
100
50
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Seminoe
Monthly Net Generation
GWh
20
15
10
5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

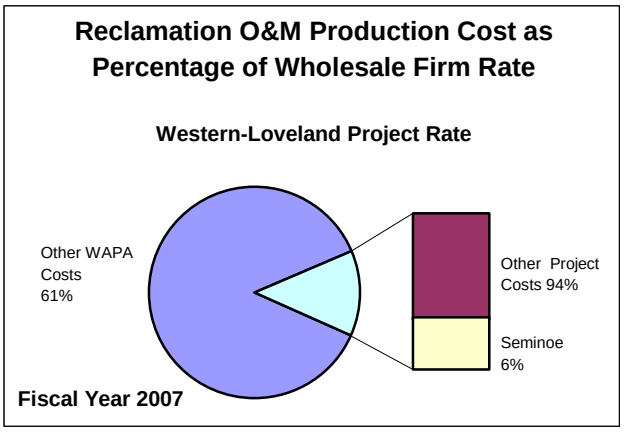

Seminoe
Water Supply
Thousand Acre-Feet
1200
1000
800
600
400
200
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

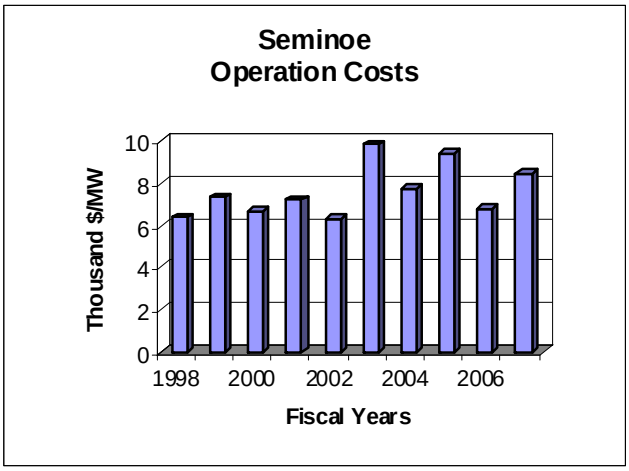
## Benchmark 1
## Wholesale Firm Rate

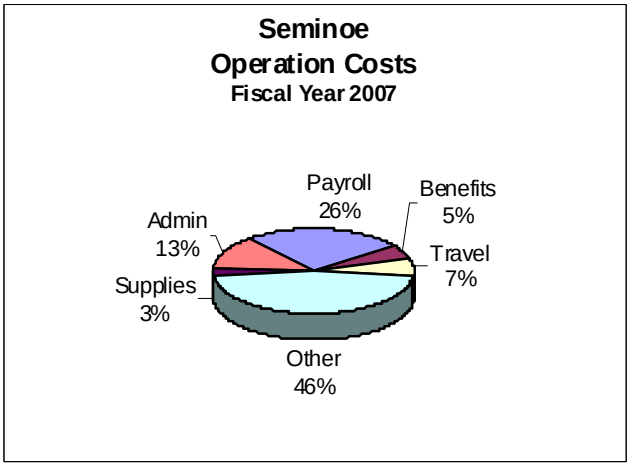


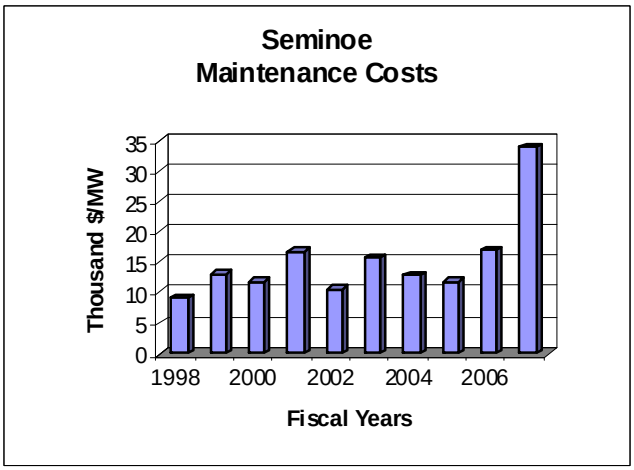

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate

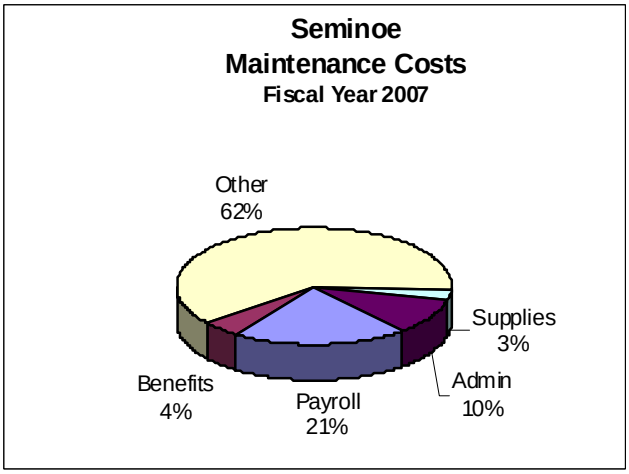


## Benchmark 3
## Production Costs



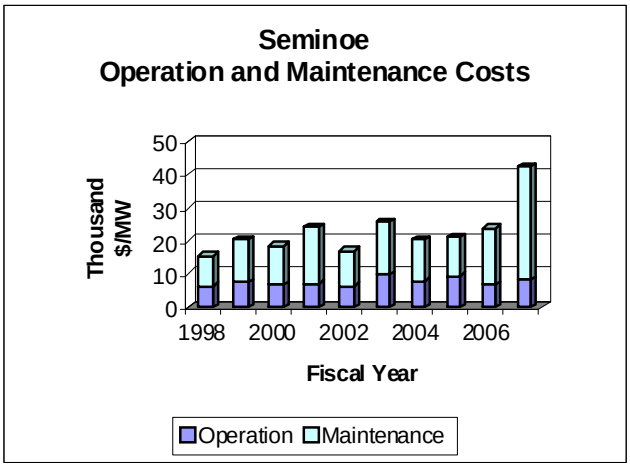



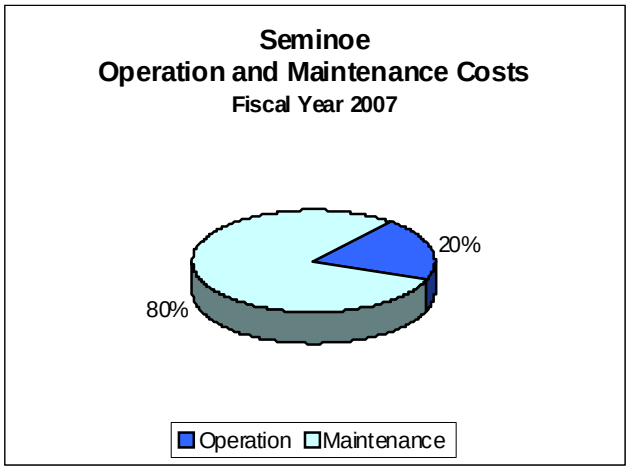



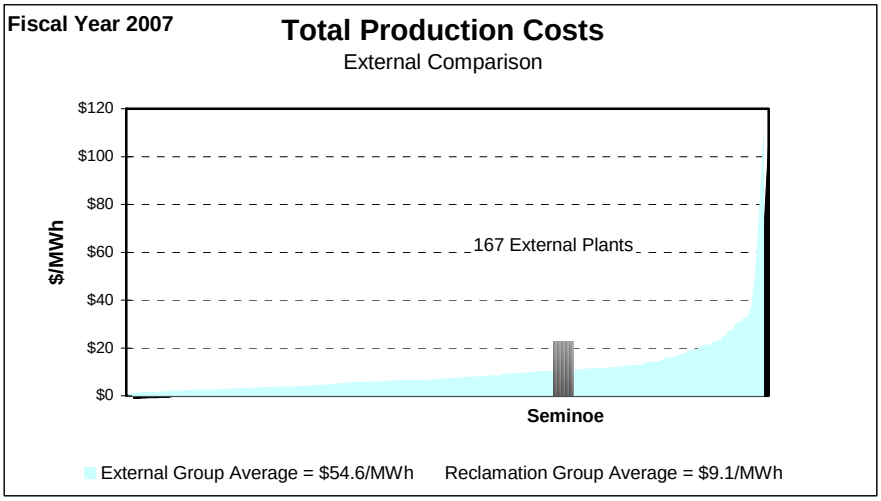



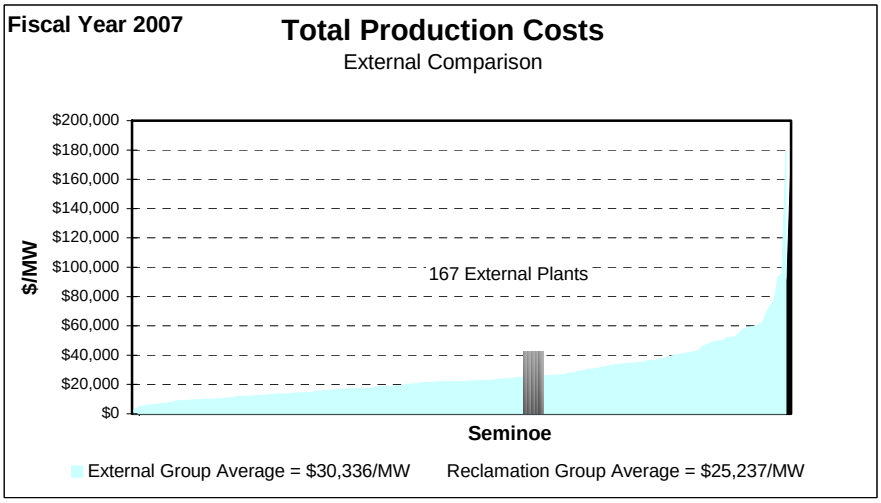

FY-2001- Significant cavitation repairs on all three units.

## Benchmark 3
## Production Costs



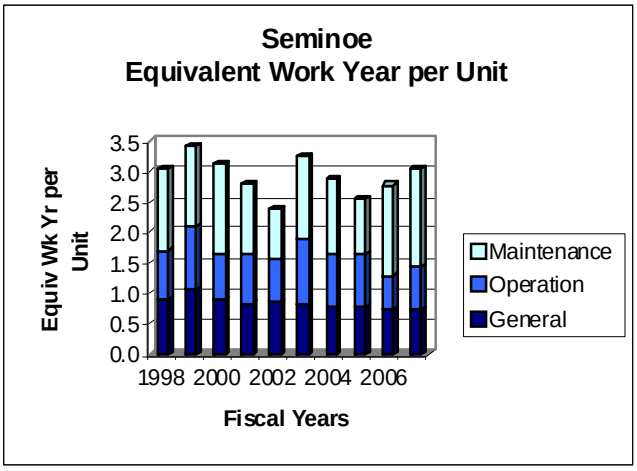



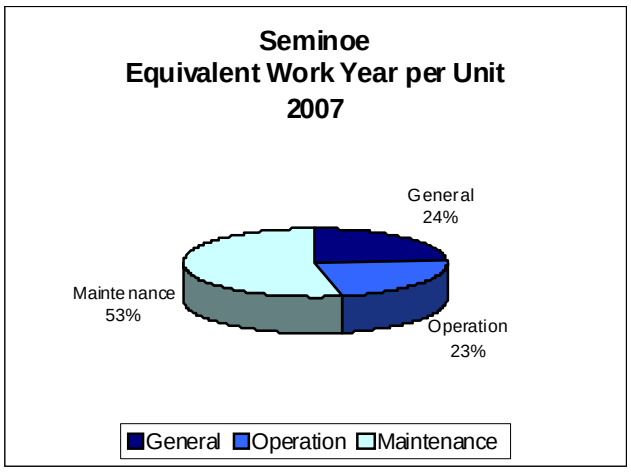



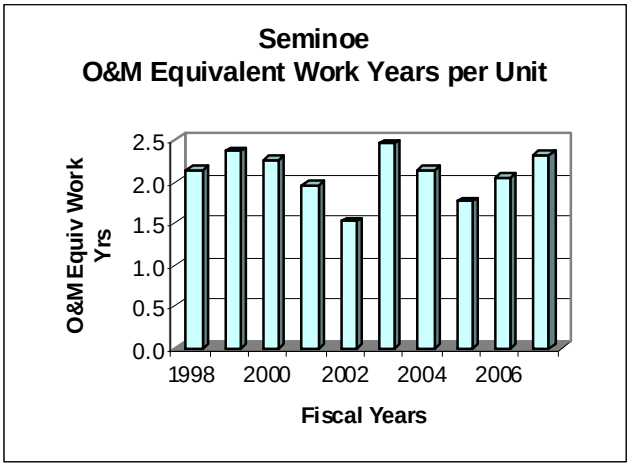



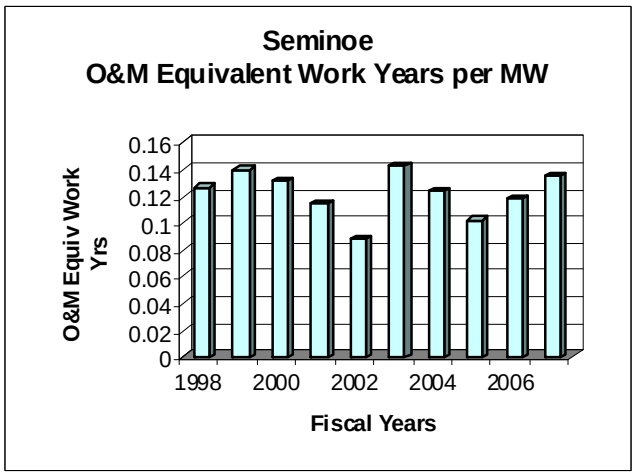
**Benchmark 4**
**Workforce Deployment**

| Seminoe FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.90 | 0.21 | 0.05 | 2.17 | 0.72 | 0.04 |
| Operation | 1.90 | 0.21 | 0.00 | 2.12 | 0.71 | 0.04 |
| Maintenance | 4.38 | 0.49 | 0.00 | 4.88 | 1.63 | 0.09 |
| Total Staffing | 8.19 | 0.92 | 0.05 | 9.17 | 3.06 | 0.18 |

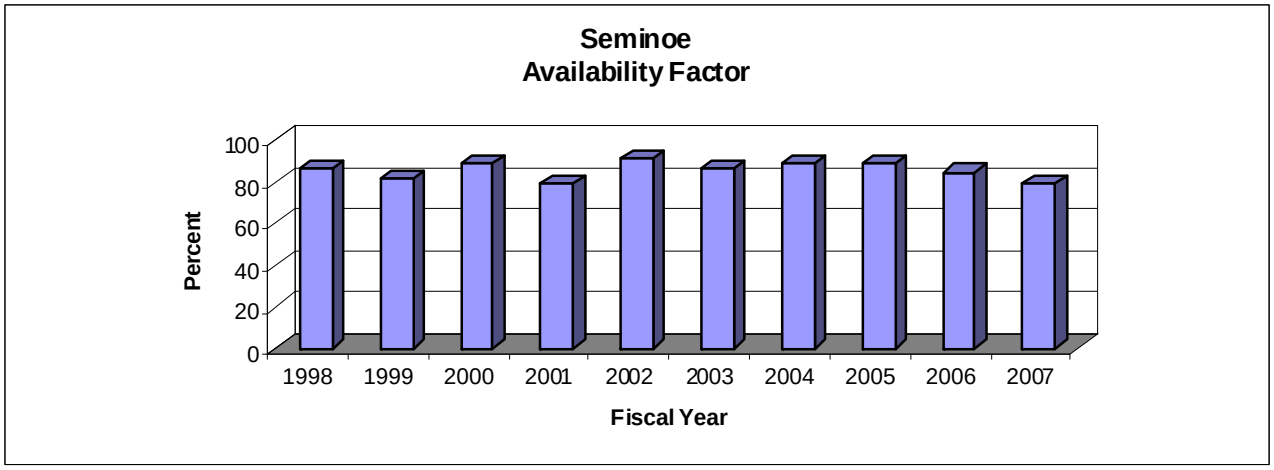


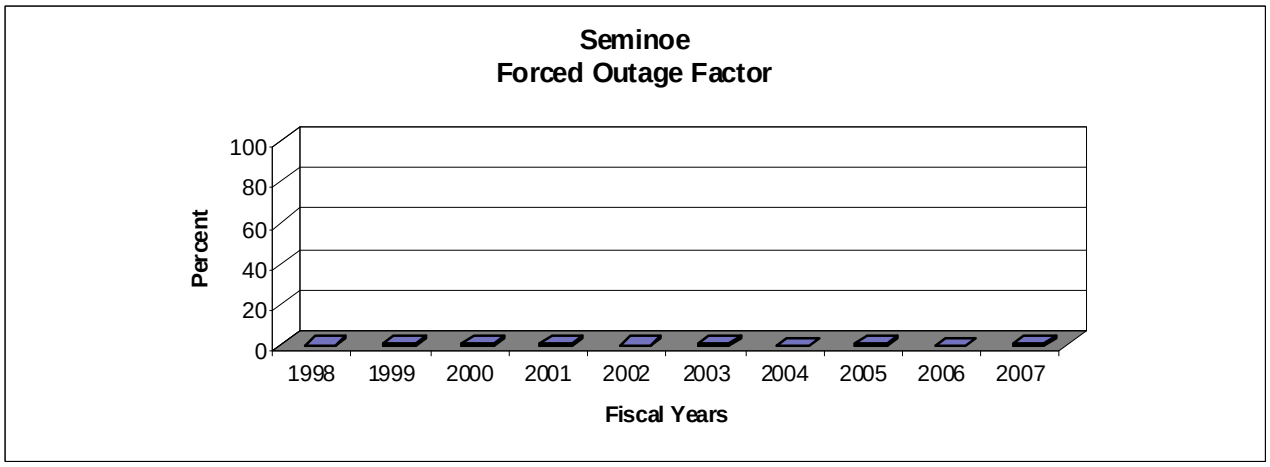



**Benchmark 5**
**Plant Availability Factor**

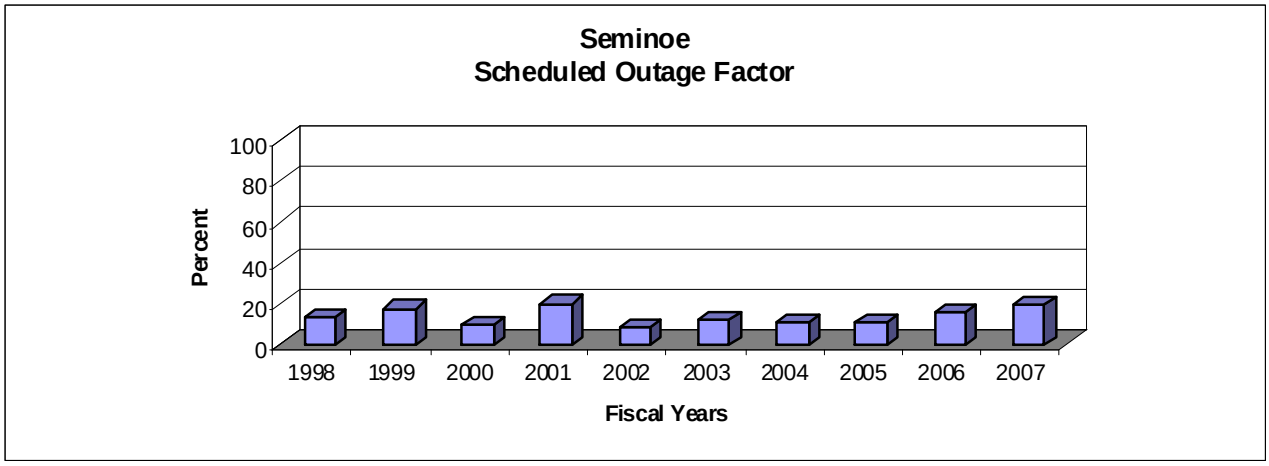



FY-2001– Extended outages on all three units for cavitation repairs

**Benchmark 6**
**Plant Forced Outage Factor**

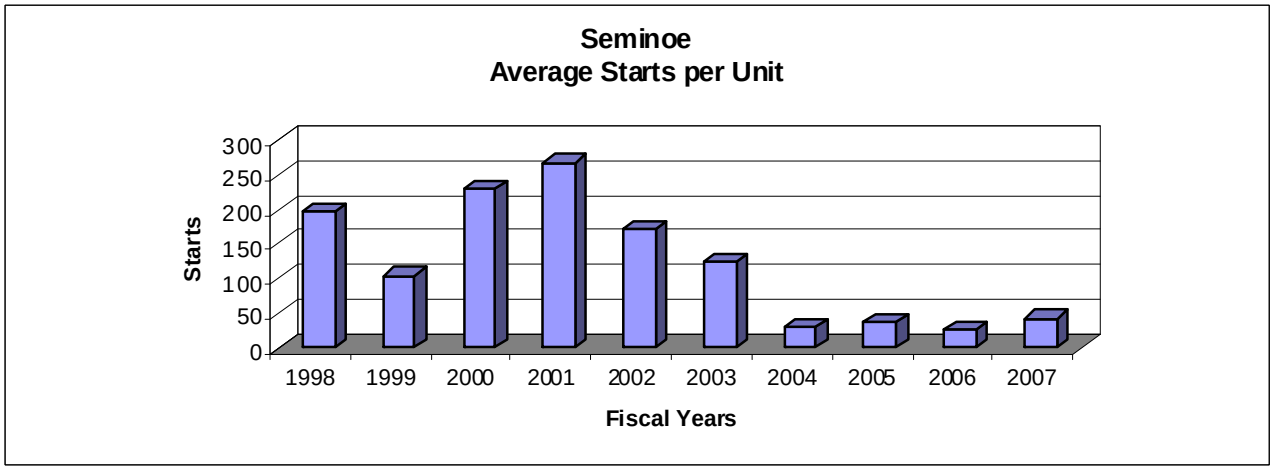


**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-1996, and FY-1998 – Extended Maintenance.
FY-1999 – Extended maintenance of Unit 3.
FY-2000 – Replacement of Unit 3 transformer.

**Unit Starts**



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Seminoe Powerplant** | **Reclamation Average 30-100 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 4.99% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 22.83 | 7.85 | 2.76 | ***54.63 | 1.00 |
| **O&M Costs $/MW** | 42,530 | 24,132 | 7,847 | ***30,336 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.14 | 0.10 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 79.4 | 81.3 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.7 | 0.2 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 19.9 | 18.5 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Shoshone Powerplant
# Pick-Sloan Missouri Basin Program

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**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region

**Project Authorization:** The Secretary of the Interior authorized the Shoshone Project on February 10, 1904, under authority of the Reclamation Act of June 17, 1902, and authorized under authority of the Reclamation Reform Act of October 12, 1982, as the Buffalo Bill Dam Modifications as part of the Pick-Sloan Missouri Basin Program.

**Project Purposes:** Floodwaters of the Shoshone River are stored in Buffalo Bill Reservoir for later release for irrigation and power generation. Power is developed at the Shoshone and Heart Mountain Powerplants. The system is interconnected with the West Division of the Pick-Sloan Missouri Basin Program.

**Plant Location:** Shoshone Powerplant is located near the base of Buffalo Bill Dam. Shoshone Power plant is located in Park County, Wyoming, approximately 4.5 miles southwest of Cody, Wyoming, on the Shoshone River.

**Plant Purpose:** Power produced on the project is fed into a grid system which serves an area extending into three States.

**Plant Facts:** The Shoshone Powerplant is near the base of Buffalo Bill Dam and has a generating capacity of 3,000 kilowatts.

**Plant History:** Shoshone Powerplant began operation in 1922 and the third unit came on line in 1931. The original total installed capacity of the three generating units was 5,600 kilowatts. Unit 1 was rewound in 1956, which increased the total installed capacity of the three units to 6,012 kilowatts. In 1980 the plant was shut down due to the deteriorated condition of the units. Units 1 and 2 remain in place in a decommissioned status. Unit 3 was removed and replaced with a new 3,000-kilowatt unit in 1991.

**Present Activities:** Normal Operations.

**Future Planned Activities:** None

**Special Issues:** None

| | | | |
|---|---|---|---|
| **River:** | Shoshone River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 8,600 kW | **Installed Capacity:** | 3,000 kW |
| **Year of Initial Operation:** | 1922 | **Age:** | 85 years |
| **Net Generation (FY-2007):** | 20.0 GWh | **Rated Head:** | 220 feet |
| **Average Plant Factor (FY-2007):** | 77.3 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load | | |

## Ancillary Services

**Shoshone**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | No |

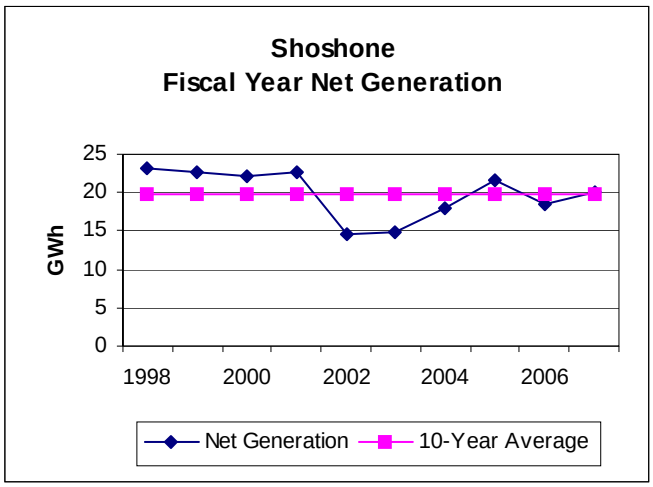
## Generators

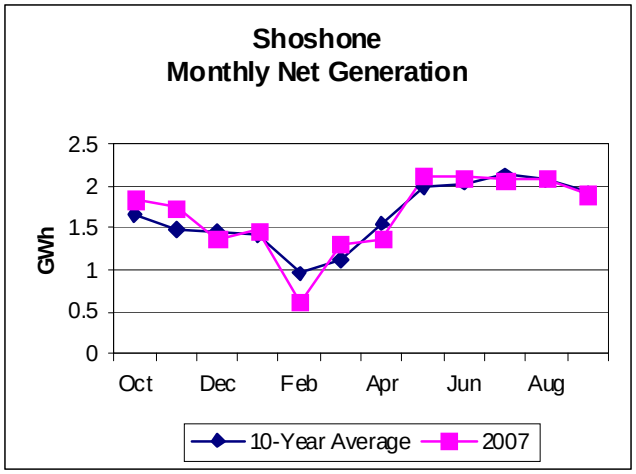
**Shoshone Generators**

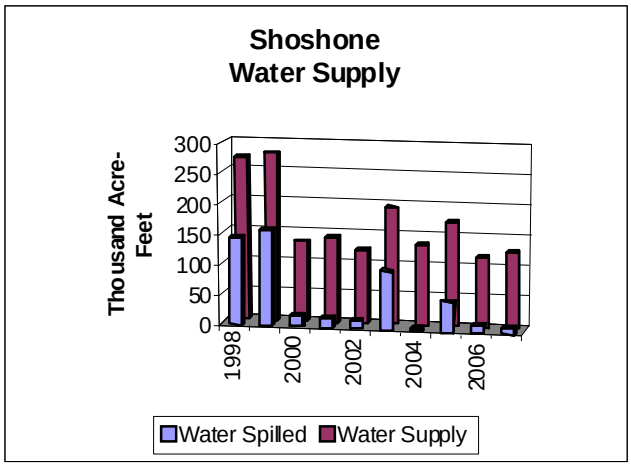
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 3,000 | - | 3,000 |
| 1 Unit | 3,000 | - | 3,000 |

## Generation

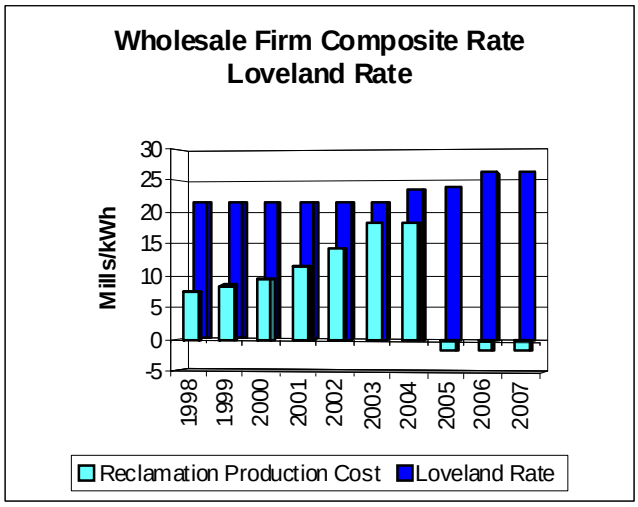

Shoshone
Fiscal Year Net Generation
GWh
25
20
15
10
5
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Shoshone
Monthly Net Generation
GWh
2.5
2
1.5
1
0.5
0
Oct
Dec
Feb
Apr
Jun
Aug
10-Year Average
2007

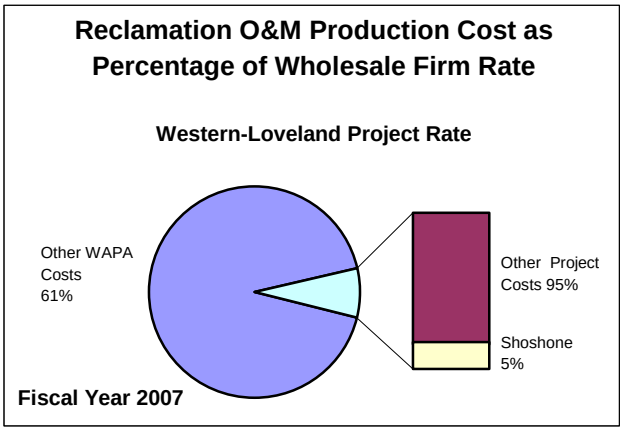

Shoshone
Water Supply
Thousand Acre-Feet
300
250
200
150
100
50
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

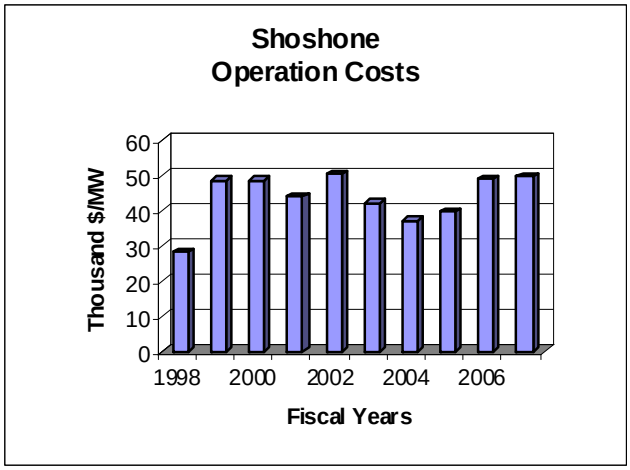
## Benchmark 1
## Wholesale Firm Rate

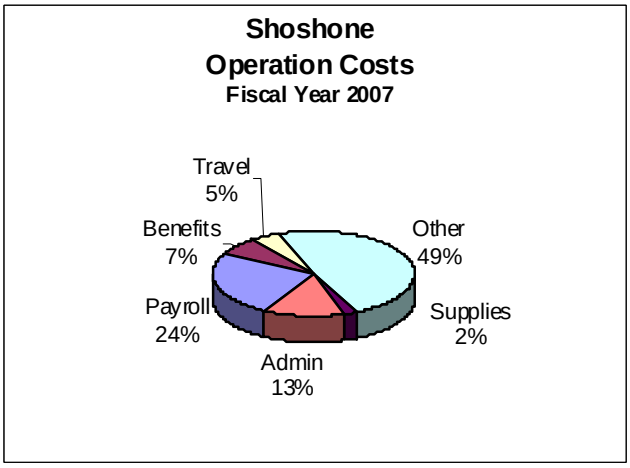


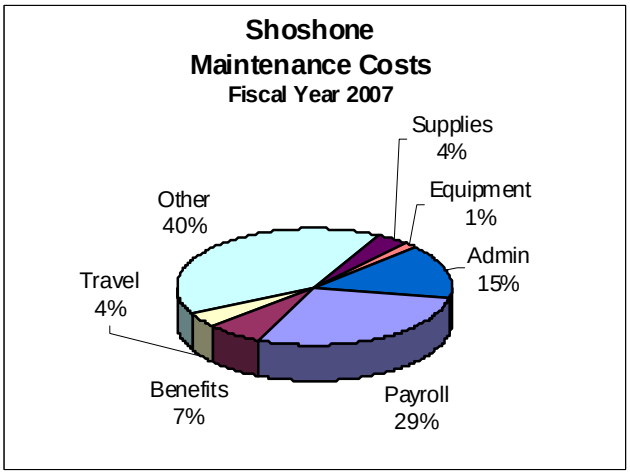

## Benchmark 2
## Reclamation's Production Costs as Percentage of Wholesale Firm Rate



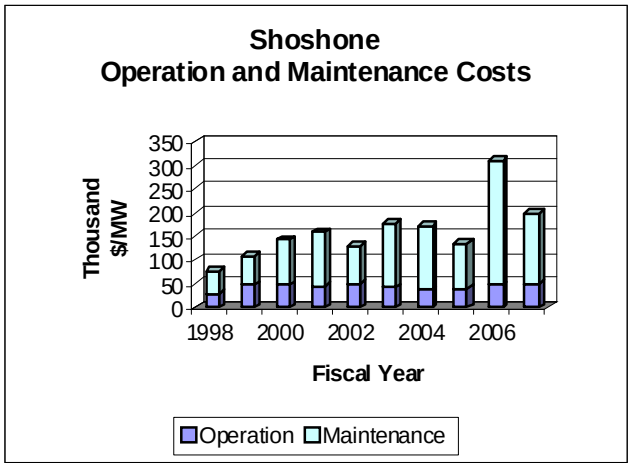
## Benchmark 3
## Production Costs

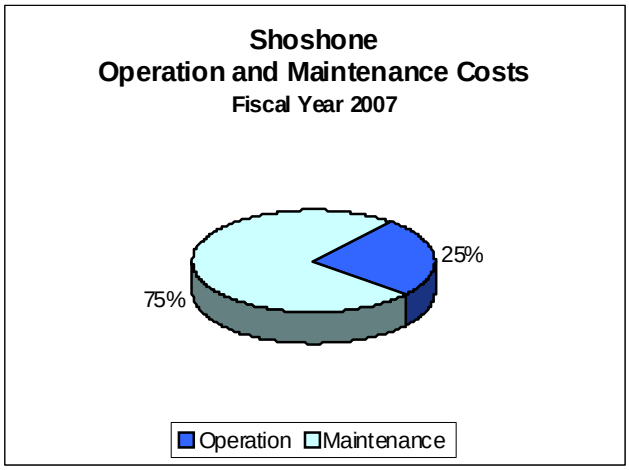


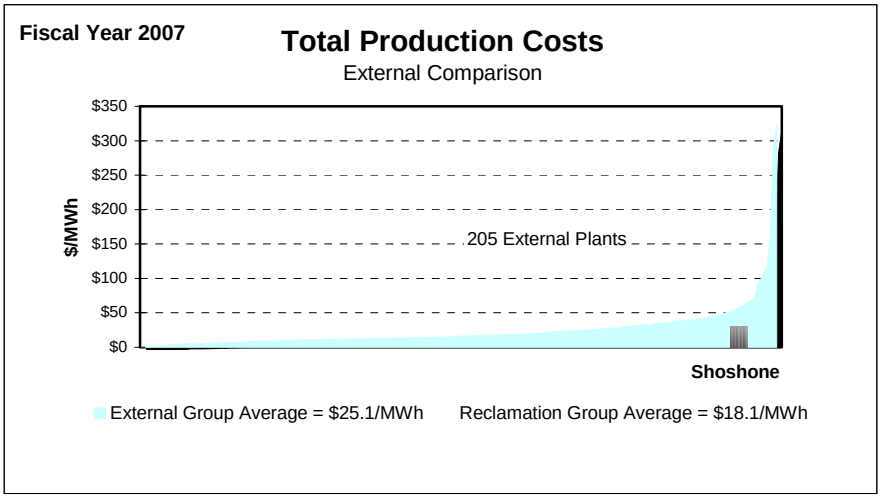



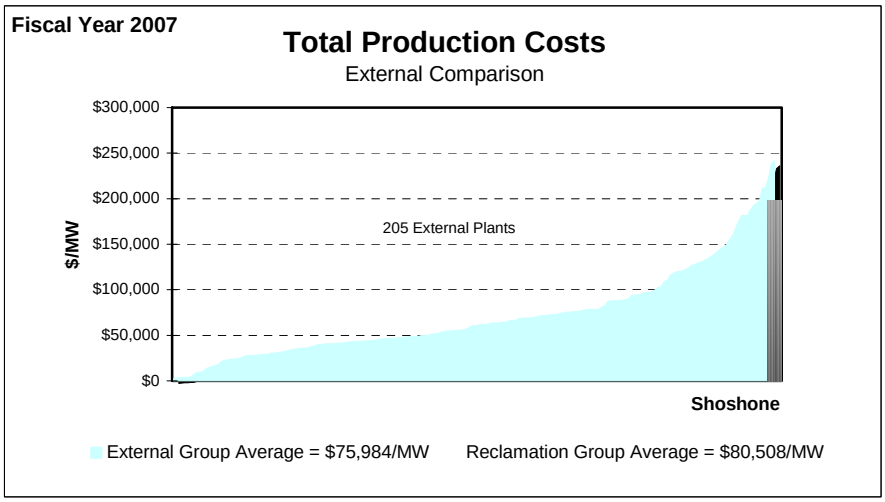


## Benchmark 3
## Production Costs



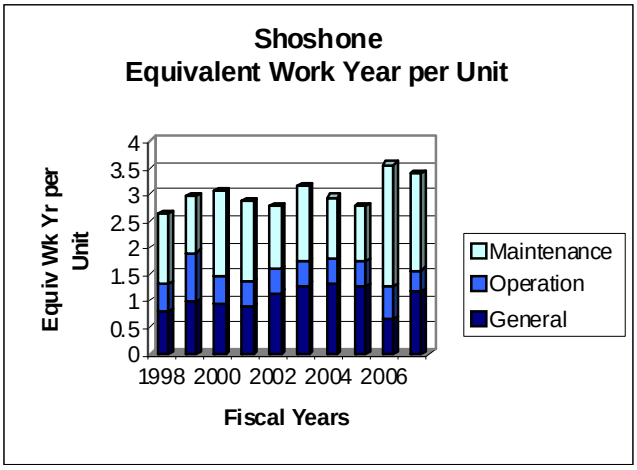



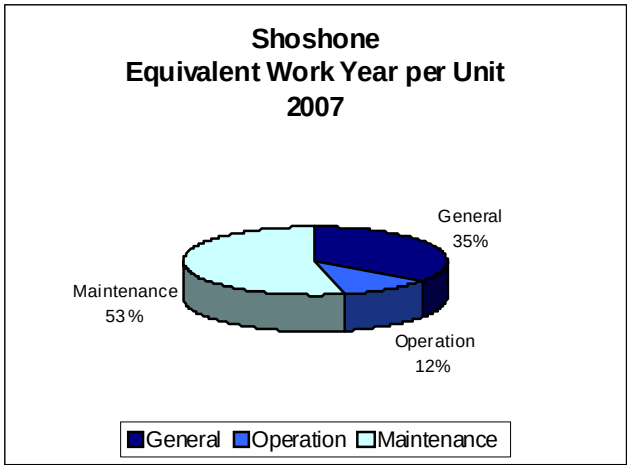



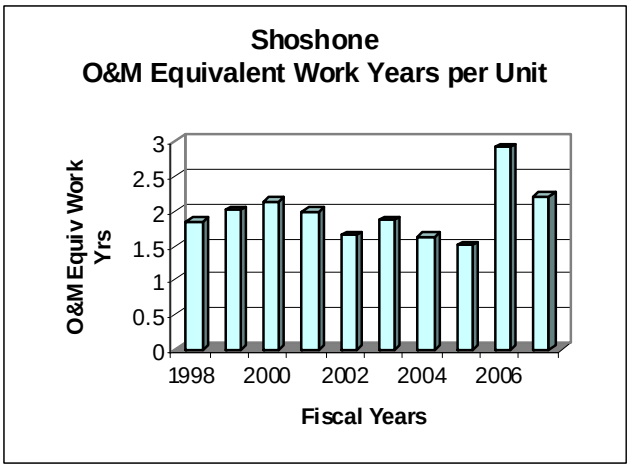



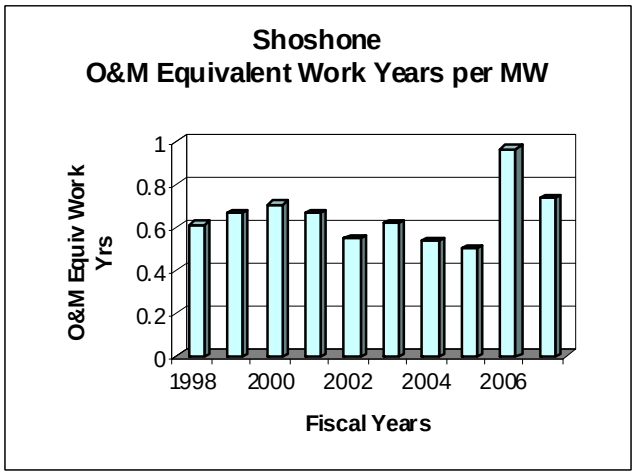
**Benchmark 4**
**Workforce Deployment**

| Shoshone FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.04 | 0.12 | 0.02 | 1.17 | 1.17 | 0.39 |
| Operation | 0.35 | 0.04 | 0.00 | 0.39 | 0.39 | 0.13 |
| Maintenance | 1.64 | 0.18 | 0.00 | 1.82 | 1.82 | 0.61 |
| Total Staffing | 3.03 | 0.34 | 0.02 | 3.39 | 3.39 | 1.13 |

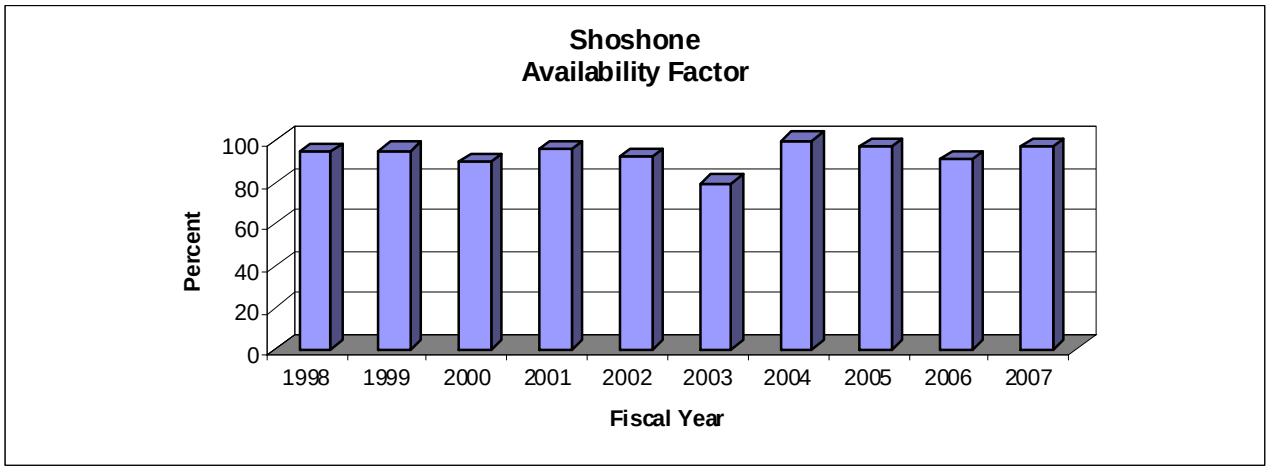


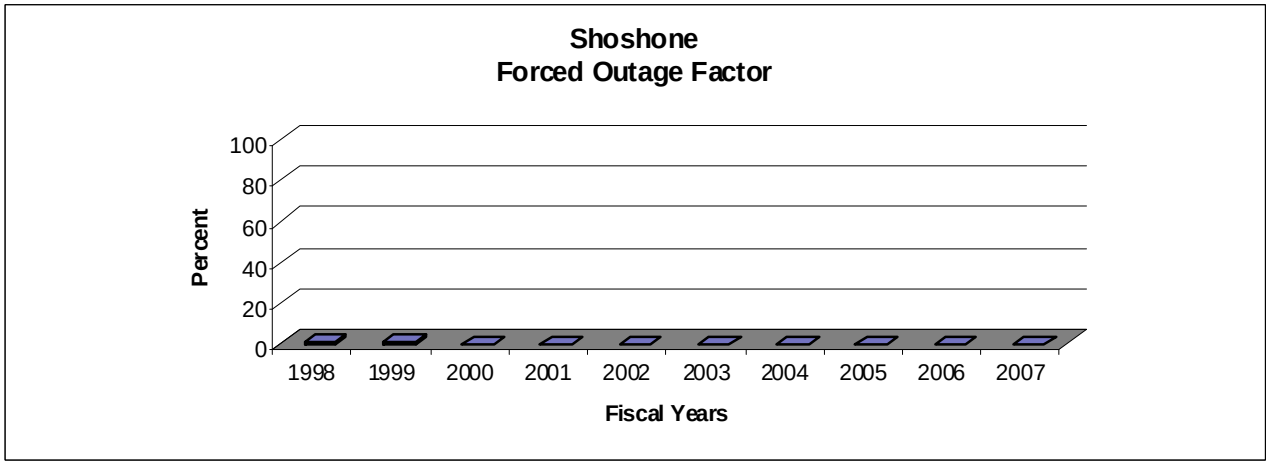



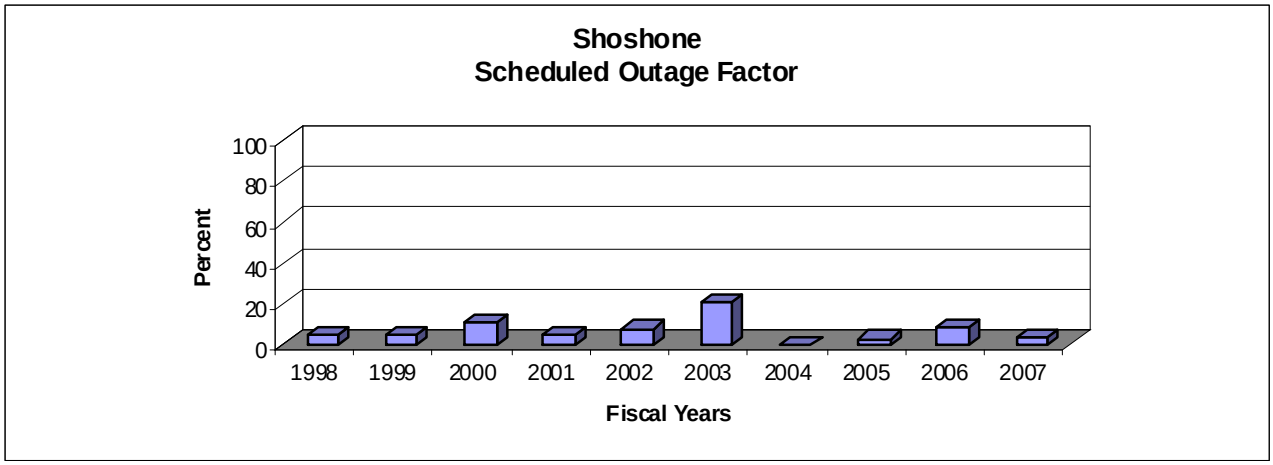
**Benchmark 5**
**Plant Availability Factor**




**Benchmark 6**
**Plant Forced Outage Factor**

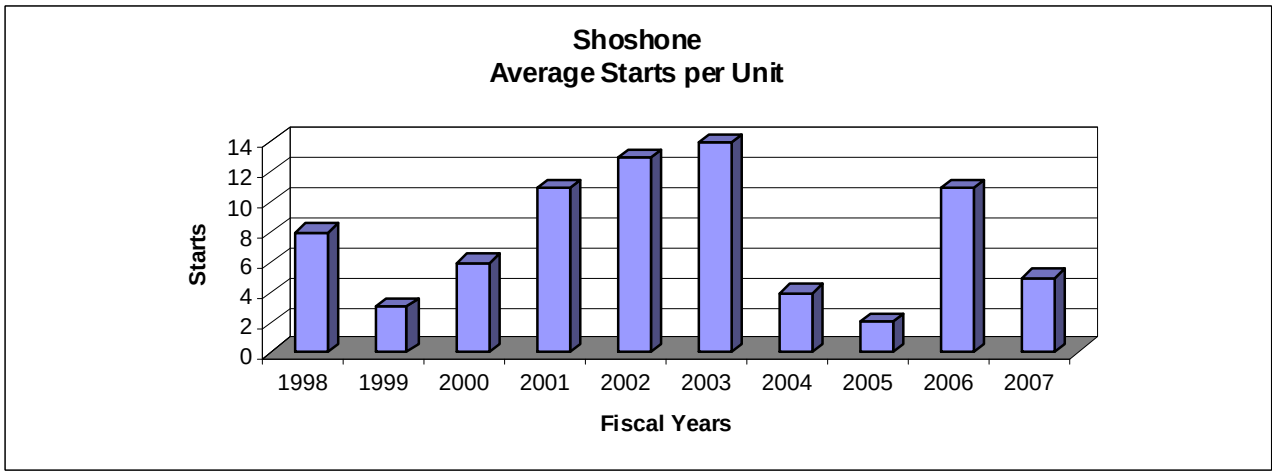


**Benchmark 7**
**Plant Scheduled Outage Factor**




FY-2003 – Contract repairs to draft tube.

**Unit Starts**



| Benchmark Data Comparison | | | | | |
|---|---|---|---|---|---|
| **Fiscal Year 2007** | **Shoshone Powerplant** | **Reclamation Average 0-10 MW Group** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 1.4% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 29.77 | 14.71 | 2.76 | ***25.9 | 1.00 |
| **O&M Costs $/MW** | 198,590 | 60,518 | 7,847 | ***75,984 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.74 | 0.41 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 96.9 | 88.73 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.0 | 0.91 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 3.1 | 10.36 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

# Spirit Mountain Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
John H. Lawson
Area Manager
Wyoming Area Office

**Plant Address:**
Spirit Mountain Powerplant
Cody, WY

**Telephone Numbers:**
Phone: (307) 261-5671
Fax: (307) 261-5683

**E-Mail Address:** jlawson@gp.usbr.gov

| | |
|---|---|
| **Reclamation Region:** | Great Plains |
| **NERC Region:** | Western Electricity Coordinating Council, Rocky Mountain Power Area |
| **PMA Service Area:** | Western Area Power Administration, Rocky Mountain Region |
| **Project Authorization:** | The Secretary of the Interior authorized the Shoshone Project on February 10, 1904, under authority of the Reclamation Act of June 17, 1902, and authorized under authority of the Reclamation Reform Act of October 12, 1982, as the Buffalo Bill Dam Modifications as part of the Pick-Sloan Missouri Basin Program. |
| **Project Purposes:** | Floodwaters of the Shoshone River are stored in Buffalo Bill Reservoir for later release for irrigation and power generation. Power is developed at the Buffalo Bill, Shoshone, Heart Mountain, and Spirit Mountain Power plants. The system is interconnected with the West Division of the Pick-Sloan Missouri Basin Program. |
| **Plant Location:** | Spirit Mountain Power plant is located in Park County, Wyoming, approximately 4 miles southwest of Cody, Wyoming, on a conduit from Buffalo Bill Dam. |
| **Plant Purpose:** | The primary purpose of the Spirit Mountain Powerplant is to dissipate energy of the water from the pressurized supply conduit from Buffalo Bill Reservoir before it enters the unpressurized supply canal which feeds the Heart Mountain Powerplant and the Heart Mountain Canal. The secondary purpose of the powerplant is to produce electrical power. |

| | |
|---|---|
| **Plant Facts:** | Spirit Mountain Powerplant consists of one 4,500-kilowatt generator. |
| **Plant History:** | Operation of this plant began in 1995. |
| **Present Activities:** | None |
| **Future Planned Activities:** | None |
| **Special Issues:** | This plant cannot operate unless the downstream Shoshone conduit is watered up. As a result of the modification of Buffalo Bill Dam, Buffalo Bill and Shoshone Power plants were completed in 1992. Due to the Revised In stream Flow Agreement associated with the reconstruction of the dam, winter releases previously discharged from Heart Mountain Powerplant that would have passed through spirit Mountain Powerplant are now made through the two upstream facilities. As a result, Spirit Mountain Powerplant has been operated on a seasonal basis since its completion in 1995. |

| | | | |
|---|---|---|---|
| **River:** | Shoshone River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Under Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 4,500 kW | **Installed Capacity:** | 4,500 kW |
| **Year of Initial Operation:** | 1994 | **Age:** | 13 years |
| **Net Generation (FY-2007):** | 16.1 GWh | **Rated Head:** | 110 feet |
| **Average Plant Factor (FY-2007):** | 41.6 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Base Load/Seasonal | | |

## Ancillary Services

**Spirit Mountain**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | No |
| Non-Spinning Reserve | No |
| Replacement Reserve | No |
| Regulation/Load Following | No |
| Black Start | No |
| Voltage Support | No |

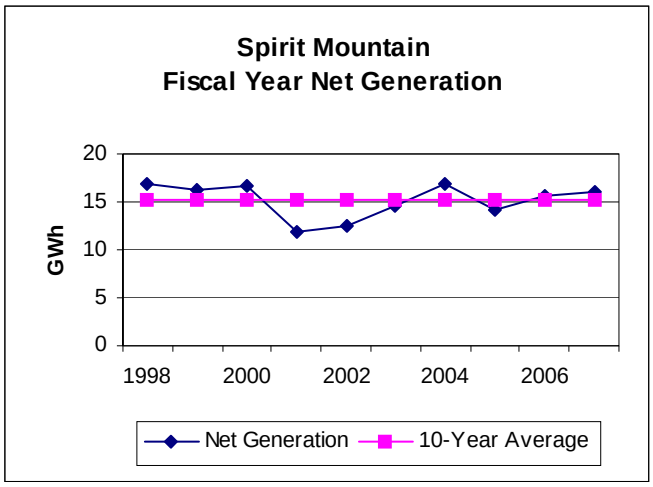
## Generators

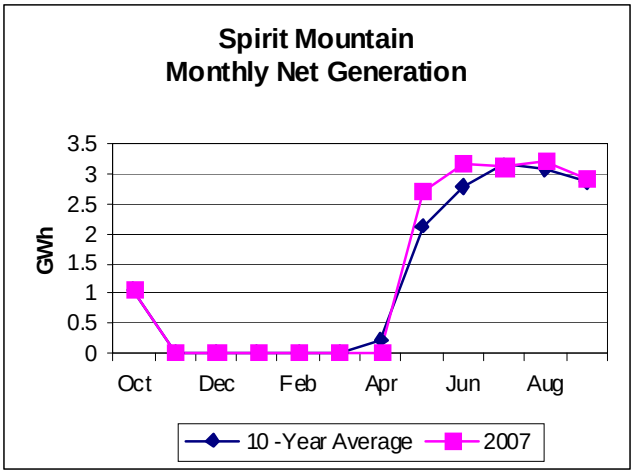
**Spirit Mountain Generators**

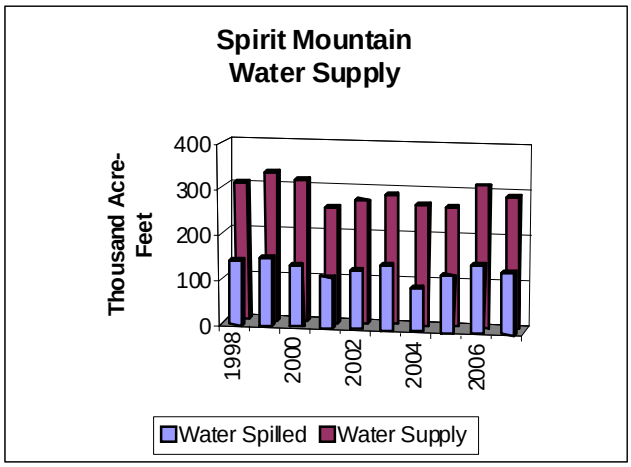
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 4,500 | - | 4,500 |
| 1 Unit | 4,500 | - | 4,500 |

## Generation

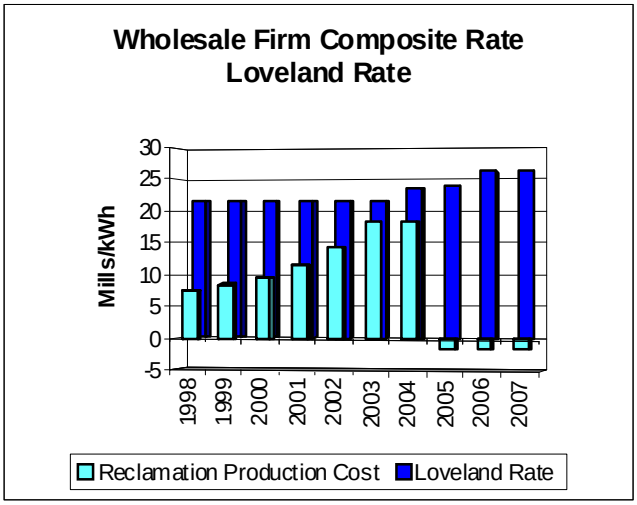

Spirit Mountain
Fiscal Year Net Generation
GWh
20
15
10
5
0
1998
2000
2002
2004
2006
Net Generation
10-Year Average


Spirit Mountain
Monthly Net Generation
GWh
3.5
3
2.5
2
1.5
1
0.5
0
Oct
Dec
Feb
Apr
Jun
Aug
10 -Year Average
2007

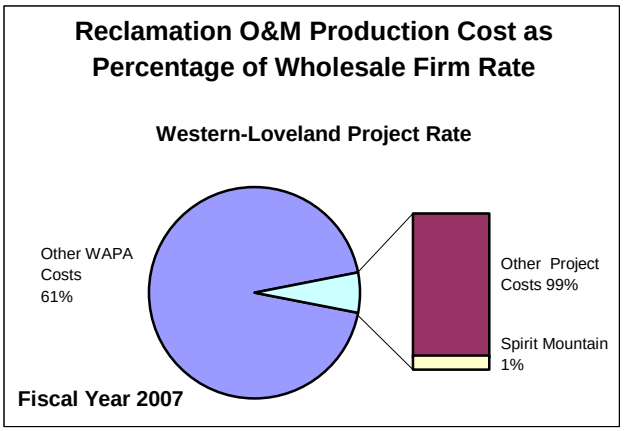

Spirit Mountain
Water Supply
Thousand Acre-Feet
400
300
200
100
0
1998
2000
2002
2004
2006
Water Spilled
Water Supply

# Prime Laboratory Benchmarks

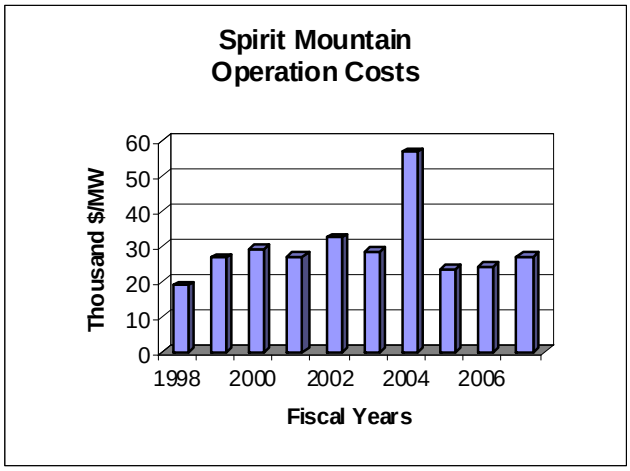
## Benchmark 1
## Wholesale Firm Rate

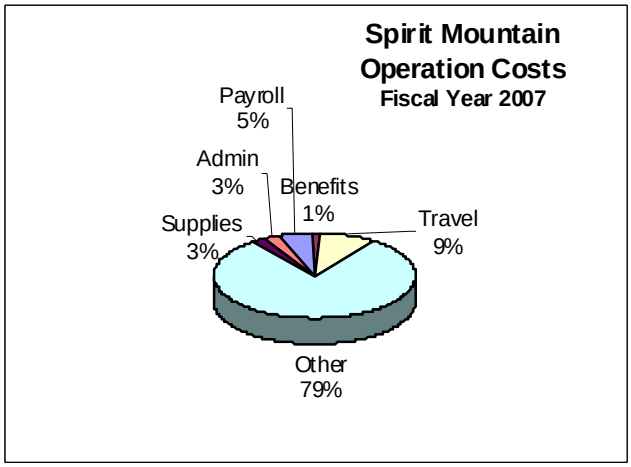


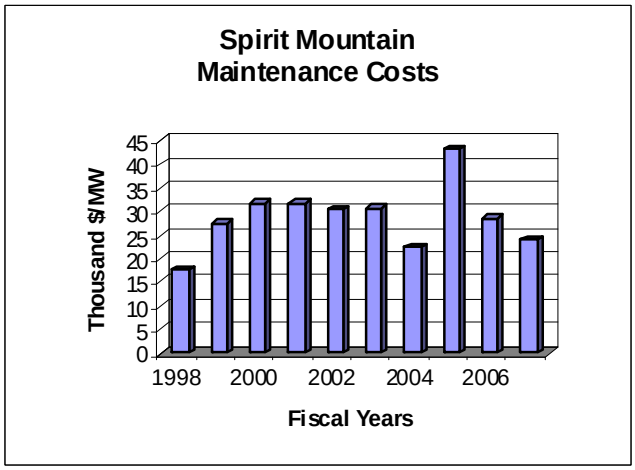

## Benchmark 2
## Reclamation's Production Cost as Percentage of Wholesale Firm Rate

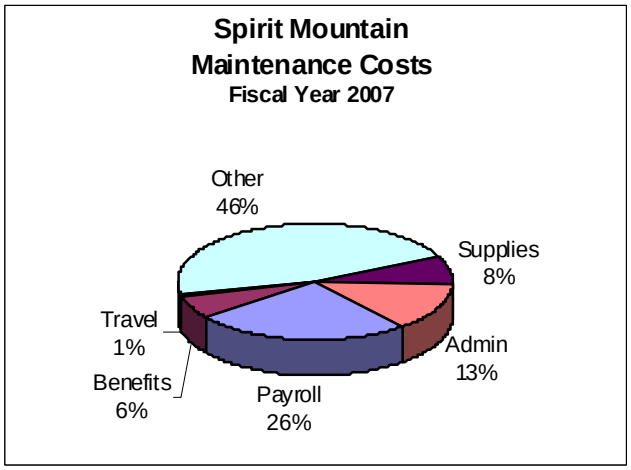


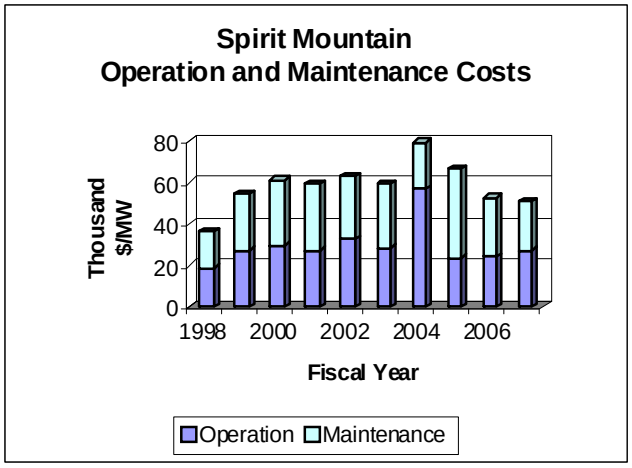
## Benchmark 3
## Production Cost

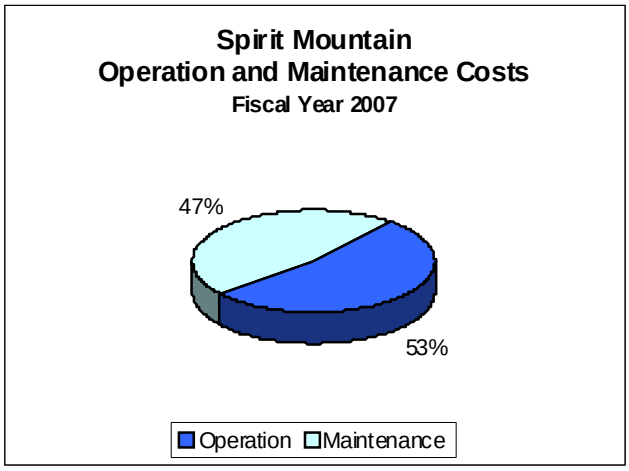


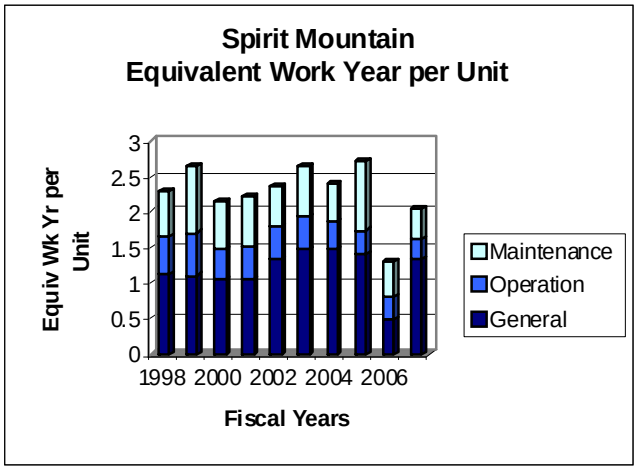



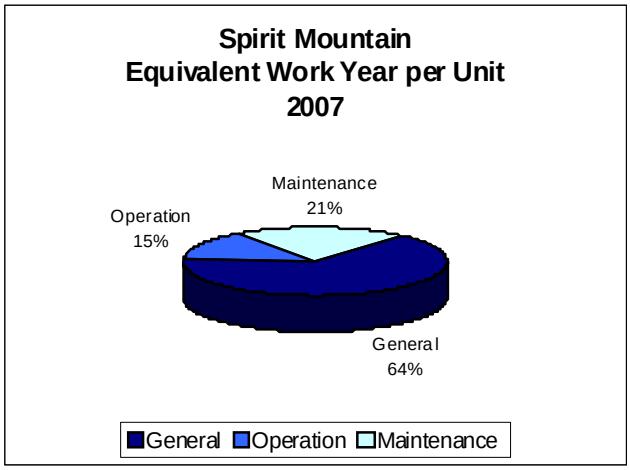



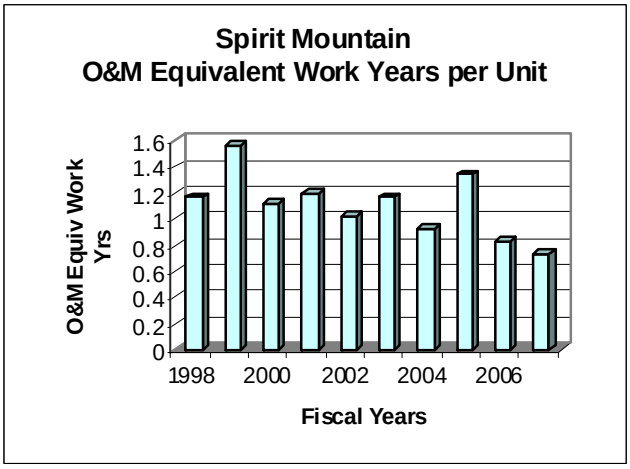



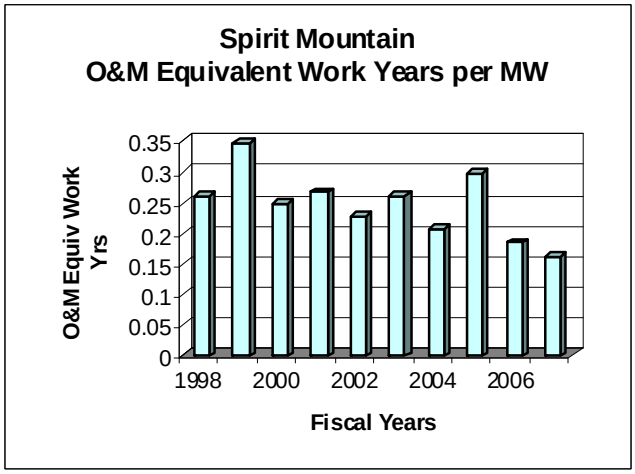
**Benchmark 4**
**Workforce Deployment**

| Spirit Mountain FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 1.18 | 0.13 | 0.02 | 1.33 | 1.33 | 0.30 |
| Operation | 0.27 | 0.03 | 0.00 | 0.30 | 0.30 | 0.07 |
| Maintenance | 0.39 | 0.04 | 0.00 | 0.43 | 0.43 | 0.10 |
| Total Staffing | 1.84 | 0.21 | 0.02 | 2.06 | 2.06 | 0.46 |

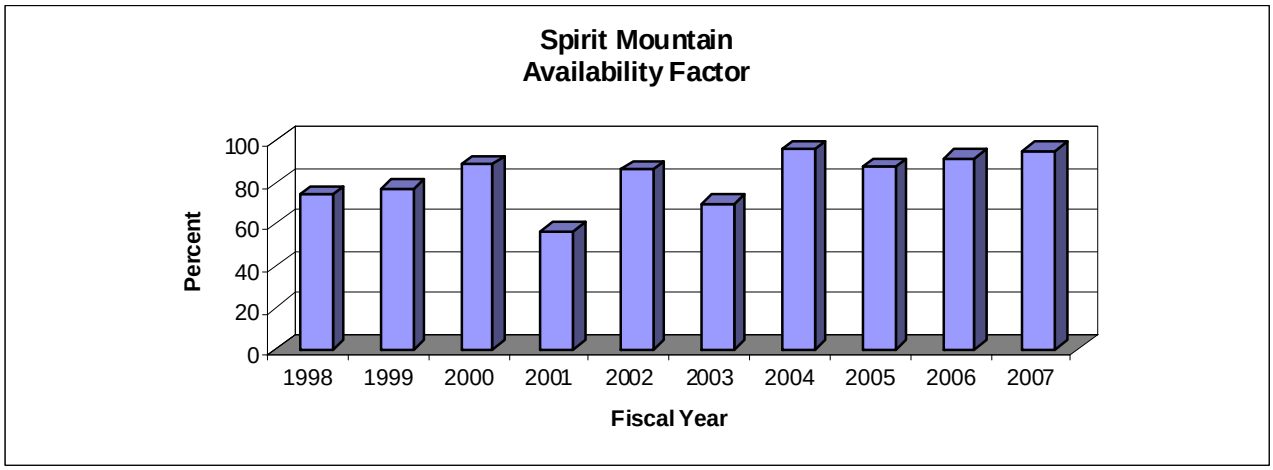


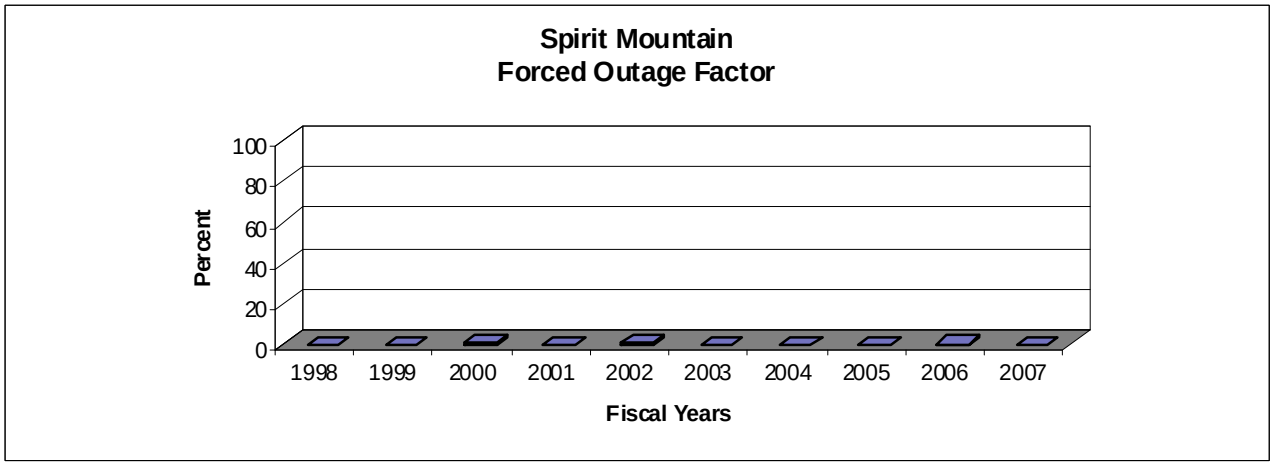



**Benchmark 5**
**Availability Factor**

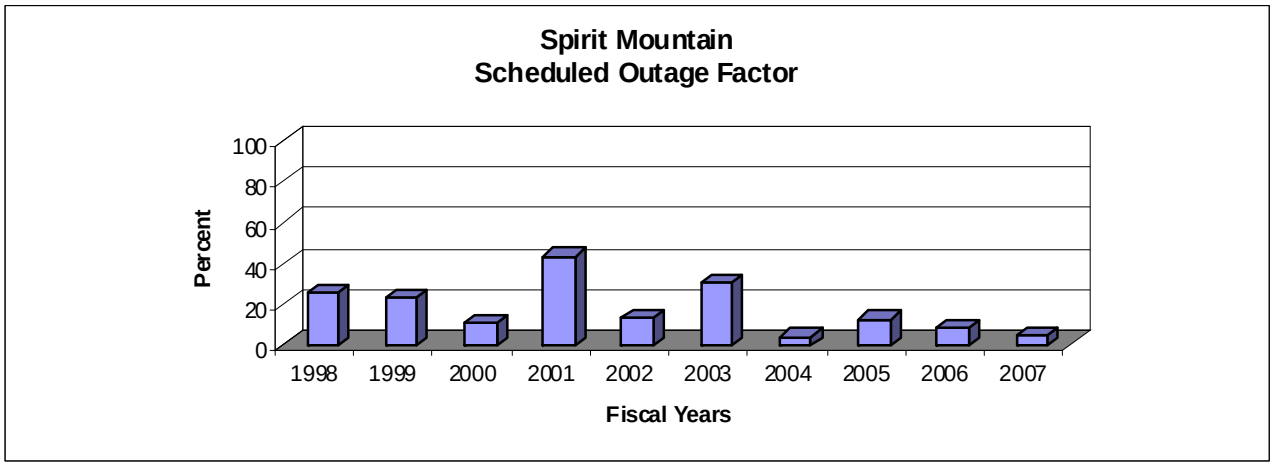



FY-01-Extended outages due to coating repairs in the Buffalo Bill penstock and to the sleeve valves.

**Benchmark 6**
**Forced Outage Factor**

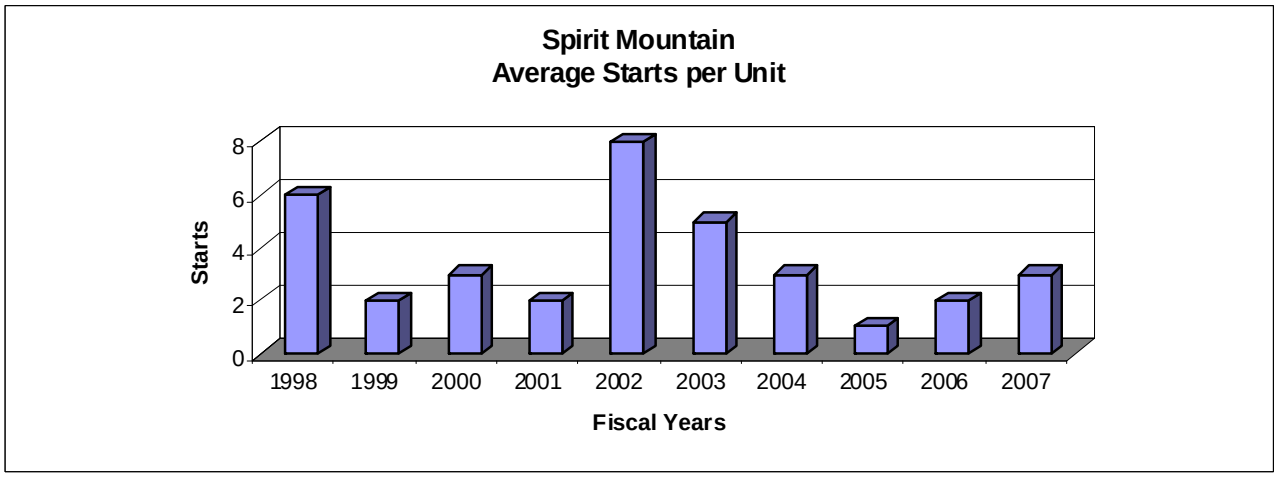


**Benchmark 7**
**Scheduled Outage Factor**




FY-01 – Extended outages due to coating repairs in the Buffalo Bill penstock and to the sleeve valves.
FY 03 – Extensive packing box repairs and replacement of failed and disconnected switch.

**Starts**



| Benchmark Data Comparison | | | | |
|---|---|---|---|---|
| **Fiscal Year 2007** | **Spirit Mountain Powerplant** | **Total Reclamation Average** | **Industry Average** | **Best Performers** |
| **Wholesale Firm Rate Mills/kWh** | 23.9 | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | 0.5% | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 14.24 | 2.76 | Not Applicable | 1.00 |
| **O&M Costs $/MW** | 51,068 | 7,847 | Not Applicable | 2,897 |
| **O&M Equiv Work Year per MW** | 0.16 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 95.23 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.00 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 4.77 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average

# Yellowtail Powerplant
# Pick-Sloan Missouri Basin Program

**Plant Contact:**
Tom Tauscher
Facility Manager

**Plant Address:**
Yellowtail Field Office
PO Box 7551
Ft. Smith MT 59035

**Telephone Numbers:**
Phone: (406) 666-3201
Fax: (406) 666-3209

**E-Mail Address:**
ttauscher@gp.usbr.gov

**Reclamation Region:** Great Plains

**NERC Region:** Western Electricity Coordinating Council, Rocky Mountain Power Area

**PMA Service Area:** Western Area Power Administration, Rocky Mountain Region and Upper Great Plains Region

**Project Authorization:** Construction of the Yellowtail Unit, part of the Pick-Sloan Missouri Basin Project Eastern and Western Divisions, was authorized by the Flood Control Act of December 22, 1944, Public Law 534, which approved the general comprehensive plan set forth in Senate document 191, as revised by Senate Document 247, 78th Congress.

**Project Purposes:** The Yellowtail Unit is a multi-purpose project which provides low cost power generation and makes an important contribution to the flood control, irrigation, and power supply in the Missouri Basin.

**Plant Location:** Yellowtail Dam, Powerplant, and Afterbay Dam, the principle structures of the Yellowtail Unit, are located on the Bighorn River, in south-central Montana, approximately 45 miles southwest of Hardin, Montana, and 90 miles southeast of Billings.

**Plant Purpose:** Yellowtail Powerplant, with an installed capacity of 250,000 kilowatts, provides low cost power and supplies expanding power needs for residential and commercial use in a wide surrounding area. The widely varying releases from the powerplant are regulated by the Yellowtail Afterbay Dam, constructed 2.2 miles downstream. The afterbay, with a capacity of 3140 acre-feet, minimizes downstream fluctuations in the Bighorn River by providing a uniform daily flow, leveling the peaking power discharges from the powerplant.

**Plant Facts:**

Yellowtail Powerplant is located at the downstream toe of the dam on the right abutment. Four 12-foot diameter penstocks embedded in the dam supply water to four vertical-shaft, Francis-type hydraulic turbines, two are the originals rated at 87,500 horsepower and two are replacements that were installed in 1999 and 2000, rated at 96,500 horsepower, each driving a 62,500-kilowatt generator. Yellowtail Dam, at the mouth of Bighorn Canyon, is a concrete structure rising 525 feet above the rock foundation and impounds flows of the Bighorn River for multi-purpose use. Bighorn Lake is about 72 miles long with a total capacity of 1,328,360 acre feet.

**Plant History:**

Construction on Yellowtail Dam and Powerplant began in May 1961 and was completed in December 1967; construction of the Afterbay Dam was started in April 1964 and was completed in November 1966. Operation of Units 3 and 4 began in August 1966, followed by Unit 2 in October 1966, and Unit 1 in November 1966. Units 1 and 2 (115-kV) are part of the Western Division of Pick-Sloan Missouri Basin Program, and Units 3 and 4 (230-kV) are part of the Eastern Division.

**Present Activities:**

Activities included: hollow jet valve condition assessment; power penstock fatigue analysis; Afterbay power line installation; triennial maintenance on generator step-up and station service transformers; Afterbay gate actuator replacement; replacement of the Afterbay 48-volt DC batteries; dam face and spillway tunnel inspections; maintenance of the Afterbay 13.8 kV switchyard supply breaker 4322; Afterbay control system upgrade; foundation drain cleaning; dam and powerplant elevator modernization; Unit 3 and 4 annual maintenance; and Unit 2 quadrennial maintenance.

**Future Activities:**

Major activities planned in the near future include: completion of powerplant station service standby engine-generator addition; hollow-jet valve refurbishment; complete Afterbay gate actuator replacement; install new shoring in the right G&I tunnel; Afterbay control system upgrade and gate automation; and MAXIMO (CARMA) implementation.

**Special Issues:**

The Bighorn River Basin experienced its seventh consecutive year of drought conditions, resulting in below average power generation in FY2000 through FY2006. Responsibilities, in addition to the 250,000-kilowatt powerplant, also include the operation and maintenance of two dams, two reservoirs, a Government camp and residential housing, two water and sewage systems, the Bighorn Canal headworks, and miles of road and fences.

| | | | |
|---|---|---|---|
| **River:** | Bighorn River | **Plant Type:** | Conventional |
| **Powerhouse Type:** | Above Ground | **Turbine Type:** | Francis |
| **Original Nameplate Capacity:** | 250,000 kW | **Installed Capacity:** | 250,000 kW |
| **Year of Initial Operation:** | 1966 | **Age:** | 41 years |
| **Net Generation (FY-2007):** | 362.0 GWh | **Rated Head:** | 440 feet |
| **Average Plant Factor (FY-2007):** | 16.7 percent | **Remotely Operated:** | Yes |
| **Production Mode:** | Peaking | | |

## Ancillary Services

**Yellowtail**
**Ancillary Services**

| | |
|---|---|
| Spinning Reserve | Yes |
| Non-Spinning Reserve | Yes |
| Replacement Reserve | Yes |
| Regulation/Load Following | Yes |
| Black Start | Yes |
| Voltage Support | Yes |

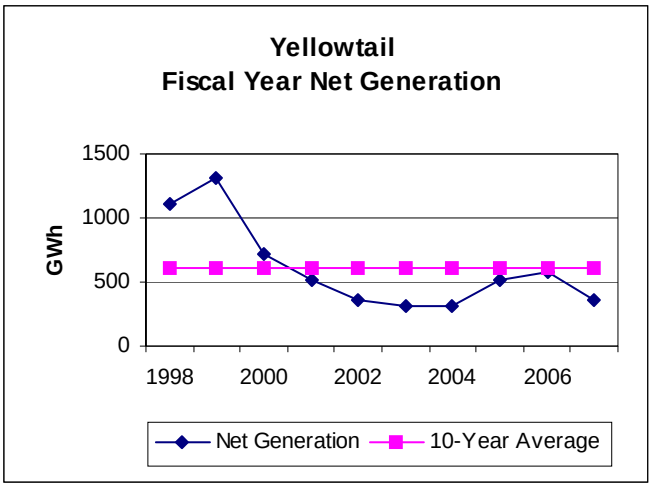
## Generators

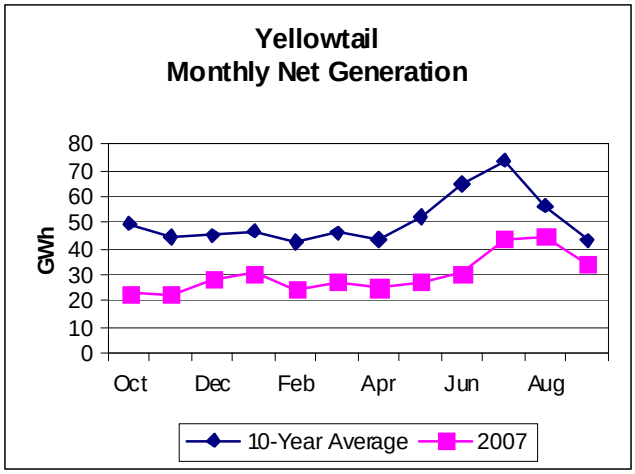
**Yellowtail Generators**

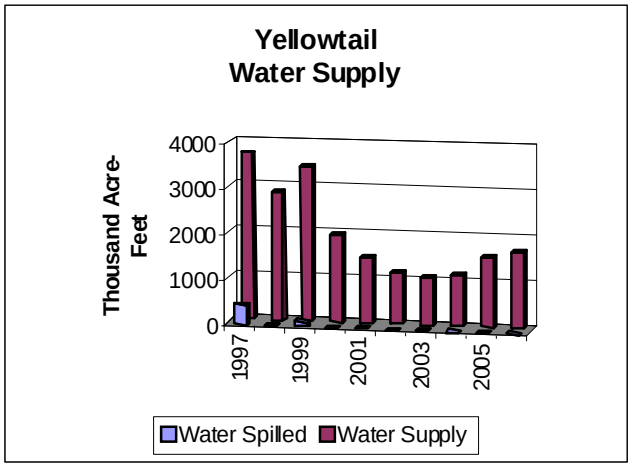
Existing Number and Capacity

| Unit # | Original Capacity (kW) | Capacity Increased (kW) | Present Capacity (kW) |
|---|---|---|---|
| 1 | 62,500 | - | 62,500 |
| 2 | 62,500 | - | 62,500 |
| 3 | 62,500 | - | 62,500 |
| 4 | 62,500 | - | 62,500 |
| 4 units | 250,000 | - | 250,000 |

## Generation



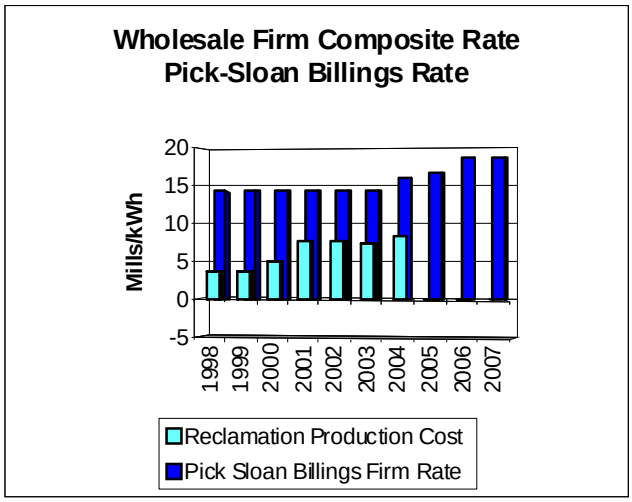



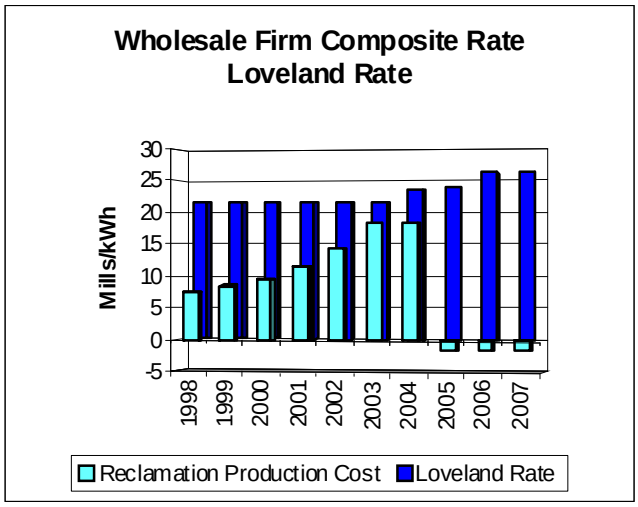




Drought conditions encountered for the sixth consecutive year.

## Prime Laboratory Benchmarks

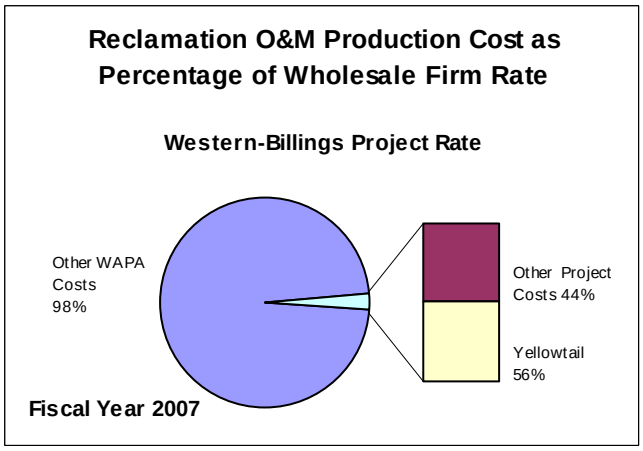
### Benchmark 1
### Wholesale Firm Rate

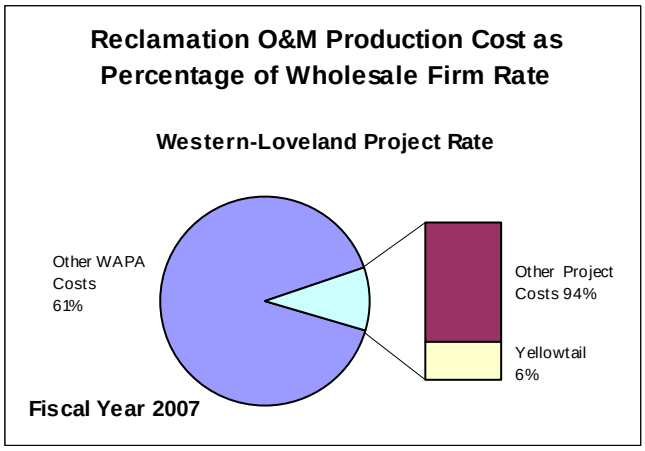


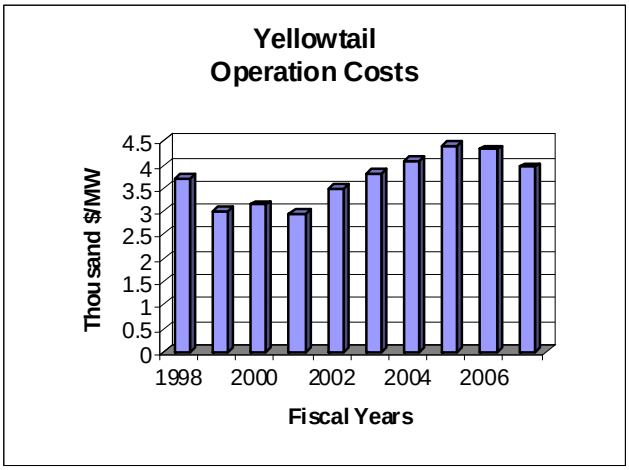

Yellowtail Units 1 and 2 are part of the Pick-Sloan Billings Rate and Yellowtail Units 3 and 4 are part of the Pick-Sloan Loveland Rate.

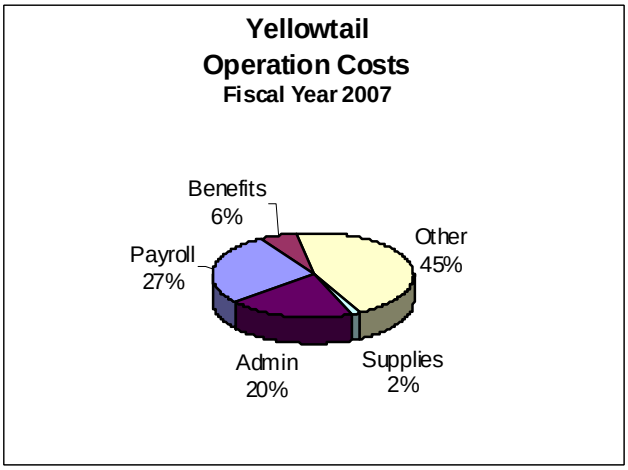
### Benchmark 2
### Reclamation's Production Costs as Percentage of Wholesale Firm Rate

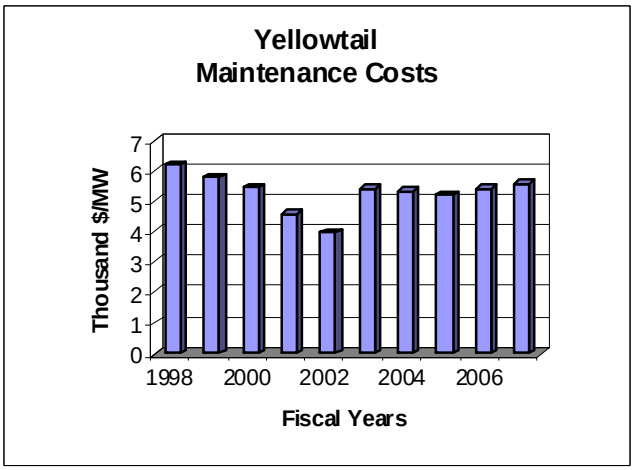


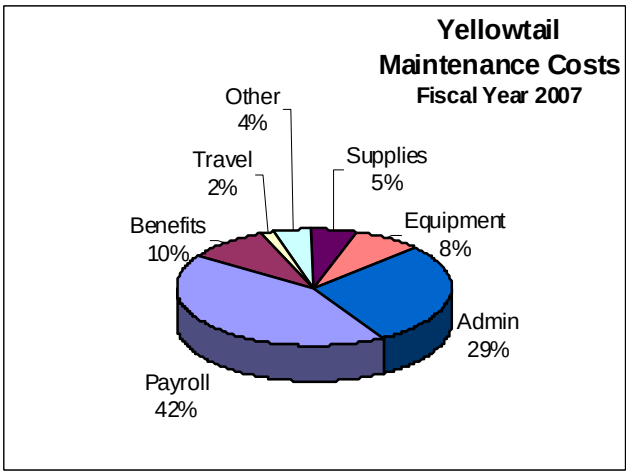



## Benchmark 3
## Production Costs

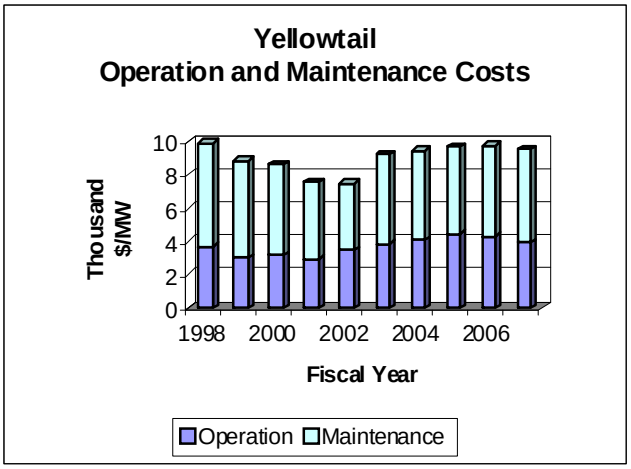


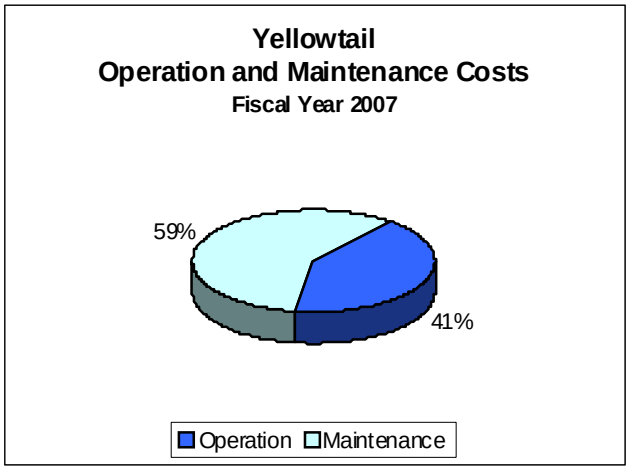



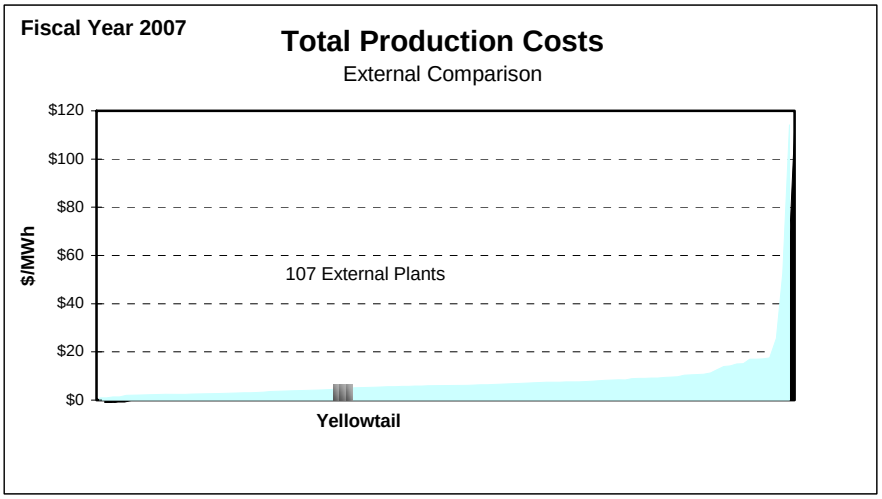



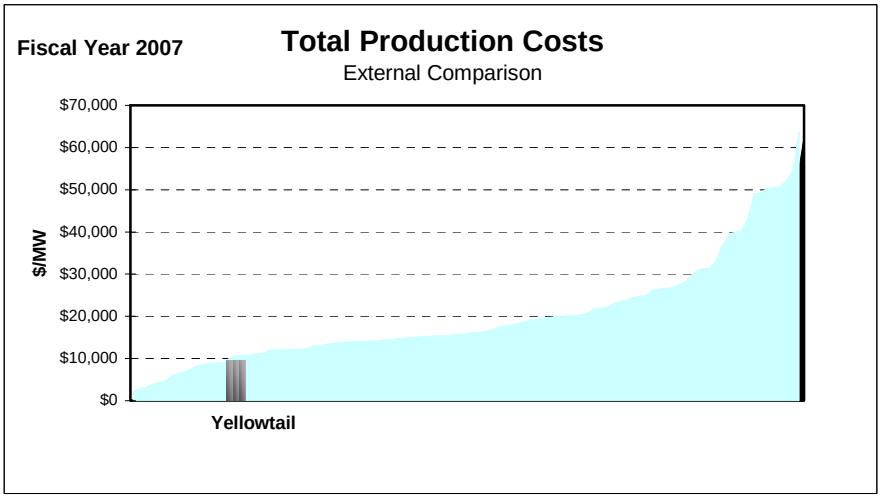



## Benchmark 3
## Production Costs



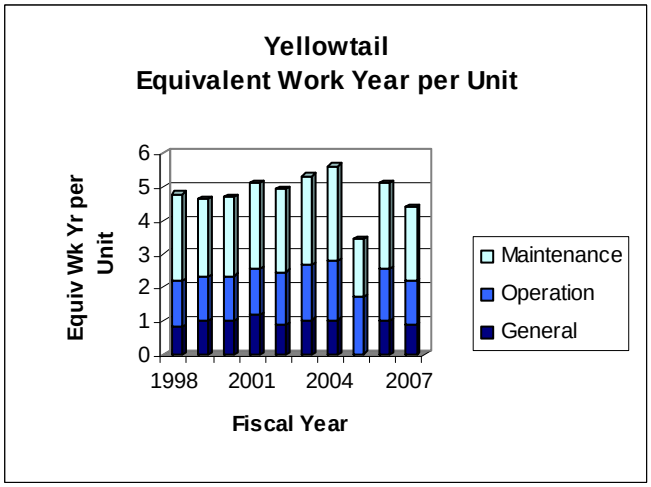



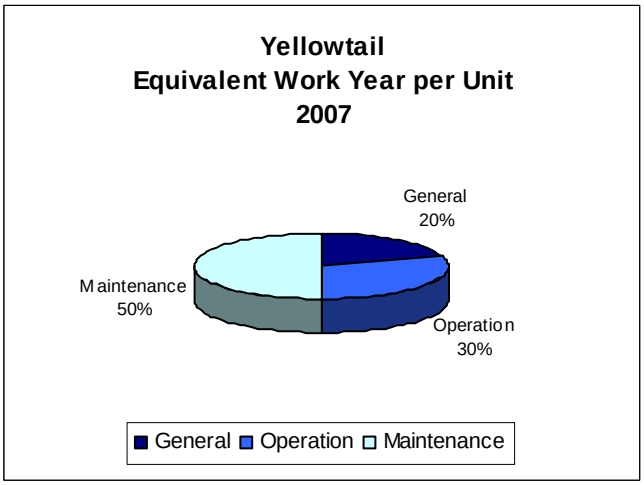



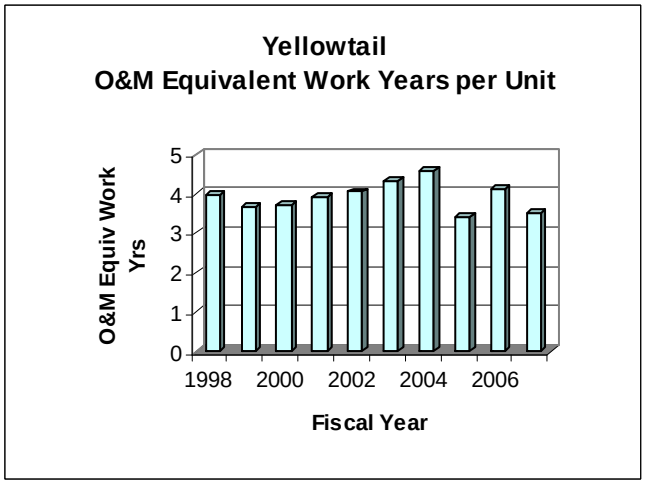



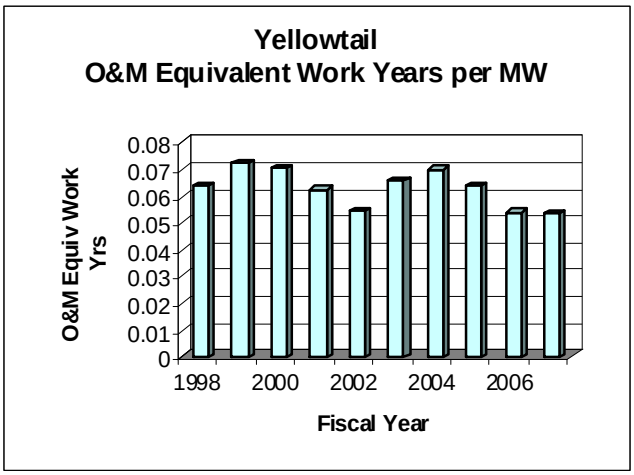
**Benchmark 4**
**Workforce Deployment**

| Yellowtail FY 2007 Equivalent Work Staffing Year Levels | | | | | | |
|---|---|---|---|---|---|---|
| | Equivalent Work Year Staffing Charged to Powerplant | Leave Additive | Denver and Washington Equivalent Work Year Staffing Additive | Total Equivalent Work Year Allocated to Powerplant | Total Equivalent Staffing Work Year per Generating Unit | Total Equivalent Work Year Staffing per Megawatt |
| General | 3.15 | 0.36 | 0.07 | 3.57 | 0.89 | 0.01 |
| Operation | 4.70 | 0.53 | 0.00 | 5.23 | 1.31 | 0.02 |
| Maintenance | 7.35 | 0.83 | 0.00 | 8.18 | 2.20 | 0.03 |
| Total Staffing | 15.20 | 1.72 | 0.07 | 16.98 | 4.40 | 0.07 |

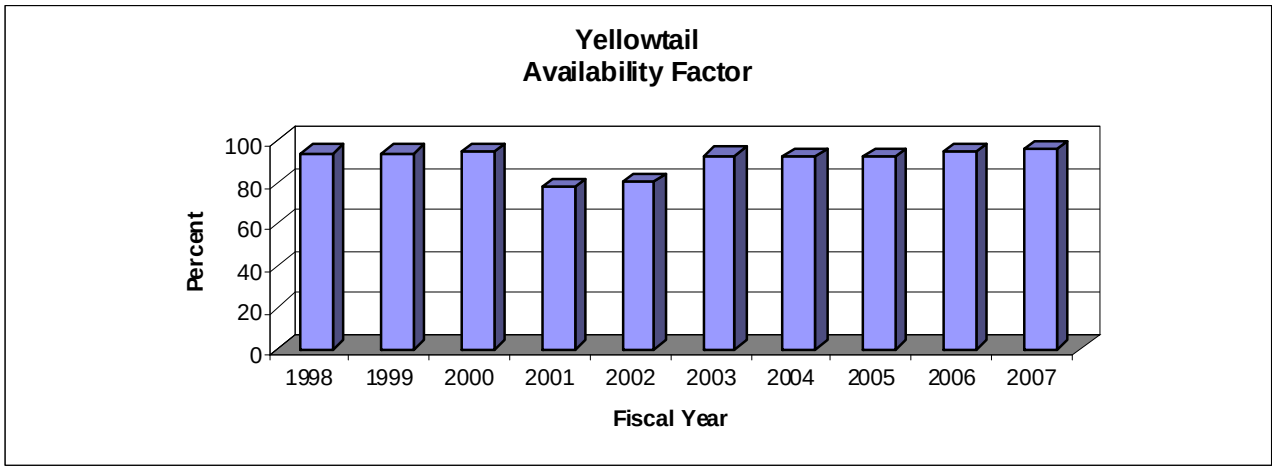


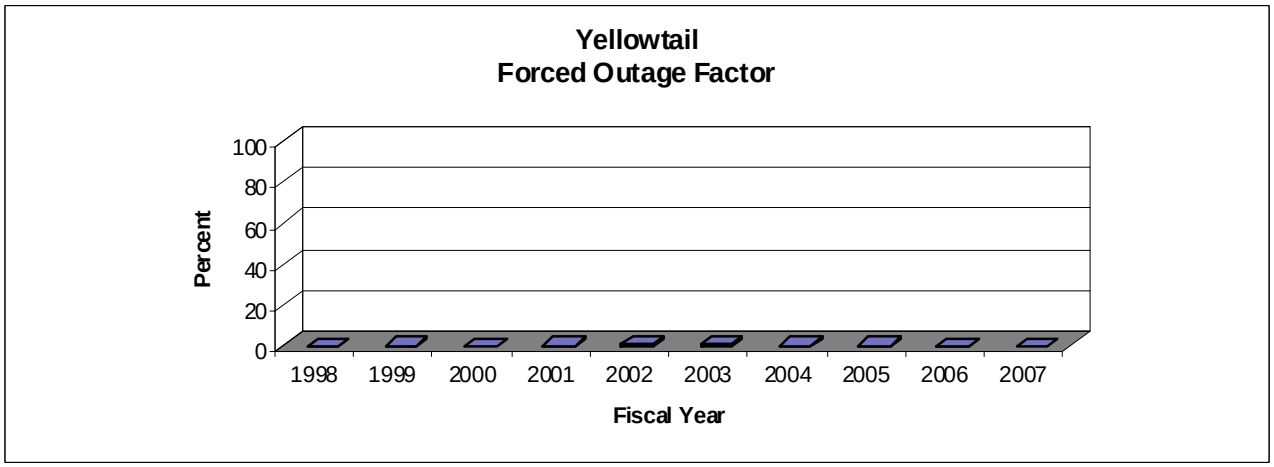



**Benchmark 5**
**Plant Availability Factor**

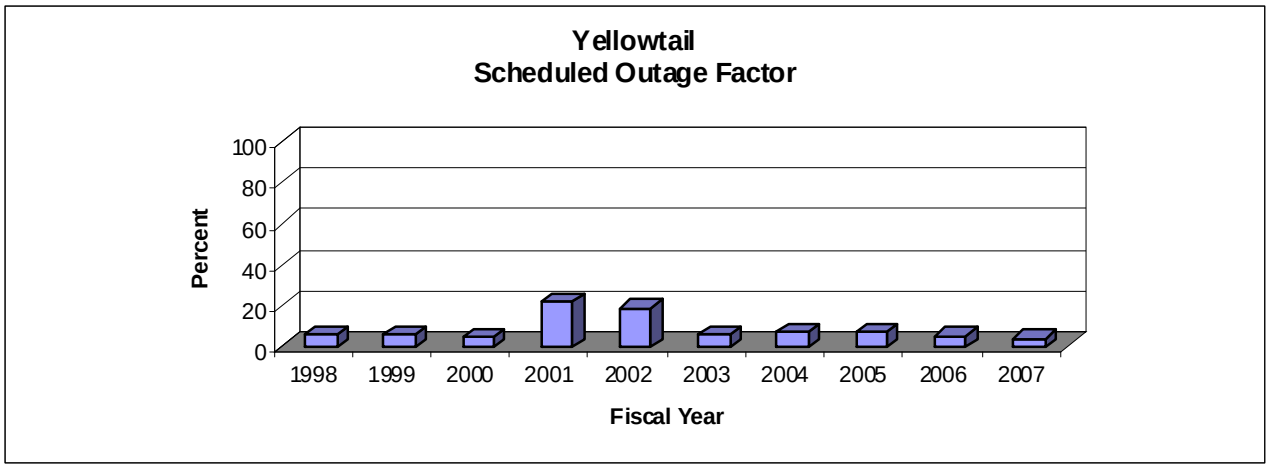



FY-2001 and FY-2002 – Extended outages occurred for replacing of the turbine runners on Units 3 and 4, and for replacing the governors and excitation systems on Units 1, 2, 3, and 4.

**Benchmark 6**
**Plant Forced Outage Factor**

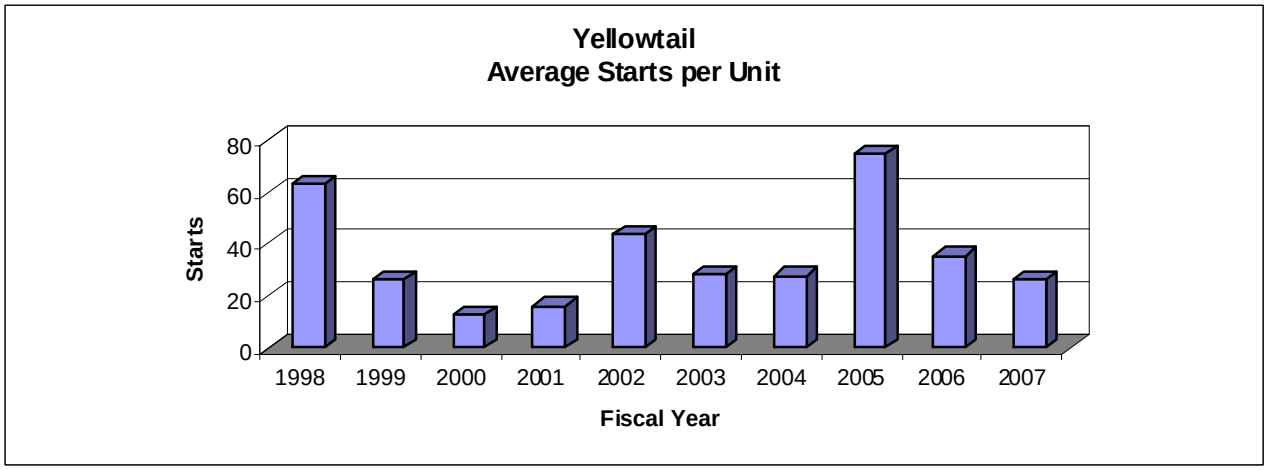


## Benchmark 7
## Plant Scheduled Outage Factor




FY-2001 and FY-2002 – Extended outages occurred for replacing the turbine runners on Units 3 and 4, and for replacing the governors and excitation systems on Units 1, 2, 3, and 4.

## Unit Starts



## Benchmark Data Comparison

| Fiscal Year 2007 | Yellowtail Powerplant | Reclamation Average 100-500 MW Group | Total Reclamation Average | Industry Average | Best Performers |
|---|---|---|---|---|---|
| **Wholesale Firm Rate Mills/kWh** | Units 1&2 16.5<br>Units 3&4 23.9 | Not Applicable | *22.45 | Not Available | Not Available |
| **Production Cost as Percentage of Wholesale Firm Rate** | Units 1&2 1.28%<br>Units 3&4 2.77% | Not Applicable | 12.1% | Not Applicable | Not Applicable |
| **O&M Cost $/MWh** | 6.59 | 4.44 | 2.76 | ***63.88 | 1.00 |
| **O&M Costs $/MW** | 9,536 | 10,502 | 7,847 | ***21,167 | 2,897 |
| **O&M Equiv Work Year per MW** | 0.05 | 0.04 | 0.03 | Not Available | 0.0 |
| **Availability Factor** | 95.8 | 83.5 | 82.3 | **88.64 | 98.5 |
| **Forced Outage Factor** | 0.1 | 1.2 | 2.6 | **2.61 | 0.0 |
| **Scheduled Outage Factor** | 4.1 | 15.4 | 15.1 | **8.74 | 0.0 |

*Weighted by Net Generation
**2006 NERC Average
***Energy Information Administration Data

The Bighorn River Basin experienced its sixth consecutive year of drought conditions in FY-2005, which resulted in below average generation.

Yellowtail Units 1 and 2 are part of the Pick-Sloan Billings Rate and Yellowtail Units 3 and 4 are part of the Pick-Sloan Loveland Rate.