



GUAM POWER AUTHORITY

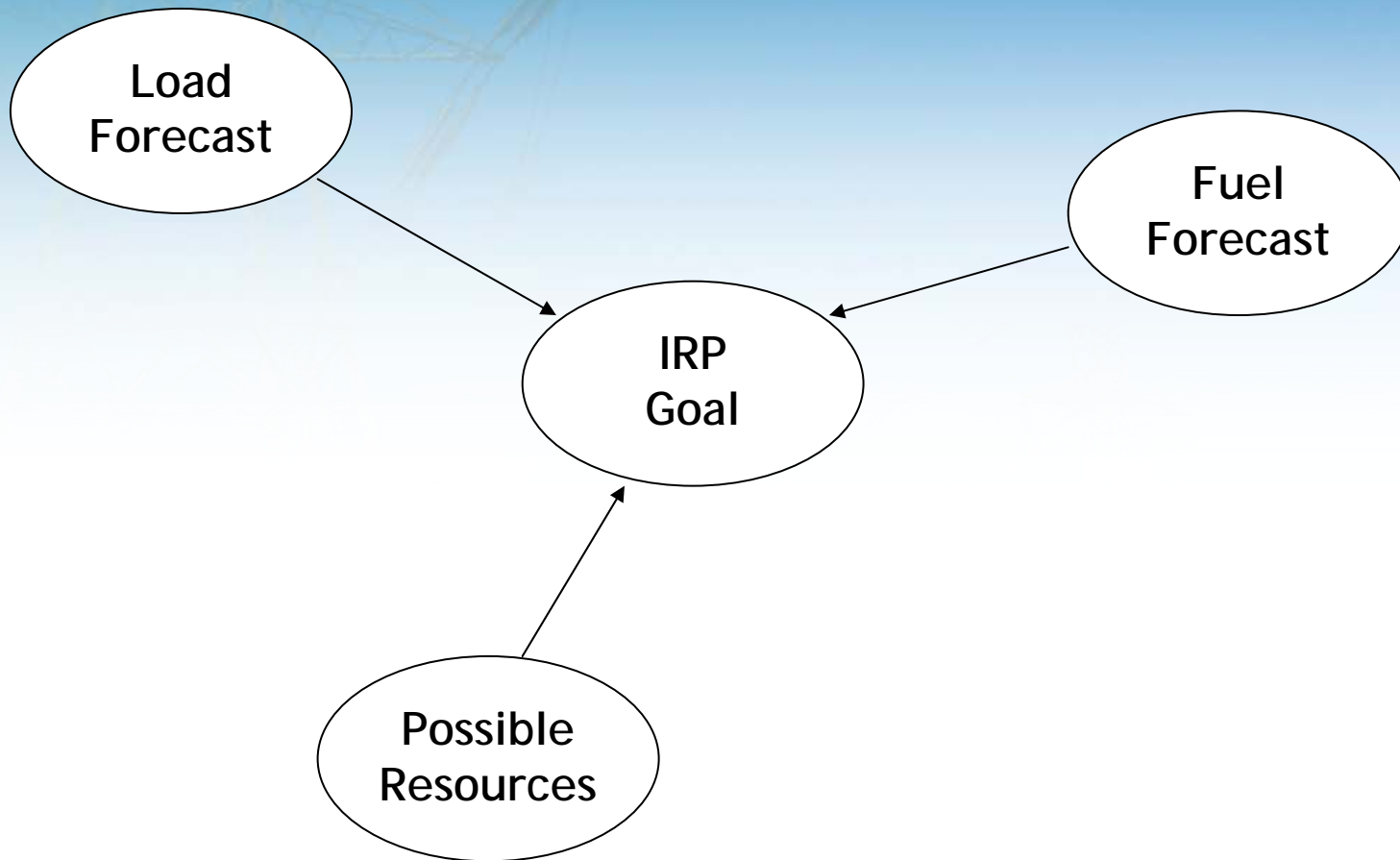
# Initial Look at New Power Plant & DSM Program Costs



November 29, 2007



Mind Powered: Insight with Impact.



# IRP Resource Options

- Goals
- Load/Resource Balance
  - Reserve Margin, Reliability, and Capacity Needs
- Planning Criteria
- Supply Resource Options
- Demand-Management Resource Options

# Goals

- The IRP process assures an adequate and reliable electricity supply at the lowest reasonable cost and in a manner “consistent with the long-run public interest.”

# Load/Resource Balance : Existing Generation

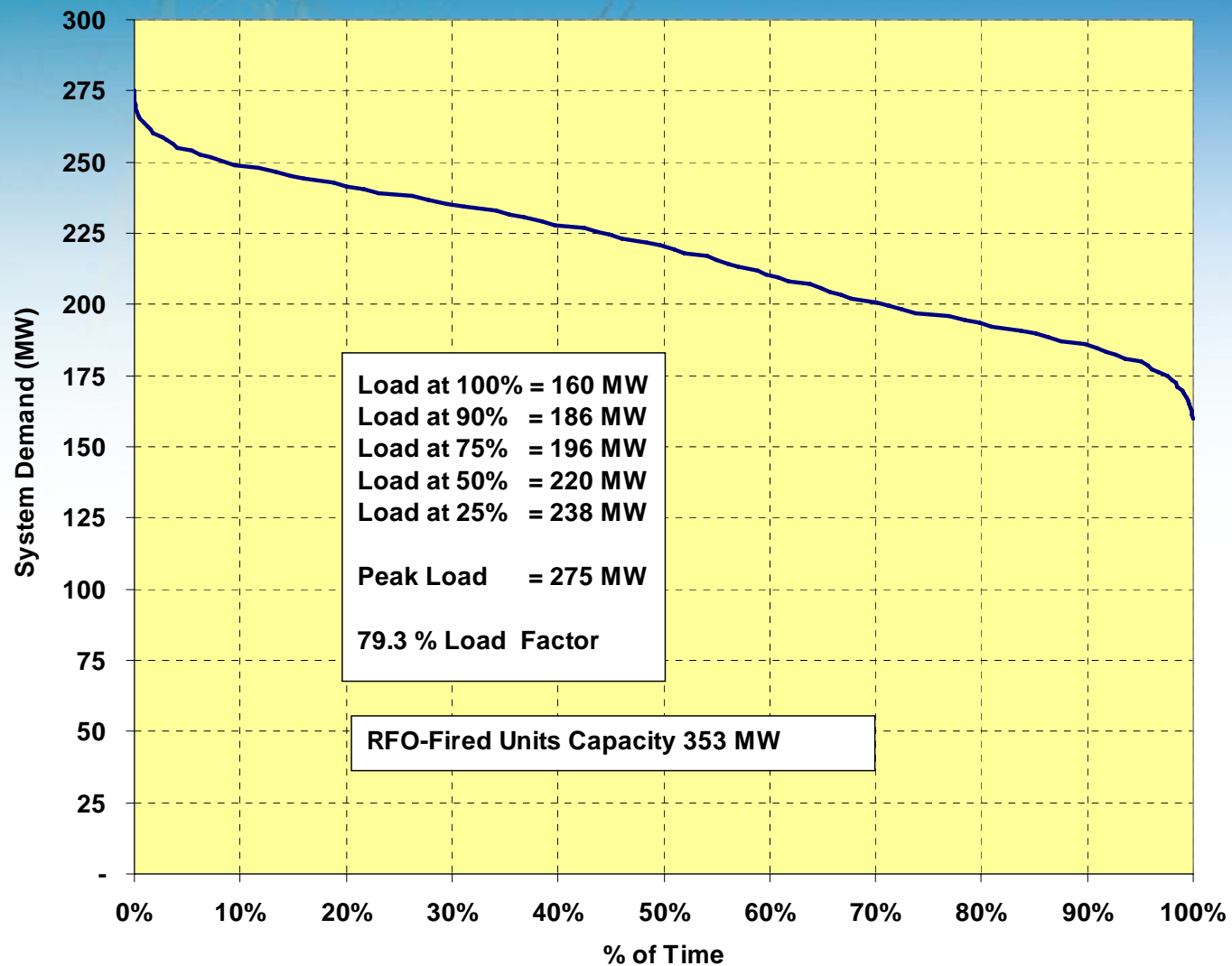
**Summary of Existing GPA Generation Resources**

Unit	Technology	Fuel	Capacity, MW	Service Date
Cabras 1	Steam Turbine (ST)	RFO No. 6	66	1974
Cabras 2	ST	RFO No. 6	66	1975
Cabras 3	Slow Speed Diesel (SSD)	RFO No. 6	40	1996
Cabras 4	SSD	RFO No. 6	40	1996
Piti 8 (MEC)	SSD	RFO No. 6	44	1999
Piti 9 (MEC)	SSD	RFO No. 6	44	1999
Tanguisson 1 (PRU)	ST	RFO No. 6	26.5	1976
Tanguisson 2 (PRU)	ST	RFO No. 6	26.5	1976
Dededo CT 1	Combustion Turbine (CT)	Diesel No. 2	23	1992
Dededo CT 2	CT	Diesel No. 2	23	1994
Machche CT	CT	Diesel No. 2	21	1993
Marbo CT	CT	Diesel No. 2	16	1993
Yigo CT	CT	Diesel No. 2	21	1993
Piti 7 (TEM)	CT	Diesel No. 2	40	1997
Dededo Diesel 1-4	Medium Speed Diesel (MSD)	Diesel No. 2	2.5 ea/10 total	1972
Talofoto Diesel 1 and 2	MSD	Diesel No. 2	5 ea/10 total	1994
Paluntat Diesel 1 and 2	MSD	Diesel No. 2	4.4 ea/8.8 total	1993
Tenjo Diesel 1-6	MSD	Diesel No. 2	4.4 ea/26.4 total	1994

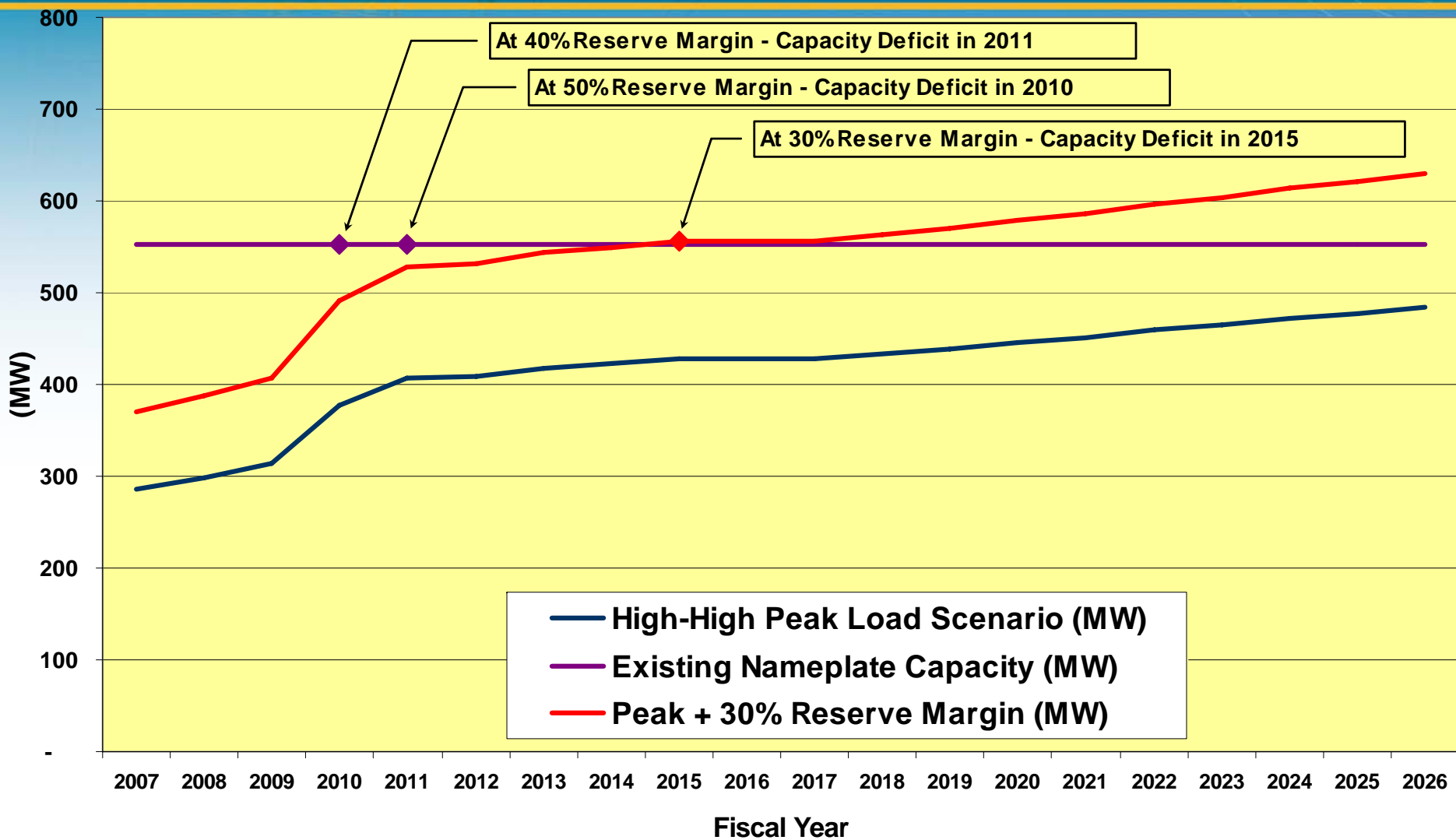
# Load/Resource Balance: Reserve Margin, Reliability, and Capacity Needs

- Load/Resource Balance:
  - Load Duration Curve: (2006 Chart)
  - Load vs. Capacity : MW (Annual Chart 2007-2026)
  - Minimum Reserve Margin for future Years : 30 %

# GPA FY 2006 Load Duration Curve

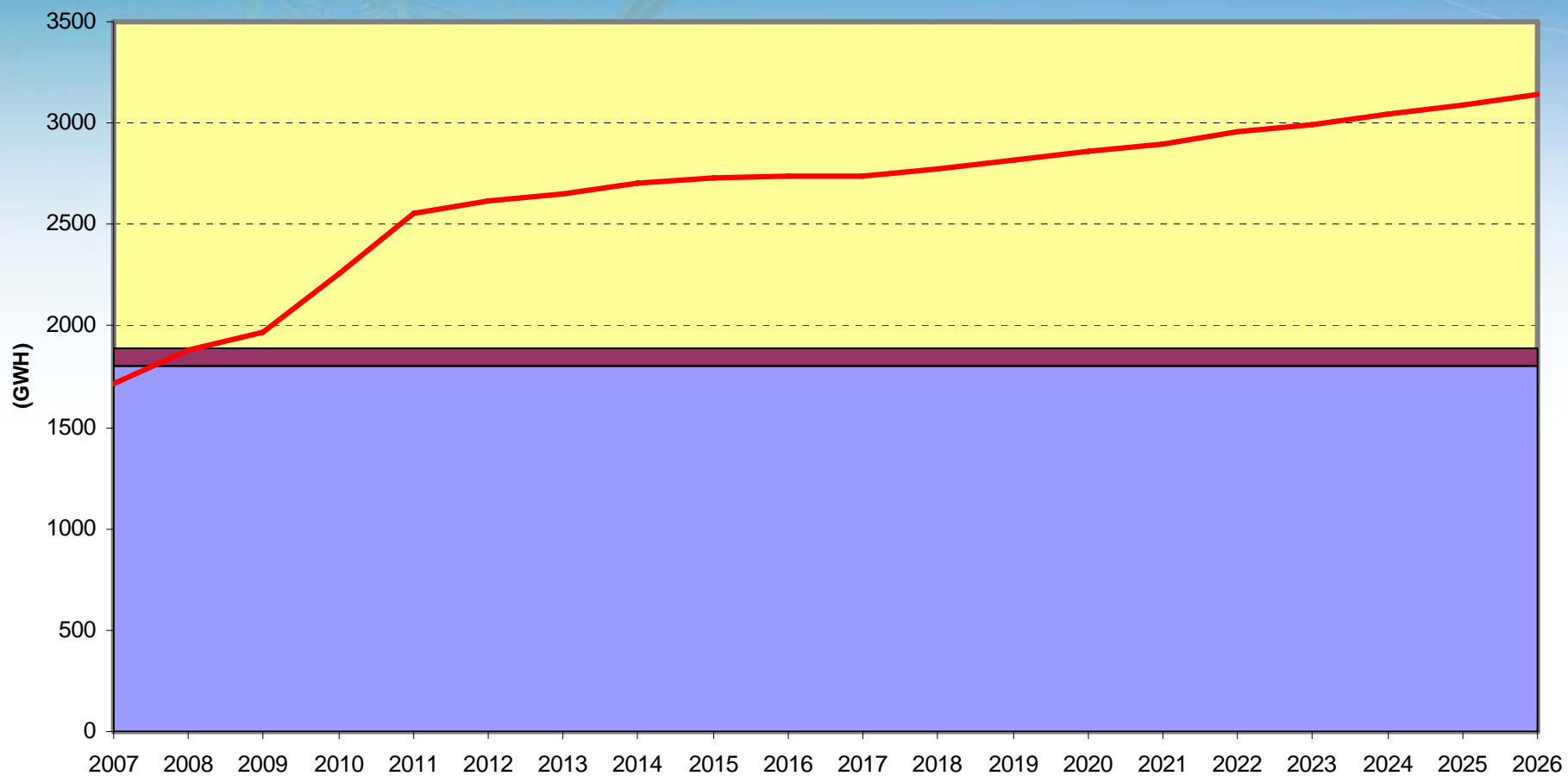


# Load/Resource Balance (MW)



# Load/Resource Balance (GWh)

Annual Energy Requirements' Projection vs. Current Generation Mix



2006 Generation from RFO (GWh)

2006 Generation from Diesel Fuel (GWh)

Total Energy Requirements GWh

# Planning and Resource Selection Criteria

- Select Least-Cost Portfolio, subject to the following Criteria:
  - Reduce Environmental Degradation
  - Achieve Reliability Standards
  - Minimize Adverse Social Impact
  - Security

# Generic Supply Resource Options

- Option 1 – Small Coal-Fueled Power Plant
- Option 2 – Small Combined-Cycle Power Plant With a Liquefied Natural Gas (LNG) Facility
- Option 3 – Wind Farm
- Option 4 – Repowering Piti 7 CT to a Combined-Cycle Power Plant
- Option 5 – Biomass Power Plant
- Option 6 – Reciprocating Engine Power Plant

# Supply Options – Technical and Economic Characteristics

Option	Technology	Nominal		HR @ Max MMBtu/MWh	HR @ Min	FOR %	Scheduled		
		Capacity MW	Capital Costs \$Million \$/kW				Maint. Weeks	FO&M \$/kW-yr	VO&M \$/MWh
Small Coal	Steam PC/CFB	60	300 5,004	10.50	11.66	5.0%	5.21	82.1	4.6
Combined Cycle	LM6000	60	334 5,567	8.05	8.56	3.0%	3.65	66.7	2.6
Wind Farm	10X2MW On-Shore	20	49 2,427	N/A	N/A	2.0%	1.04	NA	NA
Repowering Piti 7 CT	Piti 7 CC	60	72 NA	8.10	8.46	2.0%	3.65	41.1	4.6
Biomass	Stocker/CFB	10	86 8,561	17.50	NA	5.5%	5.21	410.7	76.9
Reciprocating Engine	2X20MW S/MD	40	71 1,775	8.50	9.22	5.5%	5.21	53.4	5.6

## Notes:

All Costs are in \$2007

Capital costs include 20% owner costs and exclude IDC and bank fees

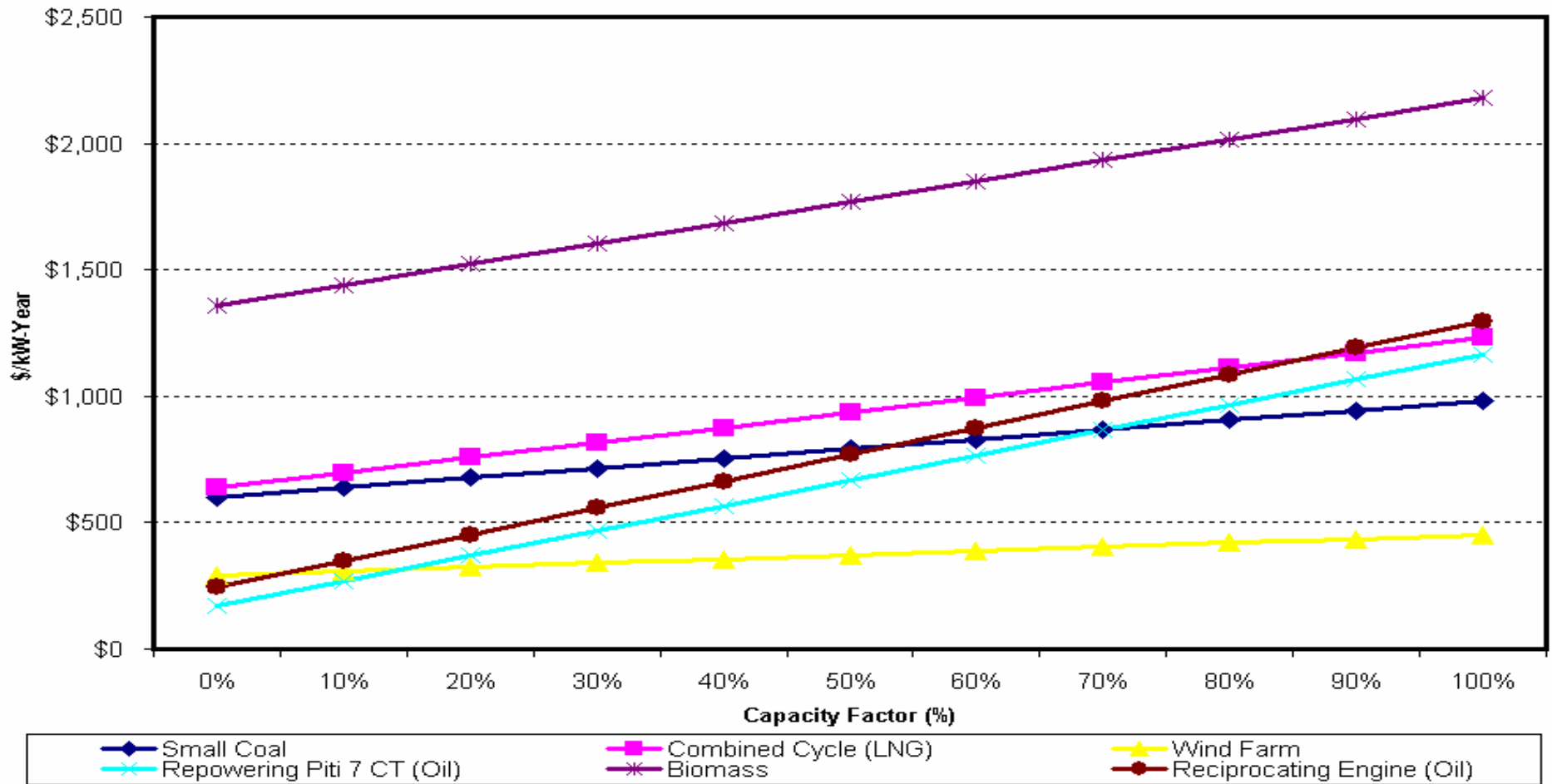
FOM does NOT include property taxes, insurance, or debt service and include CapEx

Manufacturing slots for wind turbines are currently sold out through 2009.

Capital costs for Options 1 and 2 include \$25 million of interconnection costs as an allowance for jetty design and construction and bulk handling equipment

# Levelized Costs of Resource Options - Preliminary Screening Curve

Levelized Costs of Resource Options



# Demand-resource Options: Preliminary List

## Energy efficiency equipment measures:

Boiler/furnace retrofits/installations

Air conditioning retrofits/installations

Heat pumps retrofits/installations

Insulation of air ducts

Insulation of boilers and pipes

Clock thermostats and equipment system timers (summer)

Clock thermostats and equipment system timers (winter)

Energy efficient lighting

Electric motor replacements

# Demand-resource Options: Preliminary List

## Renewable energy measures:

Solar photovoltaic (Distributed Generation)

Solar thermal

Day lighting technologies

## Energy information programs:

Energy audits

Public education programs

Use of infrared heat detection equipment

Equipment inspection programs

# Demand-resource Options: Preliminary List

## Utility efficiency measures:

Upgrading of distribution lines/substation equipment

Power factor improvement

Distribution efficiency upgrades and maintenance

Street lighting

# Demand-resource Options: Preliminary List

## Load management and Demand Response measures:

Load management (HVAC)

Load management (water heating)

Demand control techniques and equipment

Smart meters or automated equipment

Time-of-use meters

## Rate design:

Time-of-day rates

Seasonal rates

Interruptible rates

# DSM Program : GPA Past DSM Experience

- Efficient Room A/C program has highest customer acceptance (~600 rebate applicants per year). The program accounted for 86 % of total energy savings.
- Commercial A/C Program has been fairly consistent (~60 participants per year): (Hotels, Restaurants, Retail Outlets, ..)
- Incremental Energy Impact:

	Year 1	Year 2	Year 3
MWh	3,139	2,815	3,449
kW	448	421	531

# DSM Programs : Technical Screening Assessment (Measure Applicability to GPA)

	Residential	Commercial	Comments
<b>Energy efficiency equipment measures:</b>			
Air conditioning retrofits/installations	3.2	3.6	This was most popular program. 27% of Energy use is A/C (Residential).
Heat pumps retrofits/installations	2	2.6	Water heating is one of the highest contributors in residential.
Clock thermostats and equipment system timers	2.6	2.6	This can help reduce air conditioning loads, one of the highest energy contributor in residential and commercial.
Energy efficient lighting	4.2	4.6	Lighting is a larger contributor in energy bills among commercial customers in comparison with residential.
<b>Renewable energy measures:</b>			
Solar photovoltaic	3.8	3.8	Guam has an abundance of sun's energy. .
Solar thermal	3.8	3.8	Guam has an abundance of sun's energy.
<b>Energy information programs:</b>			
Energy audits	3.4	3.6	GPA used to perform commercial energy audits. This is a good program to know where energy is used and target the biggest impact. But this require a lot of resource and time. T
Use of infrared heat detection equipment	2.6	3.4	If we know where the heat sources are, we can insulate or block the heat from filtering into air conditioned homes and business buildings.

# DSM Programs : Economic Evaluation (Measure Cost Effectiveness)

- **Utility Cost Test** - A measure of whether the benefits of avoided utility costs are greater than the utility's cost to implement the DSM program.
- **Rate Impact Measure (RIM) Test** - Tests whether non-participants in a DSM program experience an impact in rates.
- **Total Resource Cost (TRC) Test** - Tests whether total benefits to DSM participants and the utility are greater than DSM program costs.

# Questions?