

Denver International Airport Energy Management Program

An aerial photograph of Denver International Airport. The main terminal building with its distinctive white, tent-like roof is visible in the center. Surrounding the terminal are parking lots filled with cars and several large, rectangular solar panel arrays installed on the ground. The airport is situated in a flat, open landscape under a clear blue sky.

Presented to Environmental
Regulations Workshop

Woods Allee CM

DIA Was Built with the Environment in Mind

- Seven Onsite CNG Fueling Stations- CNG Bus fleet
- APU and PC air supplied to 100% of contact gates
- Alternative fueled vehicles
- Terminal and concourses designed to benefit from natural light



DIA Energy Management Program

» Triple-Bottom-Line

» Financial - NPV

» Jobs

» Comfort/Performance

» Being and being seen as a good neighbor

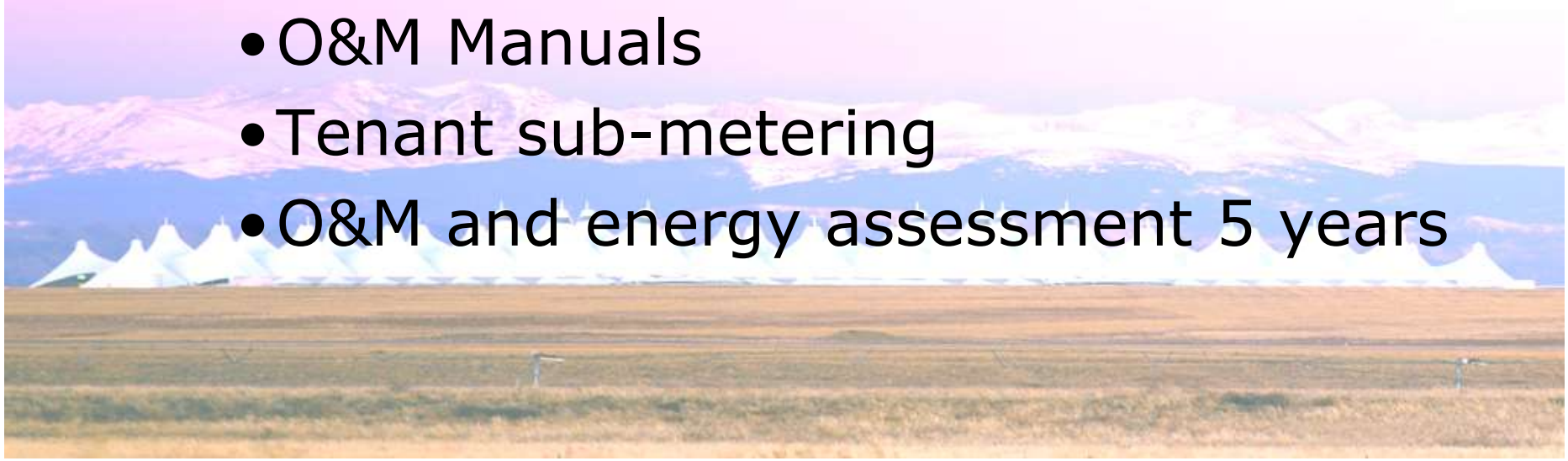


Energy Management Foci

- Improve energy related O&M procedures – Up to 15% of whole building energy cost, very short payback, requires team effort
- Recommission/optimize major energy consuming facilities – 10-25%
- Install cost effective energy conservation measures – 10-20%

O&M Procedures

- Comprehensive O&M related procedures
- ID resources
- Quality control
- M&V
- O&M Manuals
- Tenant sub-metering
- O&M and energy assessment 5 years



Periodic Recommissioning

- Plan and identify the project team
- Performance baselines
- Testing HVAC and controls systems and develop measures
- Implement
- M&V
- Regular basis



ECRMs

- Major equipment upgrades
- Payback 2-20 years, we use 4
- Examples lighting, BAS, HVAC, HE motors, VFD...etc
- Renewables
- Prioritize measures
- Multi-discipline energy management team
- Xcel rebate program

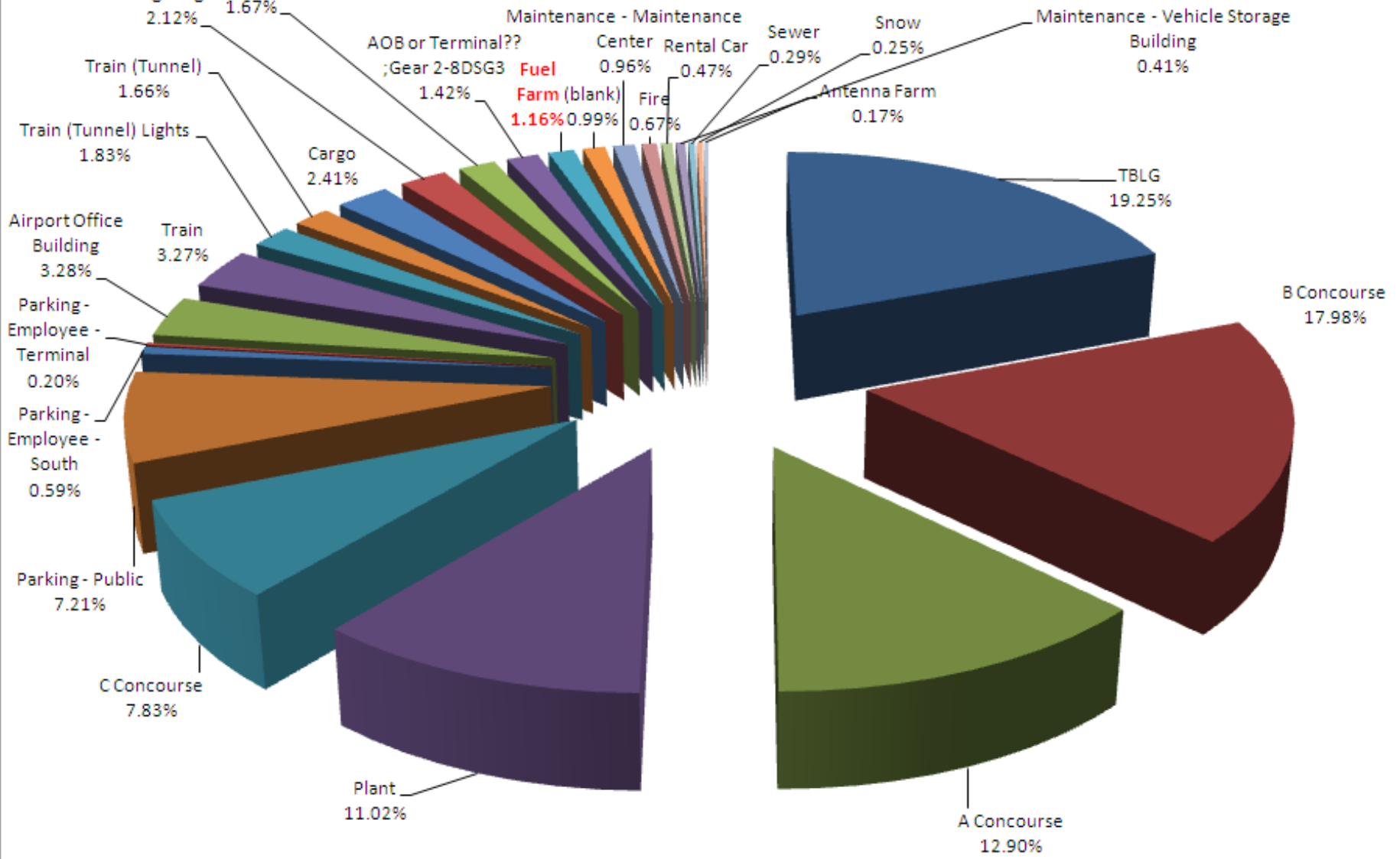
FIMs by Payback

#	FACILITY IMPROVEMENT MEASURE (See Detailed Description in Section III)	FINANCIALS										
		ANNUAL ENERGY/WATER SAVINGS \$	ANNUAL ASSOCIATED SAVINGS \$*	ONE TIME POTENTIAL REBATE \$	ANNUAL REVENUE INCREASE \$	COST TO IMPLEMENT \$	ACCUMULATED COST TO IMPLEMENT \$	SIMPLE PAYBACK YRS	NET PRESENT VALUE AT 5% & 10 YEARS	RATIO OF NPV TO COST TO IMPLEMENT	NPV AT 5% & 10 YEARS WITH 4% ESCALATION	RATIO OF NPV (WITH ESCALATION) TO COST TO IMPLEMENT
1D	Demand Based Ventilation Control	\$ 425,000		\$ -		\$ 215,000	\$ 215,000	0.5	3,292,676	15.31	\$4,047,076	18.82
1C	Air Handling Unit Tuning	\$ 88,000		\$ 15,000		\$ 179,000	#REF!	1.9	743,606	4.15	\$913,977	5.11
1G	Central Plant Variable Flow Pumping	\$ 64,000		\$ 50,000		\$ 171,000	#REF!	1.9	699,898	4.09	\$860,254	5.03
2B	Other Lighting Opportunities	\$ 418,000	\$ 356,000	\$ 179,000		\$ 4,564,000	#REF!	3.6	9,908,003	2.17	\$12,178,068	2.67
2C	Parking Garage Lighting	\$ 183,000	\$ 54,000	\$ 90,000		\$ 1,242,000	#REF!	5.4	1,768,298	1.42	\$2,173,441	1.75
1I	Destratification Fans	\$ 65,000				\$ 518,000	#REF!	8.0	501,913	0.97	\$616,908	1.19

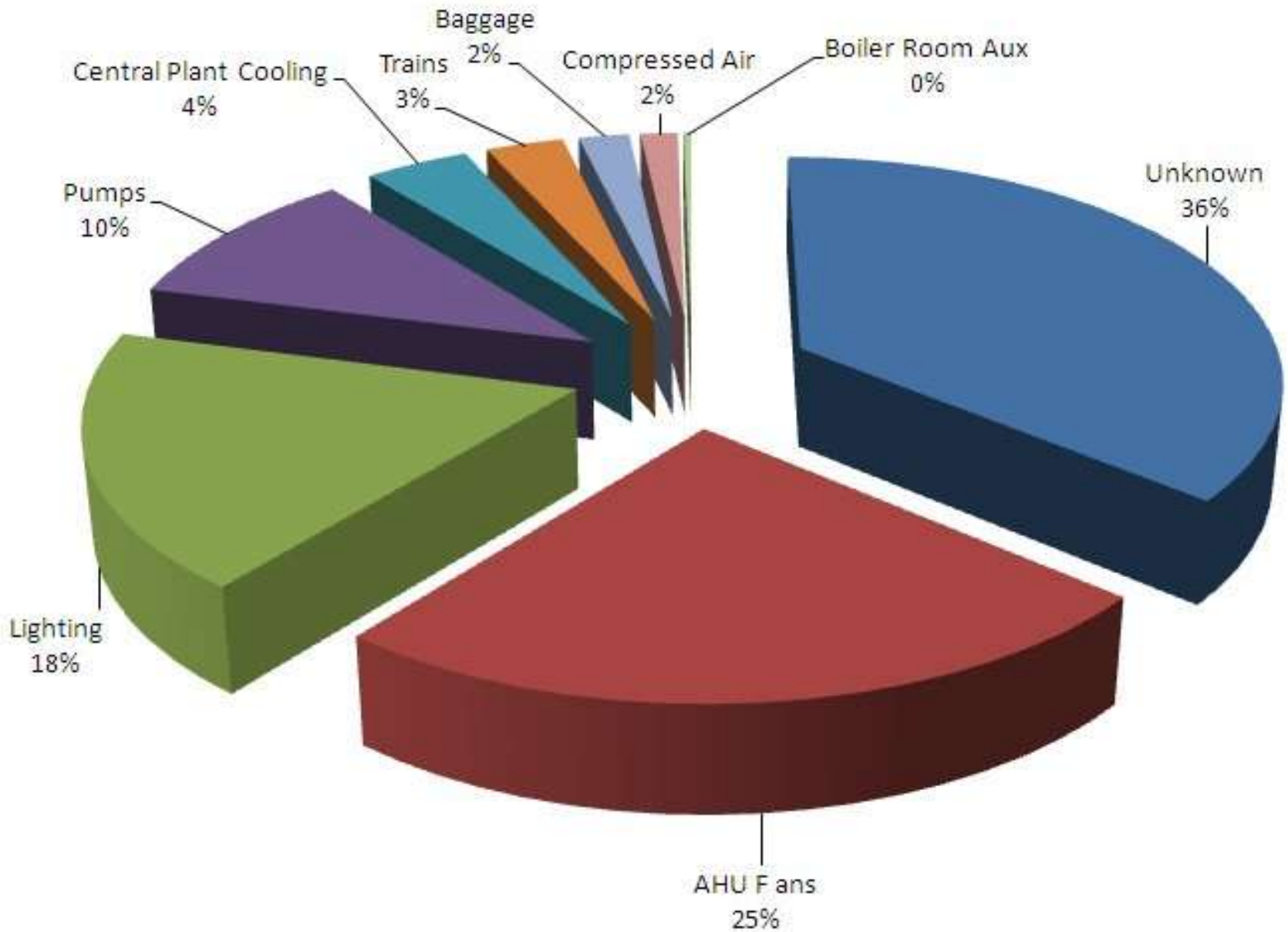
Current Top Priorities

- Monthly reports – kWh/unit e.g. area
- Conduct baseline study (Audit)
- Procedures – plant retrofit, purchasing and replacement
- Resourcing
- Demonstrate corporate commitment
 - Potential ISO certification
 - Regular agenda item at executive meetings
 - Re-establish energy committee

Electric Usage \$16.7M/yr 219 GWH/yr 2010



Preliminary Electric Allocations



DIA Energy Management Projects

- EcoStart Motor Controllers installed 2007-2009
- Lighting Retrofits – 6,500 + 4,500
- Employee Awareness Efforts
- Central Plant Control Upgrades
- Energy Strategy & Management Study
- LED Taxiway Lighting – O&M program
- HVAC Controls/recommissioning
- Hydronic Pump System Optimization
- Renewables - Solar

DIA PV Installations

- Public-Private Partnerships
- Achieved through Ground Lease and Power Purchase Agreements
- Interconnection Agreements with Xcel
 - * Owner receives:
 - Federal tax benefits,
 - Renewable Energy Certificates (REC) payments - Xcel
 - Solar Rewards rebates from Xcel
 - Sells power to DIA
 - DIA as site host --- energy in excess of that used at the meter is sold to Xcel



Denver
International Airport
Current PV
Installations

DIA II DIA III

16R

16L

8

DIA I



DIA I - Pena Blvd PV Facility

- Facility Owner – Fotowatio Renewable
- Contractor - Entech Solar (WWST) IME
- Total construction cost approximately \$1
- DIA pays RV a fixed price per kWh
- Breakeven NPV for DIA assuming 3%/yr
- Commissioned September 2008



DIA I

- Capacity: 2MW DC. (1.8MW AC)
- Annual production is approximately 3.5 million kWh
- Flat single axis tracking system
- 7.5 Acres of arrays
- 9254 panels; 8 Arrays served by 8 Inverters
- kWh production consistent with forecast

DIA II - Fuel Farm PV Facility

DIA Fuel Storage & Distribution Facility

Owner - Airport Solar One LLP (Oak Leaf Energy Partners principle developer / MP2 Capital)

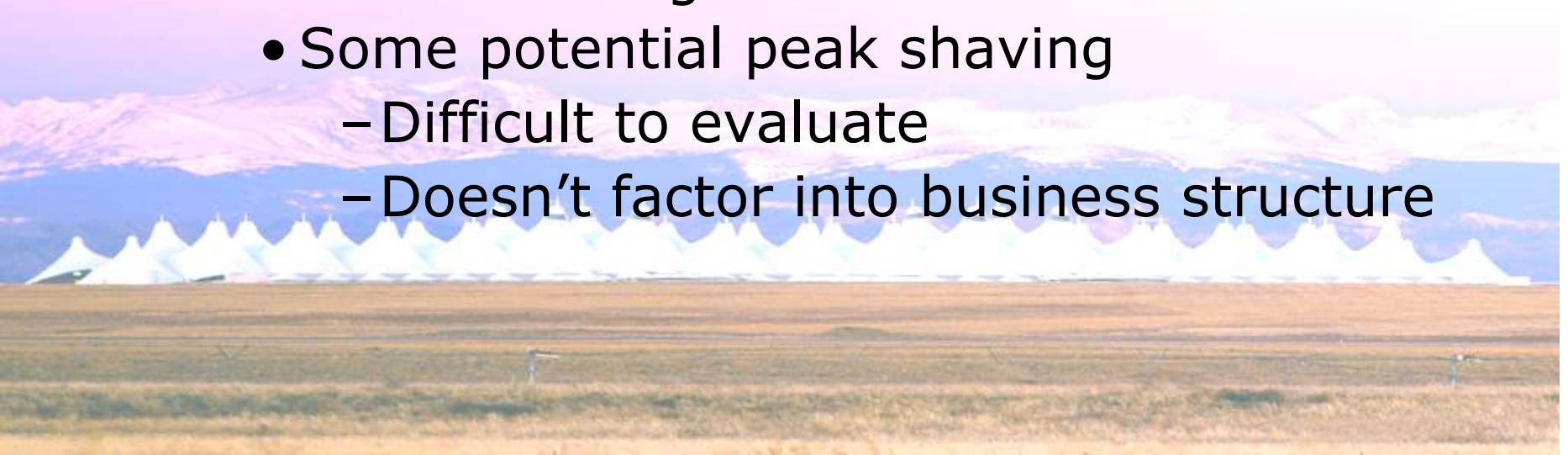
Contractor IME

DIA buys power for 90% of energy rate

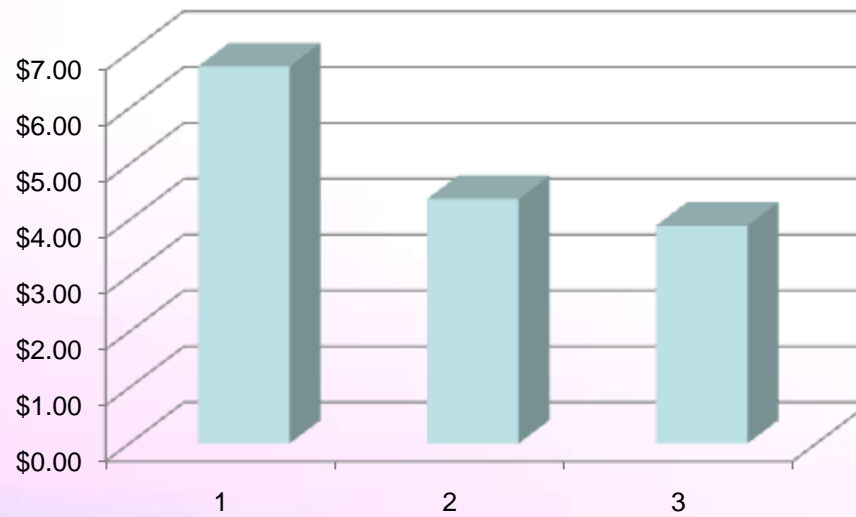


DIA II

- 1.6 MWDC, ~2.4 million kWh annually
- 25 degree fixed tilt somewhat less efficient per panel than the flat tracker...but far less costly to construct
- Cost ~ \$7 million
- 7250 Panels ~ 7.5 acres
- Output matches well to the overall electrical usage of the Fuel Farm
- Some potential peak shaving
 - Difficult to evaluate
 - Doesn't factor into business structure



PV Installation Cost/Watt



DIA III



DIA III

- 25 degree fixed tilt
- 4.3 MWDC/18,980 235W panels
- Business structure similar to DIA II
 - 80% of energy rate
- Complete and commissioned July 2011
- Approximately 28 acres
- Generates ~6.9 million kWh
- All together ~12.8 million kWh about 6% of usage

Questions?

