



iCAST
community powered results.

The ICAST Way



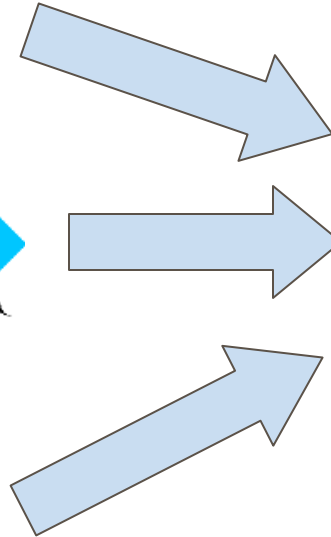
Education
Institutes



Industry



Govt. & NGO



Developing
Communities



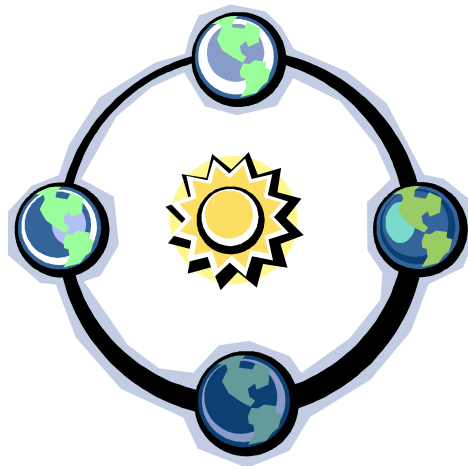
community powered results.

Team Members (sample)



Name	Background
Ravi Malhotra, Executive Director	B.S. & M.S. in Engineering & MBA. 17 yrs of business experience with start-ups including entrepreneurial.
Peter Mannetti, Chairman	Managing Partner at Isherpa Capital, a venture capital firm. Former founder and CEO of USWest Wireless.
Frank Stewart, Director	Retired. Asst. Secretary, Office of Energy Efficiency & Renewable Energy, Dept. of Energy, D.C .
Alexander Bracken, Director	Executive Director, Bard Center of Entrepreneurship, College of Business, Univ. of Colorado at Denver
Ron Bills , Director	Ex-CEO of Segway and Polaris. Investor and mentor. Board member at CU-Denver.
Paul Aldretti , Programs	Managed the Colorado Environmental Partnership . 20 years managing programs in the Energy field.

Sample Projects



Business Development



- **Off-Grade/Culled Potatoes**
 - **Food Grade Starch**
 - **Fresh Cut Processed Food Products**

- **Bio-Diesel**
 - **Oilseed crops**
 - **Community Scale**



Natural Resource Utilization



■ Solar

- Roof Top PV
- Solar Thermal
 - Hot Water
 - Space Heating

■ Wind

- Small Scale

■ Geothermal

- Spa
- Green Houses
- Space Heating
- Aquaculture



Biomass Utilization



Potential Opportunities



- Fuel Reduction/Thinning
- Sort Yard
- Sawmills – processing small diameter
 - Variety of wood products
- Construction (Log Homes, Flooring, Panels, Siding)
- Fences, Posts, Poles
- Specialty Products (Furniture, Work Surfaces, etc.)
- Pellets / Briquettes
- Animal Bedding
- Mulch and other landscaping products
- Compost (sawdust + potatoes)
- Space/district heating



Project Partners



■ **University**

- **Forestry Dept: CSU-Fort Collins**
- **Engineering: CSM-Golden, CU-Boulder, CSU-Pueblo**
- **Business: ASC, CU-Denver, UNM, CSU, Highlands Univ.**

■ **Government**

- **USFS, BLM & State Forest Service**
- **USDA – Rural Development**
- **Dept. of Energy – National Renewable Energy Lab.**

■ **Local Stakeholders**

- **Economic Development Groups**
- **Local Communities, Counties & Towns**
- **Sawmills, Loggers and other forest product businesses**
- **Potential Entrepreneurs**

Process Steps



1. Resource Assessment

- **Forest and other biomass sources**
- **Quantity, Type and Procurement Costs**

2. List Utilization Opportunities (to match the resources)

- **Identification and**
- **Preliminary Evaluation of technologies**

3. Selection of Optimal Business Solution(s)

- **Recommendation based on community input**

4. Business Plan Development

- **In partnership with community/entrepreneur**

5. Implementation & Outreach

- **Establish key partnerships**
- **Information Dissemination**

Biomass Utilization

Waste Utilization



■ Compost

- ❑ Wood Waste
- ❑ Animal Manure
- ❑ Agricultural Waste

■ Bio-Energy

- ❑ Wood Pellets
- ❑ Space Heating
- ❑ Briquettes
 - Fly Ash & Coal Fines + Wood Waste



Bio-Energy



Space Heating



Space Heating Facilities



- **Commercial/Residential/Government**
 - **Schools & Colleges**
 - **Hospitals & Prisons**
 - **Government buildings & Military bases**
 - **Residences & hotels**
 - **Nurseries & greenhouses**
 - **Sawmills**
- **Single buildings**
- **District heating**



Process Steps

1. Initial Screening

- Quick Go/No-Go

2. Feasibility Study

- Evaluate Heating Load
- Resource Availability
- Technology & Sizing
- Environmental Review
- Preliminary Economic Analysis
 - Financing options

3. Implementation

- Finance
- Engineering Design
- Environmental Permits
- Fuel Supply Contract
- Equipment Purchase
- Installation
- Training

4. Operation

- Regular O&M



ASC - Rec. Center



Economics

- **Current Gas costs ~ \$100,000**
- **Bio-energy system Capital Cost ~ \$500,000**
- **Annual Savings from bio-energy system =
\$100,000 - \$35,000 = \$65,000**
- **Performance Contracting Model**
 - **Tax benefits of depreciation**
 - **Enterprise credits**
 - **Federal Tax Credit**

ASC - Rec. Center



Environmentally friendly

- **Air emissions:**
 - **Biomass: few particulates, SO₂, NO_x, and methane**
- **Greenhouse Gases:**
 - **Biomass IGCC nearly zero net GHGs**
 - **Average coal system: ~1,000 g CO₂-equiv/kWh**
 - **NGCC system: ~500 g CO₂-equiv/kWh**
 - **Today's biomass systems remove GHGs from atmosphere**
 - **Cofiring: greater reduction than rate of biomass input**

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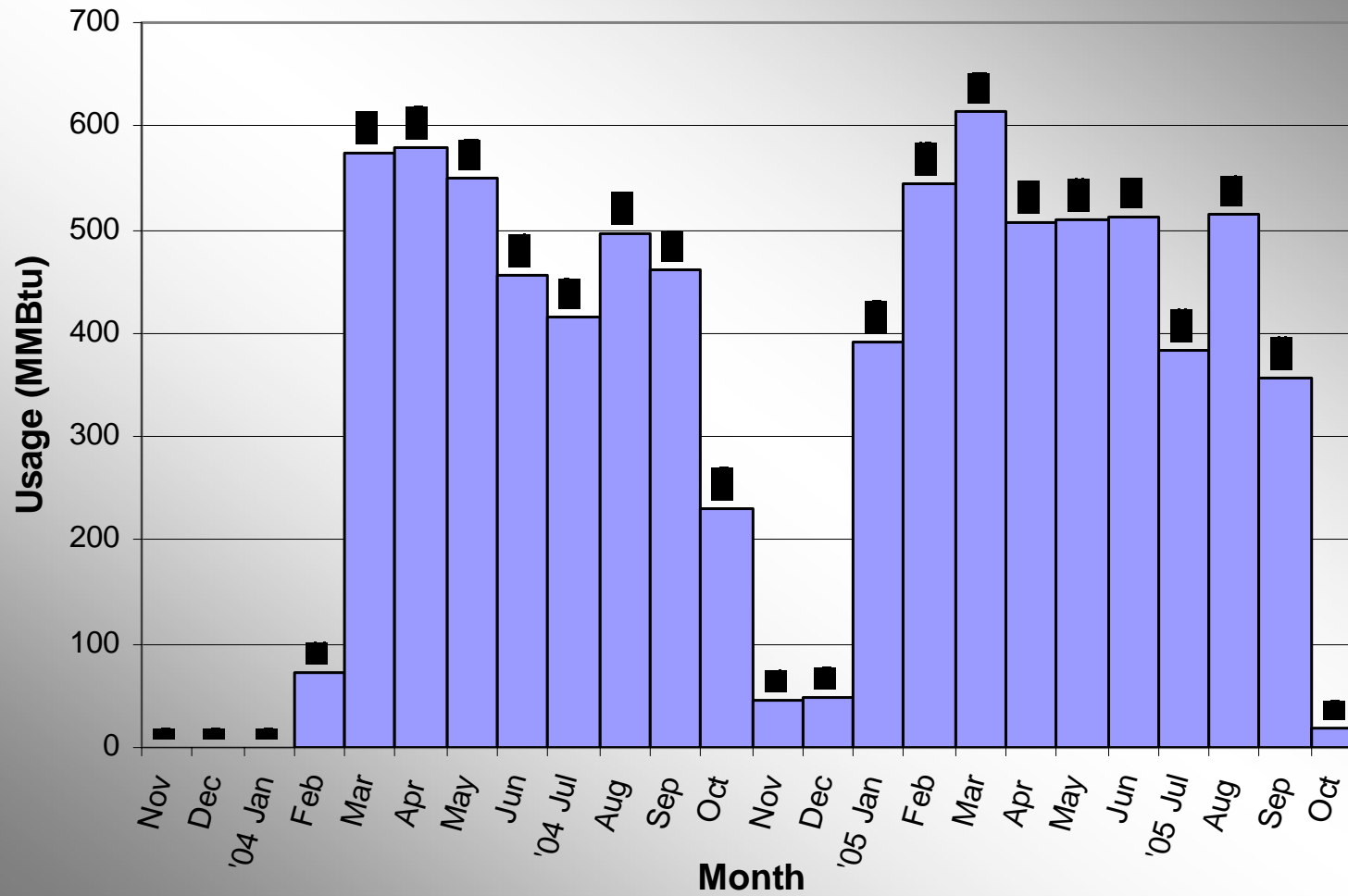
Community Acceptance

- Sample size = 200
- Initial response was 68% in favor & 10% not in favor
- Response after info dissemination was 82% in favor & 5% not in favor

Ski-Hi Community Ctr



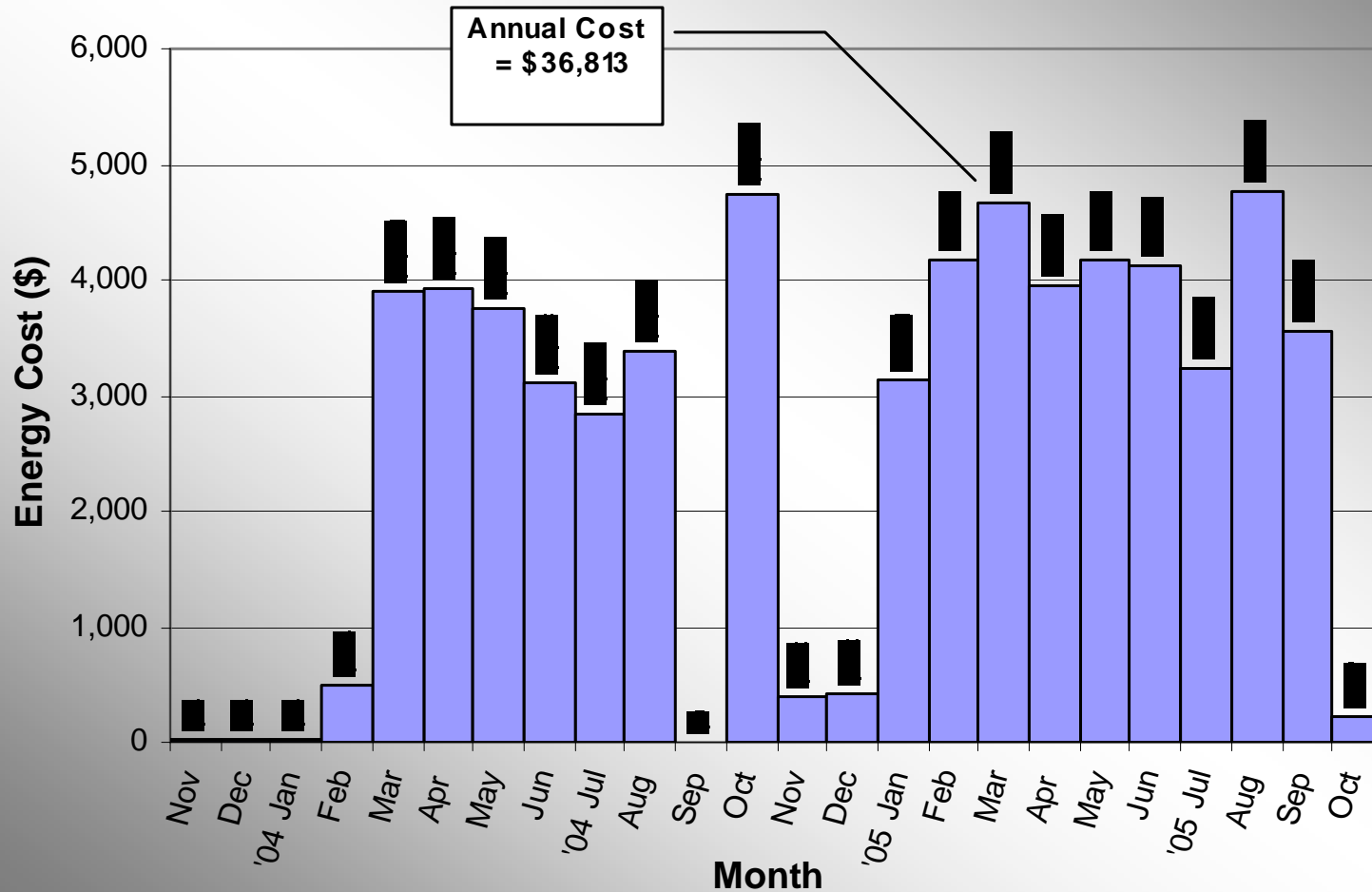
Ski-Hi Pool Monthly Gas Consumption



Ski-Hi Community Ctr



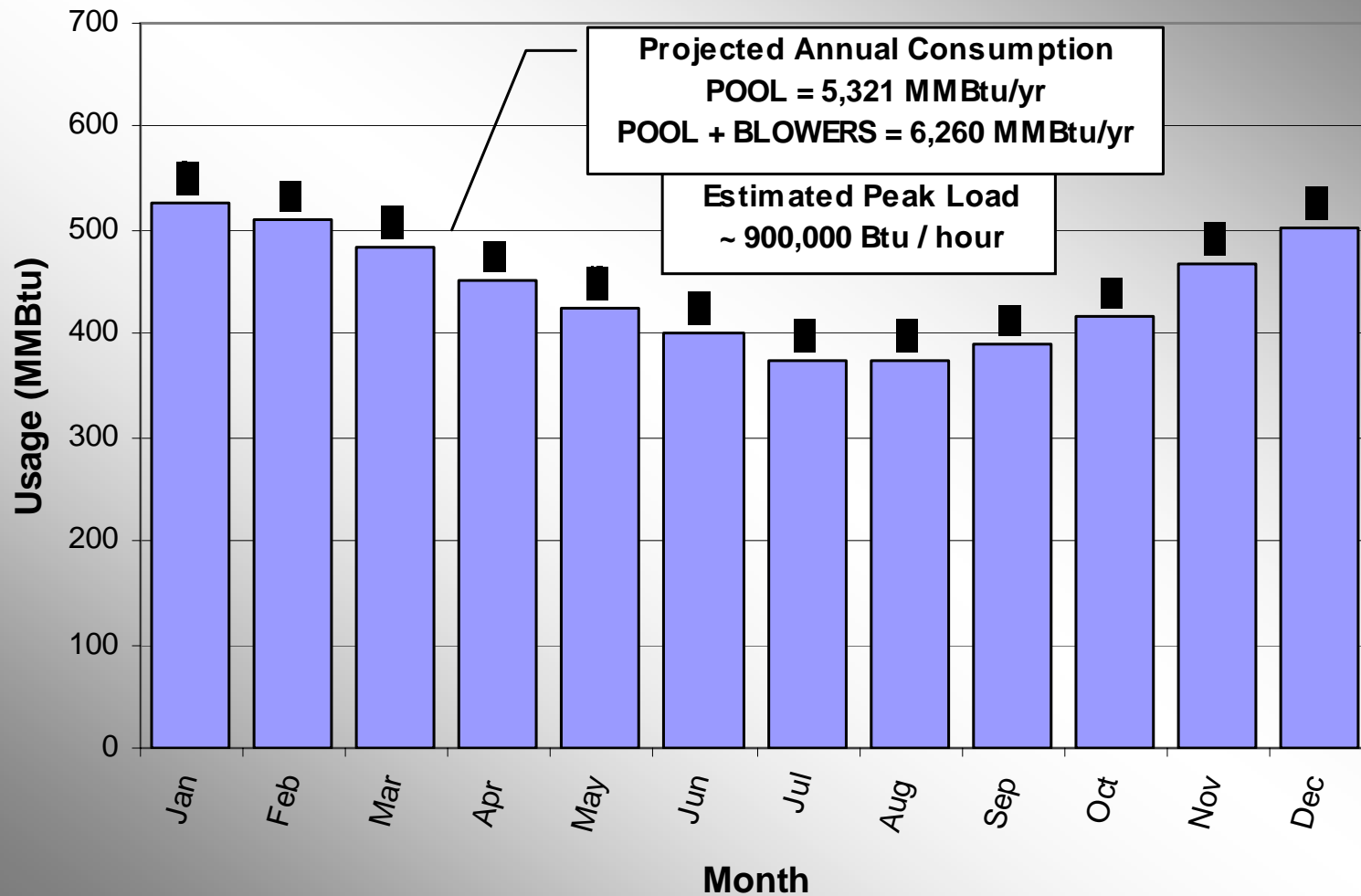
Ski-Hi Pool Monthly Gas Costs



Ski-Hi Community Ctr



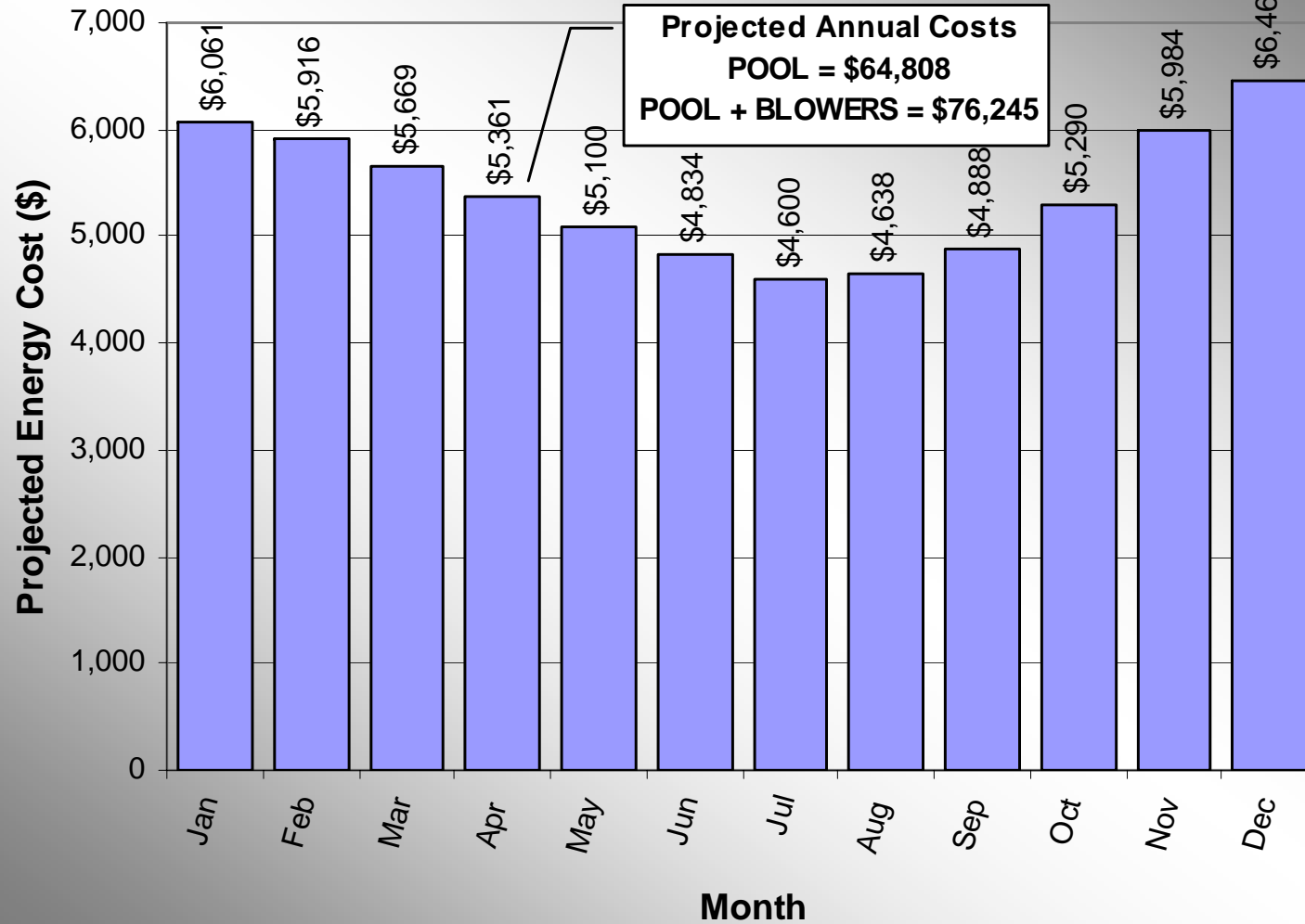
Ski-Hi Pool Projected Gas Consumption



Ski-Hi Community Ctr



Ski Hi Pool Projected Gas Costs



Ski-Hi Community Ctr



Proposed Bio-Energy System

Type:	Wood chip-fired boiler
Manufacturer:	Messersmith Mfg., Inc.
Output:	1,000,000 Btu / hour
Boiler Efficiency:	70 - 75%
Fuel requirements.:	838 tons / year (dry chips)
Fuel deliveries:	3 to 4 truck loads per month
System cost:	\$200,756
Installed costs:	\$350,000

Ski-Hi Community Ctr



Year	0	1	2	3	4	5
CapEx.	\$350,000	\$40,678	\$40,678	\$40,678	\$40,678	\$40,678
Operation costs	\$0	\$21,000	\$21,630	\$22,279	\$22,947	\$23,636
Gas Savings	\$0	\$64,808	\$69,669	\$74,894	\$80,511	\$86,549
Cash Flow	(\$70,000)	\$3,130	\$7,361	\$11,937	\$16,886	\$22,236
NPV	\$73,204					
IRR	22%					

Bio-Energy



Co-Firing



Coal Wood Co-Firing

Waste headed to local Landfill

- **Coal Fired Power Plant**
 - **Stoker Technology**
 - **Fly Ash w/ Coal Fines**

- **Forest Fuel Reduction**
 - **Biomass Waste piles**



Coal Wood Co-Firing



Inputs

Daily Coal Use	450 tons
Daily Woody Biomass Use (permitted)	22.5 tons
Coal Cost	\$../ton
Wood Cost	\$../ton
Ash Revenue	\$../ton
Briquette Wood %	...%
Briquette Ash %	...%



Coal Wood Co-Firing

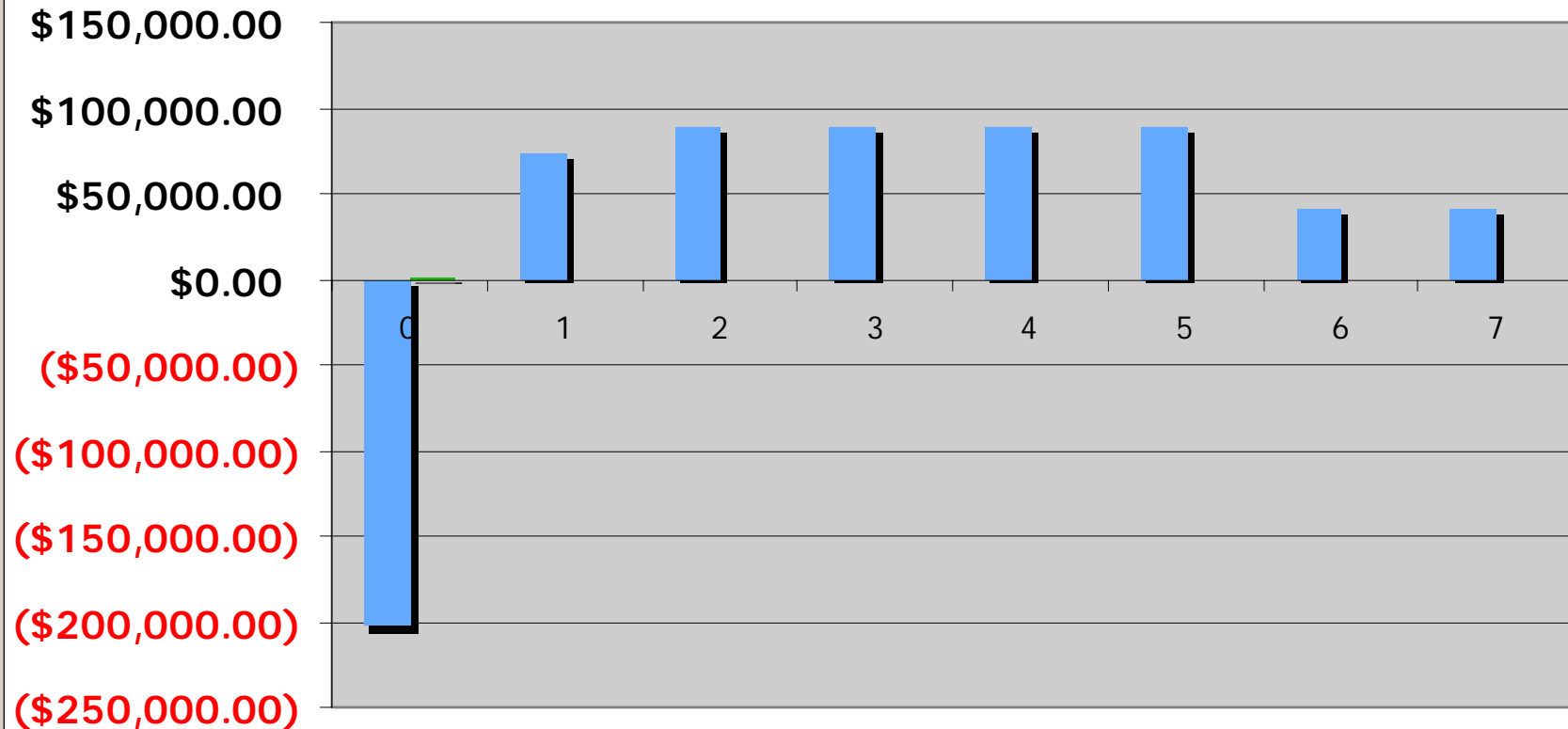


Fly Ash Production	45.5	tons / day
Fly Ash Energy Density	5,500	Btu / lb
Coal Energy Density	11,000	Btu / lb
Sawdust Energy Density	10,500	Btu / lb
Briquette Energy Density	8,500	Btu / lb
Briquette Price (same \$/Btu as coal)	----	\$ / ton
Coal Savings	----	\$ / day
Landfill fee	----	\$ / ton
Landfill Cost Savings	----	\$ / day

Coal Wood Co-Firing



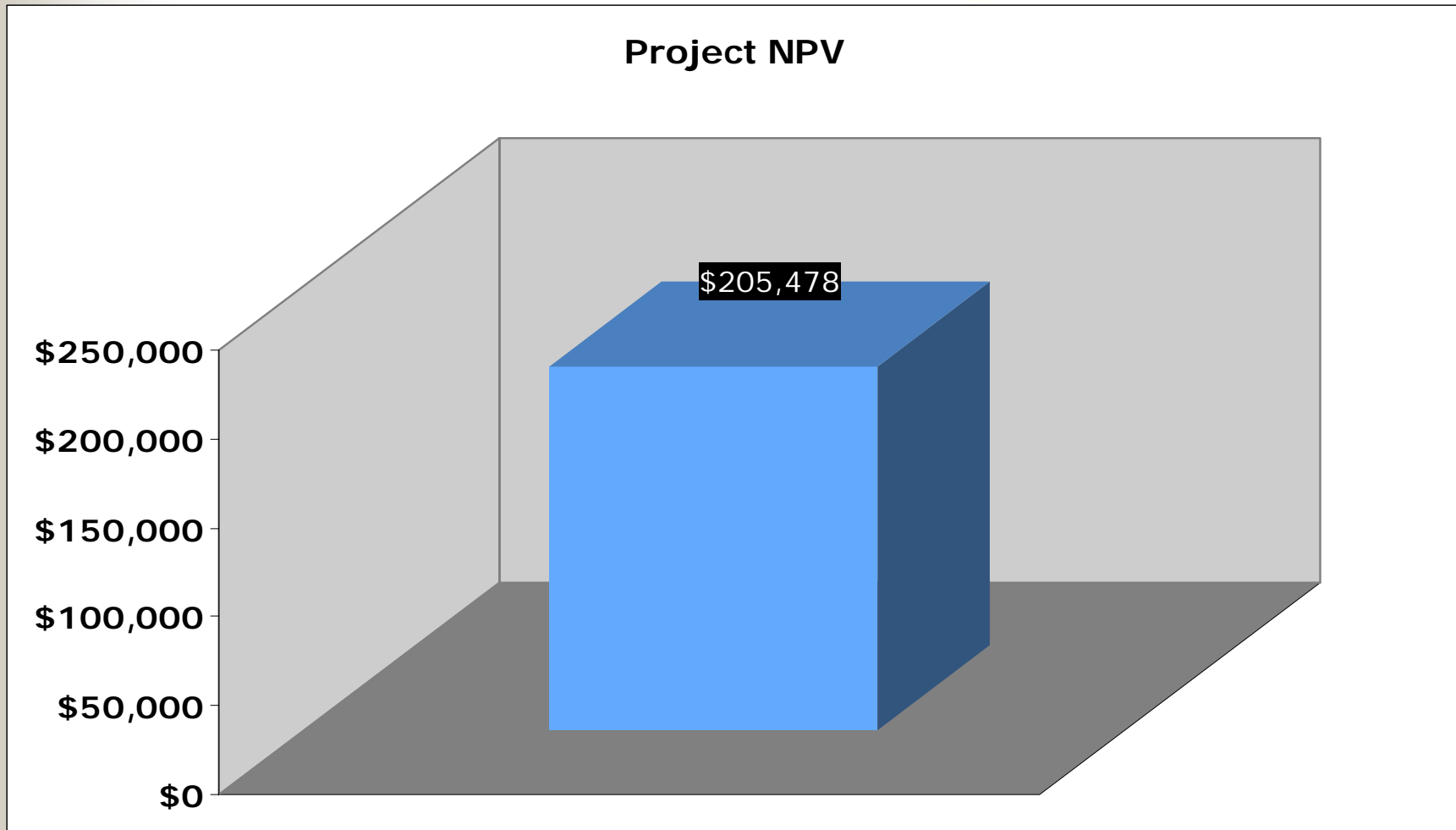
Annual Net Cash Flows



Coal Wood Co-Firing



Project NPV



Benefits



- **Creation of community wide partnership**
- **Low Capital Investments**
- **Job creation thru local entrepreneurs**
- **Develop multiple uses for forest biomass (no waste products)**
- **Replicable solution**
- **Environmentally friendly**
- **Sustainable**





ICAST

International Center for Appropriate and Sustainable Technology

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