

Energy Strategic Plan

Los Angeles Community College District

Community College League Conference

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LACCD & Sustainability

- In 2002
 - The Los Angeles Community College District adopted a “Policy of Sustainability”
 - Very progressive for the time “10% Renewable Energy”
- LACCD becomes:
 - One of the Original Signatory Members of the Clinton Climate Initiative
- In conjunction with the new building program
 - Board declares all new buildings will be at least LEED Certified
- Currently rolling out a district wide recycling
- Aggressively moving toward a “Carbon Neutral” platform and “100% Renewable Energy”

LACCD Comprehensive Energy Strategic Plan

A Paradigm Change:

1. Reconceptualizing Central Plants with efficient Renewable Energy
2. Conserving resources by managing the demand through Performance Contracts
3. Adding Non-carbon Energy Sources
 - One MW Solar/PV per campus
 - Hydrogen
 - Geothermal
 - Wind
4. Sustainable Curriculum Program

First step establish a baseline

West Los Angeles College

Total Gas Consumption

5,961 MMBTUs

Total Elec. Consumption

7,216,762 kW

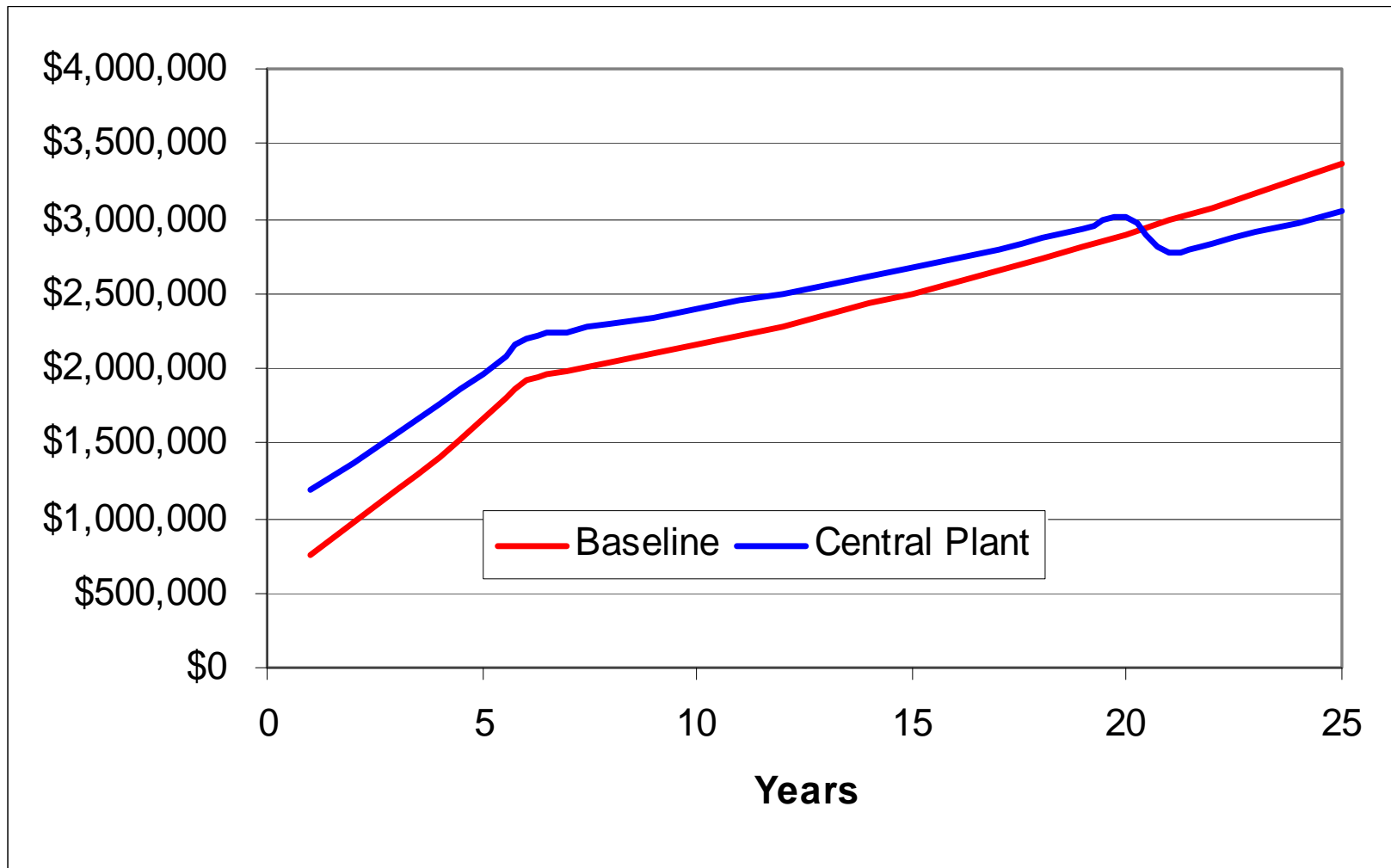
Total Water/Sewer

34,625 kgals

Overall Avg. Operating
Annual Budget

\$2,498,570

BASELINE vs CENTRAL PLANT LIFE CYCLE COST COMPARISON



Renewable Central Plant

Objectives

- One Central High Efficiency Sustainable Source for Hot Water and Chilled Water
 - Heating and Cooling
- Meet current demand with expansion capability for future facilities and needs
- Provide power for clusters of buildings
- Digital Control System

Central Plant Features

- Solar Heat Tube
 - Hot Water – near steam
- Absorption Chillers (Multiple Units)
 - Chilled Water for Air Conditioning
- Thermal Storage – Ice
- Hot Water Boiler / Heater
- Ground Source Geothermal
- Co-Generation – Electricity and Heat

Distributed Energy Solutions

- Renewable Hydrogen (H_2) is based on water electrolysis is the only pathway to deliver a zero-emission energy cycle
- H_2 is the ideal medium for storing electricity for on-demand distributed power generation and fueling
- Scale-up of renewable power and High Efficiency Storage (HES) solutions will address “clean and secure” energy requirements
- Wind power is becoming “low-cost” energy solution
 - New designs are now available
- Advanced solar technology and volumes driving lower costs
 - Significant potential for home energy applications

Central Plant Costs

- Proposition 39 bond resources
- SS. 5956 Private sector financing
- AB 1492 – State of California Financing through the Foundation for California Community Colleges
 - Lowest Cost Borrowing
 - Requires Intercept Mechanism

Performance Contracts

- Retrofit all energy consuming elements for maximum efficiency
- LED Lighting
- Install conservation features in all buildings
 - Insulation
 - Low-E Glass
 - White Roof
 - Green Roof
- State of the art and new technologies
 - Energy Efficient Equipment
- Metering and Monitoring Systems

Performance Contract Financing

- Design – Installation – Financing By Private Sector
- SS. 4217 Contract – 25 year payback maximum
- Uses Private Sector Funding
- Guaranteed Payback within existing utility charges
- Incentive Funds Available from California Public Utility Commission and municipal programs administered by the utilities

Performance Contract Arithmetic

- | | |
|--|---------------|
| • Electric / Gas Bill
Before Energy
Measures- Annual | • \$1,000,000 |
| • Electric / Gas Bill
After Energy
Measures - Annual | • \$ 800,000 |
| | <hr/> |
| • Difference (Amount
Available for
Payback) - Annual | \$ 200,000 |

Adding Non-carbon Energy Sources

- Starting with One Megawatt Solar / PV
 - Private Sector third party to install
 - Parking Lots and Roofs
- Hybrid systems with storage
 - Hydrogen
 - Ice
 - Battery
- Future technology innovations
 - New Generation Wind Turbines
 - Hydrogen Fueled Microturbines
 - Ground Source Geothermal

Initial SOLAR Cost Concept

- **Solar PV**

- Private Sector firm will install system and sell electricity equal to utility cost
- System will be net metered

- **Solar Heatpipe**

- Provides free energy source for cooling and heating
- Renewable and sustainable

Photo Voltaic Incentives

- California Public Utility Commission
 - \$3 billion over 11 years
- Solar / PV incentives
 - Investor-Owned Utility Groups such as (PG&E, SDG&E, SCE and SoCalGas)
 - Department of Water and Power (DWP)
- National Energy Act (05) with incentives in 06
- Aggregated buying of systems

Renewable Energies Arithmetic

- Federal Energy Credit – 30%
- Rapid Depreciation – 25 %
- Utility Incentives – 20 %
- Green Tag Sale – 5% (?)
- Bulk Procurement – 10 % (?)
- New Market Tax Credit – (?)
- 10 Cents on the Dollar !!!

Developing a Sustainable Curriculum

- Career tech education
 - Developing courses in green technologies
- Development of transfer courses
 - Developing classes in Sustainability
 - Infusing Sustainability into course curriculum
- Community Education
 - Forums
 - Lecture Series
 - Student-taught Seminars

Unique Learning Environment

- Green Buildings on different Campuses
 - focus on technology and learning from actual projects
- Courses offered as:
 - certificated, licenses and advanced degrees
- Career opportunities and training for:
 - jobs, new companies and advanced degrees
- Collaborate with:
 - unions, private businesses, public, government and non-profit sectors
- Provide actual experiences
 - on campus through building programs
- Sustainable Development Curriculum:
 - solar, wind, geothermal, hybrid technologies, economics, etc as well as new businesses, life cycle accounting, investment, operations and maintenance
- Impact on Climate Change –
 - the solutions for global warming are available today for immediate implementation

Off The Grid !!

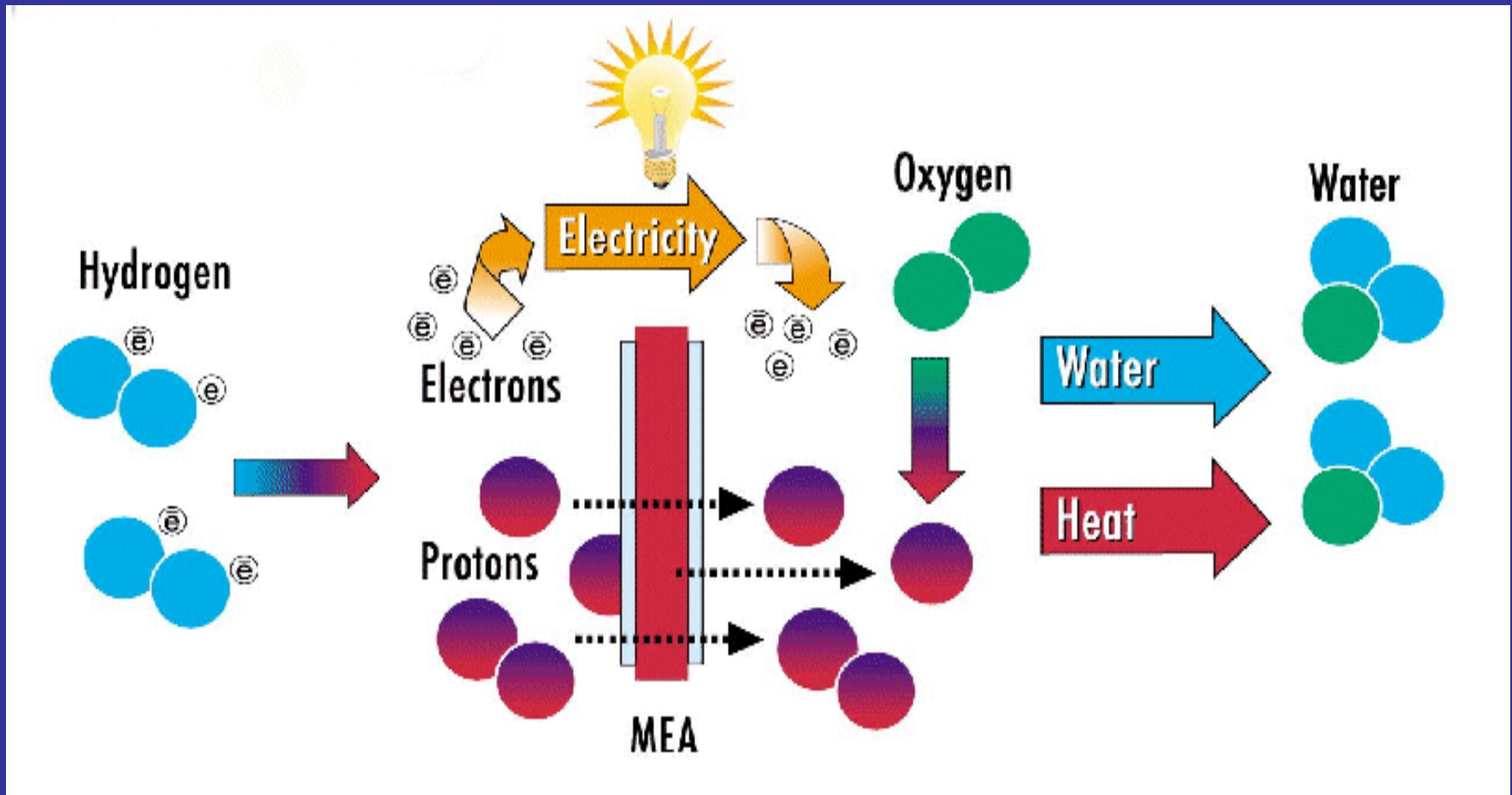
- Using current and future Proposition 39 bond resources
- Buy Out
 - Central Plant Loans
 - Performance Contracts
 - Photovoltaic / Fuel Cell Installation
- No Future Energy Cost !

Vacuum Tube Heat-pipe Collectors and Architectural Design Possibilities



Fuel Cell Basics

A fuel cell is a device that generates electricity by a chemical reaction



Fuel Cell System - 3 major modules

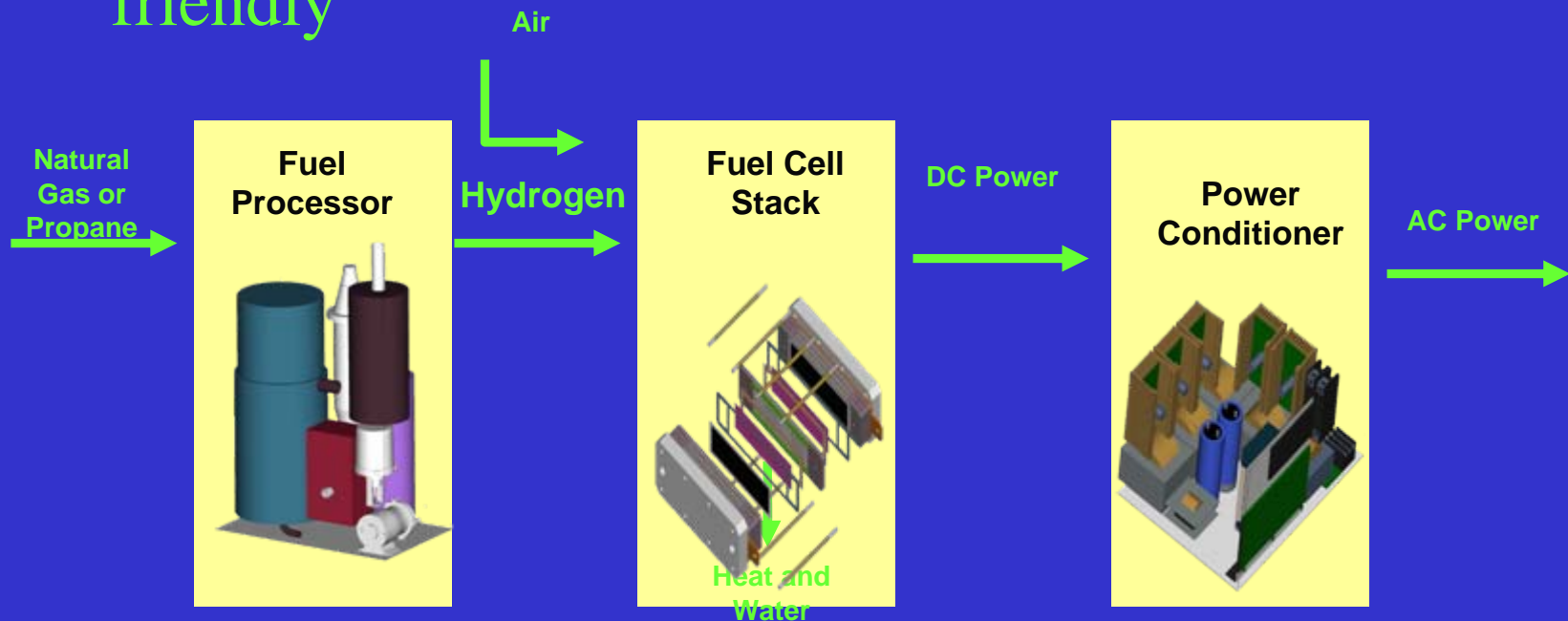
Fuel Processor Module (Reformer) - reforms natural gas (CH_4) into hydrogen rich gas (reformate) for use by fuel cell.

Power Generation Module (Fuel Cell) - uses hydrogen in reformate to produce electricity (DC voltage)

Power Conditioning Module (Inverter) - converts DC Voltage produced by the Fuel Cell into AC Voltage (240VAC) for use by the grid.

Integrated Fuel Cell System

- Direct energy conversion
- Low maintenance and capital costs
- More environmentally friendly
- Quiet operation
- Scalable
- No transmission and distribution losses



Power Generation

Fuel & Air Delivery

Cooling

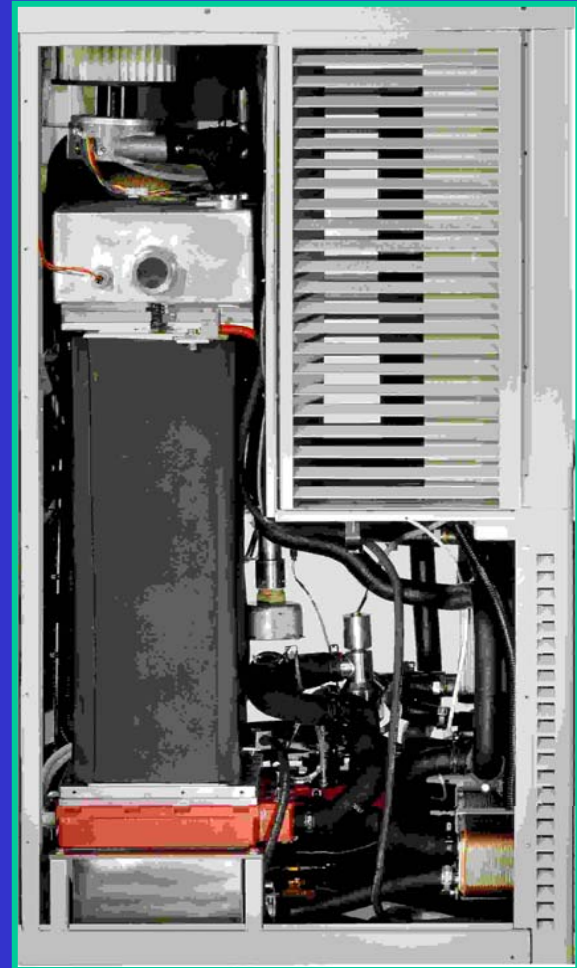
Waste Heat Capture

Integrated Controls

Fuel Processor

Stack/Balance of Plant

Inverter/Grid



Anaerobic Phased Solids Digestion Technology



An advanced and technically validated approach to the problem of handling a wide variety of problematic organic waste materials

Wind Power

Costs are competitive with natural gas



- Wind Power uses wind to create electricity
- Accounts for around 1% of California's electricity supply
- On-site Generation
- The turbine technology and costs have changed.
- *Courtesy of California Energy Commission and Distributed Energy Systems 2006 (modified)*