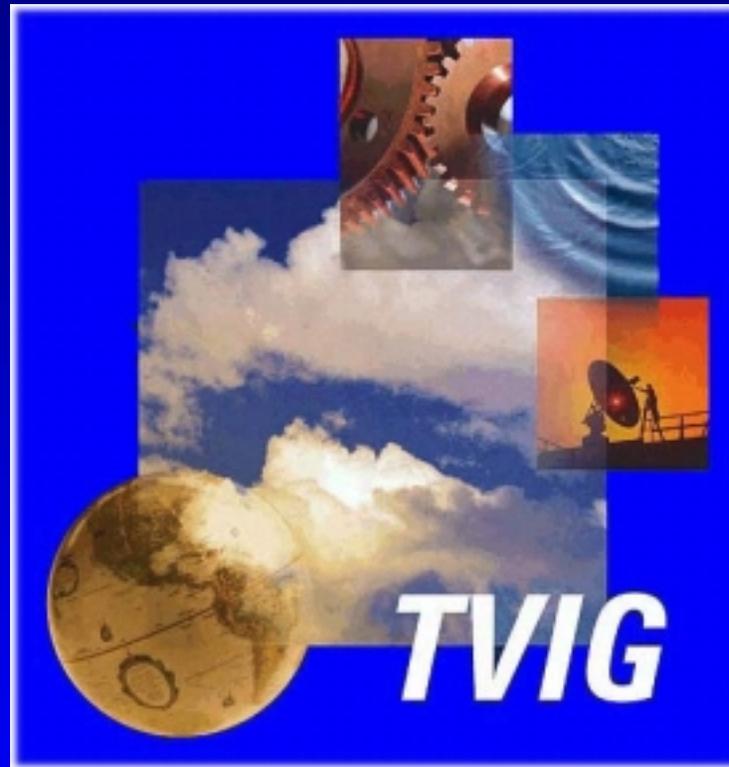




# Tennessee Valley Infrastructure Group, Inc.



## Economics of Megawatt-Scale Wind-Diesel Hybrids

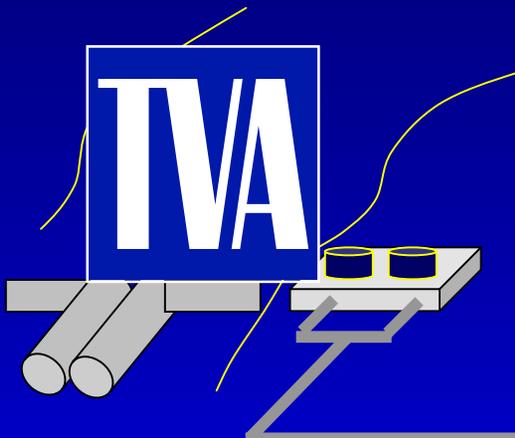
September 24, 2002

# Agenda

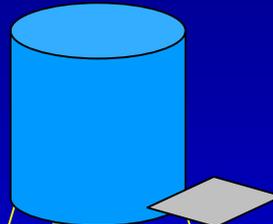
- **Who We Are**
- **Utila (Honduras) Case Study**
- **Economic/Financial Analysis**
- **Obstacles and Opportunities**



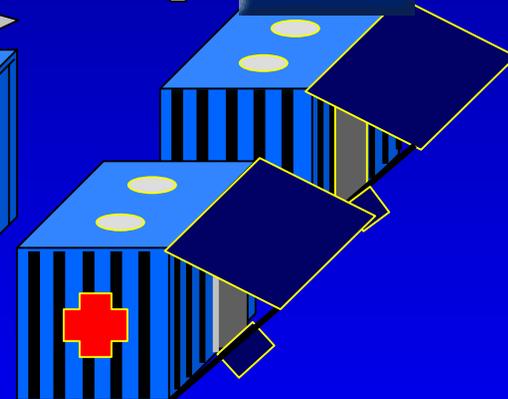
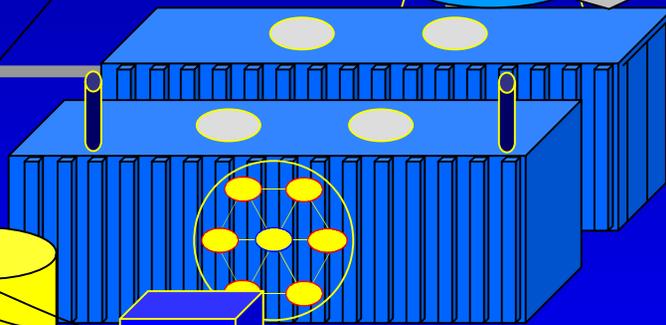
# What Is TVIG?



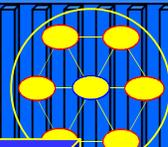
Vaughn & Melton



King Technologies



- IPDGroup
- Turnberry Investments, LP



International Business Initiatives



International Projects Group



## TVIG Accomplishments

- **Completed Projects:**
  - **Uzbekistan**
  - **Nigeria: 3.2 MW Diesel/Water Hybrid**
  - **Haiti: 5 towns, 29 MW Diesel Total**
  - **Kimball, Nebraska: 11 MW Wind Farm**
- **Under Development:**
  - **Honduras: 3 MW Wind-Diesel Hybrid**
  - **Tennessee: 25 MW Wind Farm**



# Kimball Wind Farm



# Honduras Case Study



# Utila



# Utila





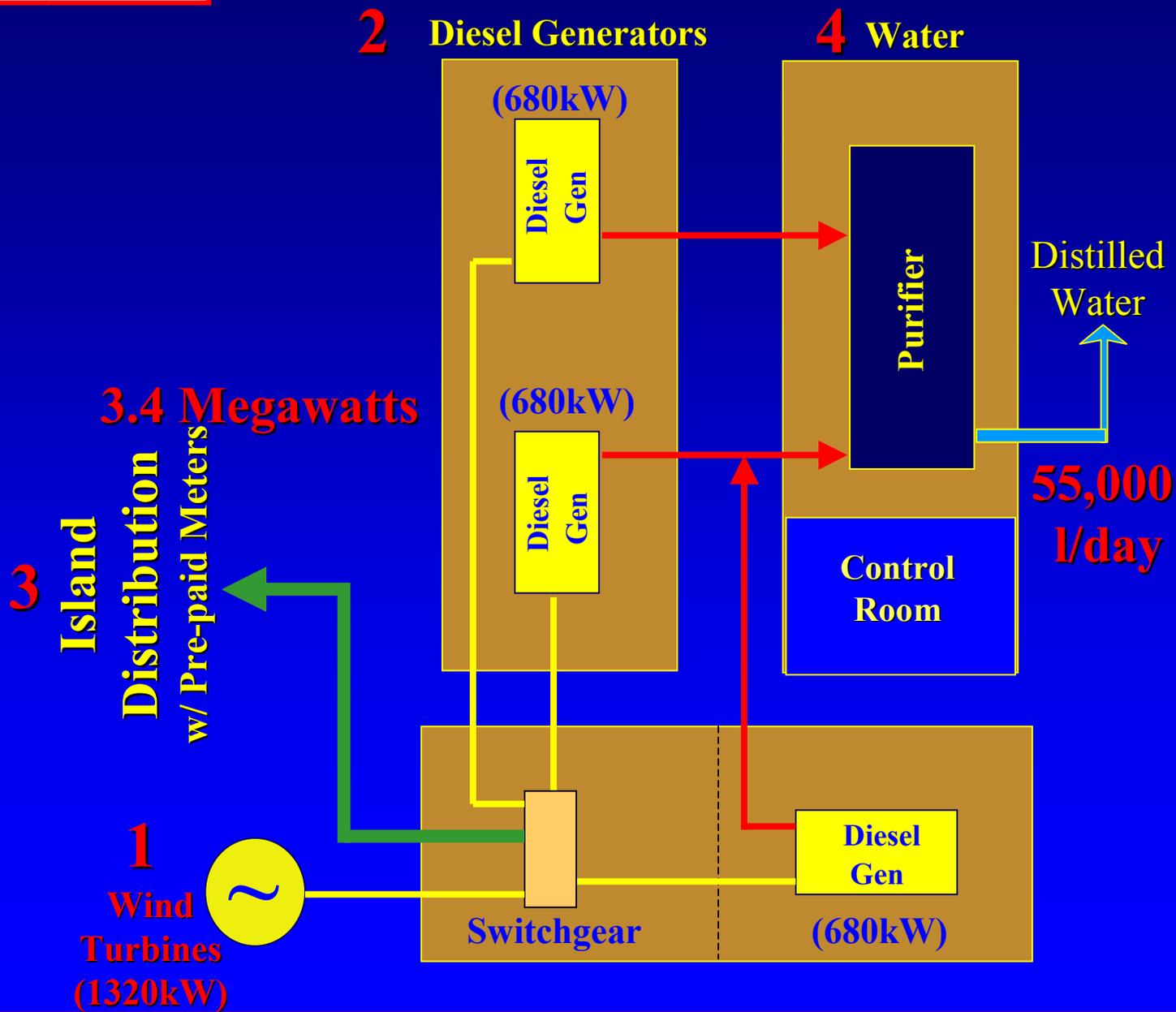
## Utila's Current Power Plant



+ 115 Privately Owned Generators!



# Utila Technical Solution



# Utila Grid Extension



# Utila





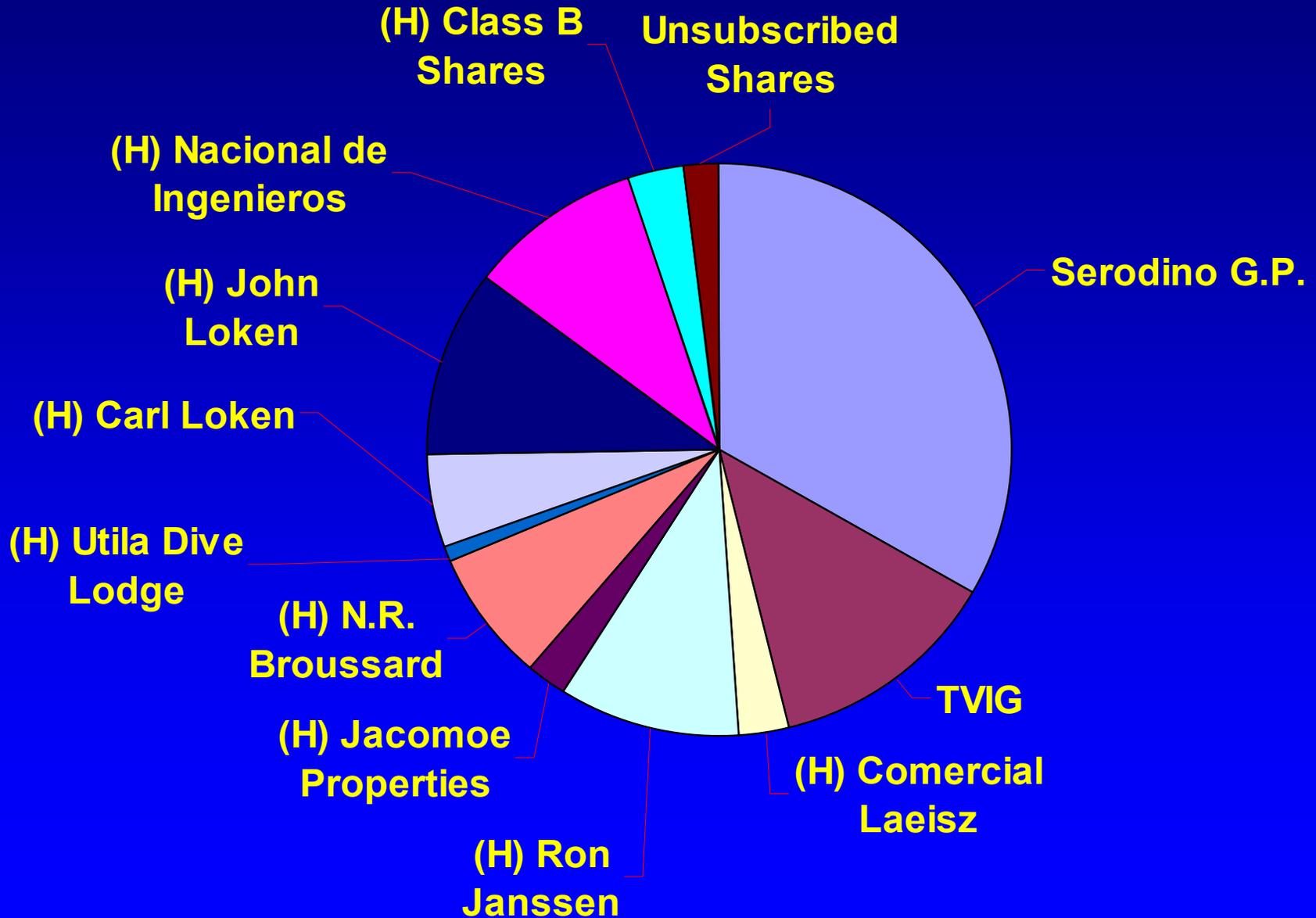
# Utila Business Objective

**Build Wind-Diesel Hybrid that is:**

- **Profitable**
- **Not Subsidized**
- **Highly Replicable**
- **Free of Beltway Bandits**
- **Free of Corruption**
- **Integrates:**
  - **Power (3-phase AC)**
  - **Water**
  - **Wastewater Treatment**
  - **Telephone**
  - **Management Systems**



# UPCo Ownership



## At UPCo Shareholder's Meeting





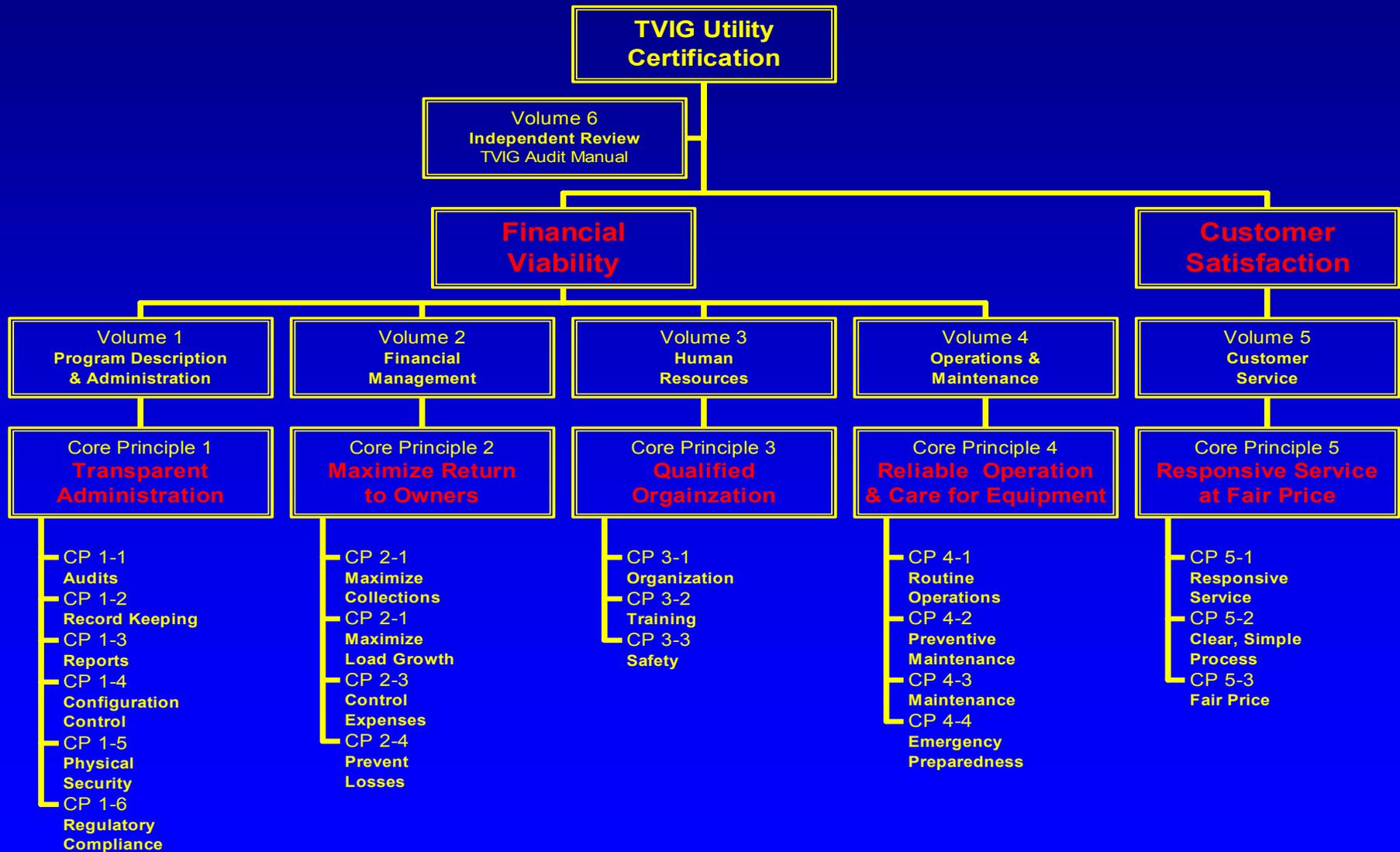
# Management Structure

## TVIG Utility Certification

- **Derived from industry & ISO 9000**
- **Core Principles:**
  - **Financial Viability**
  - **Customer Satisfaction**
- **5 Volumes:**
  - **Administration**
  - **Financial Management**
  - **Human Resources**
  - **Customer Service**
  - **Operations & Maintenance**
- **Each Contains:**
  - **Procedures**
  - **Continuing Self-Audits**
  - **Continuing Self-Training**
- **Quarterly Audits by TVIG**



# TVIG Utility Certification





# Customer Service (Control of Revenue Cycle)

**Good Customer Service is:**

- **absolutely essential for a sustainable utility**
- a Product that generates Revenue

**Customer Service =**

- Customer Relations Staff
- Billing & Collection
- (prepaid) Metering
- Piracy Prevention
- Local Owner Participation
- Regulatory Compliance
- Appliance Sales & Service
- Energy Efficiency
- Economic Development

**Utila is Batting 0 for 9**



# Utila Financial Projections

**Project Capital Cost: \$5 million**

- \$ 1,250,000 Equity
- \$ 3,750,000 Debt Financing  
(CABEI @ 9% interest)

**Project IRR = 4%**

**@ \$0.19/kWh**

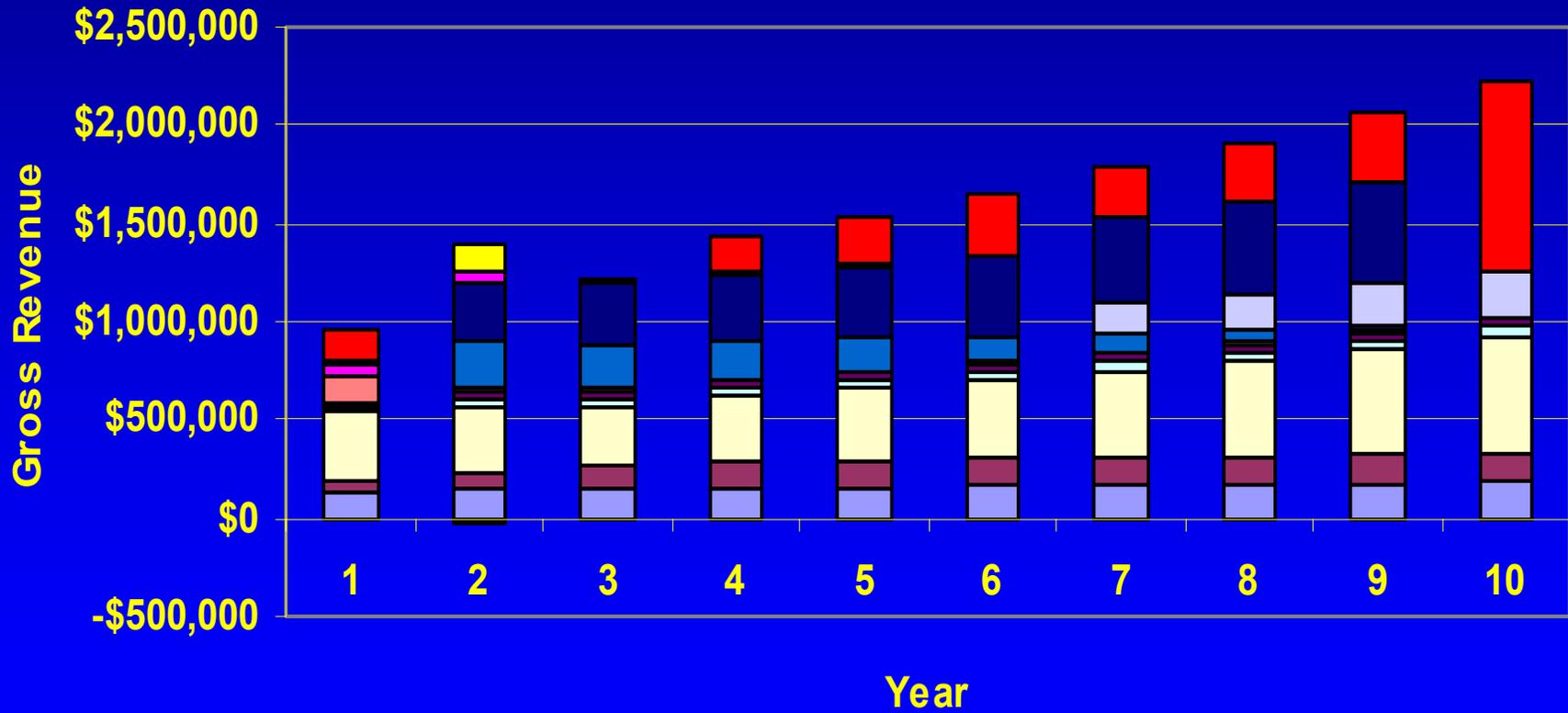
## Utila in Figures

The background of the table is a photograph of a coastal village. It shows several wooden houses with green roofs built on a hillside overlooking a body of water. There are palm trees and other tropical vegetation visible. The sky is overcast.

<b>Base Population:</b>	<b>5000</b>
<b>Tourist Population</b>	<b><u>2000</u></b>
<b>Total Population</b>	<b>7000</b>
<b>Initial Peak Load</b>	<b>600 kW</b>
<b>Peak Load in 3 years</b>	<b>1200 kW</b>
<b>Annual Energy Produced</b>	<b>4.0 GWh</b>
<b>Annual Energy Revenue</b>	<b>\$800,000</b>
<b>Distribution System</b>	<b>13.8 kV</b>
<b>Length of distribution lines</b>	<b>18.2 miles</b>



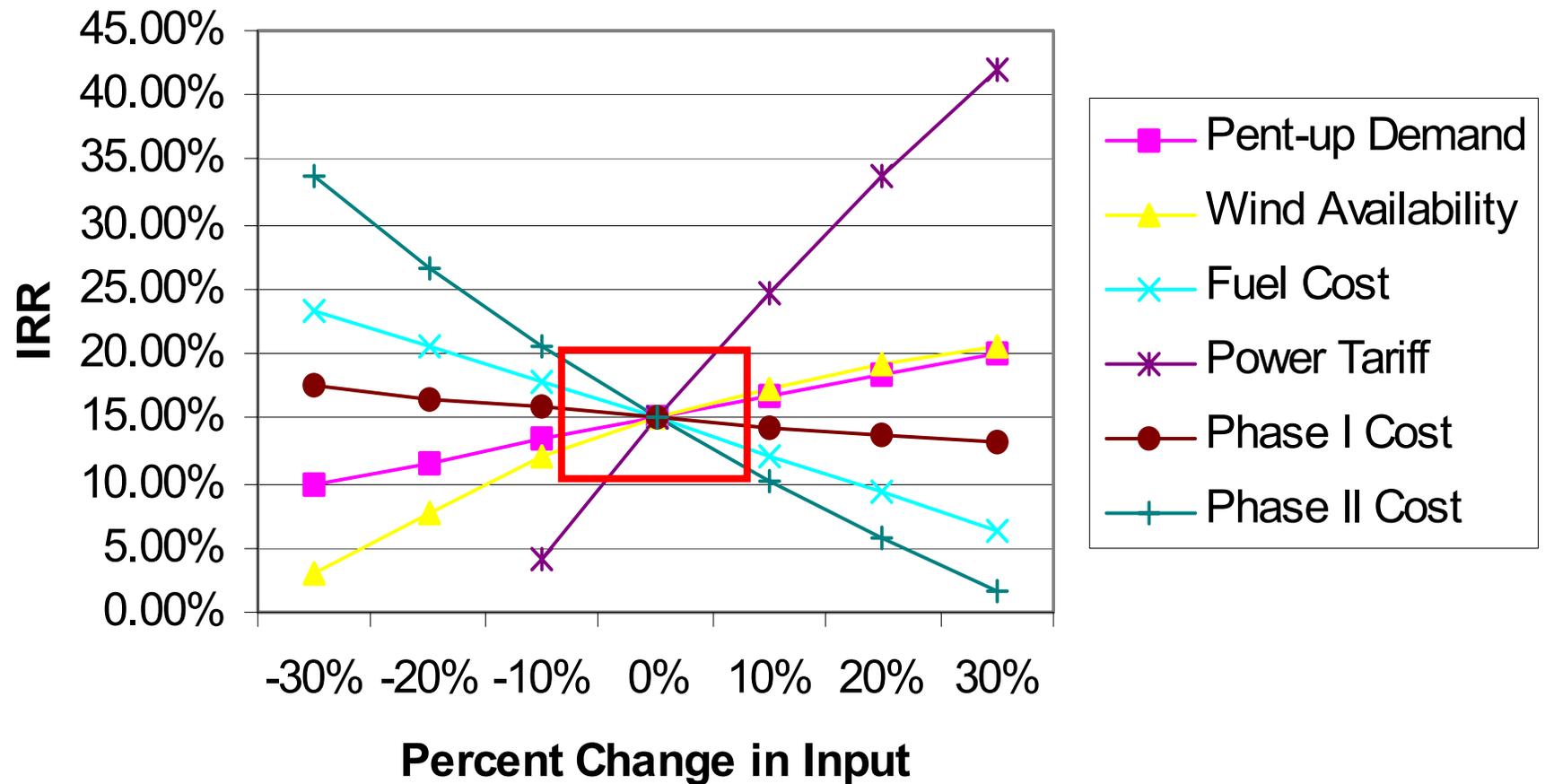
# UPCO Annual Operating Cash Flows





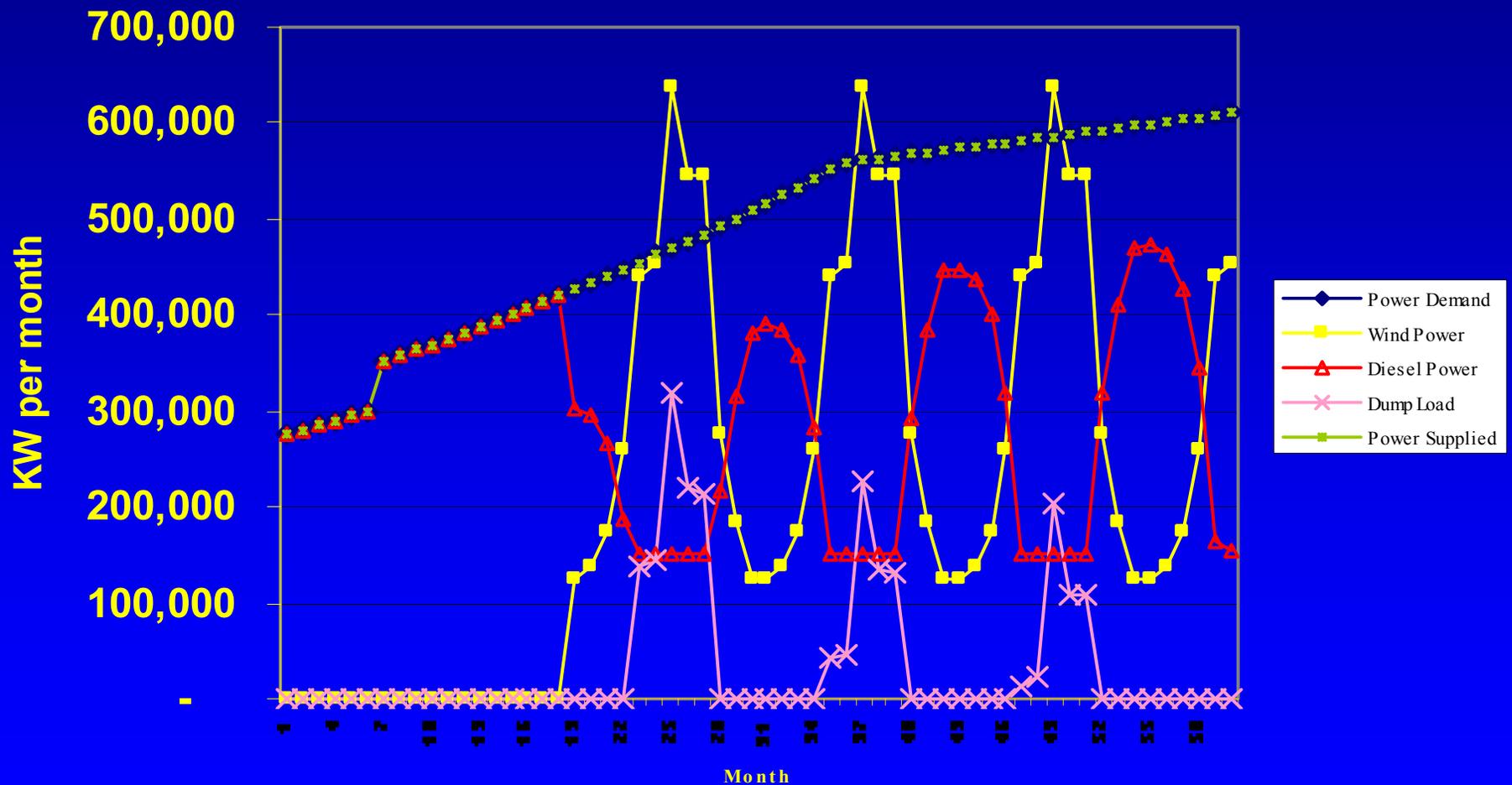
# Capital Cost Drives IRR

## Sensitivity Analysis



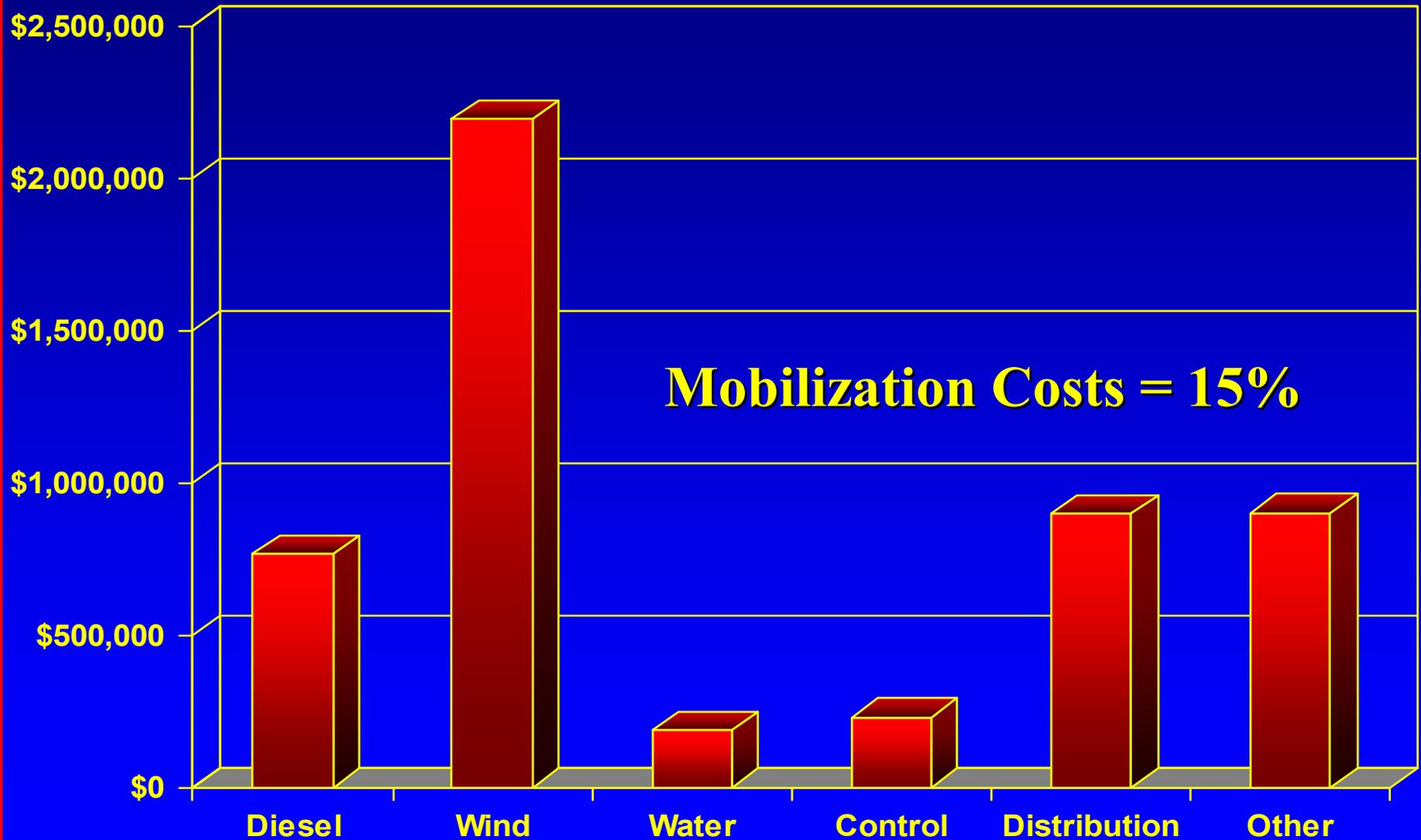


# UPCO Grid Demand: Yrs 1-5





# Utila Component Costs





# Wind/Diesel Hybrids

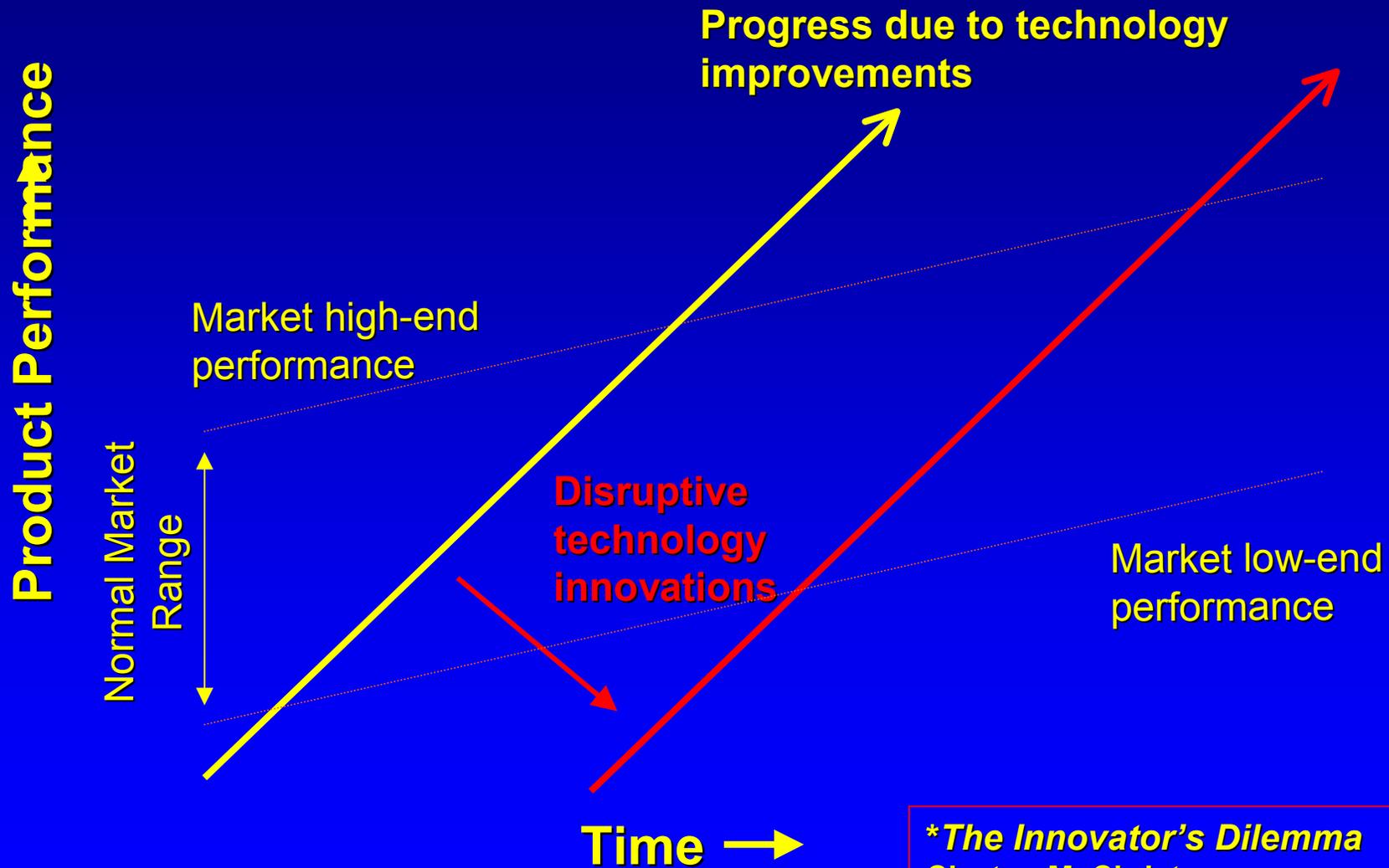
## **The Bad News:**

- **Costs are high, margins are tight**
- **Smaller projects not attractive to:**
  - **Investors**
  - **Lenders**
  - **Developers**
  - **Manufacturers**
- **Institutional barriers still exist:**
  - **Financing – Local banks don't understand wind**
  - **Regulatory – Local regulators don't understand wind**

## **The Good News:**

- **We're not far away**
- **Opportunity for a “Disruptive Technology”**

# Disruptive Technologies\*



*\*The Innovator's Dilemma*  
Clayton M. Christensen  
Harvard Business School Press, 1997



# Renewable Hybrid Systems

- Great Potential
- Many Obstacles

## • Technical Issues

- Require redundant generation systems
- Large mobilization cost
- Sophisticated control systems
- May require storage systems
- Line losses can be a big problem

} = \$

## • Development Issues

- Lack of creditworthy local investors
- Development cost for small & large projects is same
- Fees and permits
- Corruption
- Delays (time = money)

} = \$



# Renewable Hybrid Systems

- Great Potential
- Many Obstacles

## • Cash Flow Issues

- Collection
- Meters
- Staff
- Compliance
- Economic development and load growth

} = \$

## • Financial Issues

- Lack of PPA
- Lack of creditworthy customer

} = \$



## Hybrid Development Needs

- **Reduce Base Product Cost  $\geq$  25%**
- **Reduce Development Costs  $\geq$  25%**
- **More needs to be done**



# The Valmont Tower



# All That Matters

- **Satisfied Investors (IRR)**
- **Satisfied Customers (Tariff)**