



## *Remarkable Century*

### **Major Forces and Utilities**

- Governance - Competition  
Market Based Approach  
Individual Choice
- Environment - Sustainability  
Impacts - Local/Global
- Technology - Smaller, Modular, Flexible  
Information Content  
Manufactured Energy

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## **SUSTAINABLE ENERGY**

**Must Move Closer to the Near Term Flux of the Sun**

- **ONLY THREE WAYS TO GO**
  - High Efficiency Conversion of “clean” fuels
  - Renewables
  - Energy Efficiency
- **No Silver Bullet only Silver Buckshot**





## *Situations for Consideration of Distributed Systems*

- $\$G+\$T+\$D <<$  \$DU Centralized planning based on central generation (large load centers). Cost of central generation plus the cost of T&D is much less than the cost of distributed resources.
- $\$G+\$T+\$D >>$  \$DU Distributed planning based on distributed resources (islands/villages). Cost of distributed resources is less than the cost of generation, transmission, and distribution.
- $\$G+\$T+\$D -$  \$DU A mix of resources depending on localized costs and conditions (niches). Cost of distributed resources is approximately equal to the cost of generation, transmission, and distribution.

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## **Distributed Systems Radical or Disruptive Technologies**

- **Small, Modular**
- **Work as well distributed**
- **Self, locally or naturally dispatched**
- **Not on the grid**

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# Technologies

**Radical or Disruptive - “Brave New World”**

New Customers / New Values

**Evolutionary - Better ,Cheaper, faster**

Traditional Customers/Traditional values

*“Radical or Disruptive Technologies never introduced by Market Leader”*

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## Radical or Disruptive Technologies

- Don't satisfy revenue needs of large firms
- Markets hard to estimate
- Lack of quantitative data
- Cannot pass through established decision gates
- Require new organizational structure and culture

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# The Challenge

- **Village Power requires**
  - the use of radical technologies
  - business not project financing
  - innovation in organization not just technology
- **Utilities cannot change nor deliver systems economically**

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## *RADICAL or DISRUPTIVE TECHNOLOGIES*

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- **DISPATCHED BY NATURE, SELF, OR LOCALLY**
- **MODULAR, GEOGRAPHICALLY DISTRIBUTED**

**Require New Organizational Structures**

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