

DER Hybrid Systems Assessment Team: Findings and Recommendations

**Jonathan W. Hurwitch
Senior Vice President
Sentech, Inc.**

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Questions Addressed by Assessment Team?

- Are there hybrid technology combinations of merit not currently under development by existing R&D efforts?
- Is there industry interest in working with DOE in pursuit of hybrid energy technologies?
- Is there a rationale for a new hybrids energy program within DOE's DER program?
- Are there hybrid technology success stories? Could there be more with DOE leadership?
- What would this new program look like?

Technology Combinations

Technology Portfolio

Fossil Fuel Engines

- IC Engine
- Stirling Engine
- Rankine Engine Cycle
- Brayton Turbine
- Microturbine

Renewables

- PV, Concentrating
- Solar Hot Water
- Concentrating Solar Power
 - Trough
 - Dish
 - Tower
- Wind
- Hydro

Fuel Cells

- Solid Oxide
- PEM
- Phosphoric Acid
- Molten Carbonate

Storage

- Lead acid batteries
- Flow batteries
- Reversible fuel cells
- Supercapacitors
- SMES
- Flywheels
- Thermal
- CAES

CHP

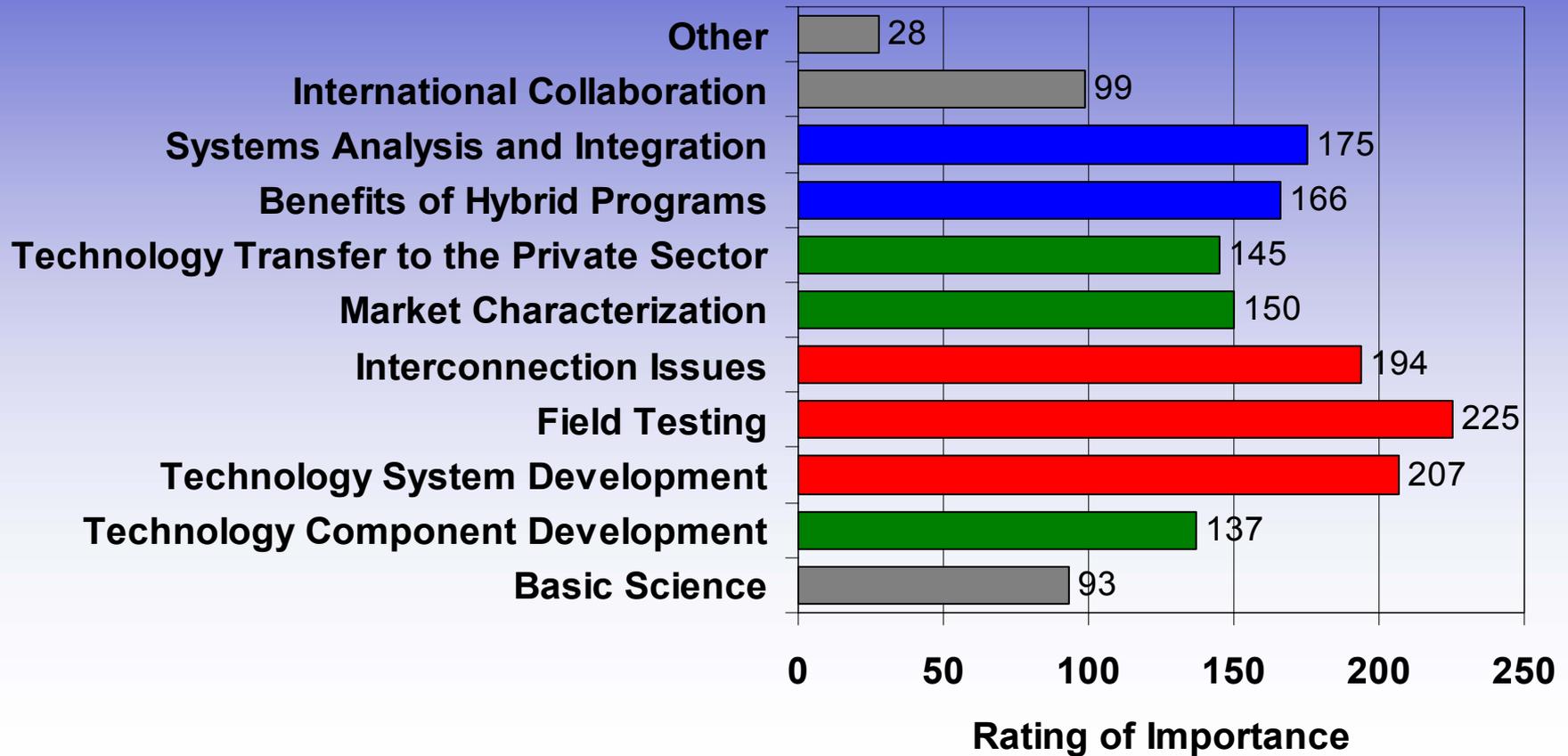
Promising Technology Combinations

- **Zero Net Energy Buildings**
 - Solar thermal roof/BIPV/daylighting/solar hot water/HVAC
 - Process heat integrated Fuel Cells
 - CHP with organic Rankine cycle bottoming
- **Remote (Off-Grid) Power**
 - Mini-grid residential: fuel cell or microturbine/storage/PV
- **Village Power**
 - Wind or PV/biogas fired engine, microturbine, or Stirling engine
 - CSP dish/propane, diesel, or biogas engine
 - Solar thermal trough/energy storage/organic Rankine cycle

Industry Interest

Industry Perspectives

Potential DOE Hybrids Program Components



Industry Perspectives - Benefits

Benefits of Hybrid Systems (from 2001 survey):

- Environmentally clean power (13)
- Enhanced reliability (12)
- Improved efficiency (8)
- Lower costs (8)
- Power quality
- Design flexibility
- Fuel flexibility
- Transmission savings

Note: number in parentheses indicates number of instances a particular benefit was mentioned by survey respondents.

Industry Recommendations

Recommendations for a new hybrids program (from 2001 survey):

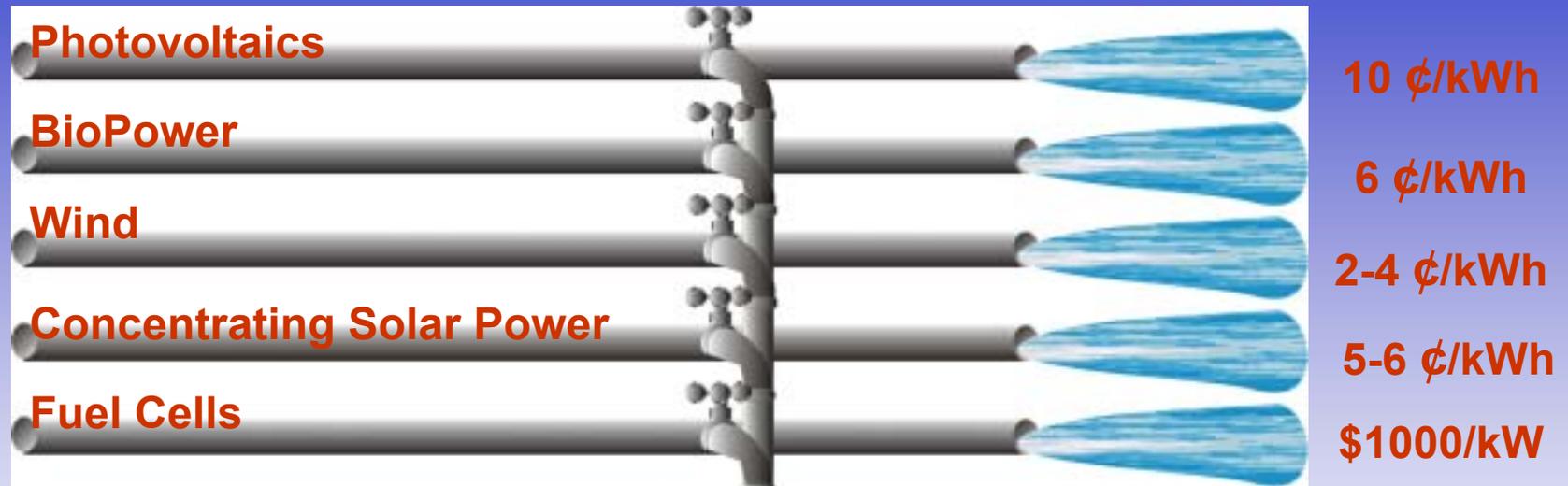
- Establish a hybrids working group (with state involvement)
- Understand the market aspects and needs first
- Remove barriers and solve regulatory problems
- Focus on commercially available technologies
- Cover a wide range of technologies
- Create cost-shared consortia
- Use only new money
- Do it

Program Rationale

New Opportunities for OPT Technologies

Technology Programs

Program Goals



A hybrids program can create market opportunities for emerging technologies before they are mature.

Homeland Security

Power Quality

Power Parks

Hybrid System Applications

Benefits to OPT

- A Hybrids program can create market opportunities for emerging technologies before they are mature
- Hybrid systems can open markets not currently available to DER due to limitations in the individual technologies
- Hybrid systems will build capacity toward the DER program goal of 20% of new additions by 2020

Emerging Market Opportunities for Hybrid Systems

- Homeland/Energy Security
- Industrial Power Quality
- Commercial Power Parks
- Distribution (Grid) Support
- Integrated Building Efficiency (CHP+)
[Zero Net Energy Buildings]
- Remote (Off-Grid) Power
- Village Power
- Green Power
- Power Price Stabilization
- Water Resource Management
- Brownfields (to Brightfields)

Hybrids Can Be Designed for Customers' Interests

Low Emissions

Green Power

Zero Net Energy Bldgs.

Commercial Power Parks

Remote (Off-Grid) Power

Homeland Security

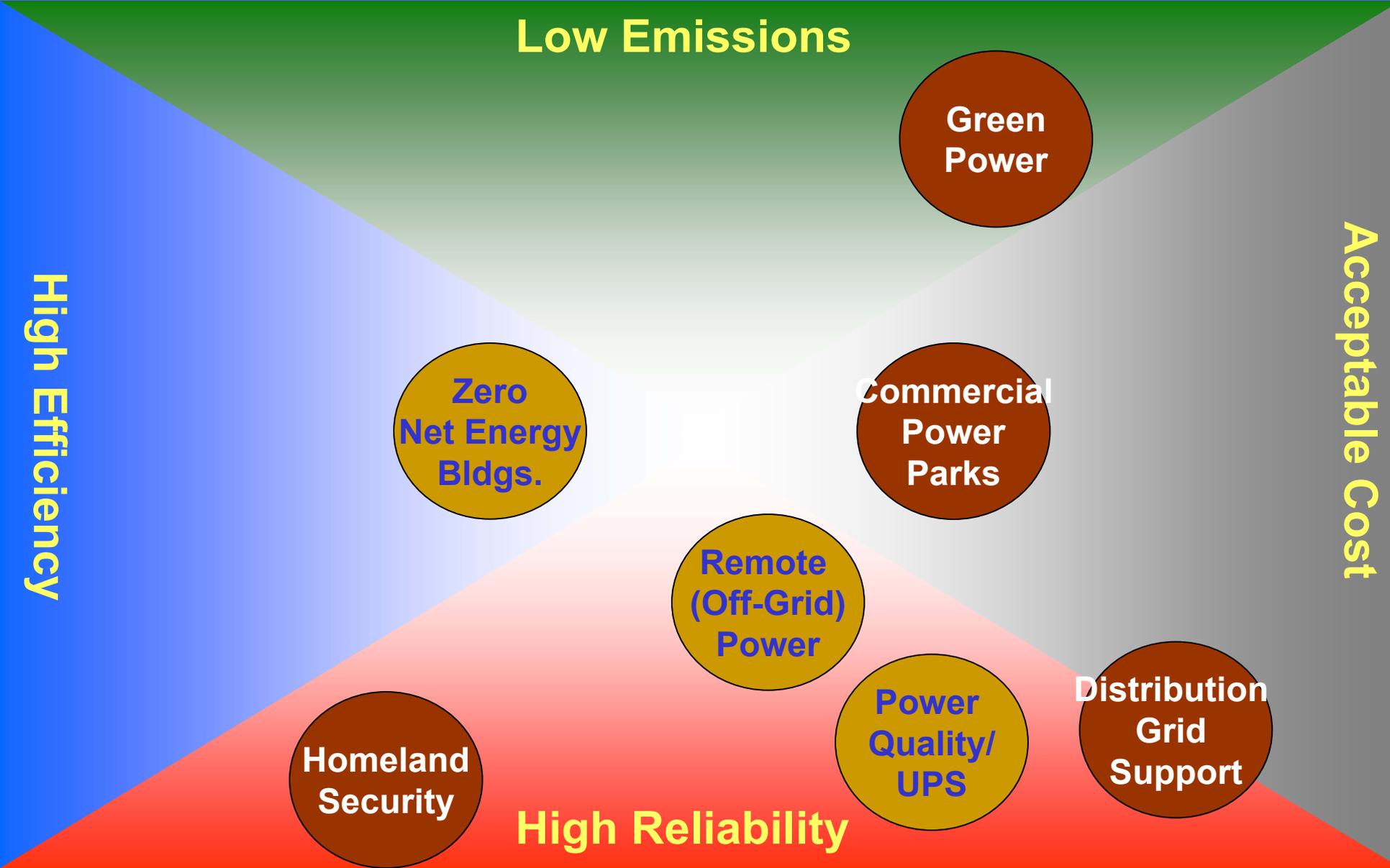
Power Quality/UPS

Distribution Grid Support

High Reliability

High Efficiency

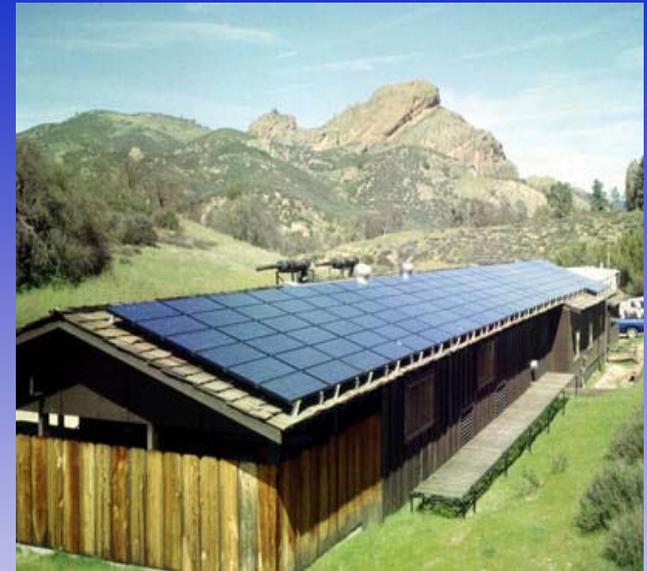
Acceptable Cost



Technology Success Stories

Emerging Market: Remote (Off-Grid) Power

- **Location:** Pinnacles National Monument
- **System:** PV/propane gensets/batteries
- **Performance:**
 - PV provided most of the electricity for the site
 - Generator only ran for 793 hours over an entire year (1997), reducing maintenance needs
 - System saved 8,000 gallons of fuel (compared to propane-only)
- **Economics:**
 - Seven-year payback
 - Total projected savings over 20 years: \$83,000
- **Environment:**
 - Reduced greenhouse gas and pollutant emissions by 85%



Emerging Market: Village Power

- NREL demonstration project underway in Wales, AK (pop. 160)



- High penetration – 130kW wind added to existing 365kW diesel
- Benefits of hybrid system:
 - Reduced fuel consumption 50-60%, requiring less diesel storage
 - Diesel generator provides continuous power when wind doesn't blow

Program Recommendations

Recommendations

Institute a DER Hybrid Energy Systems Program that will:

- Focus on emerging markets that are not being met by individual technologies
- Work with non-traditional customers (e.g., system integrators, project developers, energy service companies), not just technology developers and electric utilities
- Contribute to DOE goal of 20% of new additions from DER by 2020

Hybrid Energy Program Elements

Develop a 3 component DER Hybrid Energy Systems Program:

- Management and Systems Analysis [software]
- Systems Integration [hardware]
- Regional Partnerships [outreach/deployment]

Regional Partnerships

- Establish state and regional partnerships to Identify deployment opportunities
- Conduct systems validation testing at regional sites
- Work with partners that demonstrate commitment through cost-shared (about 50%) field testing

Questions Addressed by Assessment Team?

- Are there hybrid technology combinations of merit not currently under development by existing R&D efforts? *Yes*
- Is there industry interest in working with DOE in pursuit of hybrid energy technologies? *Unqualified Yes*
- Is there a rationale for a new hybrid energy systems program within DOE's DER program?
Yes, focus on emerging markets (Homeland/Energy Security, Power Parks)
- Are there hybrid technology success stories? Could there be more with DOE leadership? *Yes, via state and regional partnerships*
- What would this new program look like?
Market focused with three major activities