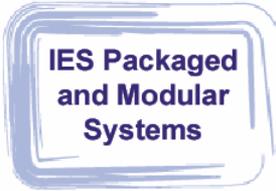




IES Packaged and Modular Systems



Jan Berry

Oak Ridge National Laboratory

**Integrated Energy Systems (IES)
Peer Review Meeting**

Nashville, Tennessee

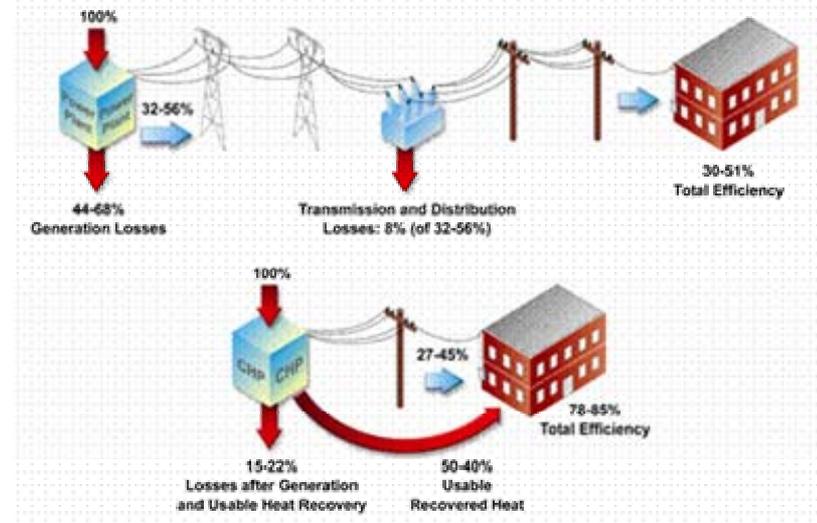
May 2, 2002



OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

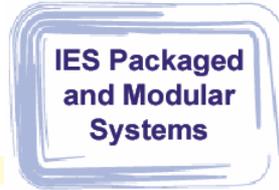


- Increased use of IES will achieve National Energy Policy goals by improving on existing systems:
 - Increase system performance and efficiency
 - Provide energy choice by reducing capital costs and maintenance costs
 - Reduce emissions
 - Conserve fuel resources
 - Improve reliability
 - Increase energy security
 - Improve energy delivery utilization





What are Integrated Energy Systems?

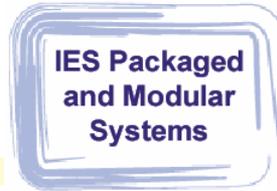


- **Integrated Energy Systems**
 - combinations of dissimilar subsystems designed or assembled so they work together with higher efficiency and/or lower cost than they would operate individually

- **Power generation equipment combined with a waste-heat-driven technology**
 - Gas turbine, micro turbine, reciprocating engine, fuel cell
 - Absorption chiller and/or desiccant dehumidification machine



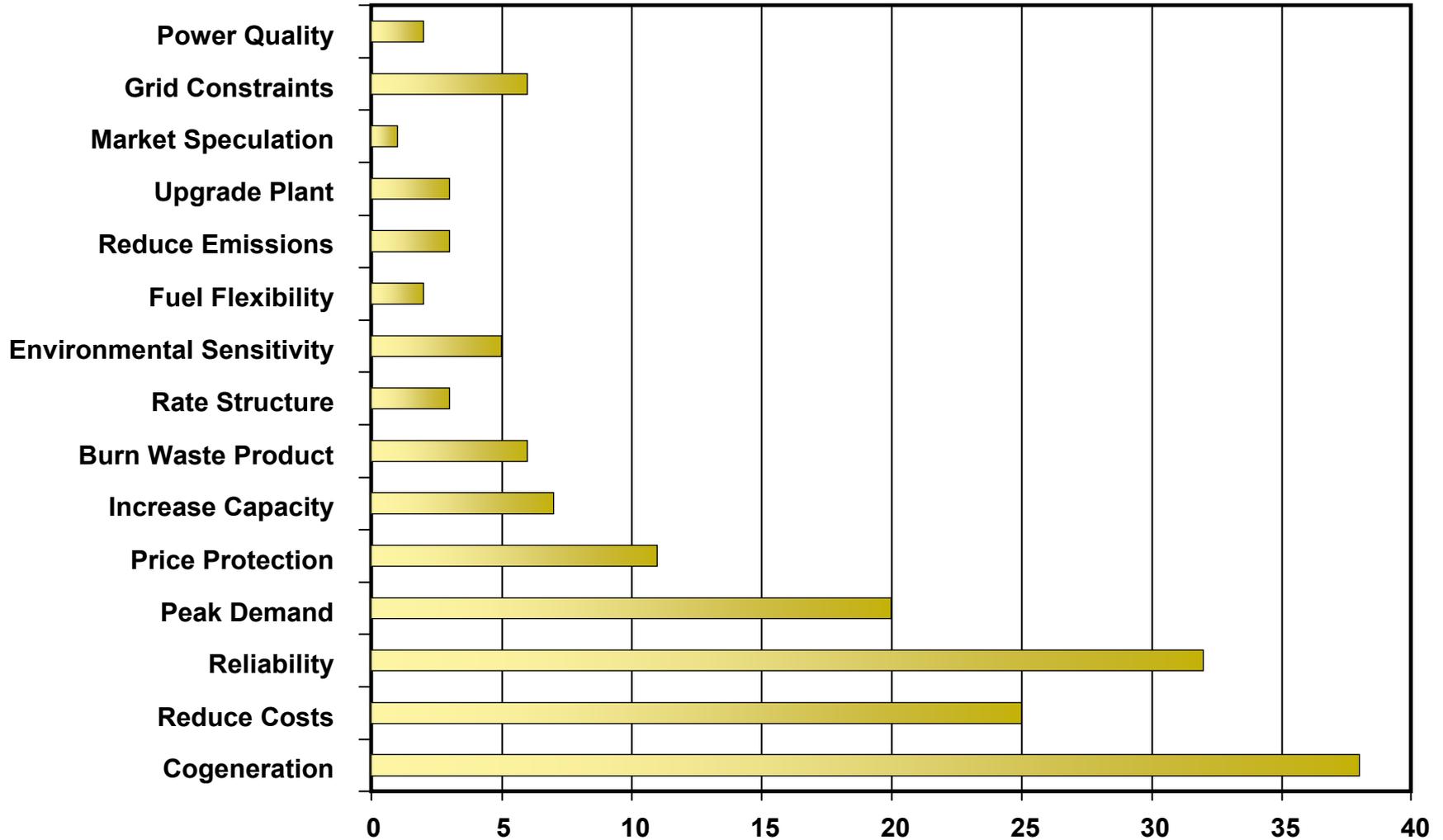
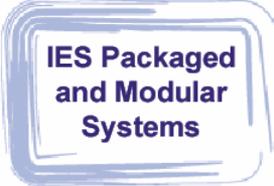
IES Speeds Commercialization



- **Single Integrated Energy System meets multiple building energy needs**
- **“One-Stop Shopping”**
 - **Packaged Systems will simplify the evaluation, specification, bidding and purchasing of CHP systems.**
- **Architects, engineers, developers, and building owners will be able to easily consider and use these systems.**



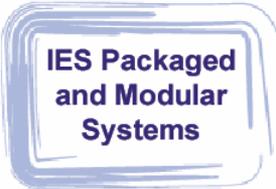
What's Driving Current Market for DER?



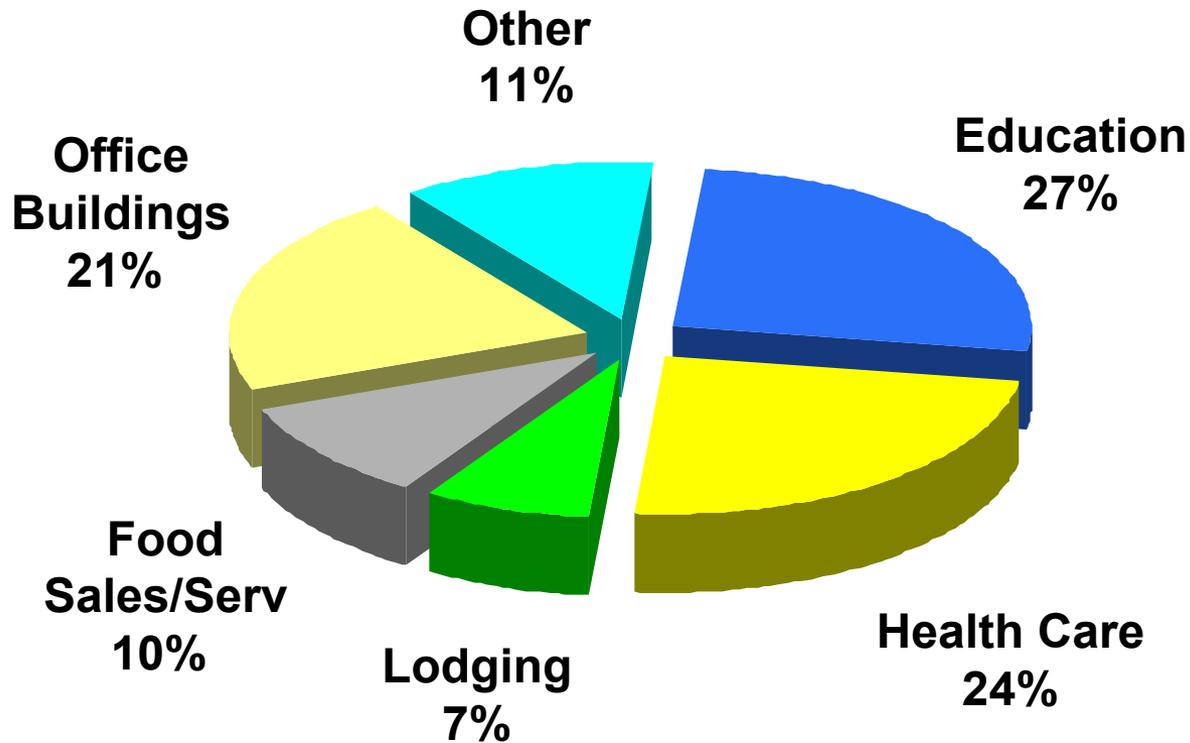
Reference: ORNL-TM-2001/290



IES Market Focus and Potential



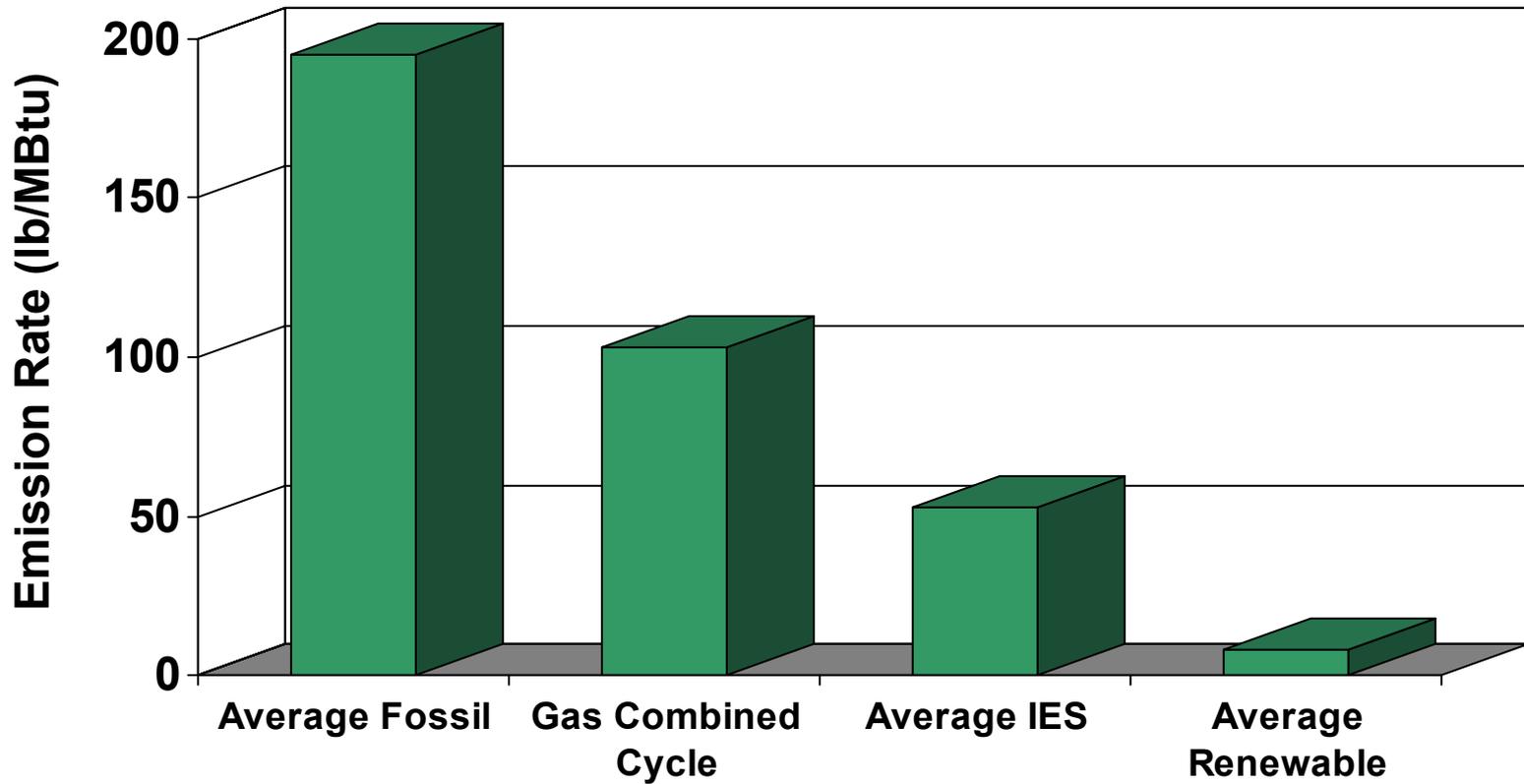
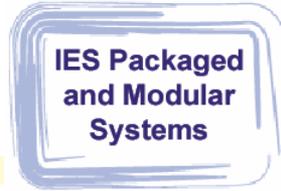
Potential: 75,000 MW



Source: U.S. DOE-EIA and Onsite-Sycom

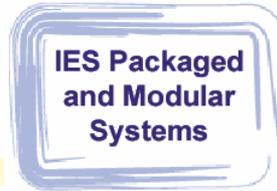


Emission of Carbon Dioxide Reduced with IES





\$19 Million Awarded For Integrated Energy Systems



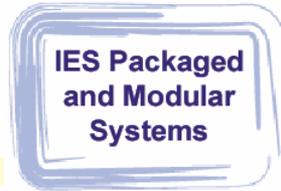
- **Seven industry teams awarded contracts to research, develop and test “First Generation” Integrated Energy Systems .**

- **Distributed Energy Resource (DER) systems are highly efficient with low emissions.**
 - **Allow power generation (< 10 MW) close to the point of use**
 - **Combined with thermal recovery to heat or cool nearby buildings increasing efficiency from 32-56% to 70-85%**
 - **Improve energy security – electric reliability**
 - **Reduce emissions of carbon dioxide and priority pollutants**

- **More than 43% Industry cost-sharing (over \$31 million total project costs).**



Seven Industry Teams Selected for Awards



Large-Scale Modular IES:

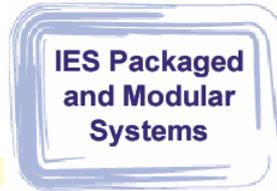
- Honeywell Laboratories
- Burns and McDonnell
- Gas Technology Institute

Small-Scale Packaged IES:

- Capstone Turbine Corporation
- NiSource Energy Technologies
- Ingersoll Rand
- United Technologies Research Center



IES Package and Modular Systems Project Goals



Overcome regulatory, institutional, and market barriers

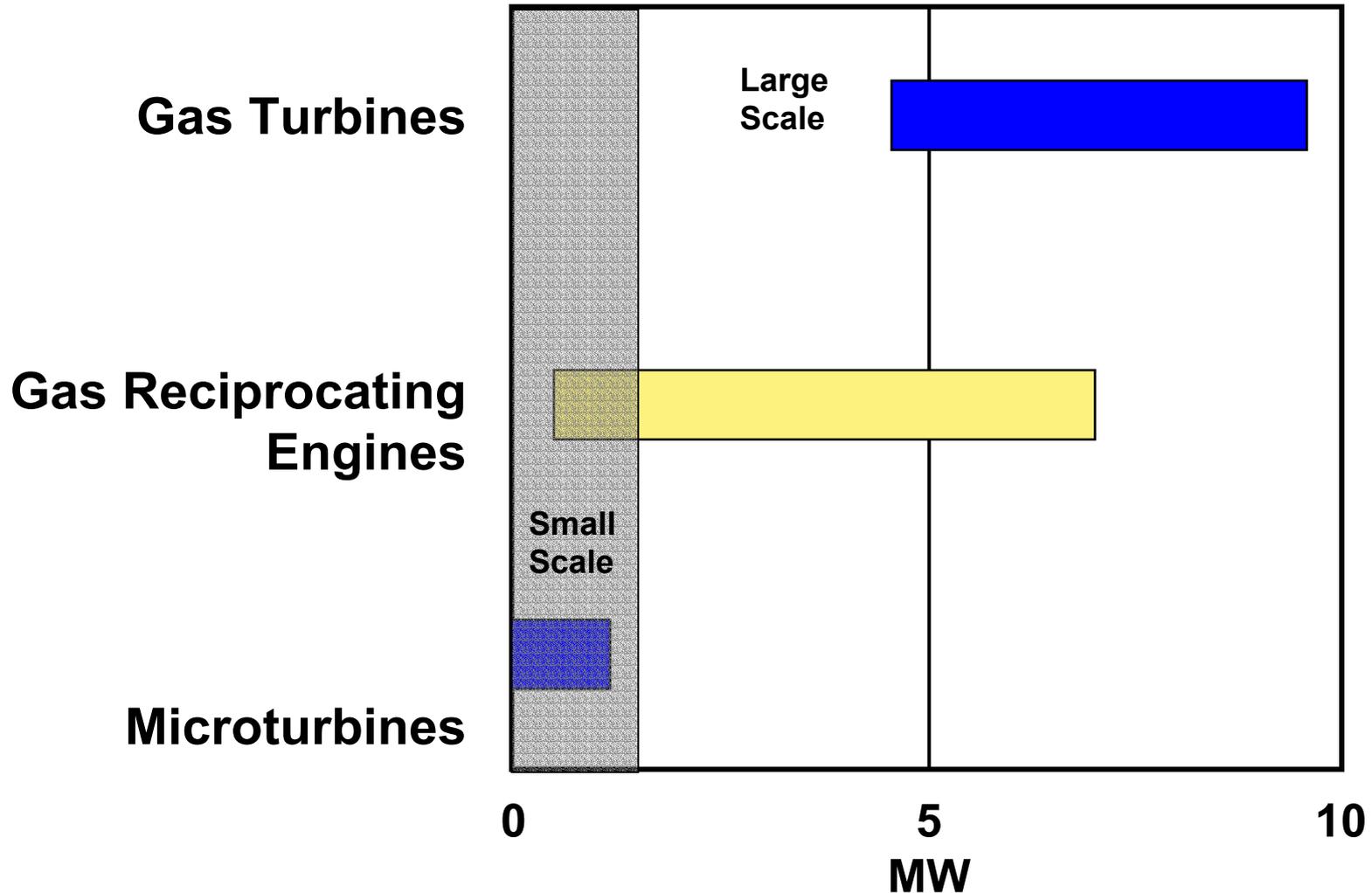
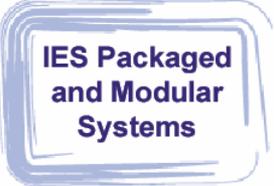
- Packaged systems—“plug and play”
- Modular components factory tested and integrated easing field installation

Projects include:

- Generalized Integrated System Concepts
- Performance Analysis
- Rating Procedures and Standards
- Prototype Development
- Field Testing

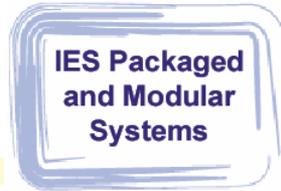


DG Optimized for Modular (>1MW) or Packaged (<1MW) Systems





Industrial Partners Developing Modular IES



Honeywell Laboratories Team

- 5 MW turbine generator integrated with 1,000 RT waste-heat absorption chiller



Burns and McDonnell Team

- 4.6MW turbine generator integrated with 2,000 RT of waste-heat and 500 RT of waste/direct fired absorption cooling.

Gas Technology Institute Team

- Engine generator (290 kW to 770 kW) integrated with absorption chillers.

