

**Distributed Intelligent Agents  
for Decision Making at Local DER Levels**  
(Phase I DOE SBIR DE-FG02-03ER83604)

**Dept of Energy  
Electric Distribution Transformation  
Annual Program & Peer Review Meeting**

October 28, 2003

Alternative Energy Systems Consulting, Inc.

Center for Networked Distributed Energy,  
Colorado State University

# Presentation Outline

- ◆ **Project Background & Objective(s)**
- ◆ **Technical Approach**
- ◆ **Project Timeline / Budget / Progress**
- ◆ **Interactions & Collaborations**
- ◆ **Contact Information**

# Project Background

## The Electric Grid:

- Has evolved over the past 100 years to meet the needs of a highly regulated electric utility industry served by vertically integrated electric utilities.
- Is controlled regionally via centralized control points with varying levels of automation.
- Is basically designed for unidirectional power flow at the distribution system level.
- Views distributed energy resources as potentially disruptive due to potential interaction with protection systems/devices.
- ***As currently designed and controlled cannot benefit fully from the use of distributed energy resources.***

# Project Background Continued

## Distributed Energy Resources:

- Prime mover and inverter technology has improved dramatically over the years,
- DER industry progress has been hampered by its inability to demonstrate its potential to defer or reduce distribution system expansion costs,
- Has been hampered by widely varying and often times costly interconnection standards,
- IEEE P1547 provides standard interconnect requirements and also serves to highlight the problems associated with DER and protection system interactions
- ***Will not be able to realize its full potential until it can be more fully integrated with the electric grid infrastructure.***

# Overall Project Plan

## ***Project Proposal:***

“...develop the high level requirements for a basic hierarchy of intelligent agents that communicate and collaborate to coordinate the operation of the electric grid system. Agents operating at the bottom-most level of the hierarchy (DER level agents) will be further specified and minimal agents will be developed and tested to demonstrate feasibility...”

# Phase I SBIR Project Objectives

## Overall Objective(s):

“...will lay the groundwork for a hierarchy of intelligent power system agents that will enable DER to be more fully integrated into the U.S. power system...”

## Phase I Project Objectives:

- ✓ Identify a basic hierarchy of intelligent agents needed for electric grid system control using a “bottom-up” approach,
- ✓ Characterize basic agent requirements at the local site/appliance level,
- ✓ Demonstrate the feasibility of applying an agent-based approach at the local site level for fault detection and/or response.

# Project Approach

## **Task 1. Project Kickoff / Information Gathering**

- *Research Summary White Papers (AESC, CSU)*

## **Task 2. Establish Agent / Agency Technical Requirements**

- *Agent Hierarchy Description*
- *DER Level Agent Requirements Paper*
- *Feasibility Test Plan*

## **Task 3. Agent / Agency Development**

- Task Analysis / Ontology Development
- Agent Software Module Development / Testing
- *Notice of Completion of Agency Integration & Testing*

# Project Approach Continued

## **Task 4. Feasibility Assessment Activities**

- Install / Start-up Agents at CSU
- Feasibility Testing
- Feasibility Test Summary Report

## **Task 5. Final Report Preparation**

- Draft / Final Report(s)

# Project Timeline / Budget / Progress

- 📄 9 Month SBIR Contract, Amount: \$99,240
- 📄 Contract Kick-off - August 27, 2003
- 📄 Contract Completion - April 29, 2004
- 📄 Task 1 is complete
- 📄 Task 2 is currently underway.

ID	Task Name	Start Date	End Date	2003				2004				
				Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	Project Kickoff & Information Gathering	8/27/03	10/21/03	█								
2	Establish Agent / Agency Tech. Req'ts	10/22/03	11/11/03		█							
3	Agent / Agency Development	11/14/03	3/4/04			█						
4	Feasibility Assessment Activities	3/5/04	4/1/04						█			
5	Final Report Preparation	4/2/04	4/29/04							█		

# Interactions and Collaborations

- ◆ **AESC is collaborating with the Center for Networked Distributed Energy at Colorado State University**
  - Wade Troxell, Ph.D. (co-founder of Sixth Dimension)
- ◆ **AESC is building on its existing contract(s) with the California Energy Commission**
  - “Intelligent Software Agents for Control and Scheduling of Distributed Generation”  
(CEC-PIER 500-98-040 Awarded in 1998, work began in June 1999, completed February 2001)
  - Follow-on contract (500-00-016) for demonstration field test during 2002 awarded August 3, 2001 and currently underway.

# Project Team Contact Information

## **Alternative Energy Systems Consulting, Inc. Principal Investigator:**

Gerald Gibson, PE  
858-560-7182  
gibsonj@aesc-inc.com

## **Center for Networked Distributed Energy @ Colorado State University Principal Investigator:**

Wade Troxell, PhD  
(970) 491-6618  
wade@engr.colostate.edu