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

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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 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

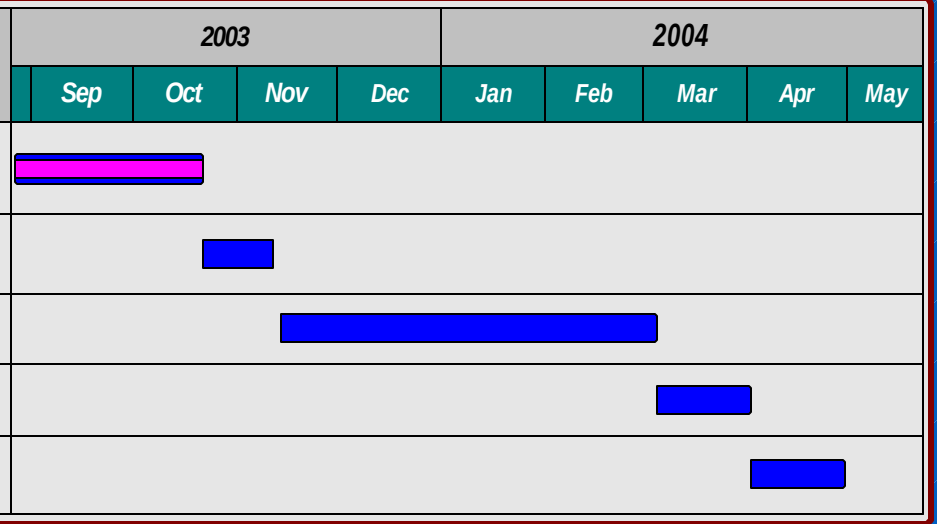
Task 5. Final Report Preparation

- 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
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

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