



Demand Response (DR) Enabling Technology Development (ETD) Project

Gaymond Yee

DR ETD Project Manager

Ron Hofmann

DR Program Advisor

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INTRODUCTIONS

- ◆ **California Energy Commission (CEC)**
 - ◆ Laurie ten Hope (PIER ESI Team Lead)
 - ◆ David Michel (Contract Manager)
 - ◆ Art Rosenfeld (Commissioner)

- ◆ **California Institute for Energy and Environment (CIEE)**
 - ◆ Carl Blumstein (Director)
 - ◆ Maureen Barnato (Funding and Development Mgr.)
 - ◆ John Snyder (Subcontract Administrator)
 - ◆ Karen Sharp (Workshop Facilitator)



AGENDA

8:30am	Introduction and Discussion of the DR ETD Project <i>Gaymond Yee and Ron Hofmann</i>
9:10am	“Control and Communications Integration” Research Opportunity Notice <i>Gaymond Yee</i>
9:30am	“Automated Demand Response and the Demand Response Research Center” <i>Mary Ann Piette, LBNL</i>
10:00am	Morning Break
10:15am	“New Thermostat, New Temperature Node, and New Meter” <i>UC Berkeley Research Team</i>



AGENDA

Noon-12:30pm	UC Berkeley Technology Demonstrations on Display <i>Networking Testbed Electrical Sensing Testbed</i> <i>Thermostat Testbed Energy Scavenging Demo</i>
12:30pm-2:00pm	Lunch (handouts with locations of nearby restaurants)
2:00pm	“California Demand Response Business Network” <i>Utility Integrated Solutions, Nexant, and Dynamic Networks</i>
3:05pm	Afternoon Break
3:15pm	“California Demand Response Business Network” (cont.)
4:30pm	Adjourn



PURPOSE OF THIS WORKSHOP

- ◆ **Introduce DR ETD Project to researchers and private industry that are not familiar to the project**
- ◆ **Describe the proposal submittal and review process**
- ◆ **Present new Research Opportunity Notice**
- ◆ **Present progress of the two funded research projects**
 - ◆ New Meter, New Thermostat, and New TempNode
 - ◆ California Demand Response Business Network



BACKGROUND

- ◆ **CA energy crisis of 2000-2001**
 - ◆ Market power (Enron, et al)
 - ◆ Aging fossil fuel plants (pollution)
 - ◆ Flaws in deregulation (AB 1890)
 - ◆ Disconnect between wholesale and retail prices
- ◆ **Supply approach** (build more plants)
- ◆ **Demand approach** (load as a resource)



ELECTRIC POWER INDUSTRY IN CALIFORNIA

- ◆ **Energy companies (Enron, Calpine)**
- ◆ **CAISO (California Independent System Operator) balances supply and demand**
- ◆ **UDCs (Utility Distribution Companies manage local distribution systems)**
 - ◆ IOUs (investor owned utilities, e.g., PG&E)
 - ◆ Munis (publicly owned utilities, e.g., SVP)
- ◆ **Regulators (e.g., FERC, CPUC, CEC)**



REGULATORY AGENCIES

- ◆ **FERC <http://www.ferc.fed.us/>**
 - ◆ Regulates the transmission and wholesale sales of electricity in interstate commerce
- ◆ **CPUC <http://www.cpuc.ca.gov/>**
 - ◆ Regulates privately-owned utilities in CA
- ◆ **CEC <http://www.energy.ca.gov/>**
 - ◆ Created in 1975 for siting electric power plants
 - ◆ Responsible for standards & policy analysis



BRIEF HISTORY OF RECENT CALIFORNIA ELECTRIC R&D



- ◆ **Investor Owned Utilities (until 1996)**
- ◆ **EPRI (created by utilities in 1973)**
- ◆ **CIEE (funded by utilities starting in 1989 to manage energy efficiency R&D)**
- ◆ **PIER (created in 1996 by deregulation [AB1890] and initially funded in 1998)**
- ◆ **PIER <http://www.energy.ca.gov/pier/>**
- ◆ **PIER has ~\$60 MM/year through 2012**



PIER R&D AREAS

- ◆ **Environmentally-Preferred Advanced Generation (EPAG)**
- ◆ **Buildings End-Use Energy Efficiency**
- ◆ **Industrial/Agricultural/Water End-Use Energy Efficiency (IAW)**
- ◆ **Renewable Energy**
- ◆ **Energy Related Environmental Research**
- ◆ **Energy Systems Integration (ESI)**



ESI

- ◆ **Improved Efficiency and Reliability of the Transmission System (T&D)**
- ◆ **Distributed Energy Resources Systems Integration (DER)**
- ◆ **Strategic and Enabling Technologies (e.g., storage, seismic, tools for market analysis)**
- ◆ **Demand Response to Electricity Prices and System Contingencies (DR)**

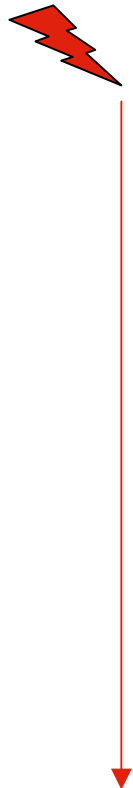


WHAT IS DR?

- ◆ **Demand response (DR) for this project is the ability of electricity users to respond “automatically” to time- and location-dependent price and contingency signals (that have varying amplitude and duration) to reduce/shift loads.**
- ◆ **DR is different from energy efficiency (EE), e.g., transient vs. permanent**



DR INVOLVES THE ENTIRE POWER DELIVERY SYSTEM



Central plants
(G)

Long distance
(T)

Step down voltages
(SS)

Short distance
(D)

Buildings
(L)

- ◆ **Generation (G)**
- ◆ **Transmission (T)**
- ◆ **Substations (SS_T)**
- ◆ **Sub-transmission**
- ◆ **Substations (SS_D)**
- ◆ **Distribution (D)**
- ◆ **Local transformers**
- ◆ **Loads (L)**



PIER DR PROGRAM

- ◆ **Is there DR potential in CA's existing large commercial/industrial facilities?**
- ◆ **What enabling technologies need to be developed to deploy DR statewide?**
- ◆ **Can we learn lessons from other states?**
- ◆ **Can the CAISO use DR to help manage future electricity imbalances?**



LC&I POTENTIAL

- ◆ **Large Commercial and Institutional (LC&I) DR Demonstrations and Case Studies (Mary Ann Piette, LBNL)**
 - ◆ Stake in the ground study to establish state-of-the-art DR capabilities and R&D needs
 - ◆ Send a dynamic tariff to LC&I buildings
 - ◆ Determine automatic DR capability
 - ◆ Report results in a form that will help make policy and R&D decisions possible



ENABLING TECHNOLOGIES

- ◆ **Wireless communications**
- ◆ **MEMS sensors**
- ◆ **Network management**
- ◆ **Systems integration**
- ◆ **Low-cost packaging**
- ◆ **Energy scavenging and storage**
- ◆ **Real-time operating systems**



LESSONS LEARNED

- ◆ **A Case Study of Niagara Mohawk's RTP Tariff (Chuck Goldman, LBNL)**
 - ◆ Characterize customer response to and satisfaction with a RTP tariff in a retail competition environment
 - ◆ Assess interactions between RTP and ISO/utility DR programs
 - ◆ Provide input to CA regulators/stakeholders developing DR and RTP options



CAISO REQUIREMENTS

- ◆ **Develop a DR R&D agenda for the CAISO to identify**
 - ◆ **how responsive loads could increase power system reliability and adequacy**
 - ◆ **what behaviors are desirable**
 - ◆ **what reliability services (ancillary services) responsive loads could provide**



DR ETD Project

- ◆ **CEC PIER Funded Project**
 - ◆ Present funding: \$5.5M to March 31, 2007
- ◆ **Purpose of funding is to develop enabling technologies for a state-wide demand responsive electric power delivery system with “10/10” objectives**
 - ◆ 10 times the capabilities and 1/10th the cost
 - ◆ Create disruptive technology
- ◆ **Leverage R&D spending by other institutions**
- ◆ **Multi-disciplinary and collaborative research**



CIEE

- ◆ **DR ETD Project: Technical coordination, project administration, and contract management of funded research**
- ◆ **Unit of the Office of Research, Academic Affairs Division of the Office of the President, University of California (UCOP)**
- ◆ **Located at 1333 Broadway, Suite 240 Downtown Oakland**



HISTORY OF DR ETD PROJECT

- ◆ **Approved by CEC: June 2002**
- ◆ **Trial workshop: October 28, 2002**
 - ◆ Meters & Thermostats RONS
 - ◆ UCB, LBNL, LLNL invited
- ◆ **First proposal funded: April 2003**
 - ◆ 5 UCB research teams
- ◆ **First public workshop: June 4, 2003**
 - ◆ Network Management & System Integration RONS
- ◆ **Second proposal funded: February 2004**
 - ◆ Utility Integrated Solutions, Nexant & Dynamic Networks



RESEARCH OPPORTUNITY NOTICES

- ◆ **Meters** (posted 10/2002)
- ◆ **Thermostats** (posted 10/2002)
- ◆ **Network Management** (posted 6/2003)
- ◆ **System Integration** (posted 6/2003)
- ◆ **Control and Communications Integration**
(posted 6/2004)
- ◆ **Project Website**
 - ◆ <http://ciece.ucop.edu/dretd/>



PROPOSAL STRATEGIES

- ◆ **RON's have no deadlines**
- ◆ **One RON**
- ◆ **Part of one RON**
- ◆ **Combine RONs (e.g., UCB proposal)**
- ◆ **Combine pieces of different RONs**
- ◆ **DR relevance**
- ◆ **Collaborate**
- ◆ **Leverage funding**
- ◆ **Start with R&D design phase (<\$250 K)**

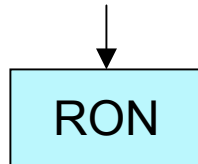


TECHNICAL ADVISORY COMMITTEE (TAC)

- ◆ **Dale Fong** (Itron, communications, software engineering)
- ◆ **Charles Glorioso** (Davis Instruments, communications, thermostats, home automation)
- ◆ **Joe Hughes** (EPRI/E2I, industry standards)
- ◆ **Roger Levy** (Consultant, business processes)
- ◆ **Belvin Louie** (PG&E, meters)
- ◆ **Mark Martinez** (SCE, load control programs)
- ◆ **Don Pezzolo** (Consultant, communications, thermostats)
- ◆ **Steve Phillips** (Consultant, IT systems and integration)
- ◆ **Mary Ann Piette** (LBNL, buildings, energy monitoring)



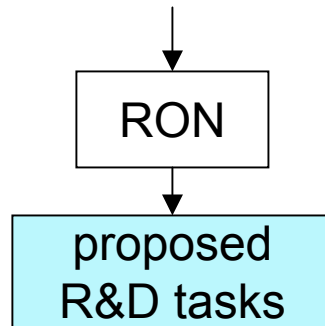
RESEARCH OPPORTUNITY NOTICE (RON)



- ◆ **RONs are posted at CIEE website in PDF file format and presented at DRETD workshops**
- ◆ **10-12 weeks to get through funding process from receipt of proposed tasks**



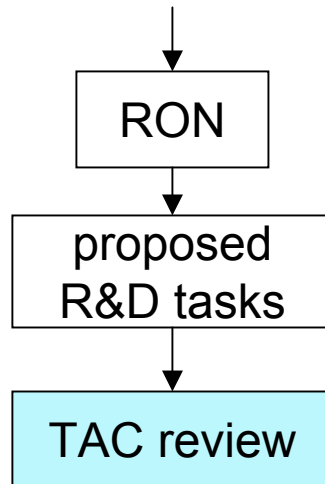
PROPOSED R&D TASKS



- ◆ **R&D tasks should be informal proposals**
 - ◆ ~ 7 written pages with
 - ◆ Budget
 - ◆ Schedule
 - ◆ Milestones
- ◆ **Discuss R&D ideas with Gaymond Yee and Ron Hofmann before submitting**



TECHNICAL ADVISORY COMMITTEE (TAC) REVIEW



◆ Key review elements

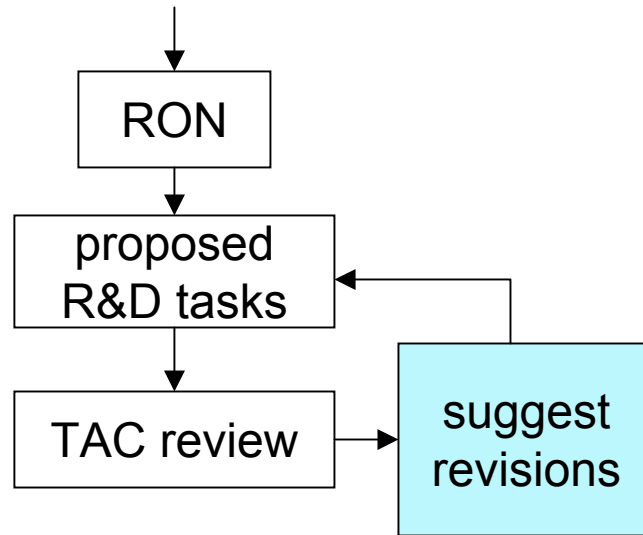
- ◆ DR relevance
- ◆ Enabling technology
- ◆ Collaboration
- ◆ Multi-disciplinary

◆ 3 possible outcomes

- ◆ Recommend
- ◆ Suggest changes
- ◆ Reject



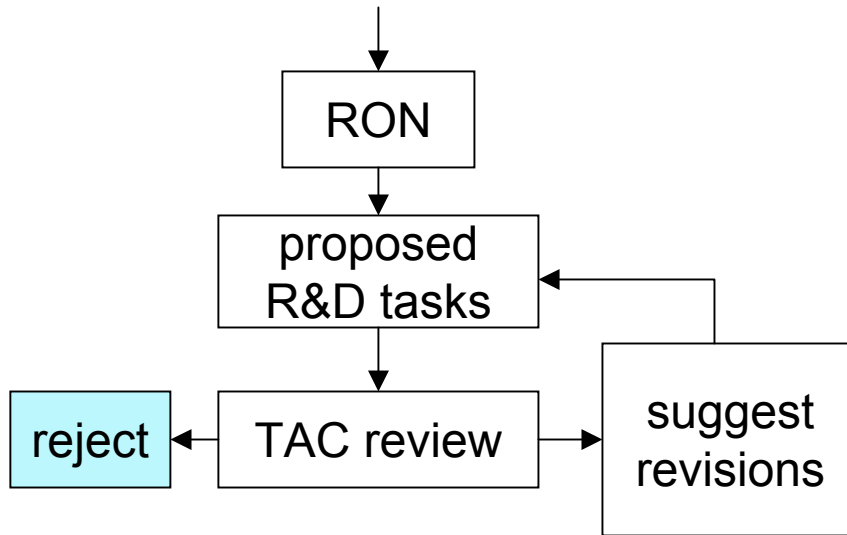
SUGGEST REVISIONS



- ◆ **Proposal is returned to submitter**
- ◆ **Suggested revisions are made and proposal is re-submitted**



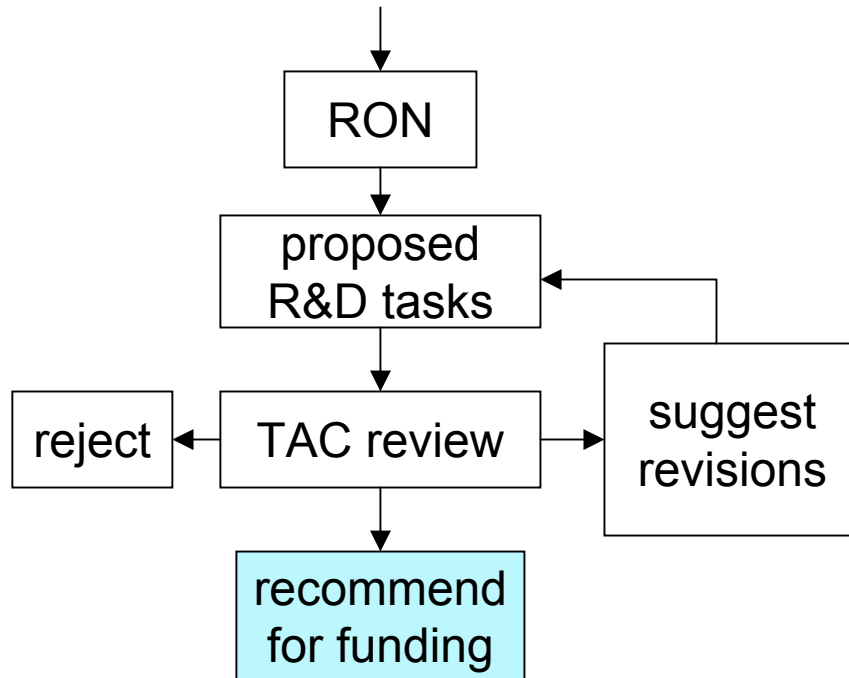
REJECT



- ◆ **Failed key element(s)**
 - ◆ DR relevance
 - ◆ Enabling technology
 - ◆ Collaboration
 - ◆ Multi-disciplinary
- ◆ **Can resubmit new proposed R&D tasks after discussions and failed elements are corrected**



RECOMMEND FOR FUNDING

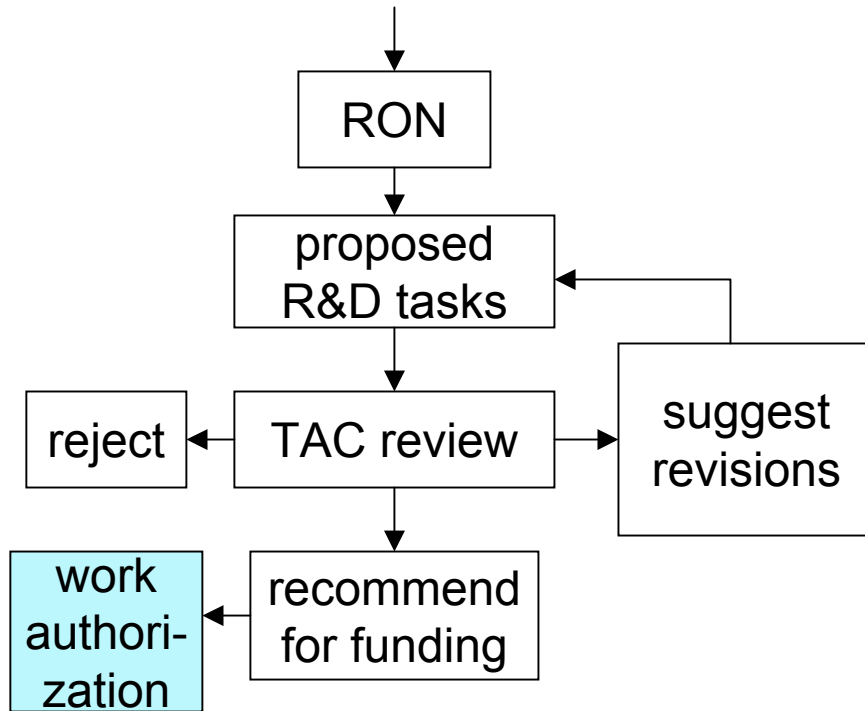


Meeting to Discuss TAC's Funding Recommendation

- ◆ DR ETD Project Manager
 - Gaymond Yee
- ◆ DR Program Advisor
 - Ron Hofmann
- ◆ CEC Contract Manager
 - David Michel



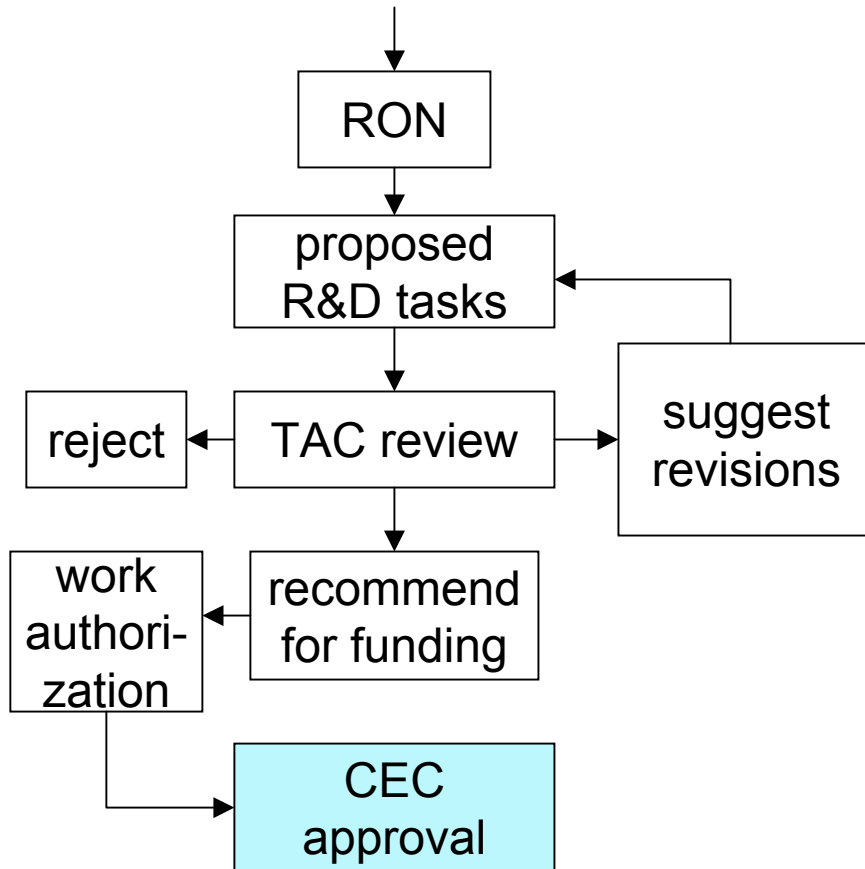
WORK AUTHORIZATION



- ◆ **Maureen Barnato (DR ETD funding and development manager)**
- ◆ **Prepares and submits work authorization package for formal CEC approval**



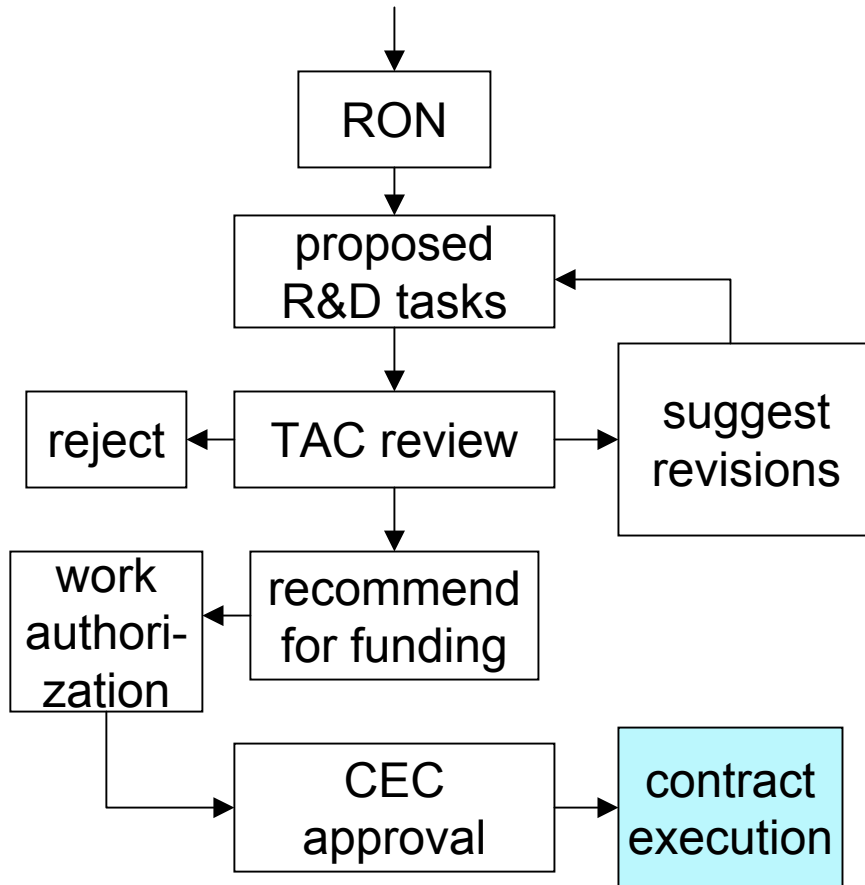
CEC APPROVAL



◆ **David Michel**
(CEC Contract Manager)



CONTRACT EXECUTION



- ◆ **John Snyder (DR ETD subcontract administrator)**
- ◆ **Prepares contract for execution**



DR ETD TEAM

- ◆ **Project management**
 - ◆ Gaymond Yee
- ◆ **Funding and development administration**
 - ◆ Maureen Barnato
- ◆ **Subcontract administration**
 - ◆ John Snyder
- ◆ **Project website**
 - ◆ <http://ciece.ucop.edu/dretd/>