



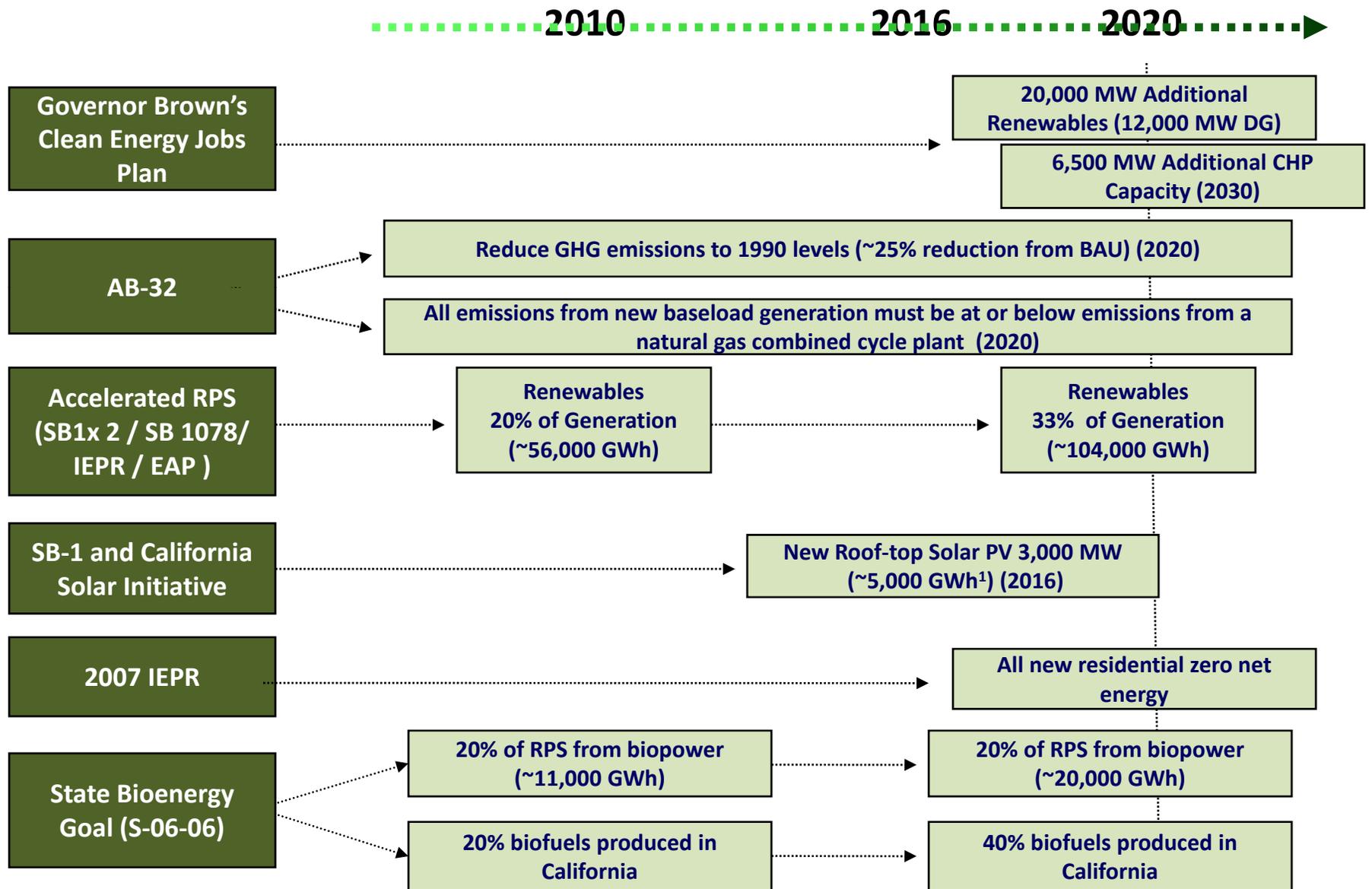
RENEWABLE ENERGY RESEARCH PROGRAM

PIER – Renewable Energy Advisory Group Workshop
June 23, 2011

901 P St. Suite 102
Sacramento, CA



Policy Drivers



Goals

Renewable Energy

- Demonstrate integration of renewable energy at the utility, community, and building scales
- Reduce technology integration barriers, and increase reliable access to renewable energy
- Increase renewable storage options
- Improve renewable energy forecasting

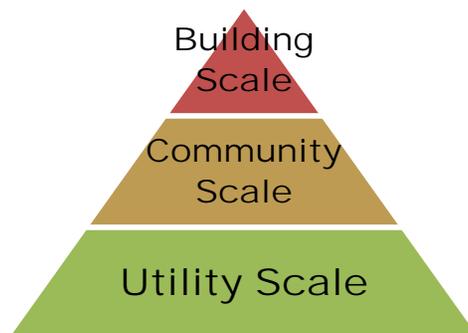
Advanced Generation

- Advance the science, technology, and market availability of grid-connected combined heat and power (CHP)
- Develop advanced generation technologies that focus on increasing reliability, efficiency, and affordability, and reducing emissions
- Demonstrate diversified applications of advanced generation technologies that use renewable energy resources and integrate storage options

General Approach

Renewable Energy

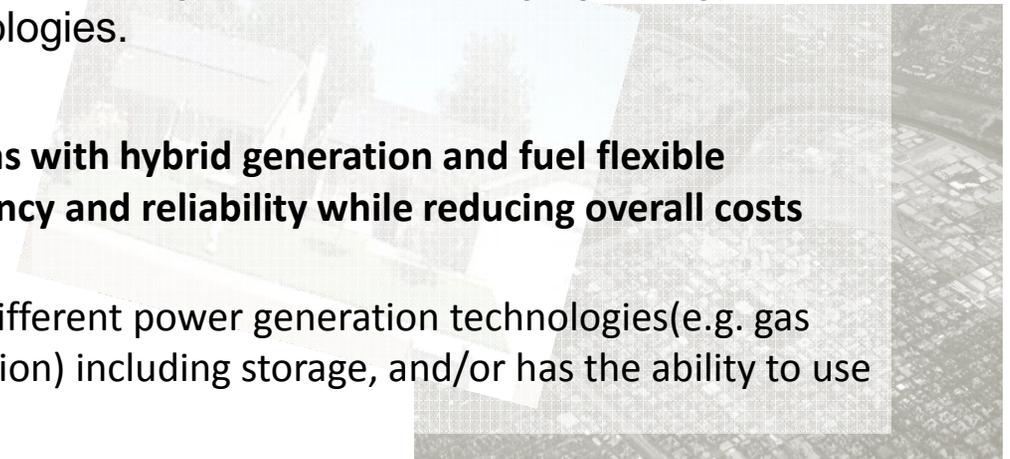
- Focus on RD&D that builds the market connectedness of renewable technologies with grid integration, storage, efficiency, and to lower the cost of renewable energy
- Research and development activities that maximize resources, infrastructure, coordination, and collaboration, and advance renewable science and technology



- Goal is to increase the penetration of renewables at all three market scales.
- Each market scale presents a unique set of issues for the deployment and integration of renewable energy and other emerging energy technologies.

Advanced Generation

- Develop and demonstrate DG/CHP systems with hybrid generation and fuel flexible capability that would help increase efficiency and reliability while reducing overall costs and emissions.
 - Combine, integrate, and demonstrate different power generation technologies(e.g. gas turbine combined with fuel cell generation) including storage, and/or has the ability to use alternative and renewable fuels.





Recent Initiatives

- Renewable Energy Secure Community (RESCO)
- PIER Renewable ARRA Cost Share Projects
- California Renewable Energy Research Center (CREC)
- Recently completed solicitations
 - Utility scale renewable energy
 - Geothermal solicitation
- Planned solicitations under FY 2010/11 Initiatives
 - Community scale renewable energy
 - Advanced Generation/Combined Heat and Power (CHP)

RESCO

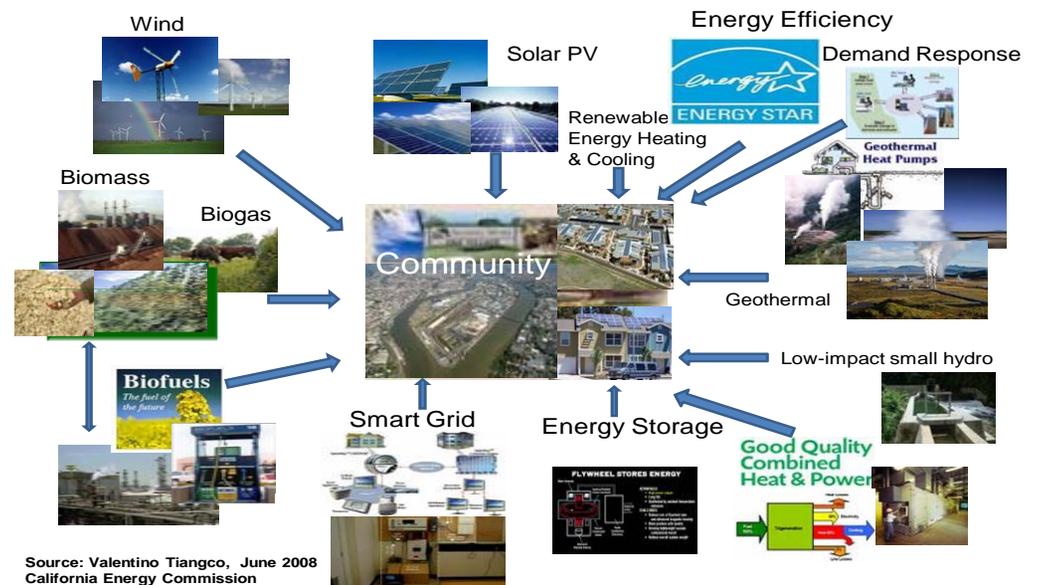
Renewable Energy Secure Community

- Communities that secure their energy supply (electricity and fuel) through indigenous RE resources
- Use of locally-available renewable resources to meet 100% of communities' energy needs

- 11 projects from 2009 solicitation

- Integration projects (8)
 - Exploratory Stage
 - Pilot Stage
 - Implementation Stage
- Collateral projects (3)

Building Blocks of Renewable-based Energy Secure Communities (RESCO)



Example RESCO: UC Davis West Village

Project Objective: Provide compact, mixed-use housing for:

- ~2,000 students
- 340 homes
- an education center
- a ten-acre recreation field complex
- a village square with neighborhood-serving retail uses.

Planned technologies include:

- Energy efficiency (passive & active)
- Demand response
- Distributed Solar, Photovoltaic
- Distributed Solar Thermal
- Biogas digester
- Fuel Cells
- Advanced energy storage
- Smart Grid technologies
- Bio-methane upgrade system
- Bio-fuels for transportation



Sta. Rita Jail RESCO

- Integrating energy generation capabilities:
 - 1.2 megawatts of *already existing* solar photovoltaics
 - an *existing* 1.0 megawatt fuel cell cogeneration system
 - 11.5 kilowatts of *new* wind turbines
 - backup diesel emergency generation system) [*already existing*]

Under a Smart Grid environment

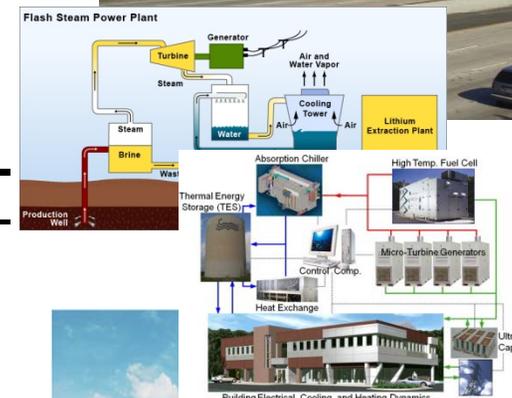
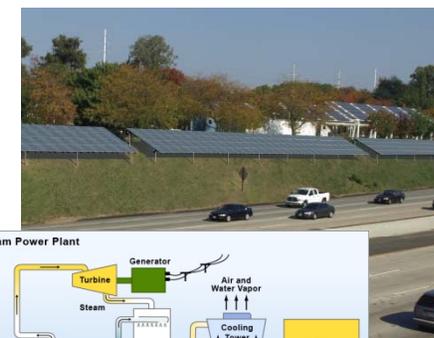


PIER Renewables ARRA Cost-share

	Project and Awardee	PIER Cost-share	DOE Funding
1	Novel Controls for Time-Dependent Economic Dispatch of CHP (UC Irvine)	\$300,000	\$1,282,576
2	Community Renewable Energy Deployment (SMUD)	\$500,000	\$5,000,000
3	Demonstration of PV and Energy Storage for Smart Grids (SMUD)	\$500,000	\$4,300,971
4	High Solar PV Penetration Modeling (UC San Diego)	\$500,000	\$1,750,000
5	Development of a Non-Contact Drilling Technology for Geothermal Wells (Potter Drilling)	\$380,000	\$5,000,000
6	West Village Energy Initiative (UC Davis)	\$500,000	\$2,500,000
7	New River Geothermal Research Project, Imperial Valley, CA (RAM Power, Inc.)	\$389,222	\$5,000,000
8	Technologies for extracting valuable metals and compounds from geothermal fluids (Simbol Mining, Inc.)	\$380,000	\$3,000,000
9	Caldwell Ranch Project (FOA 109)(Calpine)	\$410,000	\$5,000,000
Total		\$3,859,222	\$32,833,547

Research Areas:

- **Community Renewable Energy Deployment**
- **Advanced Geothermal Technologies**
- **High Solar Penetration Tools and Techniques**
- **Advanced Combined Heat and Power (CHP) Technologies**



California Renewable Energy Center

- Brought together broad stakeholders that address research and development on various renewable energy resources



Biomass energy



Solar Energy



Wind Energy



Hydropower



Geothermal Energy



Integrated Renewable Energy Systems

- Conducted research into sustainable resource management and assessment, technology development, system integration, and other aspects of renewable energy
- Resource inventory and generation assessment , standards and roadmaps, and clearing house for renewable facilities performance and environmental data
- Products generated information needed in support of strategic planning, public policy and government regulations and standards for increasing use of renewable energy.

Recent Solicitations

Utility Scale Renewable Energy

- Fund initiatives that will help meet RD&D needs related to more rapid and environmentally responsible deployment of Utility-Scale Renewable Energy (USRE) to the California electricity grid.
- Solicitation released on Nov. 2, 2010 and NOPA released on March 21, 2011
- Funding 8 projects out of 27 proposals covering 4 topic areas:
 - A. Renewable Hybrid Generation and Energy Storage Integration Demonstration
 - B. Monitoring and Forecasting Analysis
 - C. Thermal Energy Storage Modeling
 - D. Environmental Mitigation for Utility-Scale Solar Energy Technologies

Geothermal Energy Solicitation

- Funding opportunity through its Geothermal Resources Development Account (GRDA) Program
- Overall purpose is to promote the development of geothermal resources and technologies.
- Project categories: Resource Development Projects, Planning Projects, and Mitigation Projects.
- Funding 4 projects out of 13 proposals

Planned Solicitations (FY 10/11)

Community Scale Renewable Energy (RESCO II)

- Integration strategy for one or more renewable energy generation and enabling technology at the community scale
- Potential for advancing exploratory projects into the next phase
- Broaden the definition of community from the previous
- Exploratory and Demonstration
- Build on feedback from RESCO workshops held in UC Davis

Advanced Generation- Combined Heat and Power (CHP)

- Develop and integrate emerging multiple DG/CHP technology, including energy storage, in diversified applications
- Advance the science, technology and market availability of grid-connected CHP in California
- Focus on hybrid generation and fuel flexible DG/CHP



Proposed Research Initiatives for FY 2011/12

- ❖ **Game Changer: Advanced Community-based Energy Systems (ACES)**
- ❖ **California Renewable Energy Research Center (CREC)**
- ❖ **Advancement of Renewable Energy Generation Technology**

Proposed Research Initiatives

❖ **Game Changer: Advanced Community-based Energy Systems (ACES)**

- **PIER-wide solicitation in coordination with the Energy Efficiency, Transportation, and Energy Technology and Systems Integration Programs**
- **Demonstration of high-penetration deployment of DG, CHP, and other emerging energy technologies, in partnership with utilities, to supplement power needs of community**
- **Targets mixed-use multifamily residential communities, industrial and commercial parks, and brownfield sites development**
- **Emphasis on renewable energy systems, retrofits, shovel-ready projects and zero net energy communities**

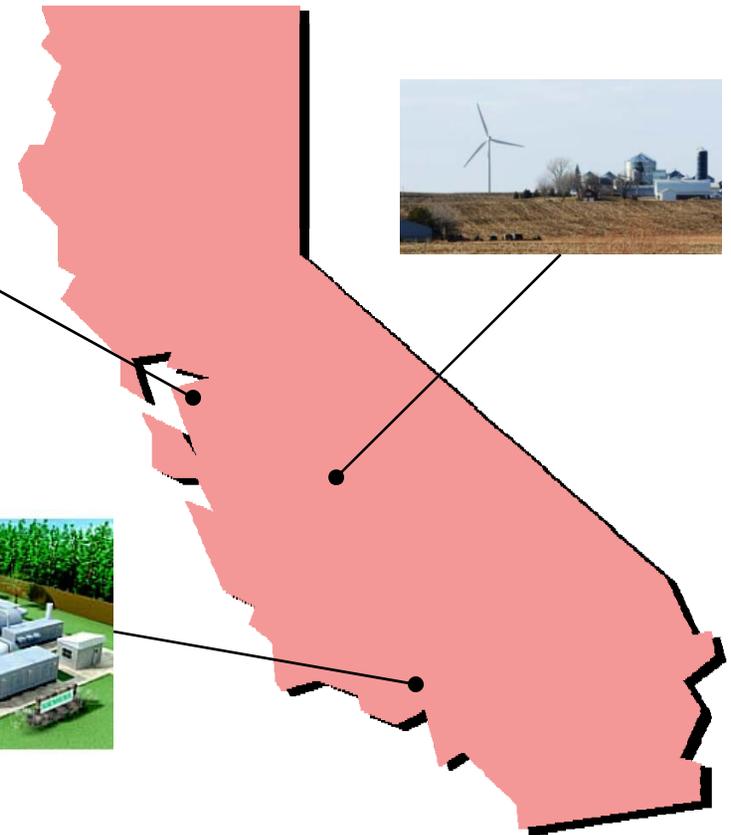
Proposed Research Initiatives

Advanced Community-based Energy Systems (ACES)

Research Initiative: This initiative will develop data, tools, and methods to address information gaps for the economically-viable community-scale deployment of DG, CHP, and other emerging energy technologies.

Potential applications include:

- Commercial business parks
- Industrial business parks
- Urban neighborhoods
- Suburban neighborhoods
- Shopping centers
- Rural Communities
- Military Complexes
- Institutional/Municipal Facilities



Proposed Research Initiatives

Advanced Community-based Energy Systems (ACES)

Mixed-use applications (Residential and/or Retail)

- Maximized penetration of DG (rooftop, parking lots, etc.)
- CHP/CCHP with possible district energy
- Efficiency measures
- Smart Grid Management Systems
- Smart EV charging stations.
- Home and/or community second-life battery storage applications.



Industrial or commercial business park applications

- DG and smart grid technologies
- CHP/CCHP systems
- Electric and/or thermal storage
- Onsite EV charging
- Co-production of fuel for fleet operation
- Efficiency measures



Proposed Research Initiatives

Demonstration Projects will Attempt to Fill Knowledge Gaps

- **What are the life-cycle impacts of DG projects versus centralized generation?**
- **What DG, smart grid, and distributed energy storage implementation strategies can reduce grid impacts of electric vehicles?**
- **How can intermittent DG resources be best integrated into communities to provide baseload generation?**
- **What role can advanced community energy systems play in providing grid support services?**
 - How feasible is using automotive-grade li-ion batteries in second-life storage applications?
 - What emerging technologies can be deployed to complement existing energy systems and provide ancillary services?
- **How effective are alternative ownership and management strategies?**

Proposed Research Initiatives

- ❖ **California Renewable Energy Research Center (CREC)**
 - **Regional/local renewable resource assessments**
 - **Help communities determine generation potentials, what renewables to access and where to site**
 - **Assessment of renewable energy technologies**
 - **Technical, economic, environmental, and other barriers by technologies aimed at providing baseline for further advancing the science and technology of renewable enabling technology**
 - **Determine potential new environmental issues based on scenarios of future renewable energy profiles**
 - **Integrated energy management tools that incorporate forecasting to handle intermittency of renewables**

Proposed Research Initiatives

❖ **Advancement of Renewable Energy Generation Technology**

- **Provide balance to RD&D portfolio through research that will help achieve demonstration-readiness of energy generation technology**
- **Help advance the science and technology and market readiness of renewable energy generation and enabling technology**
- **Develop new technologies that will address near term issues and/or help solve renewable energy integration issues**
- **Help facilitate further development and demonstration of successful PIER prior projects on renewable and advanced generation technologies**

Questions

- ❖ How should we balance supporting pilot and full-scale demonstrations of renewable penetration projects with technology development?
- ❖ What kind of support should be provided for local/regional resources assessments to pave the way for future demonstration projects?
- ❖ How much should research focus on technologies with a near term potential for commercialization compared to emerging technologies.
- ❖ Should the game changer be focused on specific end users (e.g. industrial, commercial, residential) and on specific technologies in order to contribute most to increased DG penetration?
- ❖ What is the role of utilities in promoting DG in general and in implementing the proposed game changer in particular?