

# Agricultural Sector Working Group

## Final Draft Report

January 6, 2008

### Vision of Success

Agriculture accounts for about seven percent (7%) of California's overall energy consumption, a similar percentage of its private sector jobs, and around one and one-half percent (1.5%) of the gross state product. Energy efficiency and renewable energy production are key enablers of the "vision of success" for California's agricultural sector by 2020.

This vision is that California agriculture will continue to be profitable, stable, and a valued member of the community. Energy efficiency and renewable energy resource development support this vision in the following ways:

- **Increased Profitability.** Minimization of energy use through cost-effective energy efficiency lowers operating costs, contributing to increased profitability of the sector.
- **Support of AB32.** Energy efficiency and renewable energy resource development are key strategies for displacing reliance on fossil fuels. Reduced use of fossil fuel resources reduces greenhouse gas emissions in support of AB32.
- **Promotion of Best Practices.** The availability of education and training for workforce and customers will result in best practice energy management decisions and make energy efficiency a part of the standard business culture. For example, energy efficiency best practices shape management decisions affecting pumping and irrigation, the largest single energy end use in the sector, simultaneously minimizing energy and water use and air and water pollution.
- **Support of Renewable Energy Goals.** Integration of energy efficiency and the renewable energy potential of agricultural waste streams will contribute to achievement of California's Renewable Portfolio Standard goals of 20% renewable energy by 2010 and 30% by 2030, and the 25x'25 Initiative goal of 25% of total energy from renewable resources by 2025.

Statewide programs that are integrated across demand-side sectors, segments and technologies—as well as across utility planning, marketing and delivery capabilities—hold promise for maximizing the contributions of energy efficiency and renewable energy resource development to the profitability, stability, and community value of California's agricultural sector. Success of these programs will depend in large part on utility leadership, participation and support consistent with the importance of the agricultural sector to each utility's service territory and system.

### Strategic Context

#### *Broad Themes*

As a general term, "the agricultural sector" refers to a diverse set of market segments and sub-segments. Across this diversity, five broad themes characterize the sector:

- **Increasing Pressures for Production Efficiency:** A "perfect storm" scenario is converging on California agriculture over the time horizon of this plan. Climate change is expected to reduce the supply of snowpack and rainfall water resources available to California and other western states. Continuing increases in population and urbanization will result in continuing reductions in the acreage available for agricultural production, and a simultaneous increase in demand for agricultural products. Increasing global competition in agricultural products markets will put pressure on the prices California agriculture commands. These forces provide impetus for increased efficiency in the utilization of all inputs to agricultural production including land, water and energy.

- **Concentration of Energy Consumption in Three End Uses.** The diversity of California agriculture entails a wide variety of energy end uses. However, energy consumption for the sector as a whole is largely concentrated in three end uses:
  - **Irrigation**, in which electricity is consumed to move and pressurize water from groundwater resources or surface storage to points where it is needed to sustain crops. This end-use accounts for 80 percent of all electricity used in the agricultural sector.
  - **Process energy applications** involving primarily the use of natural gas to fire boilers for steam and hot water production and to provide direct heat for processes such as greenhouse heating and post-harvest crop drying.
  - **Refrigeration** for on- and off-farm warehousing of agricultural products enroute to markets, and for on-farm processes involving chilling (e.g., winemaking, post-harvest crop cooling).

The concentration of energy consumption within these three end uses has obvious implications for targeting and prioritization of energy efficiency initiatives.

- **Increasing Energy Intensity of Irrigation.** California’s agricultural sector will become more dependent on groundwater resources as climate change reduces the size of the surface water resource (i.e., snowpack and rainfall resources) and water competition from urban centers increases. This increased dependency will result in higher energy intensity for irrigated agriculture because more manmade energy is required to lift water from groundwater resources than to deliver it from gravity-flow surface resources. Increased energy intensity will further elevate the already high priority of irrigation for energy efficiency improvements. (Increased reliance on groundwater resources also may increase concerns for the health of underground aquifers, thereby raising the environmental value of improving the water efficiency of irrigation technology and practices.)
- **Continuing Consolidation of Farming.** The increasing pressures for production efficiency mentioned above reinforce a long-term trend toward consolidation of small farming, winery, and food processing operations into large agribusiness enterprises that offer greater economies of scale. Consolidation offers opportunities for increasing the energy efficiency of agriculture by concentrating decisions affecting energy consumption in the hands of fewer decision-makers with typically greater capacities for business analysis.
- **Lack of Consistent Energy Data.** Consumption of electricity and natural gas within the agricultural sector has not been characterized at the level of detail that exists for some other sectors with larger and more visible contributions to national and state energy consumption. Utilities and government agencies with programs targeting agricultural energy use have developed considerable data, but much of the data is inconsistent with respect to definitions, currency, sources and methods for collection, etc. As noted below, data deficiencies represent a major barrier to development of realistic goals for energy efficiency and renewable energy resource development programs within the sector.

### Segments

For purposes of this strategic plan, California’s agricultural sector has been divided into seven end-use segments. Each may be defined by different characteristics including product, cultural background and history, regulatory environment, market forces, labor requirements, seasonality, profitability, and risk. Similarities and differences across segments have significance for energy efficiency program design and renewable energy development.

The seven segments, with summary characterizations, are as follows:

Segment	Summary Characterization
<b>Irrigated Agriculture</b> (Includes irrigation districts; excludes municipal water)	Irrigated agriculture represents the largest single customer segment within the agricultural sector, accounting for approximately 90% of electric energy use in the sector. These customers are involved in field crop (e.g., cotton, beans, wheat, and barley), vegetable crop, fruit and nut crop, and table grape production. A common denominator of this segment is

Segment	Summary Characterization
providers)	<p>the use of energy to lift, move, and pressurize irrigation water.</p> <p>An outlook for increased reliance on ground water, resulting from increased competition for diminishing gravity-flow snowpack and rainfall resources, positions this segment for increases in water-lifting energy intensity. This outlook gives high priority to improvements in the current average pumping efficiency within the segment, currently only about 53%.</p> <p>Increasing pressures from international competition, land- and water-use policy decisions, and labor force uncertainties—together with consolidation of smaller family farms into larger agribusiness enterprises—make this segment increasingly receptive to new technologies and practices. But this receptivity is balanced by financial concerns stemming from risks of crop failure that have historically shaped the psychology of this segment.</p>
<b>Dairies</b>	<p>Historically, dairies were primarily concerned with issues of animal herd husbandry. However, recent regulatory pressures related to air and water quality, as well as the consolidation of small farms into larger operations, are providing an impetus for adoption of new technologies and practices within the segment. An abundance of animal waste produced by dairy farms offers significant potential for use of methane digestion technologies for biogas production. Developing this potential will reduce air emissions and water contamination while contributing to achievement of statewide and regional clean energy goals, and the goals of AB32.</p>
<b>Refrigerated Warehouses</b> (On-farm and commercial off-farm warehousing for both fresh and frozen food products)	<p>Refrigerated warehouses are highly specialized, technology oriented energy consumers focused on remaining competitive with operators in nearby markets. The management mindset in this segment is technical and analytic, making adoption of technologies and practices subject to rigorous cost-effectiveness evaluation. This segment presents opportunities to incorporate emerging technologies and retro-commissioning, develop best practices guidelines, and train operators to optimize energy efficiency.</p>
<b>Vineyards &amp; Wineries</b>	<p>Winemaking encompasses elements of traditional agriculture for grape growing and food processing for wine production. This environmentally friendly segment is comprised of a small number of very large wineries and conglomerates, and a large number of small and medium facilities.</p> <p>The segment is tightly knit and highly organized through strong peer-to-peer networks. It has established environmental programs and web-based benchmarking tools, and is developing a winery carbon calculator. These initiatives support energy efficiency and potentially offer a model for other agricultural segments. Opportunities include the refinement of existing benchmarking tools to reduce industry energy intensity; improved dissemination of best practices; and a large-scale industry initiative to reduce energy intensity in support of greenhouse gas reductions.</p>
<b>Greenhouses &amp; Nurseries</b>	<p>This is a specialty segment in transition from a historical base in the cut flowers industry (which has now moved largely to lower-cost markets in South America) to new bases in the ornamental plants and vegetable transplants industries. This segment looks to Europe and especially to the Netherlands for leadership in technology and practices based on a perception that the United States lags significantly in management practices and technology. Increased mechanization in this segment presents opportunities for energy efficiency.</p>
<b>Post-Harvest Processing</b>	<p>Customers within this segment perform a broad range of on- and near-farm processing functions including ginning, nut and fruit drying, and immediate post-harvest cooling of produce. Their operations are seasonal and driven by harvest schedules, and their locations are heavily influenced by proximity to the field, to transportation, and to markets. This segment presents opportunities for incorporating emerging technologies such as more</p>

Segment	Summary Characterization
<b>Confined Animal Feeding Operations</b>	energy efficient field pre-cooling.  Consisting of feedlots and poultry operations for meat and egg production, this segment is similar to dairies in that its interest in efficiencies based on technology and practices is derived from and subordinate to a primary focus on herd and flock husbandry. However, greater pressures from global competition and recent food safety regulatory attention make this segment somewhat more receptive to new technologies and practices. As in the dairy segment, animal waste streams within this segment offer biogas development potential.

**Stakeholders**

The mix of parties positioned to affect—or interested in affecting—energy consumption within the sector has been evolving since the 1980s. The key drivers for this evolution are increased concern for the sector’s environmental impacts and, related to this concern, increased regulatory focus on the sector. A current list of agricultural sector stakeholders is:

- Agricultural owners and operators
- Government regulatory agencies
- Environmental organizations
- Agricultural trade and lobbying organizations
- State and federal agencies addressing issues of global trade and immigration.

**Barriers, Risks, and Uncertainties**

Several barriers, risks and uncertainties affect the outlook for successful implementation of energy efficiency programs within California’s agricultural sector. The most significant of these are:

- A lack of up-to-date, statewide, segment-specific data on energy consumption and the potential for energy efficiency and renewable energy generation within the sector
- Perceived operational risks arising from rapid changes in the overall business, environmental, and regulatory context of California agriculture
- Uncertainties surrounding: new technologies and techniques for tillage, harvest, irrigation, fertilization and chemical use; new formulations of fertilizers and chemicals; and genetically modified crops
- Reluctance within the sector to accept higher first costs required to realize longer-term financial benefits, and to bear production risks associated with emerging or unproven technologies and practices.

Data deficiencies pose challenges for setting realistic, concrete, long-term goals for energy efficiency and renewable energy resource development within the agricultural sector. For this reason, the IOUs have deferred development of long-term goals for the sector to future planning cycles. Successful implementation of strategies and actions outlined in this cycle will inform those goals. In the meantime, IOU actions will be guided by shorter-term goals developed through regular program planning cycles consistent with this Energy Efficiency Strategic Plan.

The continuing rapid evolution of regulation affecting the sector poses particular barriers, risks and uncertainties. For example, until recently irrigated agriculture was exempt as a non-point source of air and water pollution. Now decisions affecting irrigation technology and practices are more complex. Decision makers must consider compliance with new requirements of the Water Resources Control Board and Regional Water Quality Control Boards, and the Air Resources Board and Regional Air Quality Control Boards, as well as the potential for lowering operating costs through increased energy efficiency. The increasing complexity of decisions affecting California agriculture holds potential to slow the rate of adoption of energy efficient technologies and practices.

California’s agricultural sector needs help in working through the complexity and conflicts inherent in regulatory changes intended to combat climate change. Improved coordination of air, water and energy regulatory requirements and

programs would advance public policy objectives within the sector while helping to preserve California’s traditionally agriculture-friendly business climate.

### ***Integrating Renewables and Demand Response***

Within several of these segments there exists significant unrealized potential for renewable energy generation from agricultural waste streams. Scott Anders of the Energy Policy Initiatives Center at the University of San Diego estimates that California’s dairy segment alone could produce almost 15 billion cubic feet of biogas annually, and significantly more if use of co-digestion technology were widespread. Anders notes that California has only 22 biogas producing digester sites located on dairy farms, compared with over 3,000 farm-based biogas sites in Germany.

The total biogas potential of California’s agricultural sector is not precisely known, but based on the Anders estimate (limited to one segment of the overall sector) it is a significant resource. If its cost-effective potential were developed, consistent with the preferred “loading order” for energy resource development, biogas could make significant contributions to achieving the statewide clean energy goals of the Renewable Portfolio Standard and the 25X’25 Initiative, and the supporting goals of regional organizations such as the California Partnership for the San Joaquin Valley.

The potential for demand response in the agricultural sector through strategies such as opt-in programs and new rate options is underdeveloped and warrants further exploration.

### **Strategies and Action Plan**

Over the 2009-2020 horizon of the statewide Energy Efficiency Strategic Plan, California’s investor-owned utilities and participating stakeholders will focus on six strategies addressing:

1. Market Characterization and Goal Setting
2. Education and Training
3. Marketing and Outreach
4. Financing and Incentives
5. Process Energy Intensity
6. Emerging Technologies.

These strategies are designed to work together to support development of all available energy efficiency and demand reduction resources within the sector that are cost-effective, reliable and feasible. Associated with each strategy are implementing actions scheduled in four timeframes:

- Immediate: 2008
- Short Term: 2009-2011
- Mid Term: 2012-2014
- Long Term: 2015-2020.

Table 1 details the strategies and their rationales (targets) in an action plan identifying who leads and who participates in specific actions, the timeframes of action, and metrics for measuring progress toward achievement or necessary revisions of each strategy. Table 2 summarizes the major requirements for successful strategy implementation including knowledge, technology, infrastructure, public policy, marketing-education-and-outreach (MEO), financing, and demand-side management integration.

**Table 1: Agricultural Sector Action Plan**

Timeframes:

- Immediate: 2008
- Short Term: 2009-2011
- Mid Term: 2012-2014
- Long Term: 2015-2020

<b>Strategy #1: Market Characterization and Goal Setting.</b> Establish and maintain a knowledge base for California’s agricultural sector sufficient to support planning for development of all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible.				
<b>Target:</b> <i>Assure that decisions affecting energy efficiency and demand reduction within the sector are based on the highest quality and most comprehensive information possible, and coordinated across all major market participants and all relevant public policy initiatives.</i>				
<b>Actions</b>	<b>Leader(s)</b>	<b>Participants</b>	<b>Timeframes</b>	<b>Metrics / Milestones</b>
<b>1-1: Conduct an energy characterization study</b> for the statewide agricultural market that: <ul style="list-style-type: none"> <li>• Defines sub-sector energy use and estimates energy efficiency potential, and</li> <li>• Draws upon the information resources—and reflects the information needs—of the major energy utilities, government planning agencies, and educational institutions serving the market.</li> </ul>	CEC, CPUC	CEC, EPA, DOE, IOUs, POU, IDs, DWR, CDFR, Bureau of Reclamation	Immediate Short Term	Study plan completed (6/2009) Study completed (12/2011)
<b>1-2: Conduct a statewide technical, economic and policy assessment</b> of the potential for agricultural waste streams to offset natural gas and electric consumption or generation.	CEC, CPUC	CEC, CPUC, IOUs, POU, IDs	Immediate Short Term	Study plan completed (6/2009) Study completed (12/2011)
<b>1-3: Coordinate data collection and sharing</b> across the key organizations and programs shaping the appropriate and efficient use of energy within the statewide agricultural sector.	CEC, CPUC	CEC, CPUC, IOUs, POU, IDs, DWR, Bureau of Reclamation, CDFR, colleges/universities, ARB, industry associations, Agricultural Climate Action Team	Immediate Short Term	Integrate ARB Climate Action Team Recommendations (12/2008) Data participants confirmed (6/2009) Initial data collection/sharing process in place (6/2009) Shared data integrated into statewide planning efforts (12/2010)

<p><b>1-4: Develop benchmarking resources, tools and methods of recognition</b> at the sub-sector level to facilitate:</p> <ul style="list-style-type: none"> <li>Consistent energy baselines and goal setting within and across energy utilities serving the statewide agricultural sector, and</li> <li>Continuous improvement in energy efficiency by agricultural end users.</li> </ul>	IOUs	IOUs, industry associations (Wine Institute, Farm Bureau, Western United Dairymen, etc.) UC, CEC PIER	Short Term	Identify and confirm partners (12/2009) Benchmark methodologies identified (6/2010) Tools are developed and launched (12/2011)
<p><b>1-5: Coordinate goals and supporting accounting systems</b> established to further policy objectives of the Energy Efficiency Strategic Plan and Global Warming Solutions Act (AB32) within California's agricultural sector.</p>	CEC, CPUC	IOUs, CEC, CPUC, POUs, ARB	Short Term Mid Term Long Term	Tie to AB32 timeframe
<p><b>Strategy #2: Education and Training.</b> Promote the adoption of energy efficiency as standard practice across the breadth and depth of California's agricultural sector through comprehensive education and training programs targeting:</p> <ul style="list-style-type: none"> <li>Agricultural owners, facilities managers and operators</li> <li>Systems engineers, designers and builders</li> <li>Equipment manufacturers and vendors</li> <li>Energy services companies and consultants</li> <li>Students in educational disciplines affecting California agriculture</li> <li>Federal, state and local agricultural advisers (e.g., Cooperative Extension Service, Agriculture Commissioners' offices).</li> </ul>				
<p><b>Target:</b> <i>Assure that all major participants in the production of agricultural products are fully informed on the latest advances in agricultural energy efficiency potential, and that consumers understand the extent and value of energy efficiency embedded in the products they select.</i></p>				
<b>Actions</b>	<b>Leader(s)</b>	<b>Participants</b>	<b>Timeframes</b>	<b>Metrics / Milestones</b>
<p><b>2-1: Develop a scoping document</b> that:</p> <ol style="list-style-type: none"> <li>Outlines training objectives, priorities and collaboration/coordination opportunities across target groups, and</li> <li>Identifies partners and channels for delivery of training.</li> </ol>	IOUs	IOUs, LGPs, CEC, Strategic Planning Workforce Education and Training Task Force, University of California, California State Universities, Community Colleges, Industry Associations, Certificate Programs, Local Governments, CA Partnership for the SJ Valley, others TBD	Short Term	Scoping document completed by 12/2010

<p><b>2-2:</b> Consistent with the scoping document:</p> <ul style="list-style-type: none"> <li>• <b>Develop training curricula and design supporting training modules</b> that together provide for comprehensive energy efficiency education and training across all target groups.</li> <li>• <b>Develop training modules consistent with training priorities</b> identified in the scoping document, and support these modules with online learning resources where productive.</li> <li>• <b>Develop certification programs</b> for appropriate target groups in collaboration with training partners.</li> </ul>	<p>IOUs</p>	<p>IOUs, LGPs, CEC, Strategic Planning Workforce Education and Training Task Force, University of California, California State Universities, Community Colleges, Industry Associations, Certificate Programs, Local Governments, CA Partnership for the SJ Valley, others TBD</p>	<p>Short Term Mid Term</p>	<p>Key education and training initiatives are developed or rolled out by 12/2011</p>
<p><b>Strategy #3: Marketing and Outreach.</b> Increase the penetration of energy efficiency technologies and practices throughout California’s agricultural sector by developing an integrated marketing and outreach strategy that:</p> <ul style="list-style-type: none"> <li>• Takes full advantage of existing channels of communication with the agricultural community</li> <li>• Innovates new channels wherever productive and possible</li> <li>• Stimulates demand by California consumers for energy efficient food products.</li> </ul>				
<p><b>Target:</b> <i>Assure that knowledge required to realize the full potential for energy efficiency in agricultural processes is disseminated as broadly and with as much credibility as possible throughout the sector.</i></p>				
<p><b>Actions</b></p>	<p><b>Leader(s)</b></p>	<p><b>Participants</b></p>	<p><b>Timeframes</b></p>	<p><b>Metrics / Milestones</b></p>
<p><b>3-1:</b> In coordination with Action 1-1 (energy characterization study), <b>identify the key channels of communication within the agricultural community</b> and characterize according to:</p> <ol style="list-style-type: none"> <li>Strengths and weaknesses;</li> <li>Effectiveness in reaching the community overall and/or key subsectors; and</li> <li>Perceptions of trust among constituencies reached by each channel</li> <li>Opportunities for new channels of communication.</li> </ol>	<p>IOUs</p>	<p>Strategic Planning Marketing, Education and Outreach Task Force, UC Coop Extension, , Trade Associations, USDA-NRCS, Local Government (Ag Commissioner’s Offices)</p>	<p>Short Term</p>	<p>Key Channels listed by 1/1/2009 Assessment Complete 1/1/2010</p>
<p><b>Note:</b> Candidate channel partners include: Farm Bureau, Almond Growers Association, CA Rice Commission, Central Coast Vineyard Team, UC Cooperative extensions, CSU, San Joaquin Valley Partnership, Resource Conservation Districts, County Planning (water and energy use), CDFA, Air Districts, Irrigation Districts, Cal Poly ITRC (Irrigation Training &amp; Research Center), NRCS, Northwest Food Processors Association, public-owned utilities, Packard Foundation – CA Roundtable on Agriculture in the Environment</p>				

<p><b>3-2: Identify the most effective partners for communicating with sub-sectors</b> identified in Action 3-1, and collaboratively plan for effective communication with these subsectors.</p>	IOUs	Strategic Planning Marketing, Education and Outreach Task Force, UC Coop Extension, , Trade Associations, USDA-NRCS, Local Government (Ag Commissioner’s Offices)	Short Term	Assessment Complete 1/1/2010
<p><b>3-3: Integrate marketing and outreach to the agricultural sector</b> by the IOUs.</p>	IOUs	Strategic Planning Marketing, Education and Outreach Task Force, UC Coop Extension, Trade Associations, USDA-NRCS, Local Government (Ag Commissioner’s Offices)	Mid Term	Consistent messaging (e.g. terminology, goals) by 1/1/2012
<p><b>3-4: Establish a centralized clearinghouse</b> for all technical, programmatic, regulatory and incentive information—including best practices and case studies—for integrated DSM options within the agricultural sector.</p>	IOUs	IOUs, POUs, CPUC, CEC, DWR, Bureau of Reclamation, USDA-NRCS, UC Coop Ext, CARB, Water Board	Mid Term	Clearinghouse established by 1/1/2012
<p><b>3-5: Integrate IOU marketing and outreach to consumers</b> of agricultural products on the value of agricultural energy efficiency with existing and emerging “green agriculture” awareness programs, and with overall marketing and outreach programs and messages under the EESP.</p>	IOUs	Strategic Planning Marketing, Education and Outreach Task Force, IOUs, POUs, UC Coop, Trade Associations	Mid Term	Significant integration by 1/1/2012
<p><b>Strategy #4: Financing and Incentives.</b> Support the adoption of energy efficiency within California’s agricultural sector by coordinating the goals, program designs, and funding of all major sources of financing and incentives, including:</p> <ul style="list-style-type: none"> <li>• Water conservation and quality improvement funding</li> <li>• CEC emerging technology funds</li> <li>• Local air quality improvement funds</li> <li>• Federal tax credits</li> <li>• IOU and POU energy efficiency incentives.</li> </ul>				
<p><b>Target:</b> <i>Assure that financing and incentives targeted to all aspects of agricultural operations are consistent—and not at cross purposes—with realization of the full energy efficiency potential of agricultural processes.</i></p>				
<p><b>Actions</b></p>	<p><b>Leader(s)</b></p>	<p><b>Participants</b></p>	<p><b>Timeframes</b></p>	<p><b>Metrics / Milestones</b></p>
<p><b>4-1: Confirm the major sources of financing and incentives</b> affecting agricultural operations and establish a central database to track and coordinate available programs.</p>	CEC, CPUC	CEC, CPUC, IOUs, funding entities	Short Term Ongoing	Identify the major sources of financing and incentives by 01/01/2009 Establish database by 01/01/2010

[**Note:** Examples of financing and incentives sources include Propositions 50 and 84, AB 118, federal and state tax code provisions, the CEC’s low-interest loan program, the USDA-NRCS EQUIP program, and conservation innovation grants, among others. Goals of these sources include energy conservation, water conservation, water quality, and air quality.]

<b>4-2: Establish a task force</b> representing the sources identified in Action 4-1.	CEC, CPUC	CEC, CPUC, IOUs, funding entities	Short Term	Team in place 01/01/2009
<b>4-3:</b> Through the task force, <b>negotiate a memorandum of understanding</b> to coordinate program goals, designs, and funding targeting California’s agricultural sector.	CEC, CPUC	CEC, CPUC, IOUs, funding entities	Short Term	MOU in place 06/01/2010
<b>4-4: Institutionalize the task force</b> as a permanent clearinghouse for information and process for program coordination across sources of financing and incentives.	CEC, CPUC	CEC, CPUC, IOUs, funding entities	Mid Term	Assigned administrative responsibility in each organization by 01/01/2012
<b>4-5 Implement the MOU</b> by standardizing terminology; identifying consistent goals for education, training, and marketing and outreach; and identifying where goal conflicts arise and resolving these conflicts.	CEC, CPUC	CEC, CPUC, IOUs, funding entities	Mid Term – Long Term	Standard terminology, shared funding and participation where appropriate for education, training, marketing, and outreach, formal agreements on conflict resolution 2012 – 2020
<b>4-6: Work with/through the Governor’s Office and the Legislature to avoid goal conflicts</b> in legislation and implementing regulations affecting the agricultural sector.	CEC, CPUC	CEC, CPUC, IOUs, ARB, other state agencies, funding entities, Governor’s Office and Legislature through committee staffs	Short Term Ongoing	Liaisons established by 01/01/2009
<b>Strategy #5: Process Energy Intensity.</b> Foster advances in equipment efficiency and improvement of management practices to reduce energy consumption for irrigation pumping, process natural gas, and refrigeration throughout California’s agricultural sector.				
<b>Target:</b> <i>Assure continuous advances in equipment energy efficiency and management best practices supporting the most energy intensive end uses in California agriculture.</i>				
<b>Actions</b>	<b>Leader(s)</b>	<b>Participants</b>	<b>Timeframes</b>	<b>Metrics / Milestones</b>
<b>5-1:</b> In coordination with Strategy #1 (market characterization) and Strategy #6 (emerging technologies): <ul style="list-style-type: none"> <li>• <b>Conduct a gap analysis</b> of current research, development and demonstration (RD&amp;D) projects focusing on the target end uses</li> <li>• <b>Identify and prioritize needed RD&amp;D projects.</b></li> </ul>	CEC, CPUC, IOUs	CEC, CPUC, IOUs, colleges/universities, USDOE, USDA, CDFA, industry associations	Immediate Ongoing	Key process RD&D projects are identified and prioritized by 12/2011(and ongoing)

<p><b>5-2:</b> Coordinate with Strategies #2 (education and training), #3 (marketing and outreach) and #6 (emerging technologies) to <b>assure sufficient market awareness and technical infrastructure</b> to support adoption of key energy efficient technologies and best management practices.</p>	<p>IOUs</p>	<p>IOUs, CEC, CPUC, Strategic Planning Marketing, Education and Outreach Task Force, USDA, colleges/universities, industry associations, technology manufacturers and vendors, clearinghouse (action 3-4), customers</p>	<p>Short Term Ongoing</p>	<p>Increased awareness of key process energy efficiency technologies and management practices Enhancement of the delivery infrastructure</p>
<p><b>5-3:</b> To maximize cost-effective onsite energy and demand reductions, <b>integrate into agricultural energy efficiency evaluations and projects:</b></p> <ul style="list-style-type: none"> <li>• <b>Retro-commissioning</b> to restore existing process systems to their original levels of energy efficiency</li> <li>• <b>Onsite source-water reduction</b> to lessen energy requirements for process pumping</li> <li>• <b>Precision agriculture</b>, where it has potential to reduce irrigation and attendant pumping energy requirements</li> <li>• <b>Advanced irrigation systems that are adaptable to demand response programs</b> to promote efficient irrigation energy loads</li> <li>• <b>Pressure reduction</b> in irrigation systems to further promote the efficiency of irrigation energy loads</li> <li>• <b>Waste heat recovery</b> and other gas-savings measures</li> <li>• <b>Improved industrial refrigeration practices and technologies.</b></li> </ul>	<p>CEC, CPUC, IOUs</p>	<p>IOUs, CEC, CPUC, USDA, colleges/universities, industry associations, technology manufacturers and vendors, web portal, customers</p>	<p>Short Term Ongoing</p>	<p>Reduced agricultural energy intensity as indicated by ongoing market characterization and M&amp;V studies</p>
<p><b>5-4: Clarify measurement and verification (M&amp;V) protocols</b> related to onsite water related energy reductions.</p>	<p>CPUC, IOUs</p>	<p>CPUC, IOUs, Customers, water consultants</p>	<p>Immediate Short Term</p>	<p>Water related energy reductions are included in energy efficiency programs and M&amp;V protocols are established by 12/2009</p>

<p><b>Strategy #6: Emerging Technologies.</b> Maximize the energy efficiency contributions of emerging technologies in California’s agricultural sector through implementation of continuous processes to:</p> <ul style="list-style-type: none"> <li>• Identify the most promising emerging technologies</li> <li>• Actively manage these technologies through the early stages of their maturity curves</li> <li>• Improve communication throughout the agricultural sector of emerging technology success stories.</li> </ul>				
<p><b>Target:</b> <i>Assure that emerging technologies with the most potential to advance energy efficiency in California agriculture are continuously identified, developed, proven and integrated into standard practice throughout the sector as early as possible.</i></p>				
<b>Actions</b>	<b>Leader(s)</b>	<b>Participants</b>	<b>Timeframes</b>	<b>Metrics / Milestones</b>
<p><b>6-1: Develop a statewide action plan to identify promising emerging technologies</b> for the agricultural sector.</p>	IOUs, CEC	IOUs, CPUC, colleges/universities, clean tech venture capitalists, research labs, CEC, manufacturers	Immediate Short Term	Plan developed (12/2010)
<p><b>6-2:</b> In coordination with Strategy #4 (financing and incentives), assess the need to <b>restructure IOU customer incentives as necessary</b> to stimulate adoption of emerging energy efficient equipment and practices shaping the target end uses.</p>	IOUs	IOUs, CPUC	Immediate	If deemed appropriate, alternative emerging technology incentive structure is proposed and approved by CPUC by 12/2008
<p><b>6-3:</b> Work with customers and industry associations to <b>identify and implement emerging technology demonstration sites</b> and marketing opportunities.</p>	IOUs	IOUs, CEC, Strategic Planning Marketing, Education and Outreach Task Force, colleges/universities, industry associations, customers	Immediate Ongoing	Demonstration sites identified (immediate and ongoing)
<p><b>6-4: Aggressively disseminate information</b> from technology demonstrations through the channels identified in Strategy #3 (marketing and outreach) and the task force institutionalized in Action 4-4.</p>	IOUs	IOUs, CEC, colleges/universities, industry associations	Short Term Ongoing	Information distributed through channels and task force by 1/2010

<p><b>6-5: Maximize the agricultural sector's potential for cost-effective energy generation</b> by fully supporting the California Solar Initiative and the Interagency Bioenergy Action Plan:</p> <ul style="list-style-type: none"> <li>• Assess current technology and costs</li> <li>• Document existing projects</li> <li>• Educate customers</li> <li>• Assess barriers</li> <li>• Adjust tariffs</li> <li>• Provide workforce training</li> <li>• R&amp;D for technology requirements for use or distribution</li> </ul>	<p>IOUs</p>	<p>IOUs, CEC, CPUC, POU, ARB, CDFA, USDA, colleges/universities</p>	<p>Immediate Ongoing</p>	<p>Ongoing coordination</p>
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**Table 2: Agricultural Sector Strategy Requirements**

<b>Strategy #1: Market Characterization and Goal Setting.</b> Establish and maintain a knowledge base for California’s agricultural sector sufficient to support planning for development of all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible.						
<b>Knowledge</b>	<b>Technology</b>	<b>Infrastructure</b>	<b>Policy</b>	<b>MEO</b>	<b>Financing</b>	<b>DSM Integration</b>
<ul style="list-style-type: none"> <li>Improved understanding of tradeoffs: energy vs. water vs. air, etc.</li> <li>Resolution of pending AB32 regulations and requirements</li> <li>Understanding of where energy use data now resides and in what forms, and methods of normalizing data—especially for climatic changes year-to-year</li> </ul>	<ul style="list-style-type: none"> <li>Improved energy modeling tools</li> <li>Interactive energy benchmarking tools</li> </ul>	<ul style="list-style-type: none"> <li>Identification of technology platform and host for knowledge base</li> </ul>	<ul style="list-style-type: none"> <li>Policies and processes for collecting and sharing data across agencies and companies</li> </ul>	<ul style="list-style-type: none"> <li>Identify key channels for marketing and education</li> </ul>	<ul style="list-style-type: none"> <li>Identify sources of funding for data collection and coordination, and knowledge base maintenance</li> </ul>	<ul style="list-style-type: none"> <li>Improved understanding of sector-specific best practices and technologies, and seasonal operational trends unique to agriculture</li> </ul>
<p><b>Strategy #2: Education and Training.</b> Promote the adoption of energy efficiency as standard practice across the breadth and depth of California’s agricultural sector through comprehensive education and training programs targeting:</p> <ul style="list-style-type: none"> <li>Agricultural owners, facilities managers and operators</li> <li>Systems engineers, designers and builders</li> <li>Equipment manufacturers and vendors</li> <li>Energy services companies and consultants</li> <li>Students in educational disciplines affecting California agriculture</li> <li>Federal, state and local agricultural advisers (e.g., Cooperative Extension Service, Agriculture Commissioners’ offices).</li> </ul>						
<b>Knowledge</b>	<b>Technology</b>	<b>Infrastructure</b>	<b>Policy</b>	<b>MEO</b>	<b>Financing</b>	<b>DSM Integration</b>
<ul style="list-style-type: none"> <li>Identify target audience, formats, and content</li> </ul>	<ul style="list-style-type: none"> <li>Improved energy modeling tools</li> <li>Curricula designed for specific audiences in both “extension” and classroom settings</li> </ul>	<ul style="list-style-type: none"> <li>New and/or improved fixed and portable facilities for hands-on training that mirrors “real world” operations</li> </ul>	<ul style="list-style-type: none"> <li>Strong commitment at all levels of government to development of education and training programs and infrastructure within California</li> </ul>	<ul style="list-style-type: none"> <li>Identify and target agricultural education channel partners</li> </ul>	<ul style="list-style-type: none"> <li>Identify and integrate IOU and non-utility funding sources</li> </ul>	<ul style="list-style-type: none"> <li>Improved understanding of sector-specific best practices and technologies</li> <li>Improved understanding of both trade-offs and synergies of energy conservation and demand response practices</li> </ul>

**Strategy #3: Marketing and Outreach:** Increase the penetration of energy efficiency technologies and practices throughout California’s agricultural sector by developing an integrated marketing and outreach strategy that:

- Takes full advantage of existing channels of communication with the agricultural community
- Innovates new channels wherever productive and possible.
- Stimulates demand by California consumers for energy efficient food products.

Knowledge	Technology	Infrastructure	Policy	MEO	Financing	DSM Integration
<ul style="list-style-type: none"> <li>• Improved understanding of existing channels to the agricultural sector and sub-sectors</li> <li>• In-depth understanding of the energy-environment nexus in the agricultural sector</li> </ul>	<ul style="list-style-type: none"> <li>• Consistent models across agricultural sub-sectors to support consistent “green agriculture” messages to consumers</li> </ul>	<ul style="list-style-type: none"> <li>• Develop centralized Web-based resource for dissemination of energy information</li> </ul>	<ul style="list-style-type: none"> <li>• Agreement on terminology and messages across organizations marketing to agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• Coordination with the MEO Task Force</li> </ul>	<ul style="list-style-type: none"> <li>• Financing necessary to create new channels</li> <li>• Financing necessary for effective and on-going marketing effort</li> </ul>	<ul style="list-style-type: none"> <li>• Optimize cost-effective, integrated demand-side strategies into marketing and outreach messages</li> </ul>

**Strategy #4: Financing and Incentives.** Support the adoption of energy efficiency within California’s agricultural sector by coordinating the goals, program designs, and funding of all major sources of financing and incentives, including:

- Water conservation and quality improvement funding
- CEC emerging technology funds
- Local air quality improvement funds
- Federal tax credits
- IOU and POU energy efficiency incentives.

Knowledge	Technology	Infrastructure	Policy	MEO	Financing	DSM Integration
<ul style="list-style-type: none"> <li>• Improved understanding of financing/incentives programs across all participants</li> <li>• Improved understanding of tradeoffs: energy vs. water vs. air, etc.</li> <li>• Improved understanding of required benefit/cost ratios for different agricultural segments</li> </ul>		<ul style="list-style-type: none"> <li>• Single, user-friendly interface between financing/incentives programs and eligible energy consumers</li> </ul>	<ul style="list-style-type: none"> <li>• Budgeting and staffing this massive coordination effort across participating organizations</li> </ul>	<ul style="list-style-type: none"> <li>• “Selling” all desired participants on the value of coordinating goals, programs, and funding</li> </ul>	<ul style="list-style-type: none"> <li>• Fair allocation of costs across participants in coordination</li> <li>• Integration of allocated costs into participating public agency budgets</li> </ul>	<p>Improved understanding of sector-specific best practices and technologies, seasonal operational trends unique to agriculture; impact of other resource management goals on DR and EE</p>

<b>Strategy #5: Process Energy Intensity.</b> Foster advances in equipment efficiency and improvement of management practices to reduce energy consumption for irrigation pumping, process natural gas, and refrigeration throughout California’s agricultural sector.						
<b>Knowledge</b>	<b>Technology</b>	<b>Infrastructure</b>	<b>Policy</b>	<b>MEO</b>	<b>Financing</b>	<b>DSM Integration</b>
<ul style="list-style-type: none"> <li>Improved understanding of financial and cultural considerations affecting adoption of improved technologies and practices</li> </ul>	<ul style="list-style-type: none"> <li>R&amp;D commitment and support for increasing equipment efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Close, effective working relationships with equipment manufacturers, designer/installers, and vendors</li> </ul>	<ul style="list-style-type: none"> <li>Commitment by state and county governments to appropriate use of codes and standards to support increased equipment efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Demonstration of advanced technology and improved management practices</li> <li>Aggressive dissemination of demonstration results</li> </ul>	<ul style="list-style-type: none"> <li>Fair allocation of R&amp;D costs required to effect higher equipment efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Improved understanding of sector-specific best practices and technologies and seasonal operational trends unique to agriculture</li> </ul>
<p><b>Strategy #6: Emerging Technologies.</b> Maximize the energy efficiency contributions of emerging technologies in California’s agricultural sector through implementation of continuous processes to:</p> <ul style="list-style-type: none"> <li>Identify the most promising emerging technologies</li> <li>Actively manage these technologies through the early stages of their maturity curves</li> <li>Improve communication throughout the agricultural sector of emerging technology success stories.</li> </ul>						
<b>Knowledge</b>	<b>Technology</b>	<b>Infrastructure</b>	<b>Policy</b>	<b>MEO</b>	<b>Financing</b>	<b>DSM Integration</b>
<ul style="list-style-type: none"> <li>Improved understanding of agricultural process needs to support identification of promising technologies</li> </ul>		<ul style="list-style-type: none"> <li>Systems for identifying and tracking promising technologies, especially those originating outside the agricultural sector</li> </ul>	<ul style="list-style-type: none"> <li>MOUs in place among appropriate agencies so that identification and dissemination is a shared process</li> </ul>	<ul style="list-style-type: none"> <li>Direct linkage of emerging technologies identification with demonstration and information programs</li> </ul>	<ul style="list-style-type: none"> <li>Fair allocation of costs required to identify and develop emerging technology</li> </ul>	<ul style="list-style-type: none"> <li>Identify opportunities for emerging technologies to support DSM integration</li> </ul>