

State Energy Advisory Board
Meeting Minutes: June 8 - 10, 2010
Lakewood, CO

MEETING ATTENDEES

Designated Federal Officer (DFO):

- Gary Burch, STEAB DFO, Senior Management Technical Advisor, Intergovernmental Projects, Golden Field Office, Denver, Colorado

STEAB ATTENDANCE		
BOARD MEMBERS	Present	Absent
Susan S. Brown , Deputy Administrator, Wisconsin Division of Energy		✓
John Butler , Energy Commission Supervisor II, California Energy Commission	✓	
Dan Carol , Strategic Advisor/Organizational Consultant		✓
William Vaughn Clark , Director, Office of Community Development, Oklahoma Department of Commerce	✓	
John H. Davies , Director, Division of Renewable Energy and Energy Efficiency, Kentucky Office of Energy Policy	✓	
Cris Eugster , Executive Vice President and Chief Sustainability Officer, CPS Energy		✓
David Gipson , Director, Energy Services Division, Georgia Environmental Facilities Authority		✓
Philip Giudice , Commissioner, Massachusetts Department of Energy Resources	✓	
Ryan Gooch , Energy Policy Director, Tennessee Economic and Community Development	✓	
Paul Gutierrez , Vice Provost for Outreach Services, Associate Dean and Director, Cooperative Extension Service, College of Agriculture and Home Economics, New Mexico State University	✓	
Duane Hauck , Director, Extension Services, North Dakota State University	✓	
Cecelia Johnson-Powell , Community Development Manager, Indiana Housing and Community Development Authority	✓	
Peter Johnston , Project Manager, Clean Energy Technologies, Burns & McDonnell	✓	
Maurice Kaya , Hawaii Renewable Energy Development Venture	✓	
James Nolan , Weatherization Director, Department of Public, Health and Human Services		✓
Tom Plant , Director, Colorado Governor's Energy Office	✓	
Larry Shirley , State Energy Office Director, North Carolina Department of Administration	✓	
Janet Streff , Manager, State Energy Office, Minnesota Department of Commerce		✓
David Terry , Executive Director, ASERTTI	✓	
Steve Vincent , Regional Business Manager, Avista Utilities		✓

Contractor Support:

- Emily Lindenberg, SENTECH, Inc.
- Bryan Pai, SENTECH, Inc.

Public:

- No public representatives participated in this meeting.

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WELCOME & INTRODUCTION

The June STEAB meeting commenced at 9:00 a.m. MT on Tuesday, June 8, 2010. Paul Gutierrez (PG), Board Vice Chair, welcomed members to the meeting and thanked them for traveling to Colorado for the final meeting of the STEAB during fiscal year 2010. Due to the recent addition of three new members, one of whom, Maurice Kaya (MK), was able to attend, the Board took a moment to introduce themselves, and the organizations they represent, to all members of the STEAB.

SPEAKERS

No formal presentations were made during this meeting; however, speakers from the National Renewable Energy Laboratory (NREL) and the Department of Energy (DOE) were invited to provide insight on specific areas of interest to the Board.

- **“Welcoming Remarks – Golden Field Office”**
Carol Battershell, Executive Director for Field Operations, Golden Field Office, DOE.
- **“Welcoming Remarks – National Renewable Energy Laboratory”**
Casey Porto, Sr. Vice President, Commercialization and Deployment, NREL.
- **“Overview of Commercialization and Technology Transfer”**
Bill Farris, Vice President, Commercialization and Deployment, NREL.
- **“New Public/Private Partnerships for Accelerating Technology into the Marketplace”**
Casey Porto, Sr. Vice President, Commercialization and Deployment, NREL.
- **“Overview of Concentrated PV and Small CSP”**
Craig Turchi and Sarah Kurtz, NREL.
- **“Opening Remarks – Wednesday June 9th”**
Derek Passarelli, Acting Deputy Manager, Golden Field Office, DOE.
- **“Integrated Deployment Update”**
Steve Lindenberg, Senior Advisory, Renewable Energy, DOE.
- **“Meeting our Energy Challenges – Transitioning from 20th Century Fuels to 21st Century Options”**
Carol Tombari, Manager of Stakeholder Relations, NREL.
- **“Colorado’s Revised RE Goals (30% by 2020)”**
Tom Plant, STEAB Member and Director, Colorado Governor’s Energy Office, CO.
- **“Update on EECBG Sub-Committee”**
Mark Johnson, EECBG Sub-Committee Chair, OWIP, DOE.

WELCOMING REMARKS - GFO

- Ms. Carol Battershell thanked the Board for inviting her to the June meeting and spoke generally about her role at the Golden Field Office and how commercialization and deployment have become a major focus for DOE, as well as NREL. Ms. Battershell noted that both DOE and the rest of GFO have been carefully watching how States are spending State Energy Program (SEP) and Block Grant money since States are truly the biggest partners in the Recovery Act (ARRA). Understanding how well DOE worked with its local partners to spend funding is a key metric to realizing the success of ARRA.

WELCOMING REMARKS - NREL

- Ms. Casey Porto gave an overview of her role at NREL to the Board, noting that NREL’s organizational structure is unlike any other National Lab. With the new contract, the Commercialization and Deployment sector moved up in the chain of command in order to emphasize the importance of technology transfer from laboratories to the marketplace. Ms. Porto, as head of the Commercialization and Deployment sector, focuses on getting technology into the marketplace faster, while making sure that existing technologies are broadly adapted, all while looking at barriers facing

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new technologies entry into the marketplace. Ms. Porto emphasized the NREL is the only lab that falls under the Office of Energy Efficiency and Renewable Energy (EERE), and NREL coordinates at a very high-level with DOE deployment programs to try and introduce new and existing technologies to the marketplace.

- She also emphasized the need to understand commercialization and deployment as separate entities. *Commercialization* is the speed in which DOE and NREL can make the next-generation of technology available, while *deployment* is the concept of maximizing market adoption of the current generations' technology. John Davies (JD) asked Ms. Porto if, and how, NREL coordinates with different national labs to encourage both of these concepts. Ms. Porto responded by saying that all lab Directors participate in a monthly meeting with senior management at DOE in order to discuss the current state of each lab and their Programs.

OVERVIEW OF COMMERCIALIZATION AND TECHNOLOGY TRANSFER

- Bill Farris, VP for Commercialization and Deployment, presented an overview of what the department does at NREL and how technology transfer occurs at the lab¹. He reiterated that the focus of NREL is on analysis, science and technology, and commercialization. The Technology Portal (<http://techportal.eere.energy.gov>) is a new live site working to enhance the visibility of EERE-generated technologies and increase licensing deals. The goal is to bring new and emerging technologies together in this one location to improve the marketing of these technologies.
- Another focus of the office is to incorporate “best practices” for commercialization. NREL has an external goal to increase customer satisfaction, while also working on an internal goal of increasing invention output. NREL wants to evolve technology and customer perceptions in order to solve the current energy issues facing the nation. To that end, over the past several years, NREL has entered into 82 Cooperative Research and Development Agreements (CRADA's) and Work Force Agreements (WFO's) for a contact total of over \$63 million. With that total, NREL has more active and new CRADA's than any other national lab.
- Vaughn Clark (VC) and Philip Giudice (PGD) explained to Mr. Farris that States have been having trouble spending ARRA money and asked if National Labs offered collaborative initiatives with the States in order to assist with spending ARRA funds. Mr. Farris commented that, unfortunately, the DOE has ruled that States themselves are not commercial entities and therefore do not apply for the CRADA's, WFO's, or other opportunities. He did, however, continue to say that there is a new commercial model which links lab technologies with start-up businesses. This is a venture-backed effort, and both NREL and Oak Ridge National Lab are participating as the research and development component since there is a technological link between the two Labs.
- Mr. Farris concluded his presentation by telling the STEAB about four important Programs within NREL that are helping to encourage commercialization and deployment. The Clean Energy Entrepreneurship Center is focused on changing the culture at NREL by providing innovation at the intersection of the public and private sectors as they relate to entrepreneurship and venture capital. Gaining access to capital is a fundamental need for emerging technologies, and that capital must be applied to new business with well trained staff if a new technology is to succeed in the marketplace. The Commercialization Assistance Program helps energy efficiency and renewable energy small businesses, by providing access to NREL scientists with expertise relating to technology challenges faced by these small businesses. The third Program is the Venture Capital Network which enables collaborators to focus scientific efforts on the development or fostering of impactful technologies that can help to serve an unmet market need. Finally, the NREL Industry Growth Forum is an event for innovative clean energy start-ups to maximize their exposure to venture capitalists, corporate investors, and other partners. Since 2003, the clean energy companies have raised more than \$3.4 billion in growth financing.

¹ Mr. Farris's presentation can be found as Appendix A, immediately following these meeting minutes.

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- When asked by Gary Burch (GB) how the STEAB could assist NREL with any commercialization needs, Mr. Farris noted that perhaps what is most important is getting States connected with NREL to learn about what technologies are being developed, and also of how NREL can be of assistance to the States with regards to their energy efficiency and renewable energy needs.

NEW PUBLIC/PRIVATE PARTNERSHIPS FOR ACCELERATING TECH. INTO THE MARKETPLACE

- Ms. Porto then presented two partnerships to the STEAB which have helped to bring NREL technologies into the marketplace². The first is the Colorado Center for Renewable Energy and Economic Development (CREED), which is a State and Federal partnership. CREED is built as a kind of ‘ecosystem’ of stakeholders who support clean technology start-up companies in Colorado. This brings different partners under one roof and creates a forum in which to showcase the technology, train people how to use the technology, allow access to capital for the growth of the technology, and then find the skilled workforce in which to implement the technology.
- The second partnership is The Solar Technology Acceleration Center (SolarTAC) which is a public-private partnership put in place to accelerate the market adoption of solar technologies. Three private companies founded the Center, but there are also two sponsoring companies and a management group which operates and runs the facility. The facility allows for the research, demonstration and testing of solar technologies at a commercial scale. NREL got involved in the Spring of 2010 and has assisted the center with being able to expand test capacity and validate privately-funded solar technologies without the initial investment of market capital. Also, being a partner in this endeavor puts the Lab in a better position to view how their own technologies operate under large-scale conditions. It also provides NREL with the opportunity to collaborate with private companies and other industry experts in order to advance solar technology. Currently, NREL has two SolarTAC projects underway – one is a CSP project on how to make CSP technology more financially feasible, and the other centers about CPV.
- VC asked Ms. Porto how his home State of Oklahoma could create a better relationship with NREL, but Ms. Porto thought that may be a question for the STEAB to answer as she was unaware of any current or future programs relating to State outreach.

OVERVIEW OF CONCENTRATED PV AND SMALL CSP

- Craig Turchi then gave the STEAB an overview of Concentrated Solar Power (CSP), noting that CSP is considered solar thermal power which uses heat from the sun to drive a generator which produces electricity³. There are four kinds of CSP – parabolic trough, linear Fresnel, power tower, and dish. This is a type of power which is dispatchable to meet peak utility power demands (aka: extra solar energy can be captured during the day and dispatched in the evenings). Mr. Turchi elaborated on the science behind each of the four technologies and also noted their benefits and challenges.
- According to Mr. Turchi, CSP is very competitive in the Southwest portion of the United States, but the long-range goal is to make CSP competitive by 2015 in other markets. NREL is currently helping to do market and resource assessments in order to accomplish the 2015 goal. A lot of the research is looking at satellite mapping, doing ground surveying, and determining Solar Energy Zones in which CSP technology can be deployed. NREL is also currently doing analysis on how CSP can assist the current US power grid, and also be incorporated into the Smart Grid system. He did point out that water is a key issue facing CSP. The technology uses a lot of water to aid in cooling because it is the most efficient and least expensive method. NREL is currently working to migrate to “dry cooling” because it results in a 90% reduction in water usage. The challenges right now are finding a more cost-effective storage media for the energy produced by CSP, and also to replace oil with molten salt as the heat transfer fluid.

² Ms. Porto’s presentation slides may be found as Appendix B, immediately following these meeting minutes.

³ Mr. Turchi’s presentation slides may be found as Appendix C, immediately following these meeting minutes.

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- Sarah Kurtz provided the Board with an overview of Photovoltaics (PV), and began by stating that CPV costs overall are coming down, and over the last year, costs have dropped by about 1/3⁴. Utility companies are starting to become more engaged in this technology and new installations of CPV technologies have occurred nation-wide. There are three ways to use PV technology-silicon, thin film, or Concentrator PV (CPV). Silicon's key challenge is that you need a thick layer and this can be cost-prohibitive. Back in the 1980's, thin-film technology was the fad because it was thought of as a great technology to be put on roofs of homes and offices, which caused a stoppage in research in CPV. CPV technology was, however, re-vamped in the 1990's and uses mirrors or lenses.
- The biggest challenges facing this technology include trying to develop a hybrid of CPV and other EE and RE technologies in order to be cost effective and energy efficient. Also, getting the permits to install this type of technology can be as high as \$1 per watt, so there needs to be an improvement to the permitting structure. Additionally, educating the community about CPV and its benefits is as important as training the installers and inspectors about the hazards of incorrect installation or inspection.
- Ms. Kurtz told the Board that the best way to get CPV technology into the marketplace is with incentive programs. Offering people monetary incentives to ramp-down current energy technologies and increase the use of EE and RE technologies will help put pressure on politicians to change the laws and regulations, while encouraging consumers to make smarter energy choices. The need right now is to look at what is best for the market – roof-top systems or full-scale utility systems. Once this has been determined, it will be easier to show the true cost of installation and the savings garnered by using this type of technology.
- PDG asked a question about how we can keep the United States competitive against China for the PV manufacturing jobs which are increasingly going overseas. Ms. Kurtz answered that the best solution is to keep manufacturing costs low, and perhaps focus on increased automation at the plants. Mr. Farris added that the Solar Incubator Program is a \$3 million program which helps ramp-up manufacturing of solar technologies in the US, and enable companies to compete with China because their plants became more automated thanks to program funding assistance.

TOUR OF NREL

- John Horst (JH) then led the Board on an tour of the NREL Campus, where they visited the Alternative Fuel User Facility, the Science and Technology Facility (including the Process Development Integration Lab), and the Solar Energy Research Facility (SERF). In the SERF Auditorium, the Board was greeted by senior staff at NREL and the architects of the new LEED Platinum Research Support Facility (RSF), who discussed not only the design behind the RSF building, but also the current energy efficiency and renewable energy programs and partnerships occurring at NREL. The Board then had a special tour of the RSF, which was not scheduled to be open for occupancy for another week or so.

OPENING REMARKS – WEDNESDAY JUNE 9TH

- Derek Passarelli (DP) welcomed the STEAB on the second day of the meeting by thanking the Board for their efforts to take a very serious look at EE and RE technologies and programs. He encouraged the Board to take full advantage of the funding available through ARRA, as well as called for the Board to help harness all of the opportunities available with the transformation and deployment which is happening both at DOE and NREL. He concluded by saying that the Golden Field Office is very appreciative of the work the STEAB has and is doing, and hopes that the legislative charge of the Board continues to help bring a focus to EE and RE initiatives and technology.

⁴ Ms. Kurtz's presentation can be found as Appendix D, immediately following these meeting minutes.

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INTEGRATED DEPLOYMENT UPDATE

- Steve Lindenberg joined the STEAB meeting via conference call and provided the Board with a comprehensive update on the Integrated Deployment efforts currently occurring across the US⁵. This was a follow-up presentation to what was delivered in March of 2010. Continuing the deployment discussion, he noted how RE deployment is supported in publications and presentations, as well as through web access and other outreach programs like Solar American Cities, Wind Power America, and others. The concept of integrated deployment is that it looks to all aspects of energy needed in a community and provides the chance to re-think the overall development of a new community. He cited New Orleans and Greensburg, KS, as examples of how energy needs drove the development of these cities.
- He noted that the Hawaii Clean Energy Initiative hopes to reduce the demand for fossil fuels in Hawaii by 70% through the use of clean-energy technologies, as well as increased building energy efficiency by 30%. The biggest challenge to integrated deployment is that the current RE technologies are intermittent (i.e., PV solar, wind, etc.). Changing consumer behavior is another challenge. Getting the consumer to recognize the value of RE technology, and informing electric utilities about how to manage this technology, is what the conversations are currently focusing on. Discussing how to use existing infrastructure to create more RE- and EE-centered cities is the big issue facing States.
- Through ARRA, there was a \$20 million initiative to assist with community renewable energy deployment. This initiative was designed to help DOE and communities understand what it takes to implement EE and RE technologies and practices in a way that makes communities more sustainable, while at the same time creating jobs and stimulating the local economy. Examples of this have taken place in Vermont, Wisconsin, and California.
- The key to the success of integrated deployment is being able to tell the story of success to other States and agencies to encourage others to undertake a similar project in their community. DOE is working on a communications and marketing campaign using ARRA funds to showcase the successes in places like Hawaii, Kansas and Alaska. Ryan Gooch (RG) and PGD asked how the marketing is going to work, and there are other audiences such as State policy makers who can look at the costs and materials needed to do these types of programs. Mr. Lindenberg responded that this is something DOE is taking into consideration when developing the marketing strategy. PGD followed-up by noting other successful programs not run or managed by DOE which have had great success, so perhaps there is an opportunity for DOE to look at these programs as well, and try to link them to any future integrated deployment efforts.
- David Terry (DT) asked if the National Association of State Energy Officials (NASEO) work with Guam is something DOE is also involved with, or is there a role NASEO can help fulfill to ensure the success of current programs? The response was that the Department of Interior (DOI) has engaged with DOE; and the Governors of Guam, American Samoa, and the Northern Mariana Islands have engaged with NREL in order to better understand what is available to them and how DOE can support the activities already underway. Out of these discussions came an interagency agreement which will be signed by DOE and DOI in order to make funding available to assist these projects, as well as make NREL staff available on-site to assist with the energy planning process.

**MEETING OUR ENERGY CHALLENGES – TRANSITIONING FROM
20TH CENTURY FUELS TO 21ST CENTURY OPTIONS**

- Ms. Carol Tombari explained to the Board that her main job is talking to decision and policy makers to educate them about EE and RE technologies⁶. Over the years, the conclusion she has drawn is there

⁵ Mr. Lindenberg's presentation can be found as Appendix E, immediately following these meeting minutes.

⁶ Ms. Tombari's presentation can be found as Appendix F, immediately following these meeting minutes.

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is a lack of awareness about what choices are available with EE and RE technologies, and also the quality of information they are given is not good enough because the lawmakers do not know the right questions to ask. Education is key to making the right decisions. She noted that 62% of energy is lost simply due to inefficiencies.

- She did acknowledge that there are tough discussions happening right now. These include discussion regarding the challenges of moving away from natural gas and coal, the challenges and concerns surrounding expanding the US's use of nuclear power facilities, and discussions surrounding climate issues and health implications of continuing to use coal and natural gas. One of the focuses of her discussions with lawmakers and policy makers is that business-as-usual has become too risky. The costs keep going up, and the environmental issues are too grave to ignore. Her emphasis in these discussions is that there is a need to define end-states, reduce our technology risk, and accelerate the adoption of new energy technologies.
- Ms. Tombari commented that 21st century utilities need to be a distributed power generation system where distributed renewable technologies are incorporated with energy efficiencies in homes, buildings and within utility companies. Energy consumption, according to Ms. Tombari, is the number one problem facing the current generation; and Washington, DC, needs to know that they cannot continue down the same path.
- VC asked how does Ms. Tombari inform reasonable people who do not understand everything which was just outlined? She responded that lobbying is important, and RE and EE industries need to start making their presence known on Capitol Hill. John Davies (JD) asked what NREL had done to look at the cost effectiveness of regulating utilities, but there was no clear answer. Cecelia Johnson-Powell (CJP) commented that Indiana is coal-driven, but wants to look at making wind, biomass and biofuel investments; but there are energy entities who do not want to be energy efficient. What resources can Indiana use to create influential tools which could help change this outlook? Ms. Tombari suggested that Indiana look to educate the energy efficiency and renewable energy champions in the State and then have these people travel across the State to utility companies, schools, town hall meetings, and inform the citizens of Indiana about their other EE and RE options.

BOARD-FACILITATED DISCUSSION

- Facilitated discussion, led by Bryan Pai (BP), followed Ms. Tombari's presentation. The topics discussed included ways the STEAB could assist Mr. Lindenberg and Ms. Tombari in their efforts. Peter Johnston (PJ) suggested that better State interaction and communication with NREL could be key, and MK added another question which was how does the STEAB help NREL's deployment efforts and bring new technologies to the States? RG asked if the Board wanted to focus only on NREL, but everyone agreed that better communication is needed with all the National Labs. VC reiterated an earlier comment that the Labs need to better comprehend the role of State Energy Offices (SEO's) before a good relationship can be established.
- Duane Hauck (DH) commented that the STEAB undertook this issue several years ago and hosted webinars to try and showcase technologies available at the Labs. The big questions now are how can the STEAB make labs more transparent, and what is the constituency we are trying to reach? DH noted that the Board will need help identifying a constituency group to target. Tom Plant (TP) thought the Board could coordinate diverse efforts to help to bring Lab technologies to the States using commercialization and deployment techniques already in place at the State level. He added that there should definitely be "best practices" information available to determine how best to do this. The entire Board agreed and felt that there needed to be more discussion and collaboration between States, Labs and DOE in order to help promote new EE and RE technologies.
- Larry Shirley (LS) hopes to learn more about Mr. Lindenberg's next steps to the marketing of integrated deployment's best practices, noting there is a real need for vision on the local and State level. JD responded by saying perhaps the Board needs to revisit Resolution 09-04, which speaks to the lack of communication between Labs, States and DOE and how there is a need to re-establish a

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regional office “presence” to solve the communication issue. CJP said that STEAB needs to find someone to help accomplish all of these suggestions as the Board is not available to help solve all of them. DOE needs a marketing and communications group to help facilitate communication with Labs, States and DOE, and really needs to push EE and RE policy forward. BP closed this portion of the facilitated session and GB noted that perhaps what the Board is looking to do is establish small Task Forces which can address each of the significant issues raised during facilitation.

COLORADO’S REVISED RE GOALS (30% BY 2020)

- TP then presented the Board with updated information regarding Colorado’s revised energy plans, which increases the RE sales for investor-owned utilities from 20% to 30% by 2020⁷. This revision also established certification standards and requirements and created three funding mechanisms which will allow existing funds to be stretched even further. When asked what precipitated this effort in Colorado, TP responded by saying that the previous legislation had failed for years; and when this initiative went to the ballot, it was favored heavily. With the shift in political parties in 2008, there were 55 co-sponsors of this legislation in the Colorado State Legislature.

BOARD FACILITATED DISCUSSION, CONT.

- As Board discussion continued, PJ, RG, and JD all suggested that for future STEAB meetings, presentations should be limited to 30 minutes, and at least 15 minutes of that time should be reserved for discussion and Q&A. CJP and TP advocated for the STEAB to be more aggressive in its agenda and show DOE the relevancy of this Board as an advisory committee. The suggestion was made that the STEAB can start convening meetings and beginning dialogues with Labs, States and other agencies to combat the National to State communications issue, and then show DOE what the Board has done instead of asking for permission to do so. This comment grew out of feedback from Assistant Secretary Zoi who, in May, told the Executive Board that the STEAB can go out and “do”, but just not commit DOE to agreement or programs that would require EERE resources.
- When BP asked what action items the Board could undertake now, JD said that action on Resolution 10-01 should move forward, and PGD commented that the STEAB should give DOE a report card on how well they are supporting the States to showcase this communications issue. This report card could show DOE why the States are not able to advance the EERE agenda as quickly as DOE would like. PG circled back to the idea of dividing the Board into Task Forces to accomplish some of the suggested ideas. He noted how perhaps there could be an “outreach task force” to handle State and DOE relationships, and maybe a “USDA task force” which would link DOE to USDA in a way to advance Resolution 10-01. As others have pointed out, the Office of Management and Budget wanted STEAB to look at the Climate and Energy Bill and provide feedback. Perhaps here is another opportunity for a task force.
- CJP added that there should be a “weatherization task force” as well; and VC insisted that if these task forces are established, they have to have concrete goals and objectives, not just an abstract idea of what *could* be done. PG asked the Board to focus on moving forward with Resolution 10-01, since there was already an objective outlined in the Resolution. DH reminded the Board that the Resolution speaks to a formal agreement between DOE and USDA to deliver EE and RE education to local communities. The next step is to identify players at USDA and DOE and bring them together to discuss their interest in joining into a formal agreement to promote this effort.
- RG suggested there also be a task force for STEAB meetings, noting that many commented about the need for better structured presentations with more time allotted for Q&A. CJP echoed her earlier comment about wanting to have a task force to focus on weatherization and maybe that task force could work in conjunction with the Department of Housing and Urban Development (HUD) to start implementing the Climate Smart Loan Program on a larger scale. MK brought up outreach again, and

⁷ Tom Plant’s presentation can be found as Appendix G, immediately following these meeting minutes.

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proposed a task force focused on deployment and establish a framework for consideration of how DOE and Labs can interact with States. Out of this framework, the task force could develop the report card that PGD mentioned previously.

- GB asked the Board to formally identify and name task forces which could function as independent groups between this June meeting and the next November meeting to help accomplish the tasks and issues raised during the meeting. All members agreed that the following task forces should be established:
 1. STEAB Agenda Task Force
 2. Climate Change and Energy Bill Task Force
 3. Deployment Task Force
 4. DOE/USDA Task Force
 5. DOE/HUD Task Force
- GB encouraged the Board to formally adopt these Task Forces as sub-groups to the STEAB. PG asked if there was a motion on the floor. VC so motioned, and PGD seconded. These five Task Forces were unanimously adopted by the STEAB on June 9, 2010.
- PG then asked the Board to discuss upcoming logistics for STEAB teleconference calls and the next live Board meeting. MK, DH, PJ, LS and others suggested a different time for the monthly teleconference calls to avoid conflicts. Based on discussion, the Board teleconference calls will now be at 3:30 PM Eastern Time, on the third Thursday of each month. The next call will then be July 15, 2010, at 3:30 PM ET.
- GB reminded the Board that the next live meeting of the STEAB will be November 2 – 4, 2010, in Washington, DC, in order for the Board to receive comprehensive updates from Program Managers and senior staff within DOE and EERE. The hotel will be the Capital Hilton on 16th street, NW, and more details will be forthcoming in the following weeks.
- GB and PG then asked the Board to choose a date for a spring STEAB meeting and confirmed NASEO meeting dates with DT and PGD as to avoid a conflict. The Board agreed that the next meeting should be at a National Lab and suggested that Lawrence Berkley National Lab (LBNL) would be a good place to follow-up on the commercialization and deployment discussion and perhaps engage in another webinar with this Lab. The Board agreed to have the next meeting February 22 – 24, 2011, at LBNL.

**UPDATE ON THE ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT
(EECBG) SUB-COMMITTEE**

- Mark Johnson (MJ) attended the STEAB meeting and provided the Board with an update on the progress of the EECBG Sub-Committee, which the Board voted to establish back in March of 2010. MJ reminded the Board that the EECBG Program is only 15 months old, but all the money allocated for this Program has been given to 2,500 recipients. There have been 10 regional meetings so far to discuss the successes and challenges associated with this Program, and MJ has chosen 5 of the most vocal recipients to be members of this sub-committee. This group of 5 is diverse and all are in charge of spending the grant funds within their cities and counties.
- This sub-committee's focus will be sharing knowledge and best-practices with each other in order to create recommendations to OWIP and DOE with regards to how the agency can better assist all grantees. There will be two meetings a year in different locations where the EECBG Program has been successful, and the meetings will include both presentations and tours of locations where EECBG funds were received. MJ shared with the Board an outline of the proposed membership and asked that the STEAB vote to affirm these five members of the Sub-Committee⁸.
- When PG opened the floor to discussion, MK wanted to know what responsibilities the STEAB had to assist this group because the Sub-Committee falls under the purview of the STEAB. GB responded

⁸ A copy of the membership outline can be found as Appendix H, immediately following these meeting minutes.

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saying that the STEAB needs to review recommendations from the Sub-Committee and concur / approve before the Sub-Committee can take any action on them. MK followed-up by asking MJ how the Sub-Committee will look at and evaluate best-practices. MJ answered by noting how important it is for the Sub-Committee to look at how the Program has been implemented in all States, and try to address all questions which have come into OWIP since the Program was implemented. He noted that this Sub-Committee wants to look at this from many angles in order to make sure that nothing is overlooked.

- PG called for a vote to affirm all members of this Sub-Committee. PGD moved that the STEAB vote to confirm all these candidates, John Butler (JB) seconded, and the motion passed unanimously on June 10, 2010. CJP was the only abstention as she is the STEAB representative to the Sub-Committee.

Other Business

- The discussion then arrived at the public comments portion of the June meeting. GB noted that he had not been contacted by any members of the public who wished to provide comments at the meeting. Seeing as there were no members of the public present at the meeting, PG then closed the meeting for public comment.
- DH then asked to speak about the new launch of www.extension.org, a website which acts as an interactive learning and informational site which provides universal access to the expertise of land-grant universities about a variety of important topics, including energy efficiency and renewable energy. The site grew out of the need to assist States and communities that do not have the faculty to help answer all questions and issues currently being faced in those areas. The site is set up in a “wiki” format, allowing for a question to be posted and answered on-line, and then peer-reviewed to confirm the validity of the response. This allows questions and concerns to be addressed in real-time by the experts in the field, and provides a national platform from which States and organizations can draw information and expertise.
- DH focused on the “Home Energy” area of the site, which addresses issues relating to energy efficiency and renewable energy options for families and communities. He noted how this section contains information on tax-credits, weatherization, energy use, and also provides links to relevant headlines about current energy-related stories. The extension website also hosts monthly webinars aimed at educating the public on a variety of issues from new energy programs and technologies to reviews on policy changes. DH asked each member of the STEAB to encourage the use of this site in their States and also to provide feedback directly to him about areas in which the site could be improved to be a better resource to the public.

BOARD-FACILITATED DISCUSSION, CONT.

- PG thanked DH for this comprehensive overview of the website and then asked BP to please lead the Board in a facilitated discussion to review the STEAB’s “Priorities Through 2012” and the challenges the Board faces while trying to accomplish these challenges⁹. MK agreed that the STEAB should become more involved with organizations like NASEO, NGA, and NARUC; and DH commented that the second and fifth priorities listed in the document can be met by the USDA/DOE Task Force as they work to implement Resolution 10-01. VC noticed that “training” of any type was not included as a priority for the Board and wondered if this was an area of concern since States are in need of some form of training or guidance in order to implement all of the regulations which DOE has asked States to undertake. CJP asked the Board to consider that perhaps, in light of the previous discussions on commercialization and deployment, the fourth and sixth listed priorities could collapse into one to focus on encouraging EE and RE technology implementation and deployment?

⁹ A copy of the “Priorities Through 2012” can be found as Appendix I, immediately following these meeting minutes.

State Energy Advisory Board
Meeting Minutes: June 8 - 10, 2010
Lakewood, CO

- TP linked conversation back to the facilitated session where Task Forces were developed, and reminded the Board to proactively think of discussion topics and areas on which they would like DOE to focus in coming meetings so that they know what the Board is expecting to hear, and the Board knows the direction and focus of any future live meetings. CJP asked the Board if the HUD/DOE Task force could undertake the fourth and sixth priorities, and noted that perhaps the STEAB could tackle the last priority which deals with accelerating the growth of “green jobs”. VC agreed with CJP and thought maybe the Department of Labor (DOL) could collaborate with DOE on this issue. LS echoed VC’s comment and noted that getting DOL involved with this is imperative to the success of this priority, but questioned whether the creation or more jobs comes first, or should DOE and DOL focus on creating projects and programs which will then create these jobs? He also circled back to VC’s earlier comment about the need for more training in order to roll-out the successful growth of a “green jobs” sector. RG continued this discussion by noting DOL has the capacity to reach all States and deliver training programs, so perhaps the link needs to be made at a State-by-State level in conjunction with the SEO’s. DH summarized that the Board seems to think a Task Force is needed to bring DOL and DOE together in order to provide better training programs.
- Continuing on the Task Force topic, PJ asked that the Agenda Task Force invite a speaker to the November meeting to address State-level policy and also to ask this speaker specific questions about how the STEAB can assist the DOE with the implementation of these policies. PJ continued that too often speakers give a background to their Programs, but fail to tell the Board about areas in which they need assistance or guidance. DH suggested that per PJ’s comment, each speaker be provided a copy of the “Priorities Through 2012” document so each speaker knows what areas are important to the Board, and the speaker can tailor their presentation appropriately.
- BP asked the Board to think of the challenges they face while trying to implement and achieve the aforementioned priorities. Are there ways that Task Forces can help eliminate challenges to progress, or are there challenges which have been ameliorated by the creation of Task Forces? PJ immediately responded that the challenge of trying to facilitate positive change in consumer behavior towards energy use is being addressed by the USDA/DOE Task Force as it looks to implement Resolution 10-01. He also noted that the long-standing challenge of having a more meaningful dialogue between EERE and the STEAB is being met due to the proactive stance of the Executive Committee and their recent meeting with Assistant Secretary Zoi. GB reiterated that in the meeting in May with the Assistant Secretary, she had told the Board to be more proactive about convening meetings and participating in discussions with Program offices and other agencies, with the only comment that the STEAB could not commit DOE or DOE resources to anything without the permission of her office. With that, GB noted that the STEAB can certainly move forward in a more aggressive manner than it has in the past.
- GB then asked the group to assign themselves to a Task Force in order to continue the momentum begun at the live meeting and to complete a Task Force Outline which summarizes the objectives, deliverables and timelines for each Task Force. These outlines will serve as general “business plans” to help guide current and future activities for the group. Each Task Force should have no more than 5 STEAB members, and each Task Force is responsible for choosing a Task Force Chair. The STEAB then spent several minutes volunteering for one or more of the five Task Forces, but not all members volunteered for a Task Force. The groups then agreed to meet via phone prior to the July conference call in order to complete the requested paperwork.
- PG asked if there were additional concerns or issues which the Board wished to address. Seeing as there were no additional comments up for discussion, PG thanked all members of the STEAB for their time and for traveling to Colorado in order to attend the live Board meeting, and commented that this meeting in particular was very productive and looks forward to hearing updates from each Task Force on the July call. He reminded everyone that the next meeting would take place in Washington, DC, on November 2 – 4, 2010, and officially adjourned the June STEAB meeting.

State Energy Advisory Board
Meeting Minutes: June 8 - 10, 2010
Lakewood, CO

ACTION ITEMS arising from the June 2010 STEAB meeting are highlighted below:

In the coming weeks/months, the Board has several action items on the agenda with associated timeframes to ensure their effectiveness. The Board is currently planning a face-to-face meeting in Washington, DC, during the week of November 1, 2010. In addition, the Board is considering several potential actions based on topics discussed during this meeting, with the intention of re-visiting them for further discussion during upcoming teleconference calls, as well as during the upcoming November live meeting.

ACTIONS	RESPONSIBLE PARTY	DUE DATE	STATUS
Scribe and upload meeting minutes & handouts to STEAB website.	<ul style="list-style-type: none"> • SENTECH, Inc. (scribe) • DFO/Board Chair (approval) 	<ul style="list-style-type: none"> • Submit draft minutes to DFO for editing. • Post Minutes to site after approval. 	<ul style="list-style-type: none"> • Submitted draft minutes to DFO for review.
Next Meeting: <ul style="list-style-type: none"> • Capital Hilton, Washington, DC 	<ul style="list-style-type: none"> • SENTECH, Inc. • DFO 	<ul style="list-style-type: none"> • Week of November 1, 2010. 	<ul style="list-style-type: none"> • Stacey Young (SENTECH, Inc.) is currently coordinating logistics with the hotel. • Agenda Task Force to assist with speaker selection and presentation topics/questions.
Resolution 10-01	<ul style="list-style-type: none"> • USDA/DOE Task Force • DFO 	<ul style="list-style-type: none"> • November 2010 Board Meeting. 	<ul style="list-style-type: none"> • USDA/DOE Task Force to begin discussions with USDA and DOE officials to gauge interest in a partnership. • Meeting times and dates TBD.
Task Force Outlines	<ul style="list-style-type: none"> • Task Force Chairs 	<ul style="list-style-type: none"> • July Teleconference call on July 15, 2010. 	<ul style="list-style-type: none"> • Outlines currently with each Task Force for review and completion.
Update STEAB on new meeting date and teleconference time	<ul style="list-style-type: none"> • SENTECH, Inc. 	<ul style="list-style-type: none"> • ASAP 	<ul style="list-style-type: none"> • E-mailed STEAB on June 10, 2010, with February 2011 meeting location and dates, as well as the change in time for STEAB teleconference calls.
Send Thank You notes to Speakers	<ul style="list-style-type: none"> • SENTECH, Inc. (scribe) • Board Chair/DFO (approval) 	<ul style="list-style-type: none"> • June 24, 2010 	<ul style="list-style-type: none"> • All Thank You notes to speakers went out on June 17, 2010.

Appendix A

 **NREL** National Renewable Energy Laboratory
Innovation for Our Energy Future

NREL Commercialization & Technology Transfer



State Energy Advisory Board
June 8, 2010
Bill Farris, V.P.
Commercialization and Technology Transfer

NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy operated by the Alliance for Sustainable Energy, LLC.

NREL Mission

It is NREL's mission to ... commercialization activities that enable widespread adoption of renewable energy and energy efficiency technologies.



8.22-megawatt Alamosa, Colo., PV solar plant

Technology Portal Vision

Original concept introduced in Alliance proposal

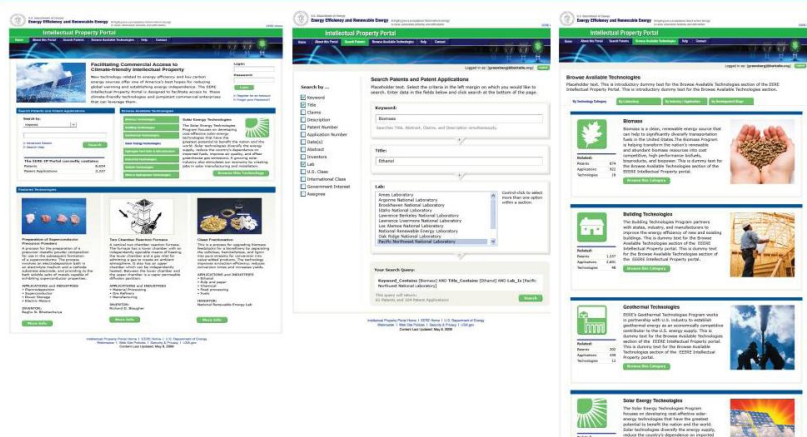
Goal: Enhance visibility of EERE generated technologies and increase licensing deal flow!



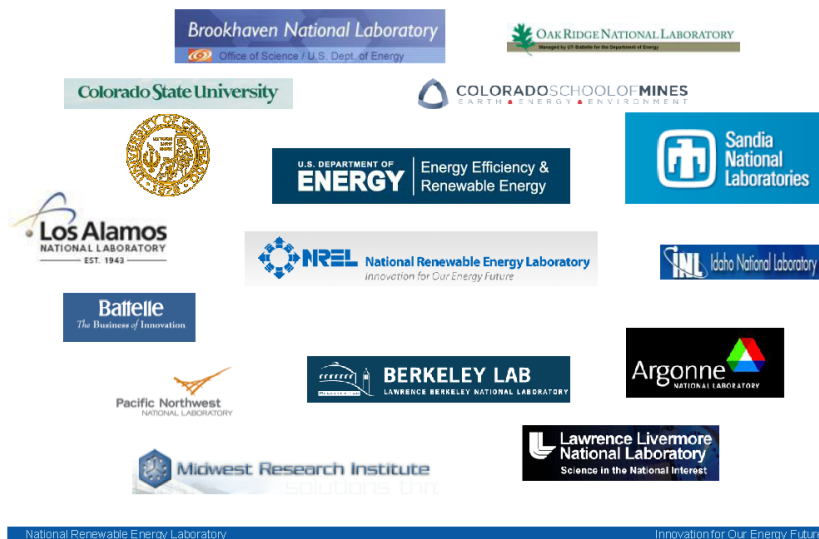
What is the Portal?

- Web-based system which provides technology marketing summaries of clean energy-relevant technologies of NREL and our collaborators
- Designed for technology seekers (companies, entrepreneurs, venture capitalists) can **identify and bundle** energy-relevant technologies
- Provides:
 - “One Stop Shopping” for technology seekers
 - Powerful mechanism for synergizing disparate technologies into solutions
 - Tool for EERE to collect and survey all program funded technologies

EERE Technology Portal



Technology Portal Stakeholders



“Best in Class” Commercialization Practices: Enable Faster and More Impactful Transactions

External focus on customers increases customer satisfaction and repeat business

- **Decision-making** on new inventions informed by Analysis for market relevance
- **Model agreements** promote transparency in all customer interactions
- **Transaction authority** within C&D to streamline execution of agreements
- **Customer-driven-timeline** imparts a sense of urgency in all transactions

Internal focus on innovation increases our invention output and our effectiveness with clients

- **LDRD** – Increase the pool, with provisions for seed projects
- **Recognition and rewards** for contributors to the commercialization process
- **Entrepreneur in Residence** – EERE program implementation
- **Improved Mechanisms** for easy disclosure of inventions
- **“Brown Bag”** seminars to promote IP basics
- **Recruiting practices** for researchers with innovation track records

NREL Partnerships Continue to Grow

Background: During FY2009, NREL had 352 active partnering agreements.

- NREL has more active and new CRADAs than any lab in the DOE system
- Roughly half our CRADAs are with small businesses
- Roughly one quarter of our CRADAs are with large businesses
- More than 40% of our WFO agreements are with Federal, State or local governments
- One quarter of our WFO agreements are with small businesses

FY10 Year to Date:

- Partnership agreement volume continues to outpace prior years with 82 new CRADAs and WFO projects to date, with a total contract value over \$63M.
- More than half a dozen significant partners recruited to use key partnering facilities (PDIL, IBRF, NWTC, SRRL), including Loyola Marymount University, Utah State Energy Program, Alcoa, 3M, EPRI
- Through a collaborative effort with DOE-GO, partnership agreement processing time has improved by 30% as of February, allowing faster and more efficient agreement development



With DOE sponsorship, NREL's concentrating solar power team is developing a pilot-scale thermal energy storage test bed to be located at SolarTAC.

A New Commercialization Model



- Venture backed start-up using NREL and ORNL technologies
 - superconducting substrate technology portfolio from ORNL
 - silicon epitaxial growth technologies from NREL
- EERE funding used to bridge the “valley of death”
 - TCF funding from with Ampulse match
- Utilized NREL Process Development and Integration Laboratory for critical materials research
- National Labs served as the R&D arm of the early stage company
- Unique three party license negotiation
- Closed Series A financing in October 2009

TCDF/TCF Program Overview

NREL received \$4MM in pilot program

- Funding received Sept. 2007

Designed to help industry commercialize NREL IP

- Bridge commercialization “valley of death”

Mandates

- NREL intellectual property
- 50% minimum cost share from partner
- Clear commercialization pathway
- Greater than \$250k TCDF investment requires DOE approval

DOE Program Contacts

- EERE Commercialization Team: Wendolyn Holland and Carol Battershell

Privately Funded Technology Transfer: Accelerates Development and Deployment

- Introduced by Battelle in 1989/new for NREL
- Alliance investment in PFTT/Maturation will be a minimum of \$1.75 million over the 5-year contract period
- Similar in some ways to our existing GFTT program but involves substantial Alliance Investment
- Specific contract terms have been negotiated with GO
- The program seeks to increase the speed of technology transfer

Clean Energy Entrepreneurship Center

Innovation at the intersection of the public and private sectors relating to entrepreneurship, new ventures, and growth capital:

- 1) Create an Innovative and Entrepreneurial Environment that is a seamless part of the fabric of NREL
- 2) Make NREL the Catalyst for Economic Development by Accelerating Commercialization and Improving the Yield of regional clean energy innovations
- 3) Facilitate robust Access to Capital and other resources for clean energy entrepreneurs.

National Renewable Energy Laboratory

Innovation for Our Energy Future

NREL Innovation Initiative Objectives

- To create an environment where our “innovation culture” is a seamless part of the fabric of the organization
- To deliver the best trained and most knowledgeable laboratory staff about commercialization and tech transfer of all the DOE labs

Photo used by permission of Uni-Fly A/S

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NREL Commercialization Assistance Program

NREL's **NCAP** will help energy efficiency and renewable energy small businesses **by providing assistance or information** to help with **technology challenges** through access to NREL expertise and facilities.



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Venture Capital Network: Pre-Stage Access to \$4 B of Investment Capital

Venture Fund Advisory Board will enable NREL and collaborators to:

- Focus science efforts on development of impactful technology
- Identify and foster technologies that can serve unmet market needs
- Form startups that can successfully raise financing
- Commercialize mission relevant technologies faster

Venture Fund Advisory Board members will also provide mentoring, education and networking opportunities through participation in C&D programs such as:

- NREL Industry Growth Forum
- EERE Entrepreneur in Residence Program
- EERE Technology Commercialization Fund
- Program for Entrepreneurial Growth

Letters of Commitment
from Venture Capital Funds to
participate in our Venture Fund
Advisory Board

Enertech
Flagship
Nth Power
Merrill Lynch
Mohr Davidow
MRI Ventures
Rockport Capital
Siemens
Battelle Ventures/Innovation
Valley Partners
NGP Energy Technology Partners

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NREL Industry Growth Forum

For over a decade the NREL Industry Growth Forum has been the premiere clean energy investment event featuring the most innovative and promising clean energy companies.



The NREL Industry Growth Forum accelerates the commercialization of clean energy technologies by:

- Fostering **hands-on-management and coaching** for evolving clean energy companies
- Providing a **relationship platform** for companies (example: creating access to capital).

The 2010 Forum features:

- Presentations from 34 emerging clean energy companies
- Provocative panels led by thought leaders
- One-on-one meetings
- Strategic investors

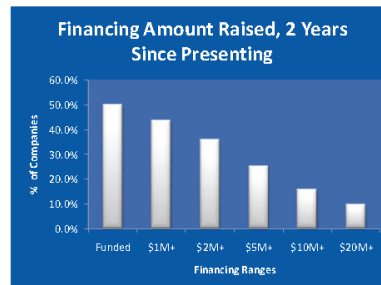
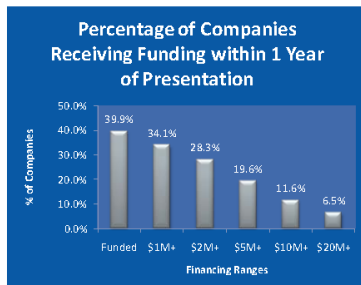
*Source: New Energy Finance
**Source: Hoovers

Forum Success 2003 - 2009

Since 2003, the companies presenting at the Forum have had success:

- More than half of the companies that participate in the Forum have received funding (91/171), cumulatively **raising over \$2.5 billion** in growth financing*
- Creating over **3,000 U.S. jobs****

*Source: New Energy Finance
**Source: Hoovers



NREL:

**Unique
Connected
Innovative**



Photo credit: Megavind

National Renewable Energy Laboratory

Innovation for Our Energy Future

Appendix B

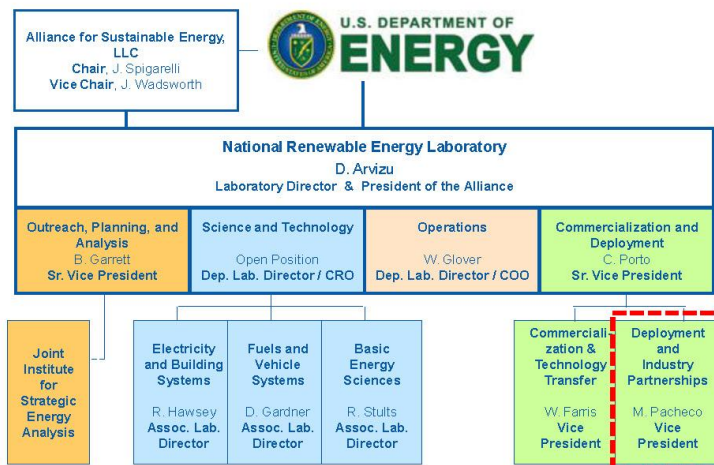


Commercialization and Deployment at NREL

June 8, 2010

Casey Porto, Sr V.P.

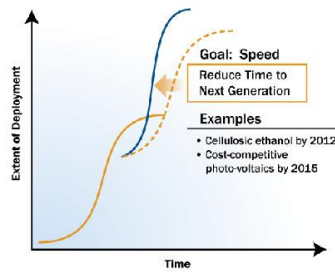
How NREL is Organized



NREL Distinction:

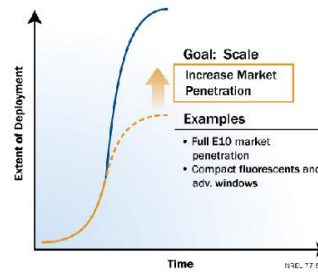
Commercialization

Accelerate the availability (**speed**) of *next generation* technologies



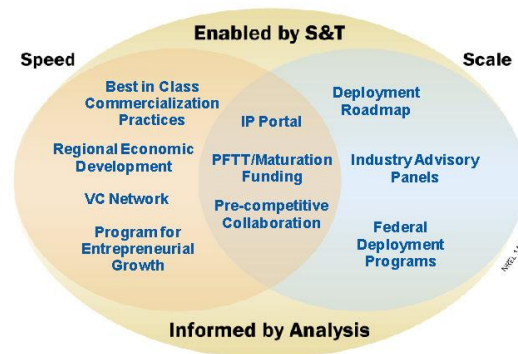
Deployment

Maximize the deployment (**scale**) of *current generation* technologies



Approaches to Accelerate Adoption

- Achieve *Speed & Scale*
- Leverage Federal Deployment Programs
- Strategic Engagement with Industry



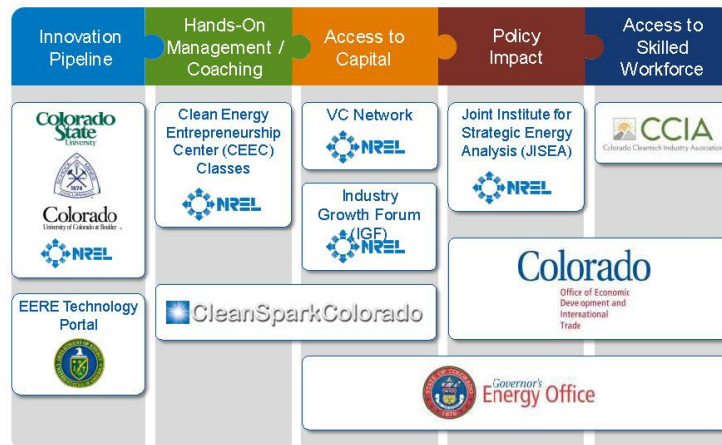
Colorado Center for Renewable Energy and Economic Development (CREED)

An ecosystem of stakeholders and services to support and expand cleantech entrepreneurship in Colorado
 Proposed by Alliance in response to DOE RFP
 Part of State of Colorado's commitment to DOE in partnership with Alliance



National Renewable Energy Laboratory Innovation for Our Energy Future

Leverage Capabilities



National Renewable Energy Laboratory Innovation for Our Energy Future

Colorado Center for Renewable Energy and Economic Development (CREED)

Providing a Home Base for CREED

- Create a physical presence – proof of Federal and State commitment to cleantech.
- Leverage and mobilize Colorado's substantial asset base and partner resources.
- Innovative model – different institutional partners under one roof.
- Centralize CREED operations and facilitate communication.
- Located within walking distance of NREL campus but outside the gate.
- Most functions are already up and running.

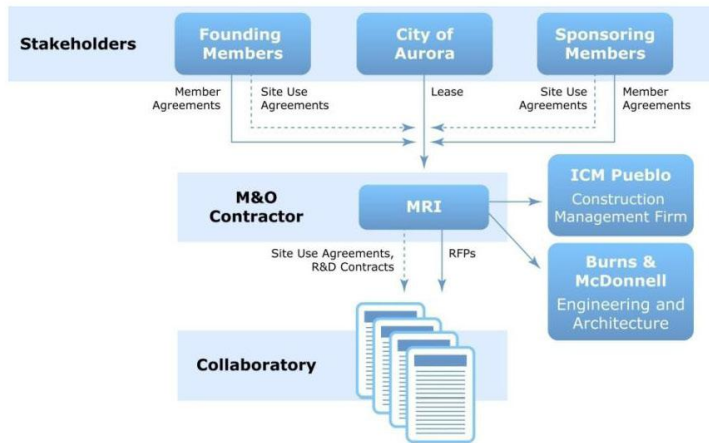


What is SolarTAC?

The Solar Technology Acceleration Center (SolarTAC) is a:

- **Public-private partnership** to accelerate the market adoption of solar technologies
 - Three private companies: Abengoa Solar, Xcel Energy, and Sun Edison are original **founding members**
 - Alliance and EPRI recently became **sponsoring members**
 - MRI **manages and operates** the facility
- **Venue** being developed for research, demonstration, testing and validation in a commercial-scale environment
 - Located on a 74-acre solar test site adjacent to DIA
 - Offers site, grid interconnectivity, roads, and utilities
 - Site offers flat, graded topography, excellent insulation conditions, and more than 300 days of sunshine per year

SolarTAC Structure



How is NREL Involved?

Alliance signed a sponsoring member agreement on April 12, 2010. This will give NREL use of a “kick-the-tires” environment that:

- Expands physical capacity to test and validate DOE and privately-funded solar technologies at scale without capital investment and under real-world conditions
- Better positions the lab to provide performance and durability data needed to assist commercial deployment of a wide array of materials and systems



Benefits of Membership

Through the SolarTAC membership, NREL research and technical staff can:

- Leverage the infrastructure to set up projects
- Access up to 5 acres of land for proprietary performance testing
- Guide future development of SolarTAC through the Executive Board (Brent Rice) and a permanent seat on the Technical Advisory Board (David Mooney)
- Collaborate with industry, provide expertise, and share (public) R&D results with other members
- Partner with corporate members or develop other privately funded projects



NREL SolarTAC Projects Underway

DOE funded, pilot-scale test bed for thermal energy storage (TES) technologies:

- Led by Concentrating Solar Power (CSP) Program team, including **Mark Mehos** and **Tim Wendelin**
- Study and evaluate CSP technologies that make projects more financially feasible
- Help meet DOE goals to make CSP cost-competitive by 2015 and provide a sizeable amount of clean energy to the grid by 2020
- \$2.5 million through Recovery Act to design and build the new test bed on site, which is expected to be completed by mid-2011.



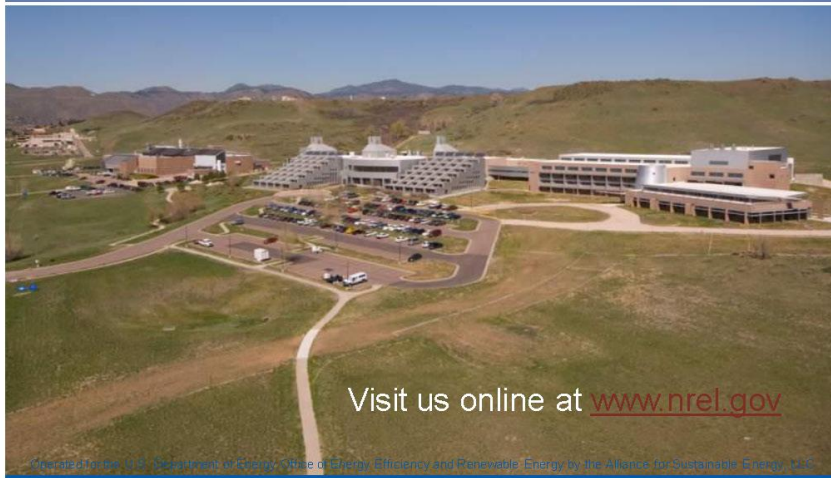
NREL SolarTAC Projects Underway

AIST (Japan) on Concentrator Photovoltaic (CPV) Demonstration

- Led by Photovoltaic Reliability Group Manager, **Sarah Kurtz**
- Project will evaluate performance details of three multi-junction CPV cells/systems and provide needed data on how cells perform in different locations
- Functional by end of 2010; construction start planned for August or September
- AIST is funding the CPV and data; NREL and AIST will publish results jointly.




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Visit us online at www.nrel.gov

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Appendix C

 **NREL** National Renewable Energy Laboratory
Innovation for Our Energy Future

Concentrating Solar Power (CSP) Overview



Mark S. Mehos
CSP Program Manager
National Renewable Energy Laboratory
Golden, CO

NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy operated by the Alliance for Sustainable Energy, LLC

Outline

- Technology Overview
- U.S. and International Market Overview
- DOE Research and Development

CSP, aka Solar Thermal Power



Parabolic trough

Linear Fresnel



Power tower

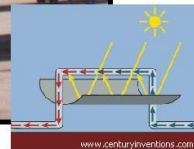


Dish/Stirling

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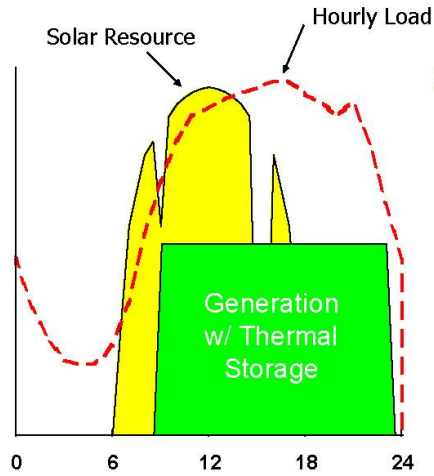
Parabolic Trough



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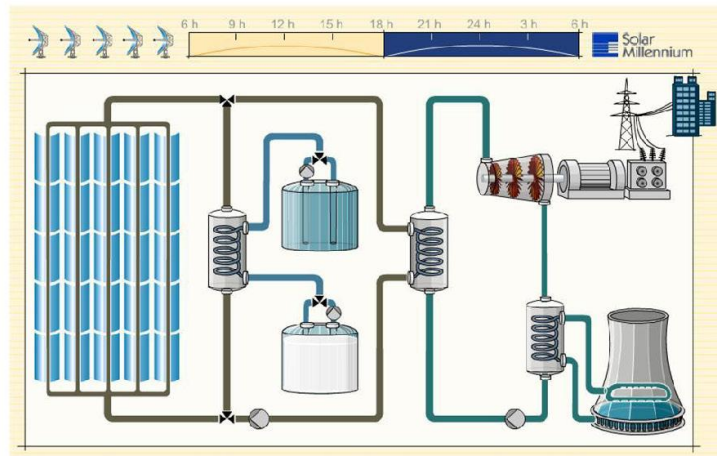
Value of Dispatchable Power? Meets Utility Peak Power Demands



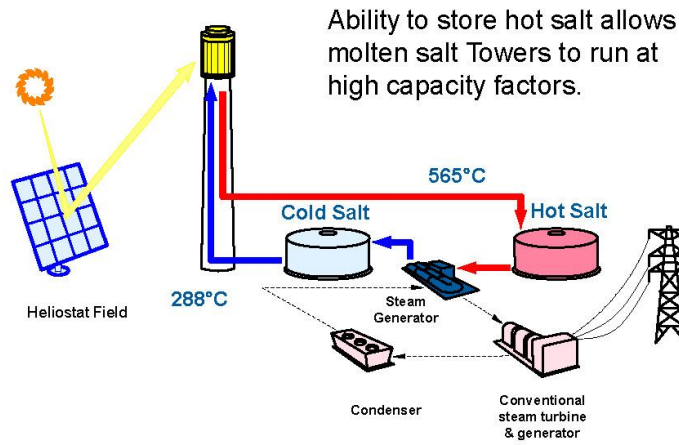
Storage provides

- higher value because power production can match utility needs
- lower energy costs if storage is less expensive than incremental turbine costs

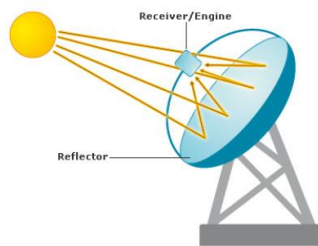
Parabolic Trough Plant



Molten Salt Power Tower



Dish/Engine



Parabolic Trough



Design approaches:

- **Oil HTF**
 - All commercial plants to date
- **Molten Salt HTF**
 - Archimedes (pilot)
 - Abengoa (R&D)
 - Solar Millennium (R&D)
- **Direct Steam HTF**
 - Abengoa (R&D)

Power Tower (Central Receiver)



Design approaches:

- **Direct Steam HTF**
 - Abengoa PS10/PS20
 - BrightSource (pilot)
 - eSolar (pilot)
- **Molten Salt HTF**
 - Solar One (pilot)
 - Gemasolar (under construction)
 - SolarReserve
- **Air HTF**
 - Jülich (pilot)

Dish/Engine & Concentrating PV

Dish/Stirling: Pre-commercial, pilot-scale deployments



Concentrating PV: Commercial and pre-commercial pilot-scale deployments



- Modular (3-25kW)
- High solar-to-electric efficiency
- Capacity factors limited to 25% due to lack of storage capability

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Technology Comparison

	Trough	Power Tower	Dish / Engine	PV
Typical Operating Temp	390C	565C	800C	n/a
Utility scale (>50 MW)	x	x	x	x
Distributed (<10MW)			x	x
Energy Storage	x	x		
Water use for cleaning	x	x	x	x
Water use for cooling	preferred	preferred		
Land Use (acre/MW)*	5-9	3-9	8-9	5-9
Land Slope	<3%	<5%	<5%	<5%
Technical maturity	medium	low	low	low to high

* Dependent on location and if storage included, values shown based on plants or announced projects

National Renewable Energy Laboratory

Innovation for Our Energy Future

-
- Technology Overview
 - U.S. and International Market Overview
 - DOE Research and Development

CSP Market Goals

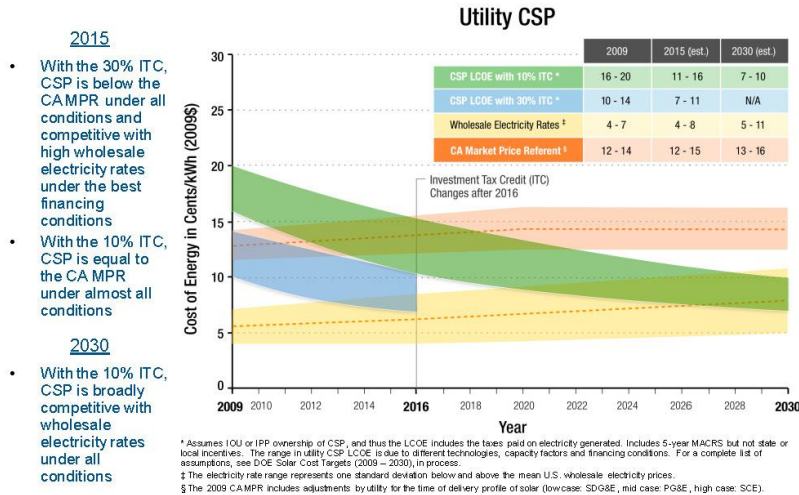
- Competitive in southwest intermediate load power markets (\$0.12/kWh nominal LCOE) by 2017



- Expand access to include carbon constrained baseload power markets (\$0.10/kWh nominal LCOE) by 2020



Utility CSP: LCOE Targets, DOE analysis

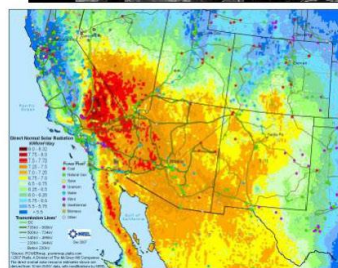


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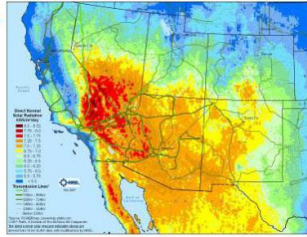
U.S. Southwest GIS Screening Analysis for CSP Generation

Screening Approach

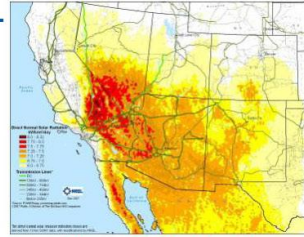
- Initial solar resource and GIS screening analysis used to identify regions most economically favorable to construction of large-scale CSP systems
- GIS analysis used in conjunction with transmission and market analysis to identify favorable regions in the southwest



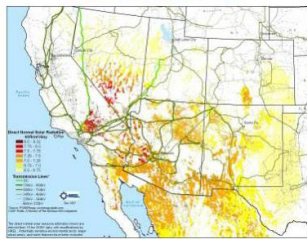
Solar Resource Screening Analysis



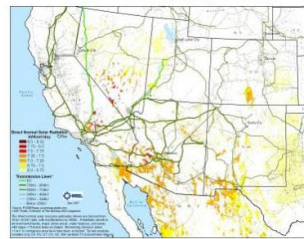
Unfiltered Resource



Solar > 6.0 kWh/m²-day

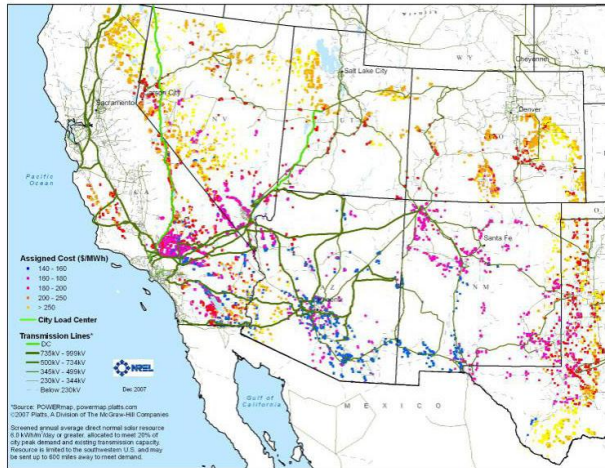


Land Exclusions

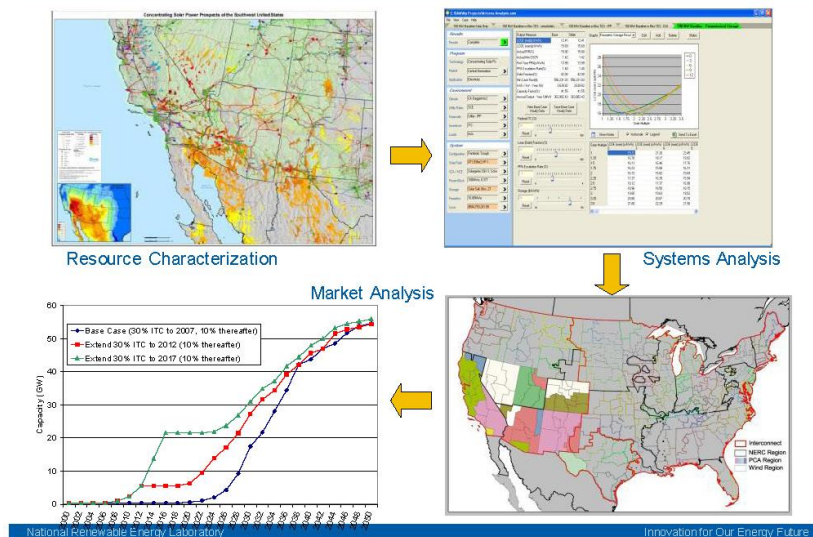


Slope Exclusions

Optimal CSP Sites – Transmission and Resource

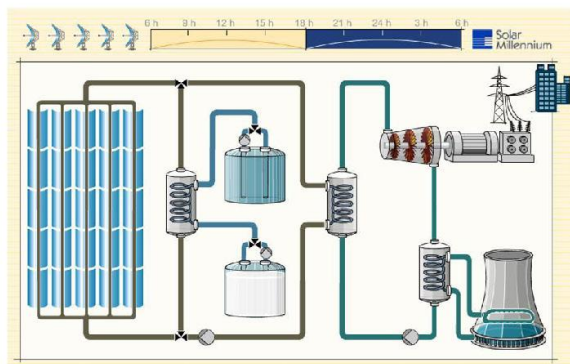


Analysis Products



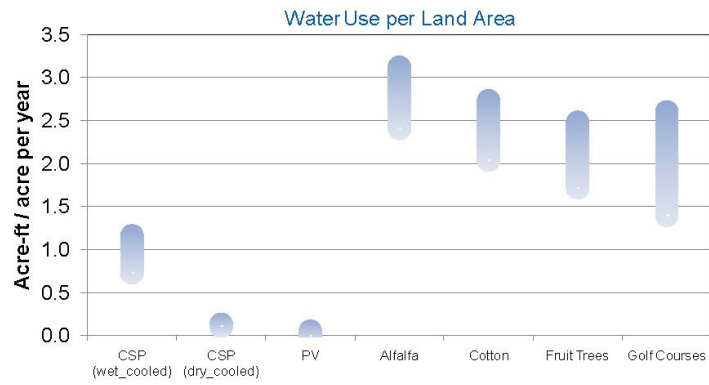
Water Use

Many power plants (including most CSP) use a Rankine steam power cycle to make electricity.



Rankine power cycles require cooling to condense the steam for reuse.

CSP Water Use



Sources:
CSP: Reducing Water Consumption of CSP Electricity Generation, Report to Congress 2009.
Crops: Blaney, Monthly Consumptive use of Water by Irrigated Crops & Natural Vegetation, 1957.
Golf: Watson et al., The Economic Contributions of Colorado's Golf Industry: Environmental Aspects.

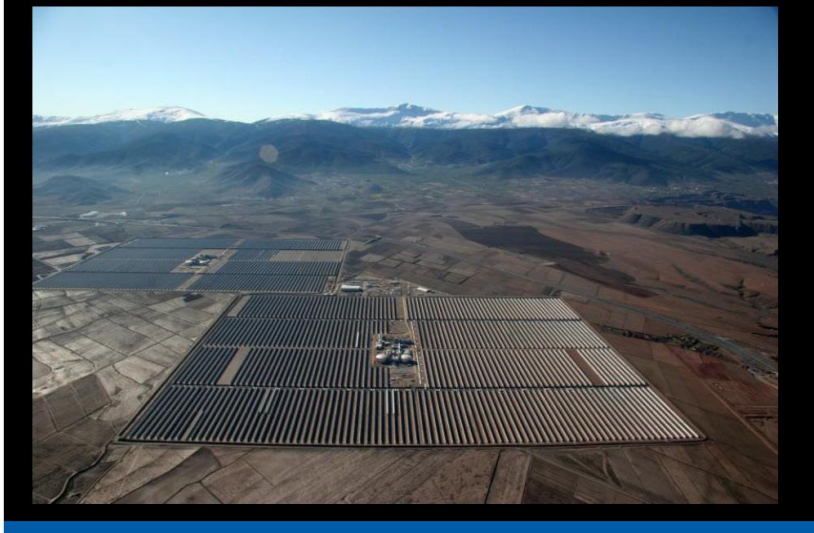
354 MW Luz Solar Electric Generating Systems (SEGS) Nine Plants built 1984 - 1991



64 MWe Acciona Nevada Solar One
Solar Parabolic Trough Plant



50 MW AndaSol One and Two
Parabolic Trough Plant w/ 7-hr Storage, Andalucía



Abengoa 50MW Trough Plants
Seville, Spain



50 MW Iberdrola Energia Solar de Puertollano
Puertollano (Ciudad Real)



Abengoa PS10 and PS 20, Seville, Spain



Power Tower Pilot Plants



6 MW_{thermal} BrightSource
Negev Desert, Israel

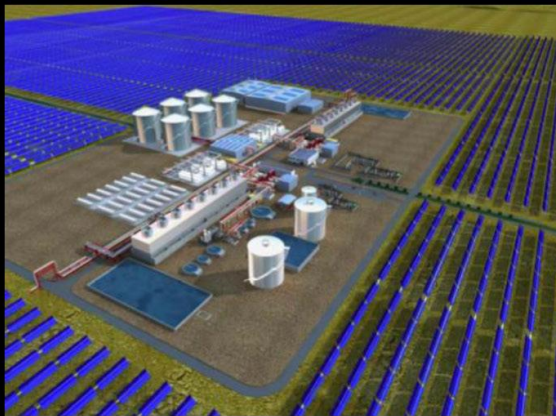
5 MWe eSolar
California, USA



1MW Dish Demonstration – Phoenix, AZ



Planned 280 MW Solana Plant with 6 hrs Storage



2 x 140MW parallel
turbine trains

Solar multiple of
approximately 2.0
(3 mi² solar field)

Artist Rendition



U.S. CSP Projects Under Development

Source: SEIA

Projects Under Development: Concentrating Solar Power (including Concentrating Photovoltaic)

Developer	Project Name	Electricity Purchaser	Location	Technology	Capacity (MW)
Abelec Solar	Mojave Solar	Paul R. Gas & Electric	San Bernardino County, CA	Trough	250
Abelec Solar	Solara	Arizona Public Service	Yuma County, AZ	Trough	250
Acciona Solar Power	FL Invert Solar Power Project	U.S. Army/Underground Utilities	Fl. Palm, CA	Trough	300
Althava	Kingman project		Kingman, AZ	Trough	700
Avell Solar-Advanced Power Corp	U.S. Lanza Peak Thermal Storage demonstration project	Western Electric Power	Lector, AZ	Trough	5
Proxwatts Incorporated (I)	Yuma Peak Solar Energy Project		Maricopa County, AZ	Trough	57.5
EngelSource Energy	Inyokah Solar Electric Generating System (SEGS) I	Southern California Edison	Barstow, CA	Trough	100
EngelSource Energy	Inyokah Solar Electric Generating System (SEGS) II	Southern California Edison	Barstow, CA	Trough	100
EngelSource Energy	Inyokah Solar Electric Generating System (SEGS) III	Southern California Edison	Barstow, CA	Trough	100
EngelSource Energy	Inyokah Solar Electric Generating System (SEGS) IV	Southern California Edison	Barstow, CA	Trough	100
Emcore/SunPeak Power				Trough	200
eSolar	Caskell Sun Tower (Phase I)			Lens CPV	200
eSolar	Caskell Sun Tower (Phase II)			Trough	100
eSolar	Santa Teresa New Mexico SunTower			Trough	100
eSolar	Alpine SunTower			Trough	92
Harper Lake, LLC	Harper Lake Solar Plant			Trough	250
Inland Energy, Inc.	Palmdale Hybrid Gas-Solar plant			Trough	50
Inland Energy, Inc.	Victorville Hybrid Gas-Solar plant			Trough	50
Nucera Energy Resources	Beacon Solar Energy Project			Trough	250
Nucera Energy Resources	Consolidated Solar Energy Project			Trough	250
Pacific Light & Power	Westside solar project			Trough	10
San Joaquin Solar, LLC	San Joaquin Solar 1			Trough ⁽¹⁾	55
San Joaquin Solar, LLC	San Joaquin Solar 2			Trough ⁽¹⁾	55
SkyFuel	SkyThrough the Rockies			Trough	45
Solar Millennium	Amargosa Valley Road Solar Energy Project 1			Trough	242
Solar Millennium	Amargosa Valley Road Solar Energy Project 2			Trough	242
Solar Millennium	Bythe Solar Power Project			Trough	1,000
Solar Millennium	Redington Solar Power Project			Trough	250
Solar Millennium	Palen Solar Power Project			Trough	250
SolarReserve	Rice Solar Energy Project			Trough	100
Solar	Mojave Solar Park			Trough	911
Tessera Solar	SE1 solar Two			Trough	750
Tessera Solar	SE1 solar Three			Trough	750
Tessera Solar	Western Ranch			Trough	17
Tenopah Solar Energy, LLC	Crescent Dunes Solar Energy Project			Trough	100
	New Mexico CSP			Trough	70

(1) World solar plants offering with other technologies reflect peak solar contribution

Concentrating Solar Power Total (MW) 10,443

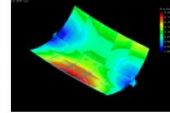
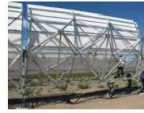
Discussion

- Technology Overview
- U.S. and International Market Overview
- DOE Research and Development

Technology/Market Support Activities

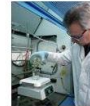
Concentrator/receiver R&D

- optimize receiver and concentrator designs
- develop next-generation collector designs
- create advanced evaluation capabilities



Advanced Thermal Storage

- develop advanced heat transfer fluids for more efficient operation at high temperatures
- analyze and test innovative designs for low-cost storage options



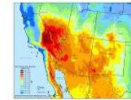
Advanced CSP Concepts and Components

- develop, characterize, and test advanced reflector and absorber materials
- develop and test advanced system components and cycles



CSP Market Transformation

- conduct market penetration analyses
- resource measurement and forecasting
- CSP benefits / impacts analyses



National Renewable Energy Laboratory

Innovation for Our Energy Future

Thank you!

For more information see:

<http://www.nrel.gov/csp/>

<http://maps.nrel.gov/>

<http://solareis.anl.gov/>




Craig Turchi
Concentrating Solar Power Program
303-384-7565
craig.turchi@nrel.gov


National Renewable Energy Laboratory

Innovation for Our Energy Future

APPENDIX D



Overview of CPV (and PV)



Sarah Kurtz

6.8.2010
State Energy
Advisory Board
Lakewood, CO

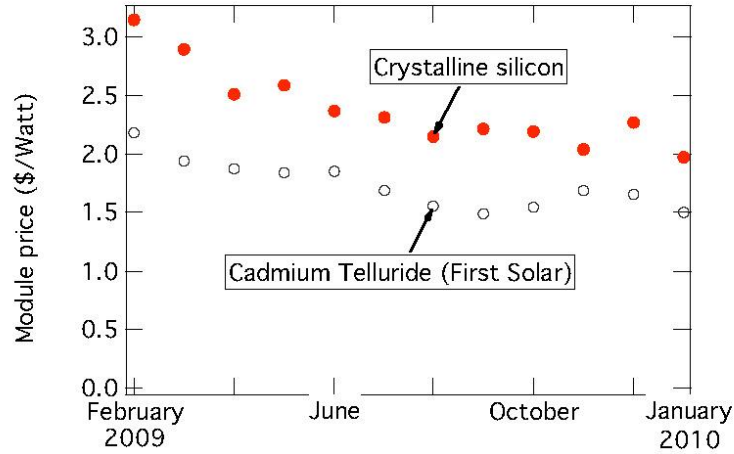
National Renewable Energy Laboratory

Innovation for Our Energy Future

Outline

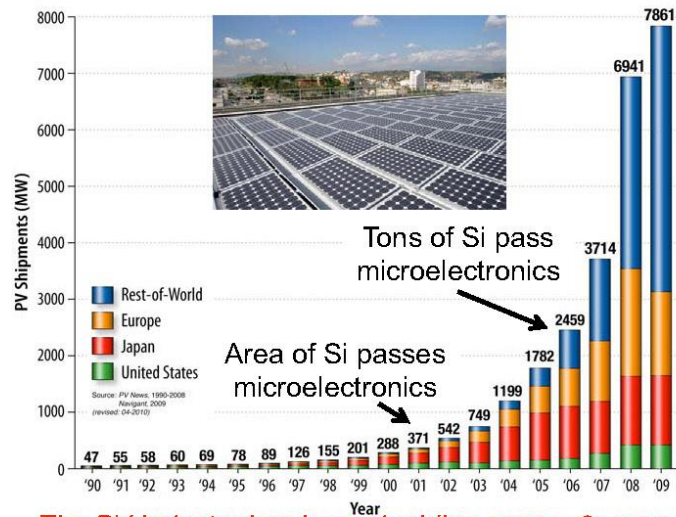
- Growth in PV is creating new opportunities
- CPV – a new technology option is just coming of age
- Opportunities for public policy to make a difference

PV prices have decreased



Source: PHOTON International

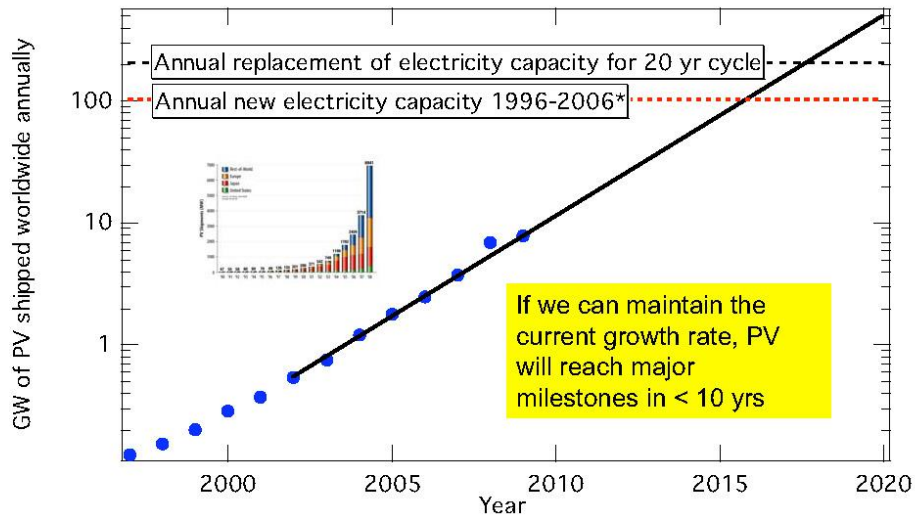
Growth of photovoltaic (PV) industry



The PV industry has been doubling every ~2 years

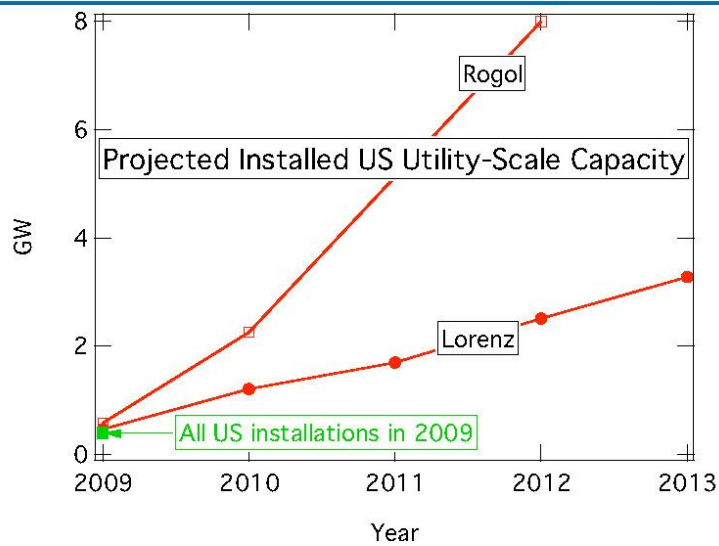
Sources: Prometheus/Navigant

Growth of PV industry



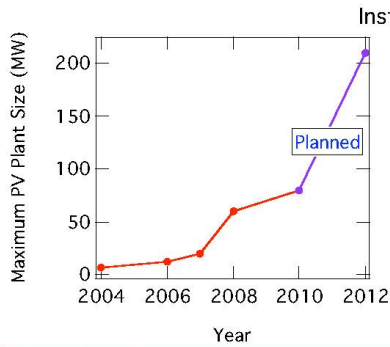
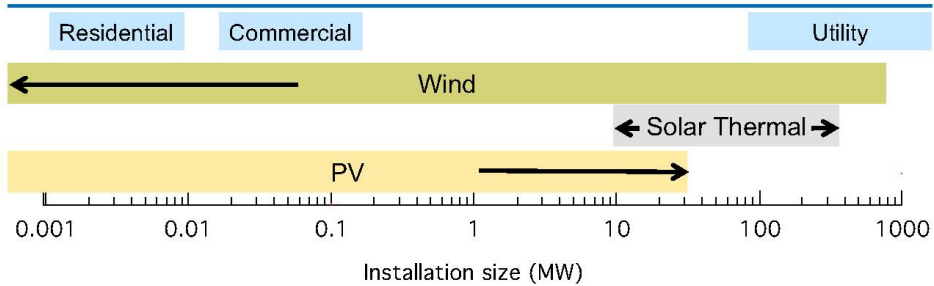
*www.eia.doe.gov/emeu/international/electricitycapacity.html (4012-2981 GW)/10 yr

Within US, predictions are for large utility growth



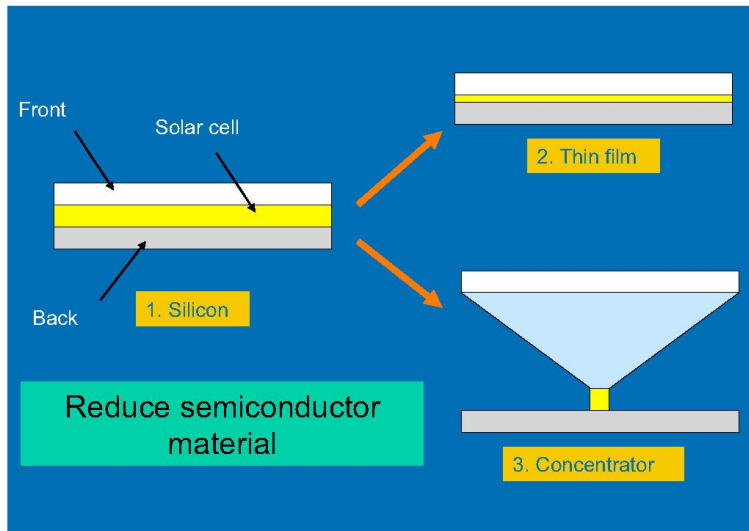
Source: PHOTON International

Distributed vs Central – Can we predict which will dominate?

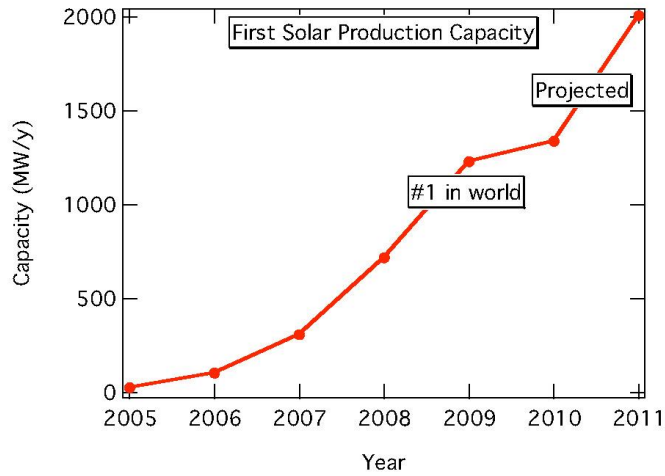


- Recently PV has seen increases in:
- Maximum system size
 - Average system size
 - Ground mount (instead of roof mount)
 - Connection at transmission instead of at distribution voltages
 - Utility ownership

Three approaches to PV



First Solar demonstrated thin-film concept



First Solar grew to be #1 in world in just four years, demonstrating the benefit of using less semiconductor material

One “winner” or many technologies?



Alkaline



Nickel cadmium



Nickel metal hydride



Lead acid



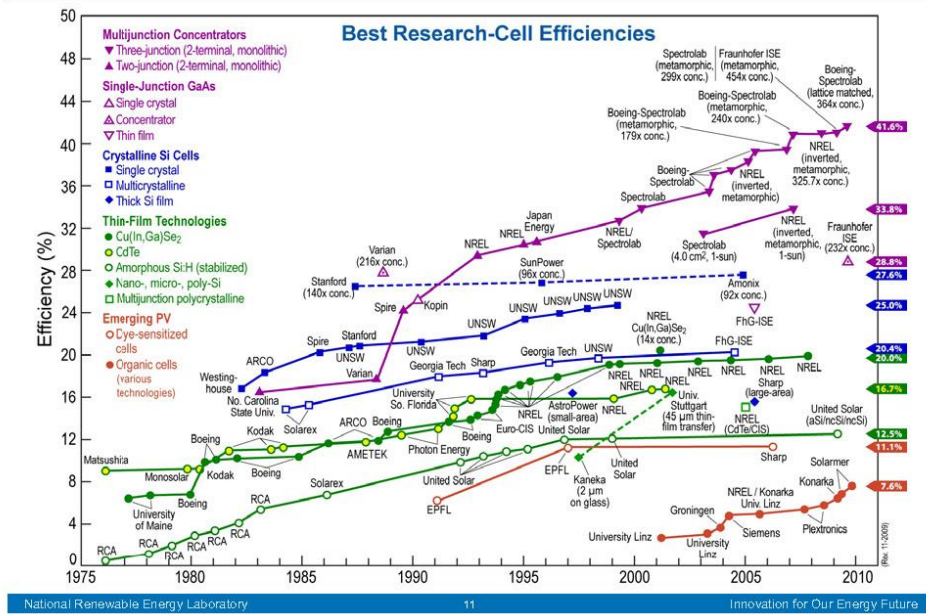
Lithium ion



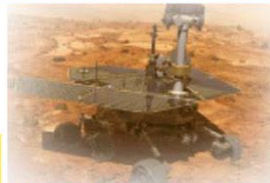
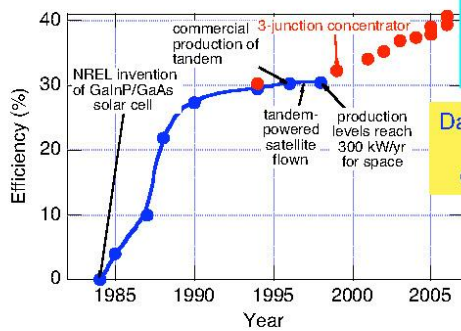
Lithium

Different technologies for different applications

Multijunction cells show highest efficiencies



Success of GaInP/GaAs/Ge cell



Mars Rover powered by multijunction cells



This very successful space cell is currently being engineered into systems for terrestrial use

Concentrator system companies using III-V cells

North America

- Abengoa Solar
- American CPV
- Amonix
- Boeing
- Concentrating Technologies
- Cool Earth Solar
- Edtek
- Emcore
- Energy Innovations
- EnFocus Engineering
- ENTECH
- ESSYSTEM
- GreenVolts
- IBM
- Menova
- Morgan Solar
- Opel International
- Pyron
- Scaled Solar
- Semprius
- SolarTech
- SolFocus
- Soliant Energy
- SUNRGI
- Xtreme Energetics
- ZettaSun

Europe

- Concentracion Solar La Mancha
- Concentrix Solar
- ENEA
- Guascor Foton
- Heliotrop
- Isofoton
- MST
- Sol3g
- SolarTec
- Zenith Solar
- Zytech Solar

Australia

- Concentrating Solar Systems
- Green & Gold
- Solar Systems

Asia

- Arima Ecoenergy
 - Chengdu Zsun
 - CompSolar
 - Daido Steel
 - Delta Electronics
 - ESSYSTEM
 - EverPhoton
 - Jiangsu White Rabbit
 - Shanghai Solaryouth
 - Sharp
 - Spirox
 - Square Engineering
 - Suntrix
-

Concentrator system companies using low-concentration approaches

North America

- Aavid Thermalloy
- Banyan Energy
- Covalent Solar
- Cool Earth Solar
- ENTECH
- Greenfield Solar
- Megawatt Solar
- Netcrystal
- Optony
- Pacific Solar Tech
- Prism Solar Technologies
- QD Soleil
- Skyline Solar
- Solaria
- Solbeam
- Stellaris
- Thales Research

Europe

- Arontis Solar Concentrator
- Cpower
- Maxxun
- Pirelli Labs
- Pythagoras Solar
- Silicon CPV
- Sunseeker Energy
- Whitfield Solar
- Zytech Solar

Australia

- Sunengy

Asia

- Anhui Yingtian Renewable Energy
-

Concentrator technology



Recent CPV developments

- Amonix: just announced \$129 million new investment
- System efficiencies have moved from 18-20% to ~25% in about 3 years
- A handful of companies have started automated production lines
- In 2010 we may expect multiple announcements of 1 MW installations
- Need to demonstrate technology before scale up
- CPV companies have the potential (not guarantee) to duplicate First Solar's success because of reduced use of semiconductor material, associated with lower CapEx and module cost

What can you do?

Help remove barriers

Opportunity: Reduce Permitting Barriers

Permitting

- Adds cost (can add \$1/W)
- Slows projects
- Increases investor risk (often projects aren't completed)

Opportunity: Education

Community needs to be educated about new technologies

- Installers
- Investors
- PV owners
- Inspectors
- Firemen

Opportunity: Provide incentives that shrink each year

Incentives are necessary today

- Consistent policy allows good choices
- Incentives need to ramp down to drive down cost and sustain sense of urgency

Opportunity: Keep the door open

New technologies may achieve lower cost or higher performance

- Must be willing to try them (in a small way)
- Must not push before they are ready
- Must be patient – expect problems

Different funding mechanisms for different applications

- Provide investment options for those who can't put PV on their roof
- Let market decide

Opportunity: Pursue all markets equally

Pursue utility market alongside of rooftop market

- Structure incentives to reflect true costs to facilitate market to wisely choose best approaches
- Allow utilities to play the roles they need to play in making sure the lights come on when a switch is flipped

Opportunity: Use public utility commissions

Today's investors are risk adverse – this is currently a big barrier

Public utility commissions can act on behalf of the community's best interest by:

- Developing a portfolio of approaches
- Trying new technologies in preparation for use in future years
- Compare risk of a few percent higher degradation of new technology with possible fossil fuel costs

Summary

PV industry may rapidly move into utility applications in next couple of years

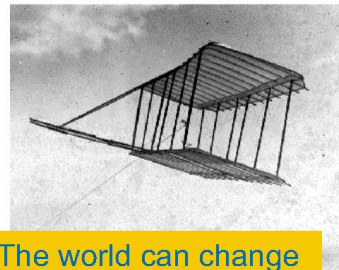
CPV and other new technologies could make a difference in the next five years

There are many opportunities for improving public policy

"Hurry — Hurry — Hurry!"



ROY JUSTUS
Courtesy: Minneapolis Star

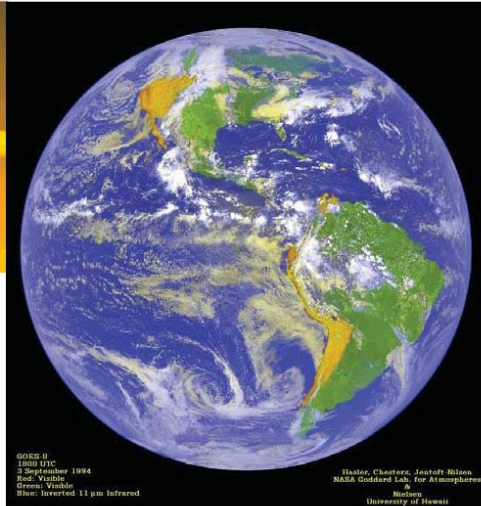


The world can change a lot in 100 years.



What will our world be like 100 years from now?

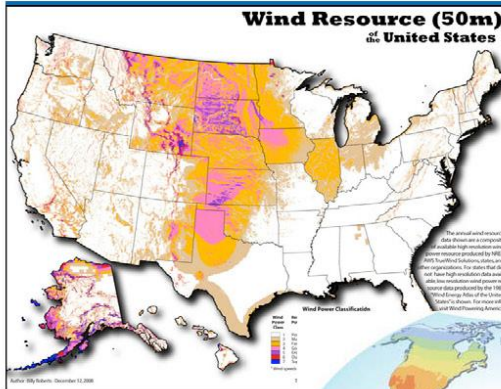




Vision of a world run by renewable energy

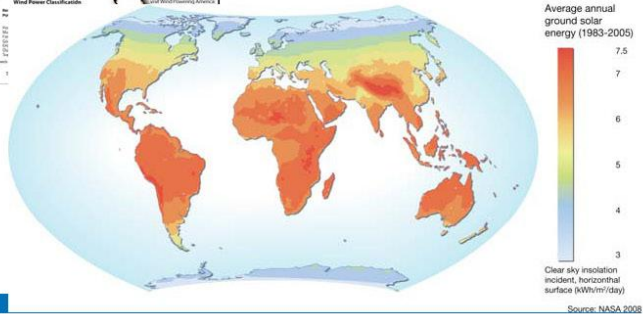
Thank you for your attention

Renewable energy is available everywhere, but varies



Best wind resource is in middle of country

Solar resource varies much less



Appendix E



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Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

State Energy Advisory Board Community Renewable Energy Deployment Briefing

June 9, 2010
Steve Lindenberg
Senior Advisor, Renewable Energy
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

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DOE Renewable Deployment

- **EERE supports renewable deployment in many forms**
 - Publications and Presentations in many venues
 - Web access to various resources and references
 - Annual market evaluations and analysis for progress to goals
 - Outreach programs to interested communities
- **Solar America Cities**
- **Wind Powering America**
- **Geo Powering the West**
- **Integrated Deployment for communities**
 - New Orleans, LA efficiency and renewables in rebuilding city
 - Greensburg, KS clean community efforts
 - Hawaii Clean Energy Initiative
 - Alaska village renewable energy integration
 - National Science Foundation Polar Programs
 - Energy Development in Island Nations (EDIN)
 - Community Renewable Energy Development
- **Weatherization and Intergovernmental Programs**
 - SEP and EECBG components of community plans

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*Rebuilding New Orleans
 To a Higher Standard*



In August & September 2005, Hurricanes Katrina and Rita flooded over 80% of New Orleans. DOE answered the call for help & placed staff onsite to focus on rebuild support.




- **Schools**
- All new schools (over 40) will now be at least 31.5% more efficient than code by 2020
- Provided energy audits on 50 schools to assist major renovations (>35 planned) in achieving 25% more EE than code by 2020
- **Homes**
- Project Home Again has built 45 affordable homes meeting DOE Builder's Challenge (34% more efficient than code) with 55 more planned
- Habitat for Humanity now building homes to Energy Star level (15% more EE)



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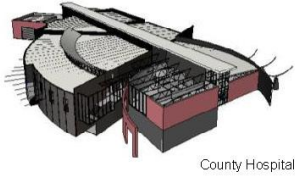
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*Greensburg, KS:
 Leader in Rebuilding Green*



On May 4, 2007, an EF5 tornado decimated 95% of Greensburg, KS, driving the 1500 residents from their homes and local jobs. DOE and many Federal, State, local, and private sector partners, helped Greensburg rebuild Green.

- **Rebuilding Efficiently**
- 161 homes avg. 42% less energy use than code
- 31 commercial buildings to achieve at least LEED certification (>30% EE)
- School designed 50% more efficient than code
- Hospital designed to 60% EE & RE savings; first LEED Platinum critical access hospital in U.S.
- **Power Through Renewables**
- 12.5 MW Wind Farm start-up March 2010 providing 100% electricity
- John Deere now North American Dealer for BTI Equipment small wind turbines



Unprecedented Results

- 1st LEED Platinum City Ordinance
- Highest Density of LEED Certified & LEED Platinum Buildings in the US
- City uses 100% Renewable Electricity
- First net metering policy in Kansas
- First Eco-Town series for Discovery Channel

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Hawaii to achieve 70%
 Clean Energy by 2030

Hawaii Powered
 Hawaii's Clean Energy Initiative

Hawaii's faces energy prices twice the National Average; 7 times the energy cost as a % of GDP compared to the national averages. As a result, DOE and Hawaii joined forces to launch the Hawaii Clean Energy Initiative Jan. 28, 2008 to change the energy future of Hawaii.

Renewable Energy Use

- 40% RPS requiring 30% new RE generation by 2030
- Voluntary Commitment by Utility; install 1100 MW of RE in next 7 years, decoupling, net metering, and feed-in tariff regulations
- Electric Vehicle Infrastructure mandated
- **Energy Use Reductions**
- 30% EE Portfolio Standard by 2030
- First Net Zero Energy Community broke ground 3/10; several more in development
- More stringent Building Codes adopted



Maui Wind Farm


Unprecedented Results

- First State to require solar water heaters on new homes
- Serving as a model for US Virgin Islands and Okinawa
- Modeling & Analysis of Highest Variable Renewable Generation Penetration ever done in US
- Unprecedented collaborative workshop held July 2008 with all major stakeholders
- DOD commitment to meet or exceed 70% Clean Energy goal

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Purpose of Community Renewable Energy Deployment Grant Opportunity

- \$22 Million in project funds for up to 4 renewable deployment projects managed by communities
- To move EERE toward improving knowledge and to promoting acceleration of renewable market adoption
- To support and enable EERE's deployment goals for multiple renewable energy resources and technologies, with the intent of
 - (1) creating jobs
 - (2) stimulating economic growth
 - (3) creating successful RE technology examples for replication
- To support communities with existing renewable energy technology plans that are ready to move into implementation through deploying renewable energy installations.



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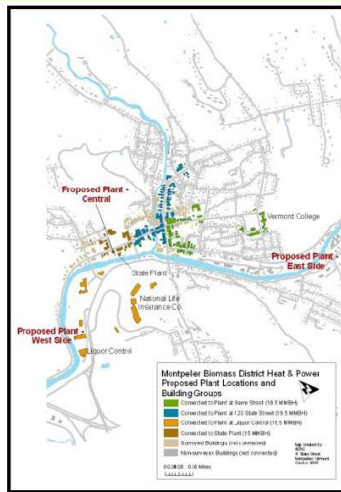


Geographic Diversity of Selected Applicants



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City of Montpelier District Energy

The Montpelier Community Renewable Energy Project encompasses the design, permitting, construction, installation, financing, commissioning and operation of a state-of-the-art 41 MMBtu (1200 HP) combined heat and power district energy system fueled with primarily locally-sourced renewable and sustainably-harvested wood chips.

- The project will also identify and implement the optimum ownership and customer marketing and connection strategies.
- As properties are connected to the system, the project will implement efficiency and conservation measures to reduce overall heat load.
- The project includes adoption of financing mechanisms that will enable property owners to implement a variety of efficiency measures and renewable energy strategies.



District renewable energy to replace the need for individual, building-based boilers, furnaces, and cooling systems. Individual building owners are able to buy their heat (and in some cases, cooling and electricity) from the energy district instead of operating their own boilers, furnaces or air conditioners.

- Rapid and universal conversion to renewable fuels,
- Greater fuel flexibility
- Professional environmental energy management.

The CHP system will be sized to provide heating to an existing 1/2 million square feet of state-owned buildings in the Vermont Capitol Complex along with a planned expansion of about 240,000 square feet. City-owned properties including schools and the City Hall Complex, and up to 156 additional buildings in the community's designated downtown district, for a total of 180 buildings heating 1.8 million square feet. By also providing 1.8 million KWh of power to the grid, the system will maximize its operating efficiency and reduce thermal costs for users in the community.



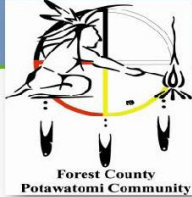
By 2013, Montpelier achieves a 50,000 ton annual reduction in greenhouse gas emissions, the equivalent of \$15 million of fuel oil annually and with an investment in the local economy of approximately \$100 million.

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Forest County Potawatomi Community

FCPC will implement integrated renewable energy plan that will employ several different renewable energy technologies. Tribe to eliminate the vast majority of natural gas and propane to heat in its governmental buildings and more than offset the electricity usage of its on-reservation buildings.

- Tri-generation biomass facility for:
 - heating and cooling Tribal government's Stone Lake site
 - produce approximately 1.25 MW of electrical energy.
- Dried woody biomass boiler heating systems for numerous of the Tribe's on-reservation buildings.
- A biogas digester and 150-kilowatt generation unit that will utilize the Tribe's organic solid waste from several sources, including Tribe-owned facilities, Tribal member homes, septic sewage and municipal solid waste from both Tribal lands and possibly from non-Tribal communities, and waste oil and grease from area restaurants, including the Tribe's restaurants.



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- Generate electrical and heat energy for FCPC reservation usage to replace existing fossil fuels. Initial estimated carbon reduction for the Tribe in excess of 20,000 tons per year.
- Turns low-value wood and waste material into green energy and coal-replacement biomass fuel.
- Preserves and increases forestry and other jobs.
- Other efforts include solar and mixed waste stream application

Renewable technologies will support wide-ranging impact, as it provides a model for local communities to produce their own energy from diverse resources thereby helping communities, and in aggregate, our country as a whole, to become energy independent and thereby improve our national security.



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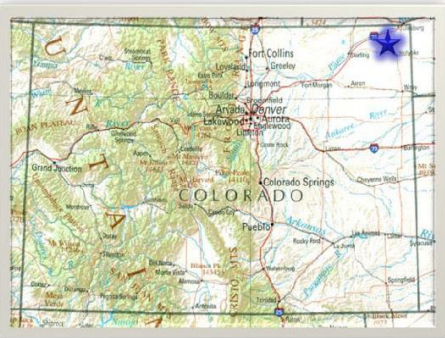
Phillips County 30 MW NECO Wind Project

The objective of this project is to develop utility scale wind energy that offers local ownership.

NECO Wind wants to produce community based wind energy that is sustainable and responsible.

NECO Wind will increase the likelihood of future development of utility scale community wind energy projects in the State of Colorado due to increased understanding and acceptance of community owned wind energy locally and with off-taker utilities.

The initial 30MW phase will generate enough electricity for approximately 9,000 homes



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<http://www.eere.energy.gov/>



A Community Wind Model

Phillips County has been selected to receive \$2.5 million in federal for the first 30MW phase in hopes of assuring the future economic well-being of Phillips County. NECO Wind proposes to positively impact the local economy by sharing the project's revenues with local landowners and other project participants, by generating local jobs, substantial property taxes, and providing clean renewable energy for the area's primary communities.

Established in 2008 by community members of Sedgwick, Phillips and Logan Counties in Colorado, NECO Wind is managed and professionally developed by National Wind, LLC. As the managing partner, National Wind will oversee the wind project from the initial planning stages until the final construction phase.



NECO WIND, LLC



Benefits to the Local Economy and Community

NECO approach to wind project development is atypical of traditional models through their inclusion of the local community in the project. Allowing local majority ownership of the project company. Encouraging landowners and the local community to share in the project's proceeds through turbine royalty and land payments, as well as through the gross operating revenues from a successful wind project. Most of the project's economic benefits will remain in the State of Colorado.





SACRAMENTO SOLAR HIGHWAY

The goal of the Sacramento Solar Highway project is to install a 1.5 MW PV system that will establish a blueprint for additional projects throughout the State of California.

- New use for restricted land in urban areas
- Help accelerate market penetration and deployment of solar PV. Resolve PV system technical integration and safety issues with California Department of Transportation (Cal Trans)
- Installation of 300kW of concentrating PV, and 400 and 800 kW of flat plate PV distributed at 2 sites



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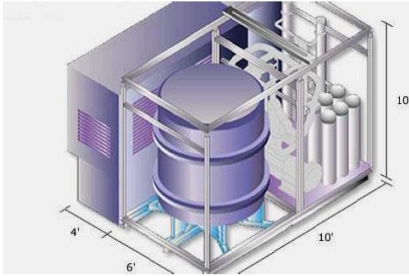


ANAEROBIC DIGESTOR FOR DAIRY FARM

Implementation of an advanced anaerobic digester system (AADS) at Van Warmerdam dairy farm.

This dairy farm has 1,100 dairy cows. The biogas produced will be fed to a solid oxide fuel cell that will generate an electrical output of 700 kW and heat for CHP application.

Implementation of this anaerobic digestion system will help resolve slow market penetration of AD systems for the dairies. Help resolve complex permitting process by implementing zero emission fuel cell technologies.



Above right: complete-mix anaerobic digester;
 Right: part of 700 kW CCP fuel cell & micro turbine

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The West Village Energy Initiative:

Project will deploy an advanced on-site waste-to-renewable-energy (WTRE) system within a large-scale mixed-use community development.

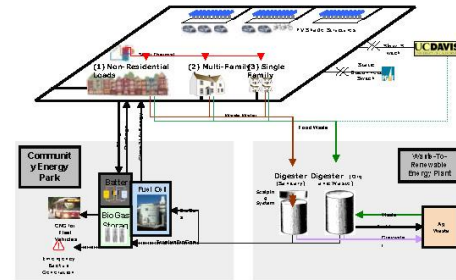
- WTRE system will be built within a Community Energy Park and combined with other components of the West Village Energy Initiative (WVEI).
- The WVEI an almost \$75 million project, incorporates an array of on-site renewable energy generation resources, Deep Energy Conservation Measures (Deep ECMs), and smart grid integrating equipment to enable the ground-breaking demonstration of a Zero Net Energy (ZNE) community development,
- Model for other such communities that can inform evolving state and federal energy policies.

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- Community Waste Receiving and Handling Facility
- Anaerobic Phased Solids (APS) Digester create on-site renewable biogas
- Bio-methane Upgrade System, which will remove H₂S, CO₂ and other impurities
- Housed alongside the WTRE system within the Community Energy Park
- 300kW fuel cell that will be fueled by the on-site biogas.
 - Not part of DOE project will be an advanced storage battery
- Committed to conduct critical design and engineering
- Enable a secure community electricity grid with increased power reliability and quality,
- Drastically reduced peak energy demand
- Lowers T&D losses and GHG emissions.



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- Planning marketing campaign based on community energy
- Focus on the DOE accomplishments
 - New Orleans
 - Greensburg
 - Hawaii Clean Energy Initiative
 - Alaska energy implementation
- Explore community funding proposals not awarded
- Work with California Energy Comm. (RESCO) awardees
- Coordinate with other DOE deployment efforts
- Search for partners to expand community energy concept

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Appendix F

 **NREL** National Renewable Energy Laboratory
Innovation for Our Energy Future

Meeting Our Energy Challenges: Transitioning from 20th Century Fuels to 21st Century Options



Carol Tombari
June 9, 2010
*State Energy
Advisory Board*
U.S. Department of
Energy

NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy operated by the Alliance for Sustainable Energy, LLC

Humanity's Top Ten Problems for next 50 years




1. Energy
2. Water
3. Food
4. Environment
5. Poverty
6. Terrorism & War
7. Disease
8. Education
9. Democracy
10. Population



2003: 6.3 Billion people
2050: 9-10 Billion people

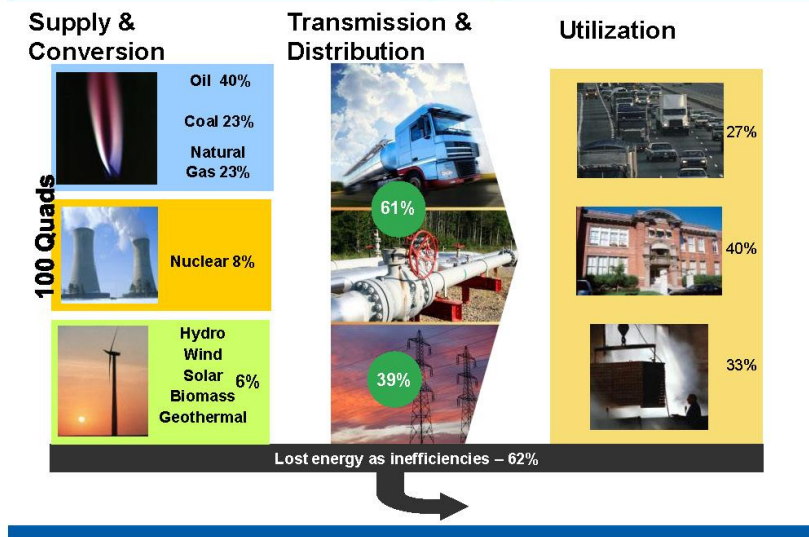
Source: Nobel laureate, Richard Smalley

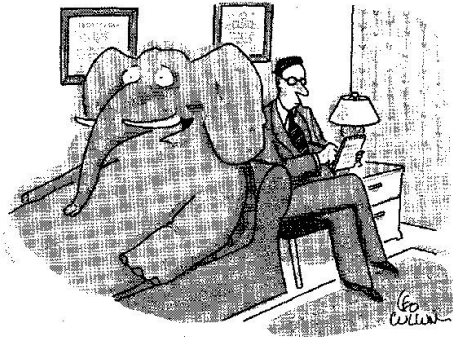
Energy is a means to an end, not an end in itself.

<p>Heat and power for where we live and work</p>	<p>Fuel and power for mobility and access</p>
	
 <p>Sustainable Electricity System</p>	 <p>Sustainable Transportation System</p>

3

Our Energy System



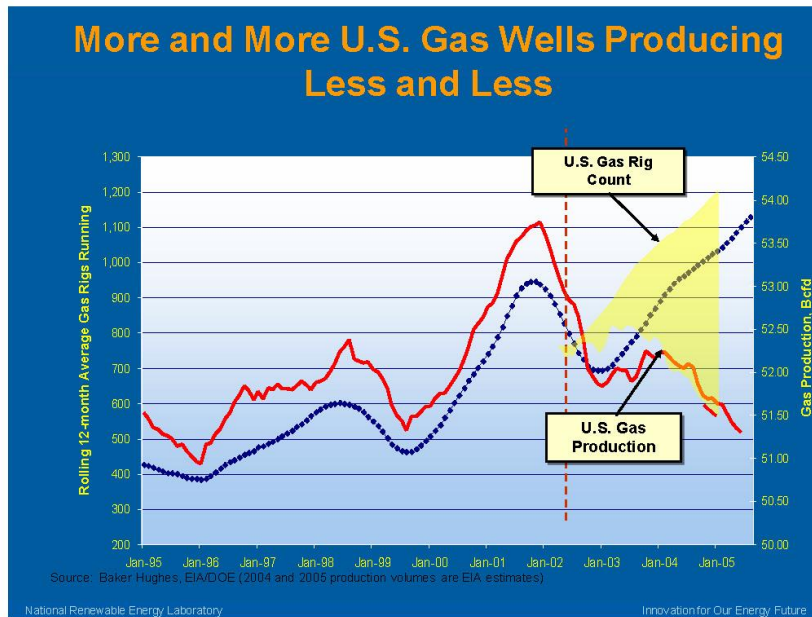


"I'm right there in the room, and no one even acknowledges me."

Energy Is the Elephant in the Room...

- ... An operating cost, a cost of doing business
- ... A vulnerability for businesses that require 99.9999% reliability
- ... A factor in local environmental conditions and associated human health
- ... A factor, for better or worse, in local economies
- ... A homeland security concern
- ... A national security concern
- ... A behind-the-ticker-tape factor on Wall Street

A Look at Costs...



Challenges for Natural Gas

- Pressure on conventional supplies
- Uncertainties regarding enhanced recovery (hydro-fracturing)
 - Undocumented success rate
 - Cost
 - Water requirements

According to Peabody Coal, there will be a

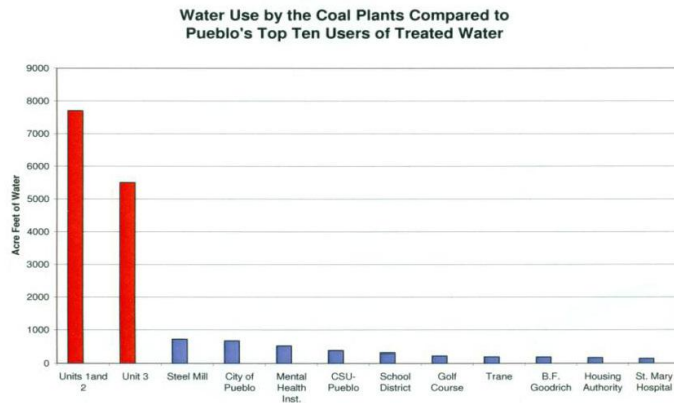
59%
Increase in the Cost of
Powder River Basin (Wyo) Coal
Between 2007 and 2009

Source: Peabody Coal, Presentation to Investors,
September 6, 2007 Lehman Brothers Conference

Challenges for Coal

- Pressure on *affordably* extractable supply: increased demand without parallel increase in supply
 - Population and economic growth
 - Larger electricity needs in built environment
 - *Larger footprints, especially in residential sector*
 - *Principal-agent dilemma inhibiting energy efficiency investments*
 - Electrification of transportation and industrial sectors
- Rising prices: ~10% in recent years

Figure 4
Water Use by the Pueblo Coal Plants
Compared to the Top 10 Water Users in the State
(Information from the Annual Report of the Pueblo Board of Water Works)



Challenges for Coal -- 2

- Need for large amounts of cooling water, even with hybridized systems

- Air- and Water-borne Emissions

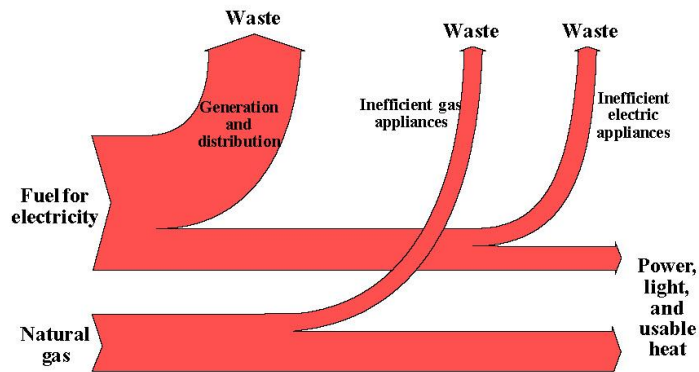
Hazardous pollutants: mercury, arsenic, benzene, chromium, lead, sulfuric acid mist

Other regulated pollutants: NO_x, SO_x, fine particulates, CO₂

Challenges for New Nuclear Power Plants

- Rising uranium costs/global competition
- Rising costs of cement and steel
- NIMBY
- Long lead times (*12 years, minimum*)
- Projected cost: **30 cents/kWh**
- Waste disposal issue
- Cooling water
- Wall Street perception of risk
- Need for continuing hefty subsidies
 - Price-Anderson Act

What is the Cost of Waste? Consumption for Average Residential Customer



Source: A Micro-Grid with PV, Fuel Cells, and Energy Efficiency, Tom Hoff, Clean Power Research.com

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Energy Intensity

The American economy is, after Canada's, the most energy-dependent in the advanced industrialized world, requiring the equivalent of a quarter ton of oil to produce \$1,000 of gross domestic product. ***We require twice as much energy as Germany -- and three times as much as Japan -- to produce the same amount of GDP.***

Source: Ricardo Bayon, *The Atlantic Monthly*, Jan/Feb. 2003

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Homeland Security:

How vulnerable are we?

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Homeland Security: *Vulnerability of the Electrical Grid to Natural Disasters*

High-voltage power line cut by fallen tree limb near Oregon/California border - August 10, 1996



Before



After

- Affected a 9-state region
- Lasted up to 3 weeks in some areas
- Almost 16 million people affected in California alone

Source: W. Becker, U.S. DOE

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Vulnerability of Our Economy to Power Outages

“It is not the cost of electricity that drives our decision-making process, rather it is the cost of NOT having electricity.”

Jeff Byron, Energy Director, Oracle Corporation

High-Value Situations: Reliability, Power Quality

Stock Brokerage = \$5M - \$7M/hr

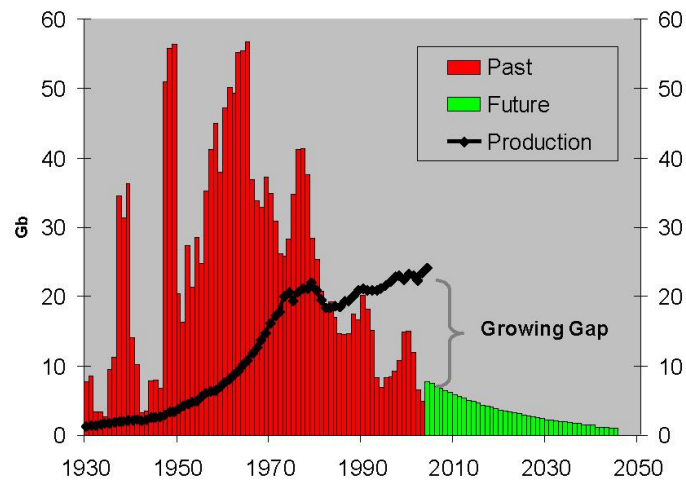
Credit Card Svcs = \$2M - \$3M/hr

Phone 800 # Svcs = \$150K - \$225K/hr

Nationwide = \$35 B to \$70 B in losses per year

Source: DOE Strategic Plan for Distributed Energy Resources, September 2000

Worldwide Discovery Trend

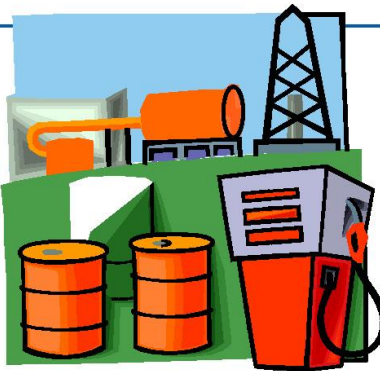
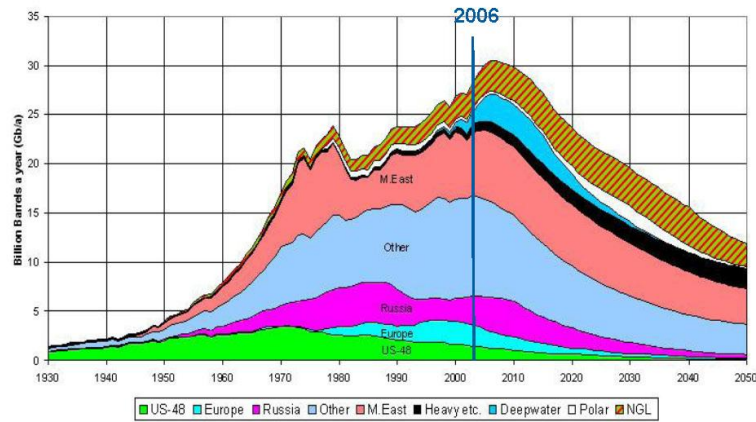


Source: Campbell, May 2005

Peak Oil Theory

according to Colin Campbell, Assoc. for the Study of Peak Oil

OIL AND GAS LIQUIDS 2004 Scenario



The world consumes about two barrels of oil for every barrel discovered.

The U.S. has consumed about 2/3 of its oil!
It's like drinking 4 cans and having only 2 left!

Except that we're drinking the last two
much faster than the first two!



*What is the value of energy
if you don't have any?*

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Individual, Regional and Global Environmental Impacts

Air Emissions & Public Health

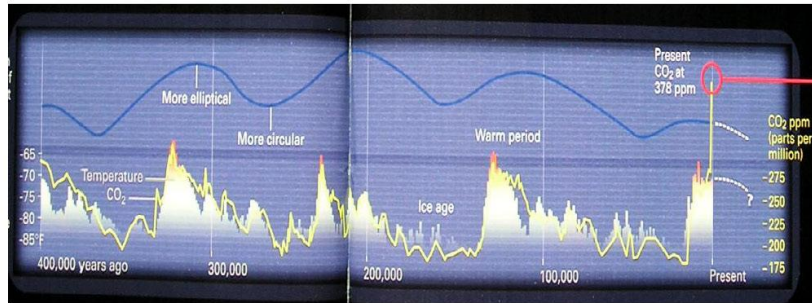
45% of U.S. Population live in non-attainment areas.



121.4 million Americans lived in counties that violated national air quality standards in 2000.

The American Lung Association estimates that Americans spend >\$50 billion a year on health care as a result.

Unprecedented Levels of CO₂



CO₂ concentrations currently ~ 390

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How long can you operate past the red line...

...with your car's engine?

...with your planet?



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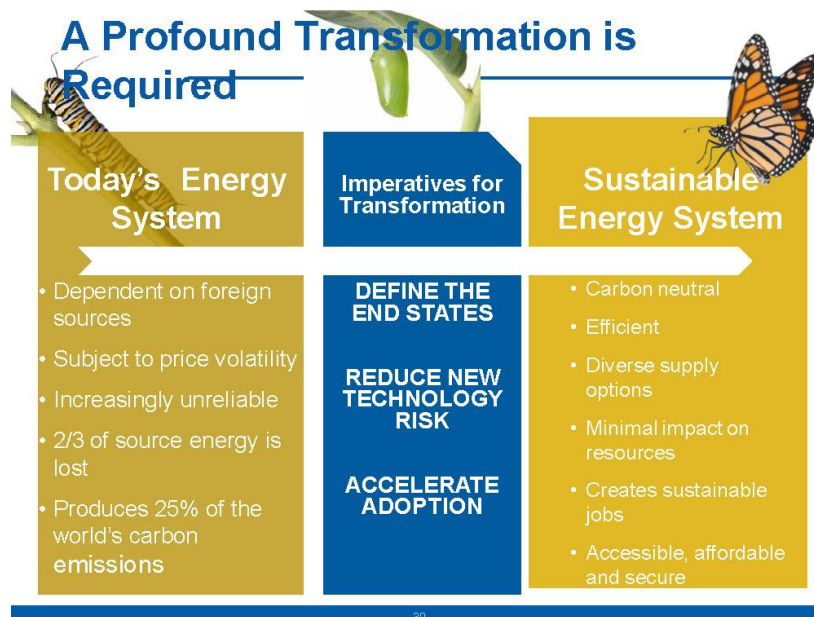
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Business As Usual

- **Expensive, and getting more so**
 - Rising fuel and commodity costs, possible carbon penalties
- **Environmental issues**
- **Impacts on human health**

Yet our energy appetite is increasing.

- **Commercial sector lag in adopting energy efficiency (principal-agent dilemma)**
- **New homes larger than old ones**
- **Urban sprawl: impact on transportation fuel use and associated emissions**
- **General growth (economic, population)**



“We cannot know with absolute certainty, so we do nothing... The essential human dilemma is that all our experience is in the past and yet ***all our decisions relate to the future.***”

Richard D. Lamm, in Elliott, Ethics for a Finite World

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Technology-Based Solutions:

There is no single or simple answer.

Energy efficiency

Renewable energy

Nonpolluting transportation fuels

Transition to smart, resilient, distributed energy systems

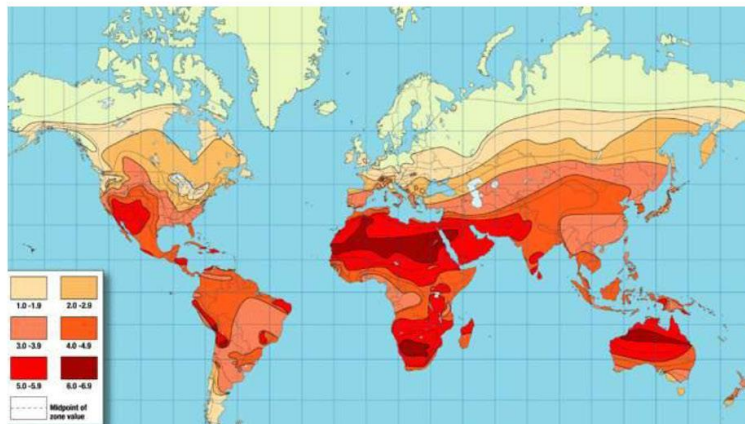


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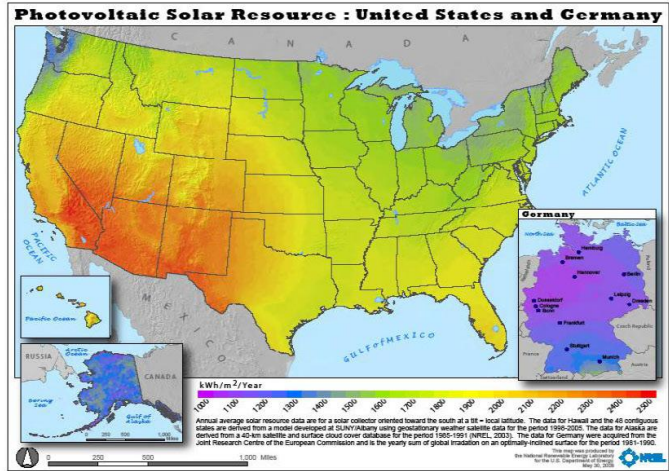
Innovation for Our Energy Future



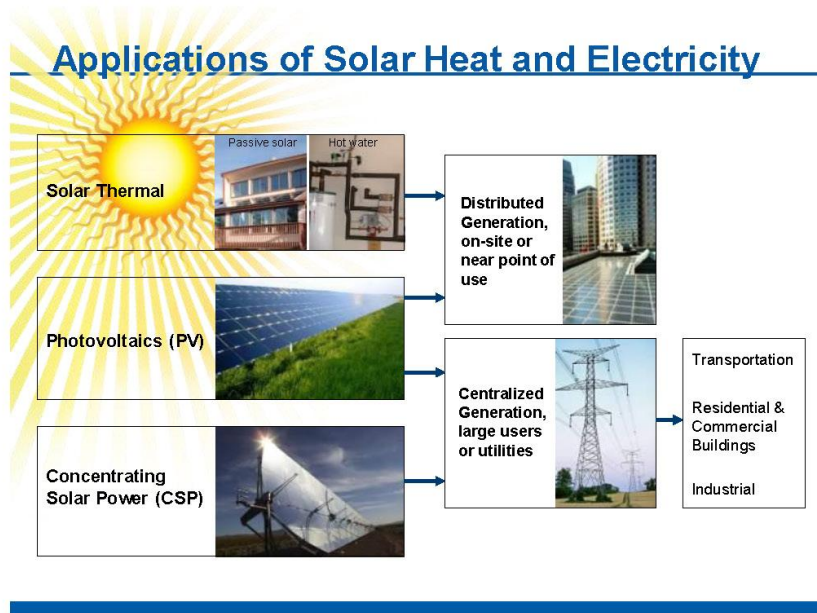
Robust Global Solar Resource



Source: <http://rowto.altenergystore.com/Reference-Materials/Solar-Insolation-Map-World/43/>



Applications of Solar Heat and Electricity



Challenges in Realizing Solar Electricity

Photovoltaics

Interconnection

- Predictable and reasonable regulations governing interconnection of PV systems are required to assure timely and cost-effective development of PV projects.

Net Metering

- Net metering allows generators interconnected to a utility grid to be compensated for the electricity their PV system produces when it is not used on-site at the time of generation. These provisions are inconsistent across States, and often do not reflect fair market value.

Grid Integration Codes and Standards

- As PV market penetration increases, new codes/standards are needed to maintain grid reliability and economics.
 - Advanced Metering Infrastructure
 - Real-Time Pricing Signals
 - Communications Protocols for DG-Grid Interaction

Concentrating Solar Power

Land Access

- Efficient and predictable permitting processes for use of Federal lands in CSP project development are needed – the current regime is causing protracted timelines and increasing development costs.

Transmission Access

- Development of CSP projects requires construction of new transmission "spurs" and corridors – the current regime does not allow for efficient cost allocation or rapid permitting for new lines.

State CO₂ & RPS Regulations

- Uncertainty about compliance costs for RPS requirements and CO₂ prices introduces complications into power purchase agreement negotiations for CSP project development.

Lack of Long-term Policies and Market Predictability

- PV manufacturers site capacity close to markets, and are reluctant to make major capacity investments in the U.S. while long-term incentive environment is uncertain, inhibiting scale-up and cost reduction.
- Downstream PV companies are even more reluctant to invest in distribution /installation capacity while long-term incentive structures are uncertain.
- Financing for CSP project development can be secured only on the basis of a negotiated off-take contract (PPA) with a utility – uncertainty in long-term incentive environment complicates transactions.

Energy Efficiency

“Every watt not used is a watt that doesn’t have to be produced, processed, or stored.”

Richard Perez, Homepower Magazine

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Energy is “produced” on the demand side.

Properly designed and oriented buildings use **60% less** energy than conventional structures.

Only **10%** of energy input to conventional light bulbs produces light; **90% is thrown off** as heat – which often must be cooled, requiring more electricity.

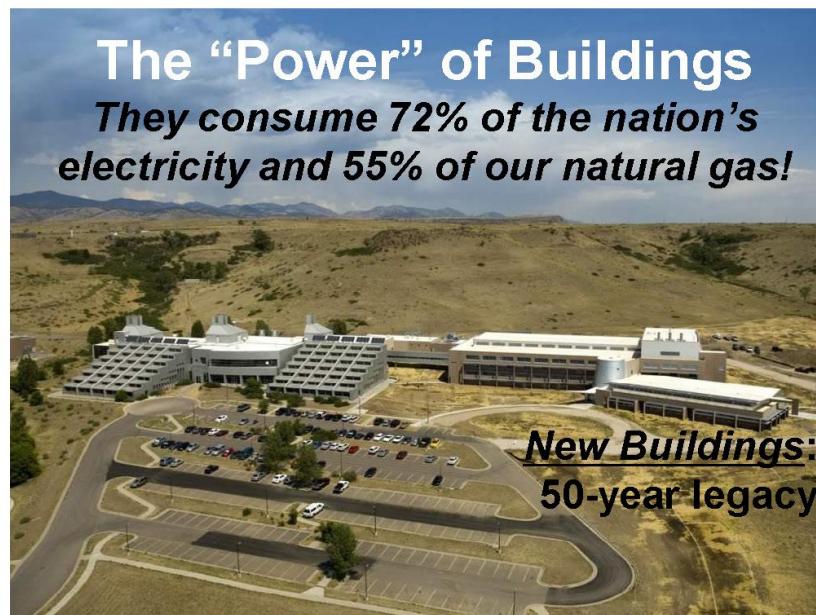
U.S. utility system wastes enough energy each year to meet the power needs of Japan.

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Energy Efficiency: The Cheapest Option

- Costs < 2 cents/kWh
 - Compared to ~ 9.5 cents+/kWh
- Permits equipment downsizing
 - Save \$\$\$ on purchase price
 - Save \$\$\$ on energy operating costs



What Makes a Building Energy Efficient?

- Proper orientation and design of structure
- Proper design and installation of HVAC
- Proper installation of insulation
- Reduced air leakage
- Water conservation
- Efficient windows
- Efficient lighting
- Efficient appliances, equipment



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Comments from an NREL researcher...

“Today’s building designs mortgage the energy future of this country.”

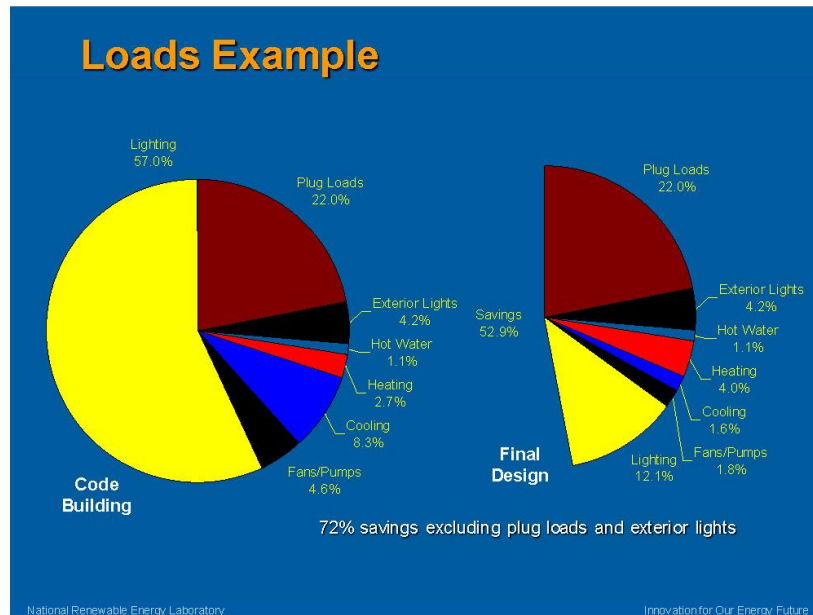
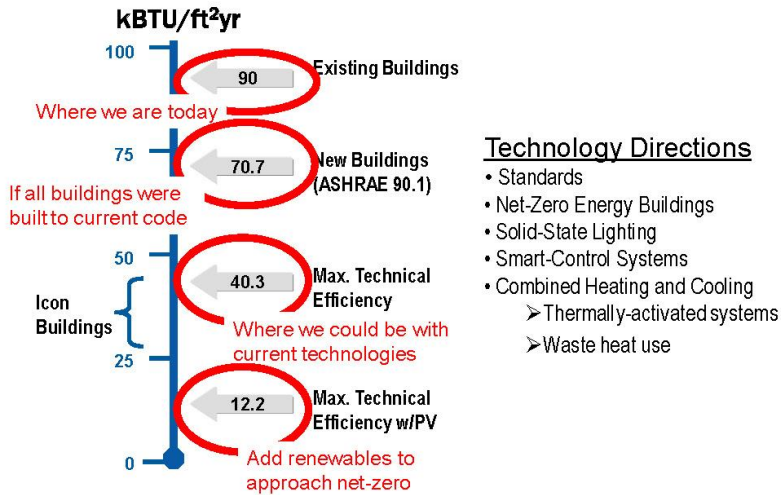
– New buildings: a 50-year legacy.

“Code compliant ‘energy efficient’ buildings are the worst buildings you can ‘legally’ build.”

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Commercial Building Opportunities



Net- or Near-Zero Energy Buildings

...generate as much, or almost as much, energy as they consume on an annual basis. ZEBs can be totally self-sustaining (grid-independent) or, if grid-connected, net electricity exporters.

Net Zero Energy Habitat for Humanity Home

Superinsulated walls, floors and ceilings
Efficient appliances
Solar water heating system
Compact fluorescent lighting
Windows coated with thin layers of metallic oxide to help keep heat in during the winter and out during the summer.
4-kilowatt photovoltaic system



Reducing Demand Through Energy Efficiency, Generating Electricity with the Sun... Shea Homes, San Diego CA



Plug-In Hybrid Electric Vehicles (PHEV)

Status:

- PHEV-only conversion vehicles available
- OEMS building prototypes
- NREL PHEV Test Bed

NREL Research Thrusts

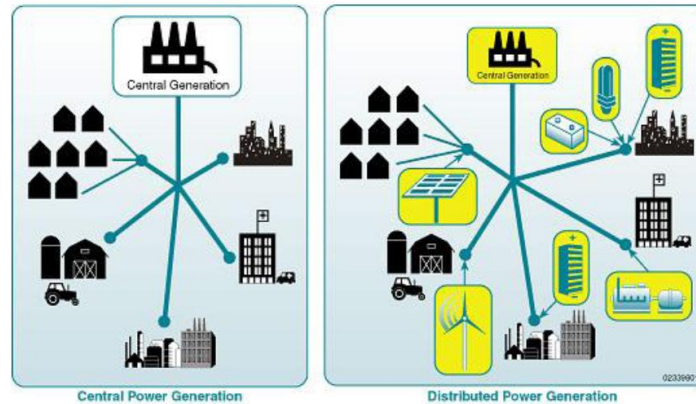
- Energy storage
- Advanced power electronics
- Vehicle ancillary loads reduction
- Vehicle thermal management
- Utility interconnection
- Vehicle-to-grid

Key Challenges

- Energy storage – life and cost
- Utility impacts
- Vehicle cost
- Recharging locations
- Tailpipe emissions/cold starts
- Cabin heating/cooling
- ~33% put cars in garage



Distributed Energy



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21st Century Utility

Premise #1: Buildings last for ~50 years and constitute a lasting legacy.

How will utilities supply electricity to them? Will it be the 20th century way, bringing electrons in by wire? Or will the buildings help supply their own needs?

Premise #2: Customers do not purchase electrons or therms; they buy heat, cooling, lighting, etc. – i.e., energy/power services.

How will utilities meet the need for services?

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“Conservation Power Plant”

Programs, policies replaced bricks, boilers.

- Loan programs for residential efficiency improvements, building code upgrades, rebates for high-efficiency equipment, etc.

Bottom Line: 550 megawatts of documented, sustained energy savings

2nd Bottom Line: Removed 450-MW coal-fired plant from planning books.

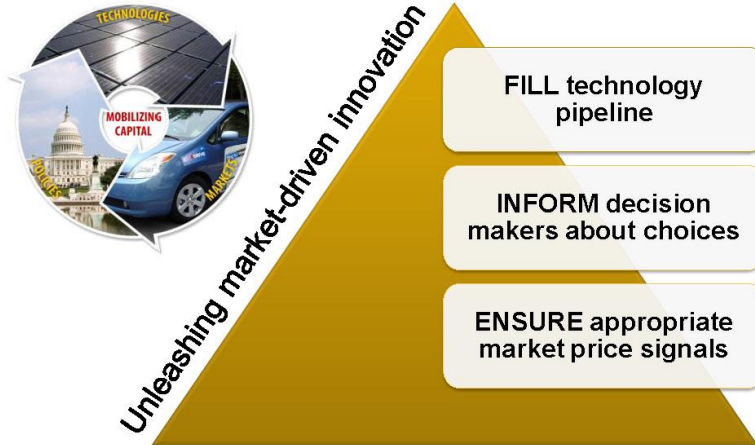
... During a decade in which Austin's economy grew by 46 percent and its population doubled!

Infrastructure and Industrial Capacity: Opportunities for Growth

- ***TRANSMISSION!***
- Energy storage for intermittent resources
- Trained work force
- Mass manufacturing capacity

Making Transformational Change

Requires an integrated approach

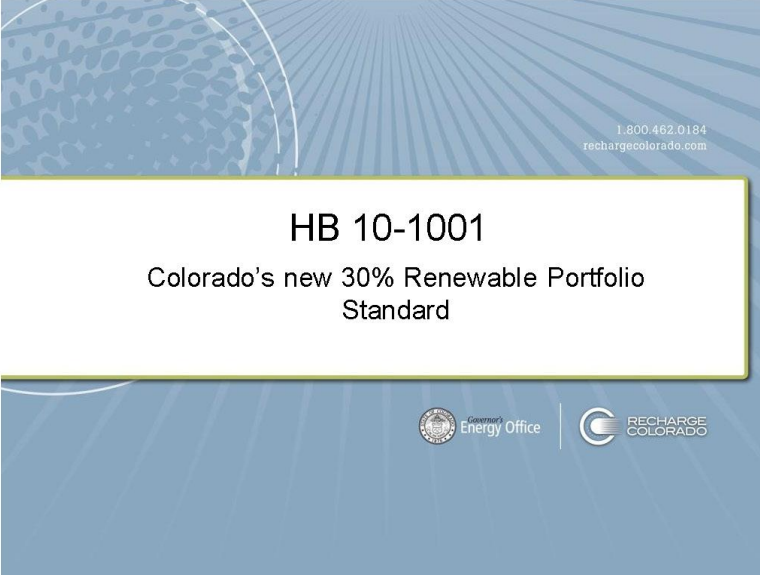


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Appendix G



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HB 10-1001

Colorado's new 30% Renewable Portfolio Standard

HB10-1001 Key Points

- Increases 20% standard to 30% of sales by 2020 for Investor Owned Utilities
- Changes the existing 4% of 20% solar carve out to a 3% of total retail generation from Distributed Generation (DG) requirement.
- Defines DG as either Retail or Wholesale and includes biomass, wind, solar, geothermal, and hydro.
- Establishes Certification Standards and Requirements for Solar Installations

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HB10-1001 Funding

- Creates three funding mechanisms that will allow the existing 2% Renewable Energy Standard Adjustment (RESA) fund to be stretched further
 1. Allows the PUC to reduce the statutory \$2/watt PV incentive (standard offer) when the market no longer needs this level of incentive.
 2. Allows utilities to advance RESA funds from future years
 3. Ensures that RESA participants continue to pay into the RES.

These three measures combined will mean millions of additional dollars for RE from the same 2% collection.

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What renewable technologies apply?

- Biomass (including wood waste, plant matter, ag crops, slash, brush, animal waste, landfill and wastewater methane)
- Solar
- Wind
- Geothermal
- New Hydro with nameplate of 10MW or less – existing hydro (Jan 2005) with nameplate of 30MW or less

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Distributed Generation

- Retail DG
 - Located on the site of customer facilities
 - Interconnected on customer side of meter
 - Primarily to serve customer's load
 - Sized to serve no more than 120% of average annual customer load
- Retail DG is 50% of the goal

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Governor's
Energy Office



RECHARGE
COLORADO

Distributed Generation

- Wholesale DG
 - Renewable Resource with a rating of less than 30MW
 - Doesn't qualify as Retail DG

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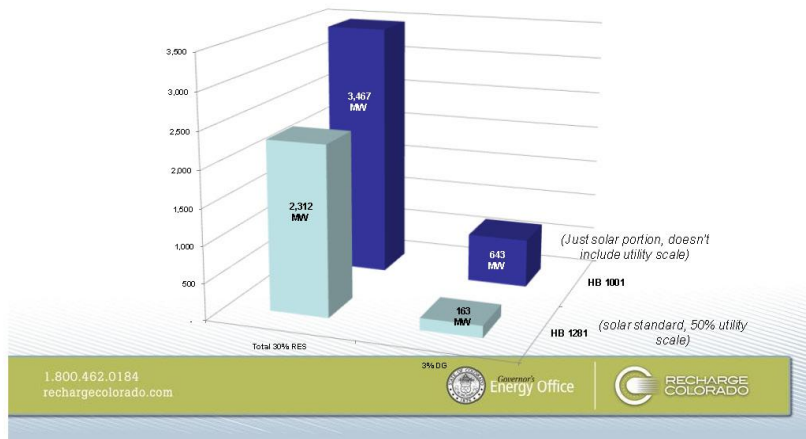


Governor's
Energy Office

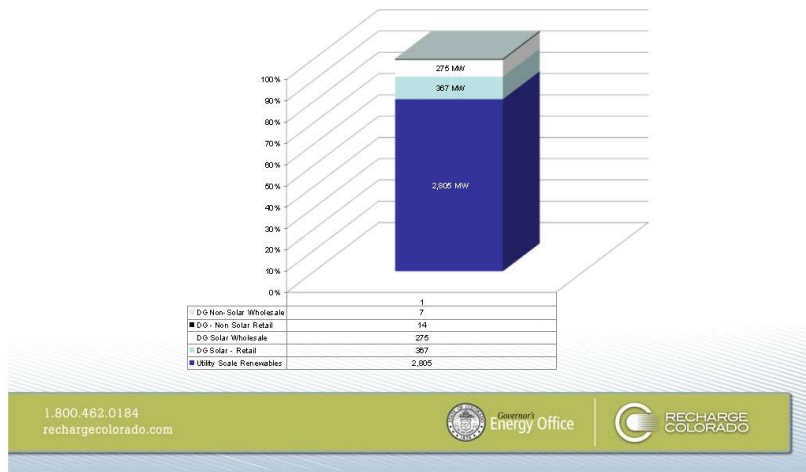


RECHARGE
COLORADO

How does new standard compare?



How does new standard stack up?



HB10-1001 Solar Certification

- Creates a Solar Certification requirement for all installations receiving either state or utility rebates.
- 3:1 ratio of North American Board of Certified Energy Professionals to uncertified workers required for all projects.
- Provides for an 18 month implementation window before this provision is in place.

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Supporters

- Xcel Energy
- Renewable Interests (COSEIA, Solar Alliance, AWEA, CIEA)
- Clean Tech (CCIA)
- Labor
- Environmental Community

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State Incentives

- Large scale renewable incentives driven largely by federal policy
- DG Incentives driven by both federal policy and utility incentives
 - \$2/watt standard offer (solar only)
 - <10kW additional \$0.39/watt SoREC Payment
 - Performance SoRECs for systems over 10kW
- All of this will likely change in upcoming PUC hearings

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In State vs Out of State

- Retail DG must be in state
- Wholesale DG and Utility Scale Renewables have in-state multiplier: 1.25
- So far all IOU renewable compliance has been in-state
- Non-IOUs are using both in-state and out of state RECs for compliance
 - Have a 3x multiplier for solar

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Thank you

Tom Plant
Director
Colorado Governor's Energy Office
tom.plant@state.co.us
303-866-2202



Appendix H

EECBG SUB-COMMITTEE

June 2010

Objective:

The Energy Efficiency and Conservation Block Grant (EECBG) Sub-committee will operate under the oversight of the State Energy Advisory Board (STEAB). This will enable the EECBG Program to fulfill its regulatory requirement of 42 USC 17153(f), which directs the Department of Energy to establish a State and local advisory committee to advise the Secretary regarding administration, implementation, and evaluation of the EECBG Program for the duration of the EECBG Program.

Members:

The Sub-Committee is comprised of the following members:

Baumel, Christie (Seattle, WA) - Christie Baumel is the Energy Efficiency and Conservation Block Grant Manager for the City of Seattle. She oversees and administers the grant, and implements programs related to residential energy efficiency. Before joining the City of Seattle, Christie served as a local government policy advisor and project manager on topics ranging from climate change planning to green building incentives. Prior to this, Christie's work focused in community development and environmental protection. She has a Master's degree from the University of Washington in Urban Planning.

Estell, Roy (Atlanta, GA) - Roy J. Estell is the Asst Director of Program Services - General Services Department Fulton County, Georgia. Currently has leadership responsibility for the county's DOE EECBG grant, consulting role to the county's "Green Team", lead responsibility for benchmarking energy efficiency and conservation performance outcomes and conducting analysis and interpretation of energy related trend data. He works closely with the facility engineering group to identify energy saving opportunities and to seek funding, including grant writing, to implement strategies consistent with energy conservation. He participates as the jurisdictional representative to the Atlanta Regional Commission which examines regional energy related issues, needs and potential areas of collaboration. He has a BA from Talladega College, an MSSA from Case Western Reserve University and an MPA from Georgia State University.

Fyfe, Angie (Denver, CO) - Angie Fyfe is the Colorado Governor's Energy Office (GEO) Local Program Manager. In this role, Angie ensures that energy efficiency and conservation strategies and renewable energy technologies are implemented at the community level across the state. Angie has also served as the GEO Greening Government Program Manager, where she lead activities to reduce the environmental impact of state government operations. Under her management, the state reduced its petroleum consumption by more than 11% over two years, developed an environmentally preferable purchasing policy, and implemented energy and water conservation and efficiency projects. Angie is a LEED Accredited Professional and graduated from the University of Colorado with a degree in Finance. She is a recipient of the 2006 State's Top Achievement Recognition (STAR) creativity award and a graduate of the National Renewable Energy Laboratories 2008 Energy Executives Program. Angie is a member of the Women in Sustainable Energy (WISE) Advisory Board. Prior to her state government experience, Angie worked in a large corporate environment and as an entrepreneur.

Johnson, Mark (Washington, DC) – Mark Johnson directly worked with approximately 600 DOE recipients across the nation, implemented guidance and searchable DOE knowledgebase and partnered with the EPA Energy Star Portfolio Manager on benchmarking retrofitted and weatherized buildings. Prior to the DOE, I did energy and utility consulting with Navigant and IBM. I have been a public corporation officer, a BuildingAmerica builder and am a Certified General Contractor. My MBA is from Loyola and BA is from the University of Notre Dame.

Johnson-Powell, Cecelia (Indianapolis, IN) – Cecelia Johnson-Powell is the Director of the Community Development Division at Indiana Housing and Community Authority in Indianapolis, Indiana. Cecelia and her staff allocate over \$300 million in annual federal and state funds for housing, energy assistance, weatherization, Community Action agencies through Indiana. Cecelia has 15 years experience working with nonprofit organizations, local units of government and for-profit companies to maximize resources, improve efficiencies, and achieve results.

Klemm, Aaron (Huntington Beach, CA) – Aaron Klemm has 15 years experience in energy management and sustainability. He is a graduate of Prescott College with a Bachelors degree in Sustainable Community Development and an MBA (2011) at CSU Long Beach. He currently serves as the Energy Project Manager for the City of Huntington Beach responsible for eveloping Huntington Beach's energy and sustainability management programs. Prior to joining Huntington Beach, he was CSU's Energy Program Manager responsible for CSU's portion of a \$38M UC/CSU/Investor Owned Utility (IOU) energy efficiency partnership. During this time he was responsible for reviewing and commenting on over \$100M of investment grade assessments in support of CSU's Energy Services Agreement performance contracting program. The balance of his experience is in the private sector.

Steele, Sam (Ft. Worth, TX) – Sam Steele has worked over 25-years in service of energy & water conservation efforts both domestically and internationally. He currently serves as the Sustainability Administrator for the City of Fort Worth. In this role he manages the City's Conservation Program through development, implementation, and performance phases for City resource conservation projects to improve City facility operations & maintenance and better manage resource demands, usage and costs. As part of this program, he also manages a Senior Contract Compliance Specialist and a Conservation Specialist, both dedicated to, and funded by, the City's EECBG award. Mr. Steele's previous employment experience includes serving as Project Developer for Energy Services Companies, Plant Engineer for a New York State "Big Five" City School District, Energy Engineer for a international utility consultant, Mechanical Engineer for consulting engineering firms, and Field Mechanic for mechanical contractors. His educational degrees include a Bachelor of Science in Energy Engineering from the Rochester Institute of Technology and an Associate of Applied Science in Air Conditioning Engineering Technology from the State University of New York (SUNY) Agricultural & Technical College at Alfred.

Appendix I

STEAB's Priorities through 2012

To actively support energy efficiency and renewable energy market growth throughout the United States:

- Enhance State / Regional EE & RE capacity:
 - Financial
 - Intellectual
 - Manufacturing
 - Technology
- Facilitate the development of more active relationships between DOE and State / local programs
- Understand common issues facing other organizations and become of value to these organizations, perhaps through partnering (e.g., U.S. Conference of Mayors; NGA; NARUC; NASCUA; etc.)
- Support successful implementation and deployment of EERE Programs
- Promote consumer education efforts
- Encourage the implementation of EE and RE technologies and services
- Propose and support strategies to maintain State activities after the ARRA funding is no longer available
- Accelerate development of “green” jobs at State / local levels

Adopted by the Board on 4-15-10