Energy Roundtable Discussion: Infrastructure Planning, Cost & Market Implications of the Desert Renewable Energy Conservation Plan

July 13, 2012

On July 13, 2012, California Energy Commission Chair Robert Weisenmiller and Commissioner Karen Douglas conducted a public workshop to gather information, perspectives, and high level principles on how the Desert Renewable Energy Conservation Plan (DRECP) can be most effective as a long-term energy infrastructure plan. California Public Utilities Commissioner Michael Florio, as well as representatives of state and federal government agencies, utility companies, researchers, developers, and the environmental community were active participants in the roundtable discussion.

A summary of some of the major points raised during the workshop is provided below. A full transcript and audio recording of the workshop, as well as materials prepared for the meeting, can be viewed at http://www.drecp.org/meetings/.

Energy Roundtable Discussion: Infrastructure Planning, Cost & Market Implications of the DRECP

PRESENTERS AND PANELISTS

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Center for Energy Efficiency and Renewable Technologies
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Background

The DRECP is a long term plan that seeks to identify areas for renewable energy development in California's desert and reserves that provide for the long-term conservation of species and natural communities. The DRECP will delineate renewable energy development areas that are located where large-scale development is commercially viable and that are sufficient to help meet California's long-term climate and renewable energy goals out to 2040 and beyond. Development areas identified in the DRECP may include areas of immediate commercial interest, as well as areas that could be viable for future development. The DRECP's conservation framework is designed to provide comprehensive conservation for desert ecosystems and covered species. The renewable energy development areas must also be compatible with this framework.

Research Presentations

Changes in the Economic Value of Variable Generation with Increasing Penetration Levels: A Pilot Study of California, Lawrence Berkeley National Laboratory

The workshop began with a presentation by Andrew Mills, Research Associate, Lawrence Berkeley National Laboratory, on "Changes in the Economic Value of Variable Generation with Increasing Penetration Levels: A Pilot Study of California". This research, studied by Mr. Mills and Ryan Wiser, looked at the extent and causes of changes in the value of renewable energy at higher penetration levels. Key findings of this research include:

- The value of photovoltaic (PV) and concentrated solar power (CSP) without storage (the term CSP is used interchangeably with "solar thermal" in the remainder of this report) is high at low penetration levels, but decreases at higher penetration levels due first to a decrease in the capacity value (the ability of new solar plants to offset the need to build other sources of capacity) and then, at higher penetration levels, a decrease in the energy value.
- The value of CSP with six hours of storage started off at the same level as other solar technologies, but did not drop to the same extent with higher penetration because the capacity value of the generation was preserved.
- The value of wind generation started off lower than solar, but did not decline as much at high penetration levels.
- Increasing the penetration levels in one variable technology does not adversely impact the value of other variable technologies. It is easier to get to a high penetration of renewable energy at least *net cost*, and with greatest reliability, with a mix of technologies rather than a single technology.
- The effect of decreasing value of intermittent generation at high penetration levels can be mitigated through geographic diversity, technology diversity, bulk storage, and demand response programs.
- Small differences in geographic location can mitigate sub-hourly intermittency in PV generation due to cloud cover. For wind generation, geographic diversity is most beneficial at a regional (interstate) level to take advantage of wind patterns that differ substantially from California wind generation.

This presentation triggered a healthy discussion amongst panel members, both to better understand the methodology and limitations of the analysis and to consider how its finding may apply in the context of California's renewable energy goals. The value of technology and geographic diversity in reducing the technical challenges and costs of moving towards high levels of renewable energy was broadly recognized and supported by panelists. Panelists suggested that the DRECP incorporate development zones that help facilitate a healthy diversity of development that reflects a reasonable portfolio and allows technologies with different attributes to complement each other.

Mike Webster of Los Angeles Department of Water and Power (LADWP) expressed appreciation for the presentation, stating that it tracked very closely with the approach that LADWP had taken to reduce risk and keep costs down. Mr Webster noted that a balanced portfolio is a "hedge into the future, and if nothing else, we have learned that being committed to just oil, or just coal, is not the right strategy, so we do need to look at that balance."

Nancy Ryan of the California Public Utilities Commission (CPUC) also took from the presentation of the report, "that there is a fair amount of latitude for substitution between regions and different resources at any given place that you are … within any given portfolio configuration."

Renewable Electricity Future, National Renewable Energy Lab

The second presentation was made by Maureen Hand, Senior Engineer, who was reporting on Volume 1 of the Renewable Electricity Future report (REF) produced by the National Renewable Energy Lab. This study looks at different renewable energy pathways to achieving a national renewable energy portfolio of 80 percent by 2050, including the geographic location of renewable energy potential throughout the United States and the associated transmission needed to access the renewable energy and provide system flexibility. The primary conclusions of the REF report are: (1) commercially available technologies exist today that could supply 80 percent of our electricity in 2050; (2) increased system flexibility is very important, and can be provided through both supply side and demand side strategies; (3) there are abundant renewable energy resources in the United States and a number of combinations of technologies can result in deep greenhouse gas reductions; and (4) the incremental cost of the high renewable energy scenario is similar to that of other clean generation scenarios.

The REF study showed that of all of the regions of the country, only California had a relative balance in 2050 of projected demand and potential renewable energy generation. Even where supply and demand are relatively balanced, transmission linkages within and between regions are important to allow the sharing of reserves and energy over larger regions, and be able to take advantage of diverse resources and their temporal characteristics.

Infrastructure Planning

Planning for energy infrastructure takes place at multiple levels. From developers, who seek to select potential project sites and compete for contracts, to utilities and governmental agencies, energy infrastructure decisions are made within the context of current planning processes. These existing planning processes seek to achieve, and sometimes reconcile, important policy or institutional goals. Workshop participants discussed their current infrastructure processes, goals of such processes, the possible impact of the DRECP on establishing or meeting established goals, and factors that need to be considered when identifying development areas in the DRECP.

Overall, panelists expressed strong support for the long-term planning that is being undertaken in the DRECP. The long-term planning perspective was seen as a way of reducing the risk and cost associated with developing renewable energy projects while helping the state effectively balance development and conservation goals.

Commissioner Florio of the CPUC said "the enormous promise of this effort is that it can reduce risk, and reducing risk benefits developers, it benefits utilities, it benefits consumers, and there are no losers in that."

V. John White, Executive Director of the Center for Energy Efficiency and Renewable Technologies (CEERT), noted that after fostering the first renewable energy development at scale in the world in California in the 1980s, the state and utility companies stopped planning for renewables. Utilities stopped procuring and acquiring renewable generation and deregulation of the market changed the focus from integrated resource planning to a reliance on market forces. Major initiatives that greatly influenced land uses in the desert such as the California Desert Protection Act, authored by Senator Feinstein and fostered by Senator Cranston, and the West Mojave Plan, led by the Bureau of Land Management (BLM), did not plan for renewable energy development, though other constituencies such as the conservation community, mining, the military, and the off-road vehicle community were provided for. As a consequence, land in the West Mojave that is perfect for solar -- likely the best solar resource within 100 miles of 10 million people – was virtually off the table for renewable energy. Therefore, his focus has been to readdress the specific problem of the West Mojave and also the general need to include renewable energy in our development planning in the desert.

Panelists emphasized the importance of connecting the DRECP to existing energy planning and procurement processes in California. Katie Sloan of Southern California Edison (SCE) said, "I think for the DRECP to be able to be useful, something that V. John mentioned earlier, was that we needed to take all the good biological work that's been done and really interlay the procurement and the transmission … and we need to just not focus on the biological aspect."

Jan Strack of San Diego Gas & Electric (SDG&E) also suggested that DRECP could provide an additional benefit in the area of transmission siting. If we can identify, at least on the bulk part of the grid, specific routes where new transmission is likely to be needed and where shorter gen-ties could be located, that could be built that into the Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS). This would help not only establish purpose and need upfront, which makes the subsequent process easier, it would also add the benefits from economies of scale.

Procurement

The DRECP is already factoring into procurement planning at the CPUC, which oversees energy procurement by the investor-owned utilities (IOU). The CPUC is currently planning for utility procurement through the Long Term Procurement Plan (LTPP) process. This planning process seeks to ensure a reliable and cost-effective electricity supply in California through integration and refinement of a comprehensive set of procurement policies, practices, and

procedures underlying long-term procurement plans. Track 1 focuses on near-term local reliability needs and Track 2 focuses on long-term system reliability needs, such as the question of whether increased variability amongst load and generation may require changes in procurement of resources to maintain reliability. The time horizon for Tier 2 is 20 years, but the focus is on the first ten years of that period.

As indicated by Neil Millar with the California Independent System Operator (CA ISO), the DRECP work was the key environmental input for the desert area to the CPUC Portfolio Calculator and "highlighted a huge step forward in the coordination between all of the entities involved". This coordination helped lead to a "set of CPUC developed portfolios that really were able to take advantage of much better quality of information coming out of the DRECP." Mr. Millar acknowledged that further refinements will be needed in future cycles, however the "three-stage process of marrying the DRECP analysis into the CPUC Calculator, lining it up with the transmission costing information that we have available, I think, could really improve the quality of the portfolios this year and made everyone much more comfortable with the underlying data."

Information generated to date in the DRECP process is also being used by the utilities. Aaron Johnson of PG&E said they are using the DRECP to augment the environmental screen that they do on projects that bid into their solicitation process, and even without the plan in place, the DRECP has really improved their ability to look at projects. The IOUs agreed that by reducing uncertainty and risk around environmental costs, permitting and litigation risk, the DRECP can benefit the utilities significantly. This reduction in risk also reduces the number of projects that utilities need to contract with to meet their renewable energy targets.

The DRECP is also a tool that can help inform utility procurement strategies. The IOUs have come from a position of being so short on renewable energy relative to state policy requirements that they were signing up almost all projects that seemed viable and with which they could agree on terms, to a position where they will not need to aggressively procure new projects until the latter part of the RPS compliance period at the earliest, which is around 2017. This enables them to be more selective in terms of optimizing the portfolio and/or reducing cost. That said, the utilities differ somewhat in their current level of interest in planning for portfolio optimization.

Mr. Johnson stated that they currently have 5,000 MW of solar signed up on a 20,000 MW system plus customer solar, and they are already seeing some over-generation from solar during the day. PG&E currently pays a factor of approximately 1.2 times the bid price for solar for time of delivery. They are doing a study now to assess whether it makes sense to continue this practice if they will be long during those times, but note that it takes a lot of modeling and resources to answer these questions. PG&E is becoming more concerned about how to optimize their portfolio in terms of technology diversity, geography, and the capacity of the transmission system to get them resource adequacy credit for renewable energy generation. PG&E does not have a target that identifies an optimal portfolio. They are developing a sense of the range of outcomes that are possible, and how to move within that over time as they add new resources.

They are also trying to be more sophisticated about looking at fit concerns, not just lowest market value.

Ms. Sloan stated that SCE is currently analyzing how to best to include integration costs in their analysis and balancing their portfolio. A few years ago, their renewable energy portfolio was 60% geothermal. As they have brought on more solar and wind, that percentage has shrunk to 47%. The large amount of geothermal in their renewable energy portfolio has been very helpful to SCE in meeting their renewable energy goals. Ms. Sloan stated that while they "aren't necessarily optimizing for a certain percentage of PV or wind", they continually evaluate the balance of their portfolio and if operating conditions become "something that we can't deal with", they may need to analyze how much PV is enough.

Mr. Strack of SDG&E stated that while obtaining a diversified portfolio is a legitimate concern, the CA ISO has indicated it is a manageable issue. Further, when viewed from a WECC-wide viewpoint, diversity issues "start going away really quickly because the wind in Wyoming is going to blow at a different time than the wind in the Tehachapi's." Mr. Strack stated that SDG&E is seeking CPUC approval to add more flexible generating capacity through the Flexible Capacity Procurement Proceeding, driven in large part by the pending retirement of once-through cooling units. He articulated less concern with optimizing a portfolio, noting that commercial activities tend to optimize your portfolio.

Two publically owned utilities, LADWP and Imperial Irrigation District (IID), also addressed this issue. Mr. Webster described LADWP's criteria that guides their procurement direction, including geographic diversity and technological diversity, not only within types of wind, but between wind, solar, and types of solar. They established the goal of clustering renewable zones while achieving geographic diversity in order to achieve the benefits of diversity and also save on costs on operating and maintaining projects. They also set out to make the maximum use of existing infrastructure, including property and transmission.

Mr. Webster expressed LADWP's thinking about the impact of higher penetrations of solar PV on the requirements and cost of ancillary services. For example, if systems will need additional Regulation (an ancillary service), then utilities will put more value on technologies that actually provide that service, such as solar thermal systems. We can't pinpoint those costs today, but LADWP does develop targets for solar thermal in its portfolio. Mr. Strack would like to ensure that the DRECP is "addressing those [integrated planning] zones where we're already planning to move forward" and facilitating the accompanying transmission.

Mr. Sandoval of IID noted that they also use a traditional integrated resource planning model. IID is in a strategic location that is very close to load and low-load centers, i.e. San Diego and LA Basin. Imperial is home to almost 3,000 megawatts of geothermal resources, more than IID could ever use. IID is working on transmission to make the development and transmission of these projects possible. Much effort has been put into transmission planning but funding and cost recovery is critical to transforming these plans to reality.

Commission Florio noted that while cost is an important factor when balancing a generation portfolio, the portfolio diversity issues that were discussed on the panel were very apparent to

him. He said, "I don't expect every type of resource to cost the same. And you know, while I compare things, I tend to compare within the same technology rather than across technologies because there are these complimentary aspects that are extremely important. So, you know, I don't expect wind, PV and solar thermal and biomass to all cost the same, and sometimes you don't take the cheapest thing because it's not what you need to have an optimal portfolio…"

Transmission Planning

Neil Millar described the annual transmission planning cycle at the CA ISO. This process has a clear time-line for certain decisions on an annual basis, which helps structure input and coordination. In the future, almost all major network upgrades for renewable energy generation will go through the annual transmission planning process.

Mr. Millar noted that the 10 year transmission planning cycle at the CA ISO could be considered "just in time" for some kinds of projects. There is still huge uncertainty over where renewable projects will be developed in California for the 2020 RPS, which has required the CA ISO to take a more conservative, shorter time-frame, "least regrets" perspective in transmission planning. The longer term perspective afforded in the DRECP offers an opportunity to narrow the uncertainty bandwidth and allow CA ISO to move more aggressively on some longer term projects.

There was considerable discussion about the pros and cons associated with the current practice of requiring existing renewable generation project proponents to bear the full cost/financing for a new transmission line, and whether this practice makes sense in the renewable energy context. Jonathan Weisgall of Mid-American Energy Holdings Company suggested that the long term perspective provided by the REF study map and the DRECP makes the case for upsizing new transmission lines with extra capacity where it looks like the line will be fully subscribed in the future with renewable energy projects. This would create a cost recovery issue for utilities, but a government entity might be able to finance the extra cost and be paid back with interest when developers do utilize the line. This approach would also help preserve transmission corridors.

Commissioner Florio questioned the ability of government to step in and help finance transmission lines, but suggested some steps that clearly should be taken, such as building a system that allows additional conductors to be added later. Mr. Weisgall stated that from an engineering point of view, it is easier to plan for the greater transmission capacity upfront rather than to add it later.

Dennis Peters from the CA ISO noted that some of this is already occurring with projects that are being built or in the permitting process. A line that will be able to run as a 500 KV line is being run as a 230 KV line.

Mr. Demeo of NREL said that he cannot understand why more upsizing is not done because "if we built highways the way people build transmission, the instant they opened it up, all lanes would be full of cars. . . So why do we do transmission that way?"

Developers on the panel uniformly agreed that developers will go where transmission is available. Mr. Strack noted that there is understandable concern by regulators with a "build it and they will come" approach to transmission permitting because "these projects are large, they're environmentally disruptive, so we need to make sure we make the right decision." Mr. Weisgall argued for a middle ground between the philosophy articulated in Jerry Maguire -- "show me the money" -- with that articulated in Field of Dreams -- "build it and they will come."

Carl Zichella, with the Natural Resources Defense Council (NRDC), agreed with the importance of looking out beyond a 10-year time horizon to "right-size" transmission lines to accommodate future needs. He noted that transmission corridors and rights of way are the most precious thing we have in terms of meeting future transmission needs, and we need to value scalability in transmission projects. Mr. Zichella also stated that the DRECP is a great model for thinking about which areas can be developed, and using that information to understand the scale and capacity of transmission that will be needed.

Renewable Integration Studies

The CA ISO has undertaken several rounds of analysis as part of CPUC's LTPP rulemakings to develop a methodology and inputs to predict need for resources to integrate renewables. In each successive round, the CA ISO has evolved its approach and input assumptions. Mr. Rothleder stated that he has been doing the renewable integration studies for the California ISO footprint for a couple years now. In comparing renewable energy portfolios for the 33 percent RPS, the ISO did not see a large differentiation between the amount of additional flexibility needed (that is, the different LTPP wind and solar portfolios modeled appeared to be resulting in similar total integration requirements), but they do see a general need for more flexibility when more renewable resources need to be integrated. The time when that flexibility is most needed shifts depending on the portfolio.

Mr. Rothleder articulated a concern with potential over-generation, especially in cases of high solar penetration where the ISO is seeing "large amounts of export out of the system, which we haven't traditionally seen in our footprint." He questioned whether there will be "the ability to turn down resources in the rest of the West to accommodate that sell-off," noting that this situation would occur not only off-peak, but also during traditional peak situations, and that when the ISO talks to the other balancing authority areas, they say that they will not be able to absorb extra generation at that time because they are in over-generation too.

Development and System Costs

California policy makers continuously strive to balance the benefits from realizing renewable energy and climate goals with costs to companies, developers, and ratepayers. The DRECP has the potential to reduce renewable energy development costs by streamlining permitting, incentivizing transmission investments in strategic areas, and providing more certainty and predictability around environmental mitigation requirements. The DRECP also has the

potential to reduce system costs associated with higher future ambitious renewable energy goals by creating a framework that may facilitate optimizing transmission investments for renewable energy, reduce integration costs, and reduce the extent of fossil back-up of the system needed. To this end, participants discussed how the DRECP may reduce or increase development and system costs, as well as the costs associated with *not* developing and implementing a renewable energy development plan for California's desert.

Development Costs

Developers provided a number of insights as to how the DRECP could help lower project costs. In general, developers strongly agreed on the importance of importance of permit streamlining and expressed interest in locating projects in development areas to the extent that those benefits could be realized. However, other factors may have a stronger impact on the location of projects such as availability of transmission. Other issues raised reflected important differences between the technologies that need to be understood in the DRECP process.

Wind

Mark Tholke of Enxco recommended including larger development areas for wind, as opposed to other technologies, as developers will need to avoid areas with eagle presence. Based upon his wind development experiences in Solano County and the Tehachapi Mountain area, the development footprint would collapse into a small percent of the larger area during the approval process and generation areas would likely be clustered.

Areas with strong potential for both wind and solar development, such as the Tehachapi Mountain region, would be able to capitalize on complementing generation times (solar and wind are generally produced at different times) and use the same transmission network. Mr. Tholke stated that he has five projects that are almost adjacent to each other in the Tehachapi Mountains and each requires a full review process. The DRECP would offer great value in streamlining such projects as it would give early signals as to which individual projects are economically and environmentally feasible and should continue to be pursued by developers.

Mr.Tholke also expressed appreciation for the discussion on diversity, noting that "that doesn't come by mistake; you don't get diversity just by luck. We need to plan for diversity."

Concentrating Solar Power (or Solar Thermal)

A number of panelists recognized both the unique needs of concentrating solar power (CSP) from a siting perspective and the unique benefits that solar thermal projects bring to the system, especially when they incorporate storage. In response to questions, Mr. Mills noted that thermal storage was a very cost-effective means of storing renewable energy. Fred Morse of Abengoa also noted that "CSP with very cost-effective thermal storage offers many ancillary and reliability services. In particular, there is a gap that occurs as you get more and more

photovoltaics on the system. The photovoltaics production drops off in the afternoon as the sun sinks in the horizon. And before the wind picks up in the evening, there is a demand gap that needs to be filled, that . . . could be filled with CSP with thermal storage."

Arthur Haubenstock of BrightSource Energy stated that usable zones for concentrating solar power typically need to consist of large areas of relatively flat, contiguous land (at least 4,000 to 5,000 acres per project), high direct radiation, access to transmission, access to water, and minimal conflicts with other land uses such as military, environmental, or cultural. Mr. Haubenstock also noted that there are significant economies of scale to larger projects. For power towers, taller towers reduce the acreage needed for a project by up to a third but may cause some complications with the Department of Defense and the FAA.

Mr. Haubenstock suggested that the DRECP is unlikely to be able to characterize development areas so completely that a large project could just do an Environmental Assessment (EA) off of the decision documents, but he saw real value in decreasing levels of uncertainty and risk. In terms of what percentage of land in a development area will ultimately be developable, Mr. Haubenstock said it depends on how well the developer knows the land. He suggested that the DRECP use an assumption that 10% of the DFAs will be developable.

Photovoltaic (PV)

Tom Starrs of SunPower noted that PV has unique attributes, in addition to its low price, which make it an important part of the resource mix. PV has more siting flexibility than other technologies in that it can fit a project such as a 30 MW generating facility on a disturbed area, such as a 160-acre former farmland parcel. It is low-cost, does not require water for cooling, and has no emissions, noise, or moving parts that may disturb birds or planes.

Mr. Starrs said that SunPower made a conscious decision to focus its siting efforts on previously disturbed private lands, and that they have almost a gigawatt of power plants under contract on private land. However, they do have a stake in public lands with respect to transmission permitting, and Mr. Starrs expressed strong appreciation for the focus on transmission issues in the workshop.

Mr. Starrs emphasized that SunPower is looking for tangible streamlining from the DRECP, particularly in light of the greater siting flexibility of PV. "If we have an outcome from this process that results in the designation of zones that make it less complicated, less cumbersome, less expensive, to site in these particular areas, then we will be the first company to focus our development efforts there." He would like permitting to be possible through at EA rather than a full blown EIS available through the DRECP.

Mr. Starrs agreed with the importance of technology diversity as a means for mitigating problems with shifting peak load periods and intermittent resources. He also noted that while Sun Power receives roughly half its global revenue from distributed PV, and he is a huge proponent of distributed PV, it is not a silver bullet. "We have to solve these problems with respect to ensuring adequate access to larger land areas, including public land areas, in order to meet our long term carbon reduction goals. "

Geothermal

Geothermal plants provide base load generation which has traditionally been viewed as a valuable resource mix in portfolios by providing baseload generation and reliability for consumers and the system. In terms of siting, geothermal energy in Imperial County is an environmentally preferred resource. The generating plants have a small footprint and provide a high number of jobs per megawatt. The considerations with geothermal is that developers are limited to location (it is where it is) and the reservoirs are geologically complex. The DRECP maps do a good job of identifying geothermal resource areas however even within a known geothermal resource such as the one at the Salton Sea, there are areas of very high temperature, there are areas of lower temperature, and the difference is huge in terms of the output that you're going to get for the same amount of capital investment.

There was a robust discussion of whether base load energy will continue to be as important as the need for flexibility in the system of the future. Mr. Weisgall of Mid-American Energy Holdings noted that his company, which has been going "gangbusters on wind and gangbuster on solar, has not been going gangbusters on geothermal at all". He observed that the CPUC is "solving for solar" because solar PV has come down dramatically in price, the time of day multiplier also benefits solar, and "then we have this third factor of not including the integration costs."

Mr. Weisgall questioned the future role of base-load energy given the clear demand for more flexible resources, but also observed that with the advent of San Onofre being down, once-through cooling restrictions, and reductions in coal imports, geothermal should become a valuable baseload resource.

Mr. Demeo responded that the need for more flexibility in the power system is not compatible with more baseload. This is consistent with the REF report, where baseload generation decreased and almost about everything else went up with the 80 percent renewables.

Mr. Weisgall noted that using geothermal plants to follow load does not seem to make sense because geothermal projects do not benefit from avoided fuel cost when they back off on generation. On the other hand, energy storage with geothermal is a really interesting idea. A project that combines molten salt with geothermal allows storage of power could be very beneficial.

System Costs

System costs refers to the costs of integrating intermittent wind and solar (such as the additional ancillary services mentioned by Mark Rothleder of the CAISO and others) and could also include the back-up generation or storage required to ensure long-term Resource Adequacy. Fred Morse of Abengoa Solar stated "We need a diversity of renewable resources in California. We also need a diversity of locations so that weather dependent variability is minimized and (on a larger scale) we can take advantages of different wind patterns. If we don't do that, we will need more natural gas back-up power plants, with associated costs and emissions." As discussed in the planning section, the DRECP can help reduce system costs by identifying

development areas that reasonably achieve the goals of geographic diversity and technology diversity.

Ms. Ryan stressed the importance of keeping in mind potential impacts to consumers when designating development zones within the DRECP, describing competition between projects to get funding as "a necessary social cost to ensure that the prices the consumers ultimately pay are as low as they can be." Boundaries or designations that are too limited can create a lack of competition that may drive up costs for developers, utilities, and consumers. To ensure that consumers ultimately realize the potential savings, the DRECP should preserve enough flexibility to maintain competition within and between areas.

Laura Wisland of Union of Concerned Scientists, reiterated the need to minimize unintended negative impacts on consumers by maintaining healthy competition within the DRECP as "none of this stuff is going to happen unless there continues to be public support for mitigating climate change and building renewables as a way to mitigate climate change."

Mr. Strack with SDG&E suggested the DRECP could reduce costs by helping concentrate renewable generation in somewhat smaller clusters and along some of the existing transmission corridors, which provides some economies of scale for transmission.

Energy Markets

Project procurement and electricity dispatch take place within a market environment. While it is impossible to predict exactly how electricity markets will function decades in the future, it is important for policymakers to consider how the DRECP may interact with electricity markets today and throughout the life of the plan. Participants discussed how the market may evolve, how DRECP may affect electricity rates, how to integrate results from LTTP and DRECP into procurement processes, how current and future energy market may influence meeting energy needs and demands with renewable energy, and how consideration of these structures should influence the DRECP.

Mr. Johnson with PG&E acknowledged the challenge of integrating results from planning processes like the LTTP and the DRECP with a procurement structure in California that is entirely based on competitive solicitations. Similarly, several panelists advocated for using the solicitation process to solve multiple needs at the same time rather than procuring renewable in isolation from the rest of the portfolio. Procuring for renewable energy, greenhouse gas reduction, resource adequacy, and reliability together at one time makes it possible for innovative projects that provide multiple benefits to be considered. As stated by Mr. Johnson, it is helpful to remember that "we're not optimizing a renewables portfolio; we're optimizing an entire generation portfolio."

Another theme from the workshop was the scale of change that is underway in the electricity system, and ways in which that change is driving market demand for new types of products. Mr. Rothleder of CA ISO described the new challenge of "turning resources down to minimum loads, trying to shut down as much capacity internal to California, and then potentially a few

hours later need that capacity right back to meet the load when the sun starts to come down, so it's a very different pattern than we see today."

Commissioner Florio commented on the profound nature of this change, from a system built around concern over the hot summer afternoon to a system where that peak demand "may not be the constraint anymore; we may have plenty of power available on peak, but it's going to be these flexibility products that Mark is looking at and, you know, meeting the ramp from one hour to the next may be the constraint and that changes the way we've thought about this industry for a hundred years "

Mr. Rothleder stated that CA ISO is trying to position itself to deal with potential daytime over-generation with new products and allocation of those products in such a way that it sends signals both to resources that can provide the needed services and also to the resources that may be exacerbating the need for those services, so that they can incorporate those market costs going forward. Mr. White indicated that it is "not satisfactory to hit a project with integration costs at the end of this process; it seems to me it belongs more in the procurement process."

Mr. Starrs commented that it would be prudent to look to Germany for impacts that Mr. Mills and Mr. Wiser's study indicated may happen in California. While Germany has "dealt quite well with the technical integration of very high penetration of renewables", they have had an "economic integration challenge." There are certain times of the day when a majority of their energy needs are being served by wind and solar. This has resulted in market prices dropping to near zero prices. "That's not a very pretty picture for incumbent utilities with baseload coal and . . . nuclear facilities."

Participants also spoke to the success of energy goals and procurement practices in California. Mr Tholke, "let me first say that the policies that the State of California have put together are working. I mean, there are projects going on the ground, this is a great success story. And I know we want to, in the spirit of continuous improvement, improve upon that, but we should recognize when we see success and I think it's important to recognize." Mr. Zichella of NRDC spoke similarly of celebrating the "success of putting steel in the ground" and acknowledged the reach and impact the DRECP will have beyond California. It is "helping people re-think the way you do this work en toto…this is a huge shift in an industry that has not changed very much in a very long time".

Mr. White cautioned that while California is currently a leader in renewable energy penetration, we need to allow for flexibility in long-term planning and review options holistically, i.e., do not procure just for meeting RPS requirements but "procure for greenhouse gas, renewables, and resource adequacy all at the same time". This approach would allow planners to address multiple issues at once and may lead to a more cost-effective renewable energy program.