BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO
DOCKET NO. 07M-446E

IN THE MATTER OF PUBLIC SERVICE COMPANY OF COLORADO'S SENATE BILL 07-100 DESIGNATION OF ENERGY RESOURCE ZONES AND TRANSMISSION PLANNING REPORT.

REPLY COMMENTS OF THE INTERWEST ENERGY ALLIANCE

The Interwest Energy Alliance ("Interwest") appreciates the opportunity to reply to comments made by others on Public Service Company of Colorado's ("PSCo") SB 07-100 Energy Resource Zones and Transmission Planning Report.

Reply to Comments of the Colorado Office of Consumer Counsel ("OCC")

Interwest appreciates and supports OCC's comments, and we are interested in reviewing PSCo's replies to the questions OCC raises regarding the company's SB 07-100 report.

Further, Interwest supports OCC's two specific policy recommendations in connection with this docket.

> "Recommendation #1: The Commission should require a utility to file updates to its ERZ Reports in every even numbered year."
>
> "Recommendation #2: The Commission should commence a rulemaking to formalize the submission and review of ERZ and annual update reports."

We share OCC's belief that adoption of these two recommendations would provide the Commission with the necessary authority to change the company's energy resource zone designations, should changes be deemed necessary.

Reply to Comments of SkyFuel

Interwest also appreciate the participation of SkyFuel in this docket, as utility-scale solar power generation will become an essential part of the state's —and the region's— electricity portfolio, and it is important that we make intrastate and interstate transmission plans accordingly. However, Interwest would like to address SkyFuel's final bullet point beginning on page 2 of its comments:

> "Other forms renewable energy that do not have storage or dispatch capability need to be integrated with equal amounts of other generation resources to ensure

resource adequacy, a fundamental tenant of system reliability. This model is particularly costly because it implies that for each MW of non-dispatchable resource an additional MW of conventional (i.e. fossil-fired or hydro) resource must be deployed as well, with the conventional resource having a lower having a lower net capacity factor. The energy produced from the conventional resource will inevitably have higher prices as the owners of the conventional capacity seek minimum investment returns."

Interwest has five responses to these statements:

1. While naturally variable output renewable energy, including CSP, does need to be integrated with other generation resources, that does not distinguish these resources from any other resources. They all need to be integrated.
2. Integrating these resources with "equal amounts" of new conventional resources is not necessary. All resources contribute energy or capacity, or both, to meet total system energy and capacity requirements. In the case of some 14,000 MW of wind capacity currently deployed in the United States Interwest is not aware of any example of "equal amounts" of conventional dispatchable resources being "deployed."
3. The "implication" that each MW of non-dispatchable resources must be deployed with a MW of conventional resources is addressed in the November-December 2007 IEEE-PES Power & Energy Magazine (Vol. 5, No. 6) in an article by Edgar A. DeMeo and others (pp 59-67; pp 59 and 60 attached for the record as Attachment 1, with the below-cited language highlighted) that states:
    a. "The impacts of wind's variability and uncertainty on utility system operation were discussed in this magazine's previous special issue on wind power (November-December 2005). By that time, it had become clear that wind is primarily an energy resource. Its main value is displacement of fossil fuel combustion in existing generation units. Existing generation units maintain system balance and reliability, so no new conventional generation is required as "back-up" for wind plants. Wind also provides some effective load-carrying capability (ELCC) and thus contributes to planning reserves but not to day to day operating reserves. Wind's variability and uncertainty do increase the operating costs of the non wind portion of the power system, but generally by modest amounts."[1]
4. Operating costs impacts of wind have been studied on the Xcel and other utility systems, and the results that document modest costs are summarized on www.uwig.org.[2]

[1] J. Charles Smith, executive director of the Utility Wind Interest Group, served as co-editor, with Brian Parsons of the National Renewable Energy Laboratory (NREL), for this special wind issue of the IEEE-PES Power & Energy Magazine

[2] The U.S. Department of Energy and NREL are currently conducting a "Western Wind Integration Study" which will examine the operating impacts and mitigation options due to the variability and uncertainty of wind and solar power on the utility grids for several states in the West. This is the largest such regional integration study undertaken to date; its website address is http://westconnect.com/init_wwis.php.

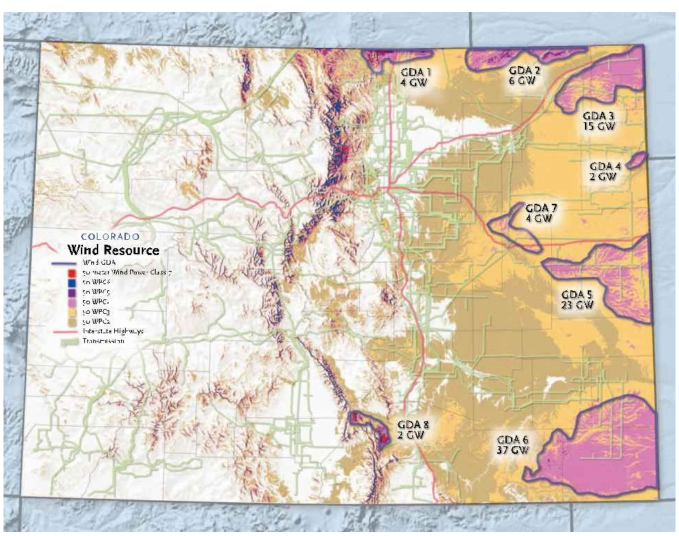
5. Fossil and hydropower can be valuable resources that can effectively be used in systems that are adding additional variable output renewable resources. So can demand-side management (DSM) measures.

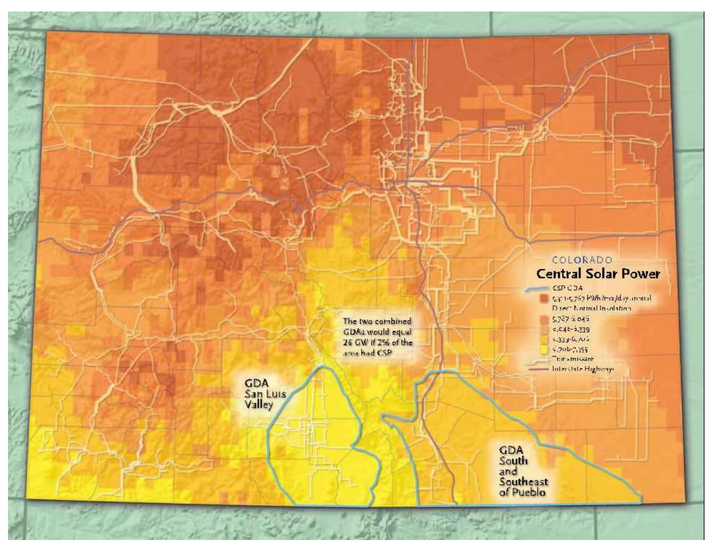
Colorado Wind and Solar Generation Development Areas

In Point 4 of our comments on this docket (07M-446E), we wrote:

> **"SB07-91 Generation Development Areas should be substituted for PSCo's resource zones.** The draft task force report in response to SB07-91 has developed Generation Development Areas ("GDAs") that are more specific and that do identify areas where transmission is insufficient and generation could be developed to the benefit of Colorado consumers at sufficient scale —1000 MW or more— to justify transmission planning and investment. The SB07-91 GDAs would also allow transmission to be planned and developed to service resource zones in which there are sufficient resources to allow competition among developers, an additional requirement of that statute and one that has potential to provide lower-cost, lower-risk, competitive results for Colorado consumers. The Commission should find PSCo's resource zones insufficient and substitute SB07-91 GDAs for PSCo's filed zones."

These December comments were submitted before the SB07-91 Task Force's report was completed and submitted to the Governor and General Assembly on December 28, 2007. Now, this report, entitled "Connecting Colorado's Renewable Resources to the Markets," is available for downloading on the website of the Governor's Energy Office (GEO) at http://www.colorado.gov/energy/in/uploaded_pdf/RenewableResourceGeneration.pdf, and shows that Colorado has 96 gigawatts (GW) of wind capacity in the Eastern Plains, and a combined solar capacity of 26 GW in southern Colorado. The GEO press release is attached as Attachment 2, and the specific wind and solar "Generation Development Areas" from the SB 07-91 Task Force Report are shown below, and display excellent resource specificity. As we point out in our original comments, these zones would allow transmission to be planned and developed to service resource zones in which there are sufficient resources to allow competition among developers, which provides the potential for lower-cost, lower-risk, competitive results for Colorado consumers.





Thank you again for the opportunity to submit these reply comments. We look forward to further participation in this most important docket.

Respectfully submitted on behalf of the Interwest Energy Alliance on January 4, 2008.

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Interwest Energy Alliance, Attachment 1

Accomodating Wind's Natural Behavior

Advances in Insights and Methods for Wind Plant Integration

by Edgar A. DeMeo,
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Michael R. Milligan,
Cliff Murley, Brett Oakleaf,
and Matthew J. Schuerger

INTEGRATION OF WIND-POWER PLANTS INTO THE electric power system presents challenges to power-system planners and operators. These challenges stem primarily from the natural characteristics of wind plants, which differ in some respects from conventional plants. Wind plants operate when the wind blows, and their power levels vary with the strength of the wind. Hence, they are not dispatchable in the traditional sense, which lessens the ability of system operators to control them while maintaining the system's balance between load and generation.

The impacts of wind's variability and uncertainty on utility system operation were discussed in this magazine's previous special issue on wind power (November/December 2005). By that time, it had become clear that wind is primarily an energy

Digital Object Identifier 10.1109/MPE.2007.906562

 1540-7977/07/$25.00©2007 IEEE

resource. Its main value is displacement of fossil fuel combustion in existing generating units. Existing generating units maintain system balance and reliability, so no new conventional generation is required as "back-up" for wind plants. Wind also provides some effective load-carrying capability (ELCC) and thus contributes to planning reserves but not to day-to-day operating reserves. Wind's variability and uncertainty do increase the operating costs of the nonwind portion of the power system, but generally by modest amounts.

Some aspects of wind integration were not well understood in 2005. Over the past two years, understanding has improved on several key issues. Much of the recent progress comes from a number of integration studies conducted since 2005 that have led to increased understanding of integration costs and impacts. Several of these new studies are summarized later in this article.

Evolution of Integration-Study Methodologies

In the United States, many wind integration studies have been done on a prospective basis, looking at a potential future power system with wind. Although the objectives of these studies are similar, they differ in some important respects. These differences stem primarily from alternative electricity markets in which the utilities reside, and whether the objective is to determine the integration cost of wind or to determine the impact of wind on electricity market operations. In most cases the focus is on system operation, and not on planning, and there are differences in the scope of costs and benefits that are captured by the various studies. It is also important to note that the state of the art is advancing and that each subsequent study typically includes additional refinements in study methods, data, or both.

The 2005 *IEEE Power & Energy Magazine* wind integration article discussed the emerging use of sophisticated atmospheric (meso-scale numerical weather prediction) models to develop credible wind power time series for use in the integration analysis. Since that time, this trend has continued, and it is now generally accepted that integration studies should use this type of data, synchronized with load data, if actual data are not available. This becomes critical as more wind is added to the system because the wind plant output is a function of the individual wind turbines, each of which sees a different wind speed at the same moment.

The wind speed data that are extracted from the meso-scale modeling effort are converted to wind power, which is then entered into a production simulation model to help determine wind's impact on the system. The recognition that the grid is a large, complex, synchronized machine (divided into the relevant interconnections in the United States) has led to more sophisticated treatment of the interaction between utilities and balancing areas. This in turn has led to larger and more complex simulations that can look outside the balancing area boundaries and interact with generators in other markets. This recognition of the interconnected nature of the system increases the complexity of the modeling task because the physical characteristics of the interconnection must be accounted for in the modeling. Examples of this approach were carried out in the recent California Intermittency Analysis Project (CA IAP) and the 2006 Minnesota Wind Integration Study, both discussed later in this article.

In other cases, such as the Xcel-Colorado integration study and the Avista study (also discussed below), the utility operates in the absence of large liquid organized markets and with a smaller balancing area. In nearly all cases, however, system simulation studies continue to be supplemented by statistical analyses of the interaction between load and wind. These analyses allow estimation of additional regulation and load-following reserves.

Many recent integration studies focus on calculating the integration cost of wind. To carry out this calculation, a benchmark no-wind case is needed as reference. The additional variability that wind imposes on the system can be measured against an energy-equivalent source that does not change the regulation or load following requirements of the system. For the reference-case simulation, many studies convert each day's wind energy into a flat block over the 24-hour period, which has no impact on ramping or regulation requirements. For the wind case, the wind variability that was calculated by the meso-scale modeling is used in the simulation. This does impose additional variability on the power system that must be dealt with by existing nonwind generation. The cost differential represents the cost of wind's variability.

There is not unanimous agreement that this technique is valid, and indeed the validity of this method may depend on the context of the study. For regulated utilities that bring in wind to offset fuel consumption, a significant benefit of wind is the fuel cost saving achieved. The influence of this fuel saving on wholesale and retail electricity cost will flow to consumers. However, if the utility has sufficient market opportunities, the daily flat block of the wind-equivalent resource allows for sale of a firm flat block, which typically commands a premium market price. Comparing actual wind against this flat-block equivalent in cases like this may not be valid. This issue needs further exploration and discussion.

Other wind-integration studies have been conducted in environments with large, well-functioning wholesale markets. They have not focused on integration costs as a separate item but instead have rolled these costs into a broader picture. The primary focus was on evaluating the feasibility of adding substantial amounts of variable renewable generation to the power system and identifying actions necessary to accommodate the variability. In general, these studies have estimated net values for wind energy that reflect market prices, fuels displaced, and operating-cost increases arising form wind's variability and uncertainty.

Wind's contribution to uncertainty results from wind forecast errors. Forecasts can be done over a few hours ahead and are useful in economic dispatch decisions. Day-ahead forecasts are useful in the unit-commitment time

Governor's Energy Office

FOR IMMEDIATE RELEASE
THURSDAY, JANUARY 3, 2008

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"GOVERNOR'S ENERGY OFFICE RELEASES REPORT ON STATE'S RENEWABLE ENERGY RESOURCES"

DENVER– The Governor's Energy Office (GEO), in compliance with Senate Bill 2007-091, worked with a task force to map Colorado's renewable energy resources. Members from utilities and the renewable energy community were appointed by the Governor and legislative leadership to produce "Connecting Colorado's Renewable Resources to the Markets." The purpose of the report is to identify renewable energy resources in the electricity sector that will advance Colorado to a New Energy Economy.

The task force reports that Colorado's abundant renewable resources provide great opportunities to improve the state's energy, economic, and environmental conditions. Also, Colorado will continue to benefit by adding more renewable energy and expanding its limited transmission infrastructure to serve its population and what may evolve as a regional electric power marketplace.

The report specifically identifies 96 gigawatts (GW) of wind capacity in the Eastern Plains, and a combined solar capacity of 26 GW in southern Colorado. Colorado's electric load peaks at 11 GW. One GW from a renewable resource can generally serve about 330,000 homes. There are many challenges to connect Colorado's renewable resources to the markets. The report also details how Colorado's transmission is constrained and why new high voltage transmission lines are needed to connect the state's rich renewable resources to electric customers.

"This comprehensive mapping of our renewable energy resources serves as a roadmap to advance our state to a New Energy Economy. By identifying our areas of greatest resource, we can leverage these solar, wind, and other renewables to provide more clean power, jobs, and revenue for our state," said Tom Plant, director of GEO.

"Connecting Colorado's Renewable Resources to the Markets" has been distributed to legislators, utilities, the Clean Energy Development Authority and other interested parties. For more information as well as a complete downloadable copy of this report, visit the GEO website, www.colorado.gov/energy.

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