Non-REZ Renewable Resources

The West contains a significant amount of commercially viable renewable energy resources outside the renewable energy zones (REZs) that will be identified in this initiative. What distinguishes non-REZ resources is:

- they do not require multibillion-dollar investments in extra-high voltage (EHV) transmission extending across state lines;
- they primarily serve load in the same locality, state or utility service area;
- they do not need to be concentrated in one place in order to be developed;
- development is unambiguously within the regulatory purview of the state where the resource is located; and
- the ability of any state to develop them is largely unaffected by policies in neighboring states.

WGA's Clean and Diversified Energy Advisory Committee (CDEAC) estimated in 2006 that the West contained more than 35 GW of developable renewable energy potential.[1] The estimates for wind power assumed few new EHV transmission lines, an assumption that stands in contrast to the goal of the WREZ initiative to assess the conceptual feasibility of new large-capacity EHV corridors across the West. Consequently, the REZ resources identified in this initiative are (at least with respect to wind power) *additional* to the potential estimated by CDEAC.

This document explains how REZ and non-REZ resources fit as complementary pieces in the same big picture of strategic, low-carbon energy planning. REZ resources represent the new opportunities that could arise after setting aside the transmission constraints assumed by CDEAC, allowing the West's least-cost renewable resources to serve the West's largest load centers by moving regionally. Non-REZ resources – summarized in this paper – serve subregional or in-state demand, and correspond to the potential identified by CDEAC.

The paper begins with an overview of important electricity resource categories, including utility-scale renewable generation, community resources, distributed generation, and demand reduction. With that background, the discussion takes a closer look at the specific types of non-REZ resources found in the West: small photovoltaic solar; enhanced geothermal; biomass; hydroelectric power; tidal power; and community wind, solar and geothermal power.

[1] The renewable energy potential identified by CDEAC task forces included 9 GW of wind, 4 GW of CSP, 5.6 GW of geothermal, and 17 GW that was either distributed or local (4 GW of distributed solar, 10 GW of biomass, and 3 GW of incremental hydroelectric potential). The wind power estimate explicitly took into account existing transmission limitations. Portions of all these estimates, however, include WGA states that are not part of the Western Interconnection. WGA, "Clean Energy, a Strong Economy and a Healthy Environment," report of CDEAC to WGA, June 2006, pp. 7-8.

While both REZ and non-REZ resources are important, each has a different development path. The critical difference between the two paths is the sometimes confounding role of federalism. Non-REZ resources are developable under current state laws and regulatory institutions; although individual cases may be difficult, there is little question that the state already has sufficient authority to reach binding decisions. In contrast, regulatory decisions to permit and pay for EHV transmission of the scale required to move renewable resources across several state jurisdictions are likely to require institutions (an interstate compact, for example) that do not yet exist; the contribution of the WREZ initiative is to develop a body of factual analysis that can inform a multi-state dialogue on the new option of regional transmission for renewable resources.[2]

One puzzle, many pieces

Both REZ resources and non-REZ resources are subsets of a larger portfolio of policies relating to energy security and climate change. As articulated by Western governors, the broader goal is "to improve the balance and overall adequacy of renewable and traditional energy resources in a manner which will strengthen economic growth, promote energy price stability, mitigate environmental impact, maximize reliability and result in an abundance of diversified resource supplies."[3]

This bigger picture includes not only clean traditional resources, but also utility-scale renewable energy, community-scale renewable energy, distributed generation (on-site resources supplying power to the customer's side of the electricity meter), and load reduction through energy efficiency and demand-side management. Each has its place in a comprehensive energy strategy; if one falls short, the others take on more of the burden – and possibly at a higher cost to consumers.

In the context of the WREZ initiative, three types of non-REZ renewable generation technologies are important:

- Existing technologies such as wind and utility-scale solar where resources are not highly concentrated but are close enough to in-state load centers to be economically viable;
- Existing technologies such as small hydro, biomass, conventional geothermal, landfill gas, anaerobic digestion and distributed solar PV whose natural and physical resource characteristics are decentralized; and
- Emerging technologies such as enhanced geothermal, tidal and next-generation solar PV.

[2] Institutional issues affecting REZ transmission development will be addressed in later phases of the WREZ initiative.
[3] WGA, "Transitioning the West to Clean Energy and Energy Security," policy resolution 07-16 (2006).

Table 1: REZ Resources, Non-REZ Resources, and the Low-Carbon 'Big Picture'

Utility-scale renewable resources	*Some REZ (regional)* *Some non-REZ (in-state)*
Community renewable resources	*All non-REZ*
Renewable distributed generation	*All non-REZ*
Energy efficiency	*All non-REZ*

Utility-scale renewable resources

The most pertinent attributes of utility-scale resources in the context of this analysis are that they need not be co-located with the load using them, and that they are centrally managed by the utility. Because resources and load are geospatially separated on the grid, the utility needs to control the total resource output so that it matches load minute by minute. Larg plants tend to be more cost effective than small plants; in addition, a handful of large resources are easier to coordinate centrally than are hundreds of small resources.

Existing and emerging technologies can operate at utility scale, but not in the concentrations necessary for a REZ. While constraining the size of a wind or solar project on the basis of in-state load may forfeit some economies of scale, the higher costs are often balanced by the ability to use available transmission capability on existing lines.

California, Colorado, Arizona, New Mexico, Nevada and Utah are conducting or have completed their own state assessments of renewable energy resources. Unlike the WREZ analysis, the utility-scale renewable resources addressed in these efforts are by and large intended to meet in-state load.[4] An in-state focus means that resource screens need not be as rigorous as those used to identify a regional REZ. For example, an area with Class 3 wind potential may not be sufficient to justify a billion-dollar EHV transmission line, but it could very well be a cost-effective option for meeting local or in-state needs.

Community generation

The geographic character of the West makes community generation a particularly important aspect of the regional generation portfolio. Nearly half of the electric generation facilities operating in the WECC region are 10 MW or smaller, and more than

[4] While California's Renewable Energy Transmission Initiative also looks at resources in surrounding states, the analytical objective is to identify resources that can help California meet its own renewable energy goals.

60% of those are hydroelectric.[5] Although facilities 10 MW or smaller make up only 2% of the West's total generating capacity, they are scattered throughout the West, often located close to communities that are difficult and expensive to connect to the regional grid.

Community generation differs from utility-scale generation in its proximity to the load it serves. This is in fact the main source of value for community generation resources. These plants are highly decentralized because, unlike utility-scale generation, they are location-dependent. Consequently, it makes little sense to evaluate the regional concentration of resources that work well as community resources, as the concentration would not affect the benefit that a community may realize.

In addition to small hydroelectric facilities, other renewable technologies especially suited for community application are biomass (especially near large forested areas), geothermal, and solar PV. The U.S. Department of Energy's Wind Powering America Program also provides technical support to communities for developing small-scale wind power.[6]

Distributed generation

Electricity generated on the customer's side of the meter is operationally invisible to the utility, showing up as an effective reduction in the amount of power supplied to the customer by the utility. This means that distributed generation (DG) acts much like energy efficiency with respect to reducing the need for new transmission and utility-scale generation.

DG is decentralized by definition, and as with community generation it is location-dependent. The main issue with development is not whether a lot of it can be concentrated in one place, but whether enough sunshine, wind or biomass feedstock is available where the customer is located.

Rooftop solar PV is perhaps the best-known form of renewable distributed generation. Commercial operations such as lumber mills, stockyards and agricultural processing can have larger on-site electric generators fueled by various forms of biomass. Among emerging technologies, enhanced geothermal also has potential as a DG resource.

Energy efficiency

As noted by the Western governors, "Energy efficiency is the easiest, least expensive and least controversial way to reduce energy demand."[7] CDEAC estimated that implementing best practices for energy efficiency could produce outcomes equivalent to 48 GW of new generation capacity.

"Efficiency," however, is more than simply reducing demand. Both the amount of generating capacity and the transmission required to move electricity to customers are determined by peak demand – how many megawatts are used during the one hour of the year when demand is at its highest. In many cities, utilities are implementing an array of

[5] Computed from Energy Information Administration, Form EIA-860 Database (Annual Electric Generator Report), 2006. Includes only operating generators located in the WECC region.
[6] See http://www.eere.energy.gov/windandhydro/windpoweringamerica/.
[7] WGA policy resolution.

new demand response programs that provide additional incentives for large customers to shift electricity use to off-peak times. Even if the total amount of electricity used remains the same, keeping the instantaneous use relatively even throughout the day can reduce or eliminate the need for a new power plant or a new transmission line.

Among the newer tools for energy efficiency:

- Advanced metering systems that show both how much electricity a customer uses, and when the electricity is used throughout the day;
- Time-of-use rate tariffs that charge more for electricity used during peak hours, and less for off-peak use;
- Demand-response programs in which large electricity customers voluntarily cut demand when scarcity drives real-time wholesale power prices high; and
- Building codes and appliance standards that require energy-efficient practices.