



CLEAN ENERGY VISION

Easy on Water and Land

The western U.S. will spend \$200 billion over the next 20 years to maintain and enhance our electric system. We can continue Business as Usual (BAU). Or instead, we can begin orderly transition to more secure and sustainable resources. The choices we make now will enormously affect our health, our economy and the planet.

Clean energy requires less land and water than the BAU, which continues to rely on coal mining, gas drilling and risky and polluting transportation and storage of fuels.

Transforming fossil fuels into electricity requires processes that are polluting and resource-intensive. Fossil fuel combustion accelerates climate disruption, devastating many species and their habitat. Moving to clean energy can mitigate these impacts.

WATER - ENERGY

Water is used extensively in both resource extraction and electric power generation. With growing populations and prolonged drought putting unprecedented pressure on limited freshwater resources in the West, this close link between energy and water has become critical.

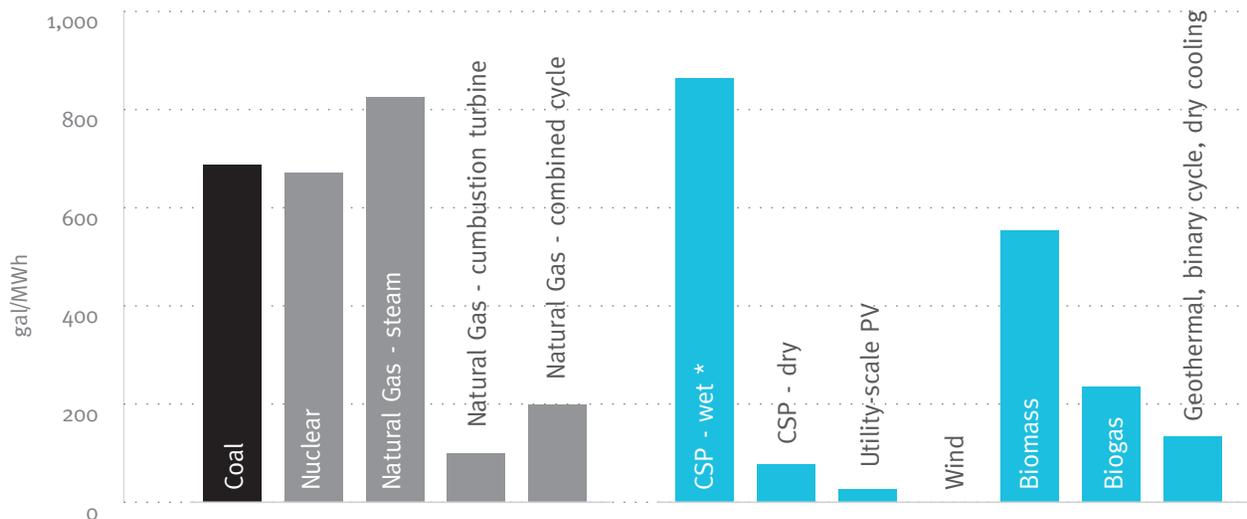
Fossil fuel combustion contaminates water resources, creating serious health and pollution risks. Copper, zinc, magnesium, aluminum, chloride, iron, sodium, arsenic and sulfates make their way from fossil fuel plants to neighboring water sources.

The Importance of Large-Scale Wind and Solar

Even if we implement all cost-effective energy efficiency and install solar panels on 25% of all residential and commercial rooftops by 2050—a herculean achievement—we would still only generate 15% of the West's electricity needs.

As we transition away from coal and gas, large-scale wind, solar, geothermal, and biomass generation provide a cost-effective complement to rooftop PV.

WATER INTENSITY OF ELECTRICITY GENERATION



* California, location of most CSP plants, now requires dry cooling.

Consumption vs. Withdrawal

Water consumption is water lost in generating electricity, mainly to evaporation. Water withdrawals is water eventually returned to the ground. The water intensity chart to the left reflects consumption.

BY THE NUMBERS: WATER IMPACTS

Business as Usual

Continued use of fossil fuels will increase water consumption to between 446 and 484 billion gallons annually in the West by 2050.

Discharged waste water from a power plant may be as much as 17 degrees warmer than the river or lake it is returning to. Warm water holds less oxygen, putting significant stress on fish and their food chain.

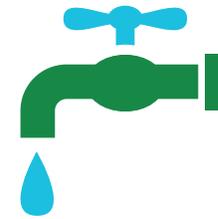
Natural gas power plants are usually much less water-intensive than coal or nuclear plants. However, the growing use of hydraulic fracturing, or “hydrofracking,” to extract natural gas uses significantly more water and has been linked with aquifer declines and water pollution.

Clean Energy Vision

Moving to clean energy can reduce water consumption to between 143 and 157 billion gallons annually in the West by 2050.

The demand for water is expected to increase due to growing population and climate change. Water saved through CEV policies can be used for other uses like irrigation, hydropower and recreation.

Using dry-cooling for a concentrating solar power (CSP) consumes 90 percent less water per unit of electricity than typical wet-cooled CSP plants.



Relative to current (2010) water use, clean energy strategies cut water requirements in half through 2050. This savings will free up “new” water for other uses such as agriculture, drought management, hydropower and sports and recreation.

WHY ARE CEV WATER IMPACTS LOW COMPARED TO BAU?

Clean energy strategies use energy efficiency to reduce the overall amount of energy production needed and take advantage of renewable energy technologies like wind and solar photovoltaics, which have virtually no water requirements. As a result, the CEV will cut our current energy-related water requirements in half by 2050.

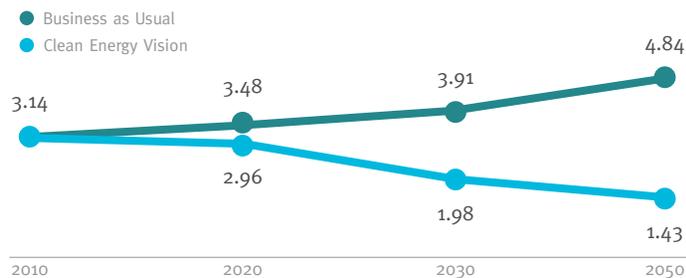
HOW CAN WE MINIMIZE WATER IMPACTS?

Locate renewable energy projects on retired agricultural lands and other disturbed lands. These sites often have access to enough water to support renewable energy projects, which typically consume less water than prior uses. Federal and state agencies are working to encourage projects to locate on disturbed lands.

Shift to dry-cooling technologies. State water performance standards or other policies can encourage new CSP power plants to shift away from wet- to dry-cooled generation that uses less water.

Use reclaimed or recycled water. State water performance standards for energy generation can be structured to encourage generators to move away from using potable water.

BILLIONS OF GALLONS PER MWh



LAND - ENERGY

The West contains some of our nation's most biologically important lands and culturally celebrated landscapes. Energy development has significant direct and indirect impacts on these lands and the habitats they support.

HOW CAN WE FURTHER MINIMIZE LAND IMPACTS?

Identify appropriate areas for renewable energy development.

Proactively identify areas having high-quality wind, solar, or geothermal resources suitable for renewable energy development. The Western Governors Association and many western states are identifying Renewable Energy Zones.

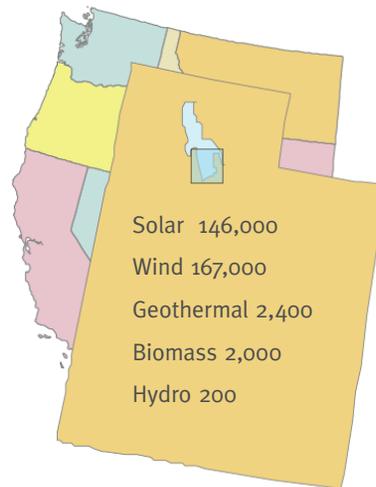
Plan projects to minimize impacts. Consider ecological, cultural, and social values in planning for renewable energy development. Local, state and federal government agencies, environmental groups, and project developers are working across the West to agree on such planning protocols.

Incentivize or streamline renewable energy development in suitable areas. Carry out environmental assessments of potentially suitable areas. Provide for expedited reviews and financial incentives for projects located in those areas. Federal and state land management agencies are pursuing this approach.

CEV RENEWABLE ENERGY FOOTPRINT

Aggressive implementation of energy efficiency reduces the overall land required for energy generation.

ACRES NEEDED TO POWER THE WEST



Only 622,000 acres are needed to implement CEV targets for renewable energy. This could fit into 1/3 of the Great Salt Lake and includes acres needed for both **generation resources** and **transmission**.



To minimize land and water impacts of power production, wind, solar and geothermal can supply most U.S. electricity.

BY THE NUMBERS: LAND IMPACTS

Business as Usual

Coal mining alone disturbs 1 million acres every year nationwide (1 million acres = Rhode Island). BAU will destroy habitat on 20 million additional acres (20 Rhode Islands or about the size of half of Washington state) by 2032.

Nearly 38 million acres of public lands are under lease for onshore oil and gas development, 16 million of which are actively being developed. Development on private lands disturbs roughly the same number of acres.

BAU forecasts a doubling of gas burned to generate electricity, which will add several million acres to the total now being developed.

Clean Energy Vision

Over its lifetime, the mining footprint of a coal plant is about 20% larger than the land footprint of a solar thermal plant.

Replacing the generation produced by all US coal plants with solar could require only 6 million acres.

Deploying photovoltaics on 35 million residential rooftops could generate 85 GW. An additional 85 GW could be generated on commercial roofs. 170 MW of rooftop PV would supply 15% of US demand for electricity in 2030.

POLICY CHOICES

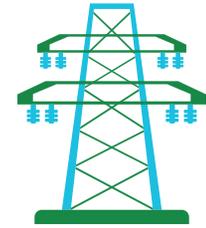
The Western Governors' Association June 2012 report, "Meeting Renewable Energy Targets in the West At Least Cost: The Integration Challenge," provides detailed explanations of nine approaches for reducing the costs of adding large amounts of renewables to the western grid. Four of the most effective of these include:

Faster scheduling and dispatch of power to the grid. Shorten schedules to every 15 minutes instead of once an hour, the current practice in most of the western U.S.

Increased use of dynamic transfers between Balancing Authorities. Dynamic transfers help take advantage of the geographic diversity of wind and solar output across the West to reduce aggregate variability of those resources.

Better weather forecasting. Electricity use is driven in large part by weather. More accurate forecasts allow operators to schedule and balance wind and solar generation in ways that save money.

Geographic Diversity. The most effective way to reduce the aggregate variability of wind and solar generation is to install more of it. While the output of a single wind or solar project can be highly variable, the combined output of many such projects is orders of magnitude less variable. Geographically dispersed projects allow renewables to play larger roles in system balancing, reducing the need for fossil resources.



Smart From the Start Transmission Planning

More complete wildlife and species databases and Geographic Information Systems (GIS) mapping tools now make it possible to plan large infrastructure projects with unprecedented levels of knowledge about environmental impacts.

Smart from the Start planning takes advantage of this information to minimize environmental and cultural conflicts.

THE CLEAN ENERGY VISION PROJECT

Western Grid Group (WGG) is a network of former state regulators working to modernize the grid and win access for clean resources. Western Clean Energy Advocates (WCEA) is a coalition of clean technology companies, environmental NGOs and others committed to making electricity supply more secure and sustainable.

The Clean Energy Vision Project, a joint venture of WCEA and WGG, focuses on detailing a plan for orderly transition away from fossil fuels.

CLEAN ENERGY VISION REPORTS AND DOCUMENTS INCLUDE:

Report. *Western Grid 2050: Contrasting Futures, Contrasting Fortunes* is a comprehensive comparison of CEV and BAU development trajectories for western electric service.

Fact Sheets on *Economy & Jobs, Energy Security, Climate, Public Health and Cost* outline differences between CEV and BAU.

Moving to Clean Energy: Plan for an Orderly Transition

Grid - *Modernizing the Grid: How Our Electric System Can Welcome New Resources, Improve Reliability and Reduce Costs*

Policies - *Lower Risk, Lower Cost Electric Service: Policies Western States Can Build On.*

Investments - *Clean Energy Investments and Incentives: Choices for Investors, Utilities and Regulators.*

Clean Energy Vision Video - a brief overview of the benefits of a clean energy future.



For other fact sheets, the Western Grid 2050 report, Transition Plans papers on the Grid, Policies and Investments and more information about the Clean Energy Vision Project, go to: www.cleanenergyvision.org