SMART LINES

Transmission for the Renewable Energy Economy

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ABOUT THIS GUIDE

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About Resource Media: Resource Media provides media strategy and services to nonprofits, foundations and others who are working to protect communities and the environment in the West.

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Part I: Introduction

CLEAN ENERGY: RELIABLE, AFFORDABLE AND BETTER FOR THE WEST

The West is at a crossroads as population growth and rising demand for energy intersect with concerns over air pollution, climate change and increasing impacts to public lands and wildlife resources. Meanwhile, support grows for developing renewable energy from the wind, sun and earth's geothermal stores.

Western states are, in many ways, perfectly positioned to begin an historic shift toward renewable energy. Indeed, the West's transformation to a renewable energy economy is already well underway.

Meeting the West's anticipated energy needs with renewable energy over the next decade and beyond will require new utility-scale generation and delivery through expanded electrical transmission lines as many of the best renewable energy resources are far from major population centers. Given the vast scale of this development, it will be essential to site and configure new energy infrastructure to minimize environmental impacts.

The potential of energy efficiency and distributed small-scale generation, such as rooftop solar, to meet Western energy needs is strong. However these strategies alone can't provide the clean and sustainable energy Westerners need. Without utility-scale wind, solar and geothermal facilities and adequate transmission access, we won't be able to meet future energy demand, much less reduce carbon emissions to levels needed to avoid the damaging effects of climate change.

In the past two years, the prospects for renewable energy development have improved dramatically. Eight of 11 western states have now adopted Renewable Portfolio Standards requiring utilities to generate 15-25 percent of energy demand from renewable sources. The U.S. Department of Energy projects that wind energy could potentially supply 20 percent of the nation's electricity by the year 2030. And in the first quarter of 2008 alone, the American Wind Energy Association reported that industry installed $3 billion worth of new generating capacity. Solar power also has made significant gains, while efforts to tap additional geothermal energy sources are gathering steam.

But the current lack of transmission capacity could cloud the future of renewables. To ensure the benefits of clean energy are fully realized, Westerners and resource managers must work together to develop the transmission network needed to link wind, solar and geothermal energy to existing grids and to ensure they have equal footing with fossil fuel sources.

The West's near-term projected energy demand, for example, will require the addition of 15,000 megawatts of renewable energy simply to meet the minimum Renewable Portfolio Standard requirements of 2017. That's just the beginning. The Western Governors' Association Clean and Diversified Energy Initiative established adding 30,000 new megawatts of clean energy in the western states over the next decade. Moreover, the governors' Diversified Energy report demonstrated the potential for more than

80,000 megawatts of energy from wind, solar, geothermal and biomass by 2015 if the right incentives and infrastructure are available. Without sufficient transmission capacity, however, the West's clean energy future—and economy—won't materialize.

It is important to acknowledge that developing solar, wind and geothermal resources will have environmental impacts. The tremendous benefits of renewable energy do not eliminate the need to avoid and minimize impacts to Western landscapes and wildlife habitats. Importantly, major planning efforts already underway will decide how to both develop and deliver larger quantities of renewable energy.

Ensuring that these projects capitalize on the region's renewable potential in an environmentally sensitive manner requires the active participation of public lands advocates and wildlife conservationists. Inadequate planning, improper siting, insufficient mitigation and the law of unintended consequences have the potential to link clean energy development to unacceptable—but avoidable—environmental impacts.

The shift to renewables hasn't always been as green as it could be. In the past, poorly sited wind farms have affected birds and bats. Solar power plants can disturb hundreds or thousands of acres. The roads, pipelines and other infrastructure associated with geothermal plants may resemble a gas field. And the new transmission needed to connect these renewable energy sources with cities and towns has the potential to further fragment the West's public lands and wildlife habitat.

While there are a number of ongoing discussions about siting renewable energy projects—particularly wind—the subject of transmission for renewable energy resources needs more attention. This guide is intended to help further that discussion. First and foremost, transmission planning needs to be smart from the start.

The development of new transmission lines is a complex process that can take from five to 10 years. In contrast, large wind farms can be planned and completed in a few years—underscoring the importance of sound transmission planning in the beginning and subsequent stages in order to facilitate responsible renewable energy development in a timely manner.

First, efficiency gains and local power generation should be maximized to reduce the overall need for power lines and their associated rights-of-way.

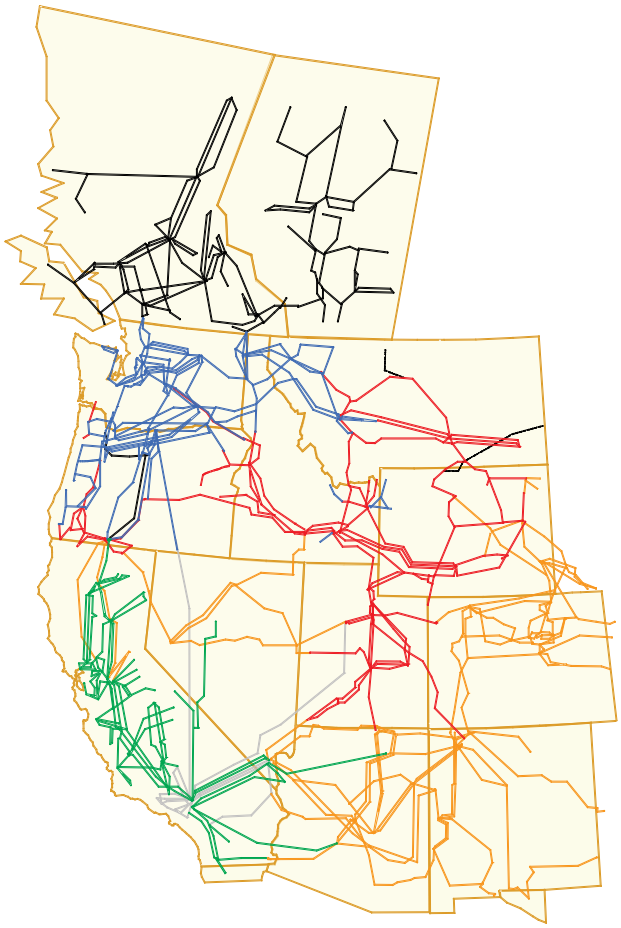
Power line proposals for renewables need careful scrutiny as they can open new conduits for carbon-heavy resources—such as coal—that could ride new transmission lines alongside renewable electricity. Indeed, pairing renewable energy resources with conventional coal on new or upgraded power lines will undermine the climate change benefits associated with the renewable energy economy. To avoid impacts to key western landscapes and wildlife habitat, the conservation community needs to be engaged early in the planning process, when avoidance and mitigation are most effectively addressed. Some of the key planning principles are outlined in this publication, *Smart Lines: Transmission for the Renewable Energy Economy.*

The West is turning to clean energy. But the future of renewables could be clouded by a lack of transmission.

To avoid unnecessary conflict and ensure the timely progress of environmentally smart transmission projects, the public lands and wildlife conservation communities should be advocating for solutions during the critical planning processes that are now moving forward.

Western states are already developing the projects needed to meet their respective Renewable Portfolio Standards. The time is now for land and wildlife resource interests to advocate for well-planned renewable energy expansion *with linkages* to existing transmission corridors. In some cases, new transmission lines will be needed so that renewable sources can fulfill their promise of delivering a clean energy future for the West.

Without clean energy, we won't be able to reduce carbon emissions enough to ward off the worst impacts of climate change.



WECC
WESTERN ELECTRICITY COORDINATING COUNCIL
Existing power lines in the West, color coded by sub-region.

Part II: Clean energy

CLEAN ENERGY MUST BE GREEN ENERGY

Thanks to the availability of renewable energy sources in the West, wind, solar and geothermal sources will become increasingly important energy players in the region. And given its resources, the West's vast public lands are destined to play a significant role in the future development and transmission of renewable energy.

Despite the benefits of renewable energy, and the key role it will play in combating potentially devastating impacts to wildlife from global warming, the large-scale development of renewable energy resources will still have environmental impacts.

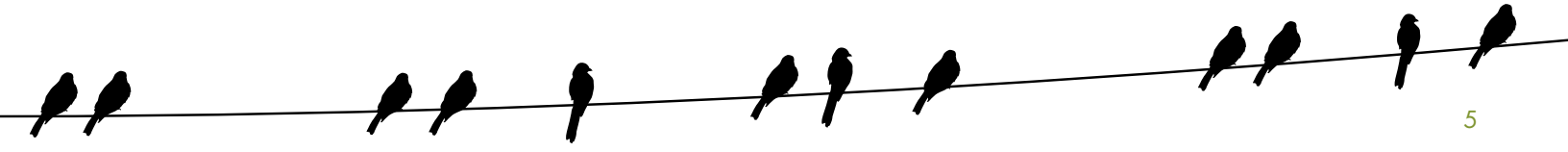
Western lands are home to a number of endangered, threatened or declining species, many of which are vulnerable to habitat fragmentation, disturbance and displacement from the installation of tall structures like transmission towers. In February 2007, the Western Governors' Association approved a resolution titled "Protecting Wildlife Migration Corridors and Crucial Wildlife Habitat in the West," which directed the association to identify key wildlife migration corridors and to make recommendations for habitat preservation.[1]

New wind, solar and geothermal projects need to consider foreseeable wildlife impacts before development begins. Currently, the magnitude of impacts from wind energy development on wildlife, particularly migratory birds and bats, is not consistently articulated to wildlife managers, decision makers or the public. Avoiding, minimizing and mitigating harmful impacts to wildlife are important elements of 'green energy' and it is imperative that renewable energy developers, scientists and natural resource agency specialists cooperate in developing strategies that minimize harm to wildlife.

In general, when siting renewable energy projects:

- Avoidance of key Western landscapes and wildlife habitat is job one.
- Planners should first look to locate renewable generation and transmission projects close to existing corridors or roads in developed, fragmented or otherwise low-value wildlife habitat before considering unfragmented or high-value public lands.
- Requiring best management practices in areas deemed acceptable for development is necessary to keep impacts at a minimum.
- Habitat fragmentation, soil impacts, vegetation disturbance, visual and noise impacts and specific threats to migratory and ground-nesting birds and other species should be considered at the earliest stages of planning.

Projects that are poorly planned and sited, or lack sufficient wildlife mitigation measures, risk losing buy-in from stakeholders.



Part III:

Why talk about transmission?

BUILDING A BALANCED ENERGY POLICY

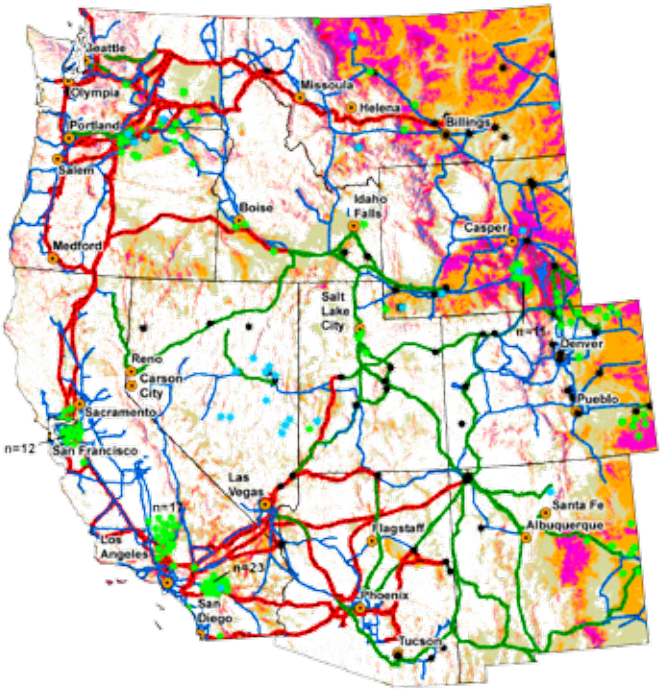
Promoting energy efficiency and local power sources, such as rooftop solar, are important strategies in the effort to build a balanced energy policy in the West. Reducing demand can lessen the need to add new generation sources and transmission facilities.

However, efficiency and local generation won't be enough to satisfy future demand, let alone provide the capacity that will be needed to retire older coal facilities in order to make a dent in U.S. carbon emissions. Renewable energy at the utility scale will be required, and in the West, the resources that can provide this type of power are often far from population centers. That means significant new transmission capacity will be needed to tap these resources.

Energy efficiency is a growing part of the West's new energy economy—and it also needs to be commonplace in transmission planning and expansion proposals. In one study, the Western Governors' Association Transmission Task Force found that if high levels of efficiency are reached in the region, 1,150 miles of a projected 4,000 miles of new power lines could be eliminated—approximately 30 percent.[2] Likewise, rooftop solar can help reduce, but not eliminate, the need for utility-scale renewables. For example, California estimates it needs approximately 20,000 megawatts to meet its Renewable Portfolio Standards goal of 33 percent by 2020. It would take 33 *million* rooftop installations to accomplish this goal (at the generation rate of the current average-size project).

In 2005, the 11 western states had 7,712 megawatts of installed renewable energy generation capacity, including 4,200 megawatts of wind, 412 megawatts of solar and 3,100 megawatts of geothermal. With eight western states now having Renewable Portfolio Standards, numerous new clean energy projects will be advanced in the next few years. The renewable energy economy will require aggressive investments in renewable energy infrastructure. By 2017, the West will need 15,000 megawatts of renewable energy to meet the bare minimum of state renewable targets, and more than twice that to meet the high renewable energy target set for 2025 by the Western Governors' Association Clean and Diversified Energy Initiative.[3]

Without transmission, we won't be able to deliver the clean energy projects necessary to combat climate change and build the renewable energy economy.



WIND POWER RESOURCES, EXISTING/PROPOSED COAL PLANTS AND EXISTING HIGH-VOLTAGE POWER LINES IN THE WESTERN UNITED STATES

COMBATING CLIMATE CHANGE

To build a clean energy economy and seriously combat climate change, the West needs to develop large-scale renewable energy projects in renewable rich areas. A major obstacle to getting these sources on the grid and powering western homes and businesses is the availability of transmission.

In fact, the U.S. Department of Energy has concluded that establishing a reliable interstate electricity-transmission superhighway is the critical requirement for achieving a 20 percent wind-power goal. Capacity on the existing grid is absent or minimal—the system under current electrical configurations is maxed out and needs extensive upgrades in many locations. As a result, *thousands of wind turbines in the United States are sitting idle or failing to meet their full generating capacity* because of a shortage of power lines able to transmit their electricity to the rest of the grid.[4]

Current proposals call for at least 9,000 linear miles of new or upgraded power lines and associated rights-of-way in the West. Not all of these proposals will materialize, but it is clear the region needs a significant expansion of its aging power grid to accommodate renewable energy development.

Creating this clean energy transmission grid won't require new technical breakthroughs. But it will entail new impacts to federal lands because the best renewable resources have inadequate or no access to transmission.

That means the active participation and cooperation of Westerners is necessary to ensure acceptable projects are developed in a timely manner.

SMART LINES:

TRANSMISSION PLANNING PRINCIPLES

Analyze the need for corridors.

The smartest line is the one you don't have to build.

- **EFFICIENCY FIRST: Employ demand-side management**
- **Maximize the existing grid**
- **Connect clean and renewable energy resources**
- **Ensure long-lasting protection for public lands and wildlife resources**

GETTING IT RIGHT FROM THE START

The Western environmental community must get involved in both the renewable generation and transmission-planning processes now underway. Public lands advocates and wildlife conservationists are vital sources of essential natural resource data. They can authoritatively educate planners about where and how renewable energy generation and transmission are acceptable.

If planning and implementation devolve into protracted battles, renewables won't scale up fast enough to have an impact on climate change. Meanwhile, the other benefits that flow from a clean-energy economy, such as a restored tax base, new jobs, high-tech relocations and cost savings to consumers will be lost.

If Westerners aren't able to agree on the need for clean energy and new transmission, renewables won't take hold and we'll be left with yesterday's energy policy. Investors and utilities could fall back on fossil fuel expansion if renewables cannot be delivered on the scale and schedule needed to keep pace with our growing energy demand.

Part IV: Smart Lines

TRANSMISSION PLANNING PRINCIPLES

While energy efficiency and localized energy production such as roof-top solar will make contributions toward meeting future energy demand in major population centers, the bottom line is that Westerners will not be able to aggressively combat climate change without significant additions of utility-scale renewable energy sources.

Without utility-scale wind, solar and geothermal facilities, Westerners won't be able to avoid building new coal-fired power plants, much less retire existing coal plants in order to start rolling back carbon emissions.

In a very fundamental way, the nation's renewable energy transformation hinges on the ability to bring these resources to the market. Two key facts underscore the important role transmission will play in the region's new energy economy.

First, many of the region's best renewable energy resources—Wyoming's impressive wind resources are a perfect example—are far from major population or "load" centers. Renewable energy generation is place-dependent—wind farms need to be built where it's windy; solar plants where it's sunny. Wind, solar and geothermal potential cannot be shipped via rail or pipeline to a power plant for energy production. Generation must take place on-site. Sufficient transmission must be brought to these places in order to bring clean energy resources to market.

Second, the existing power grid in the West is inadequate, both in terms of physical location and overall carrying capacity, to accept large quantities of renewable energy. New and upgraded power lines will be the missing link that brings the West to a new and prosperous energy economy befitting the 21st century.

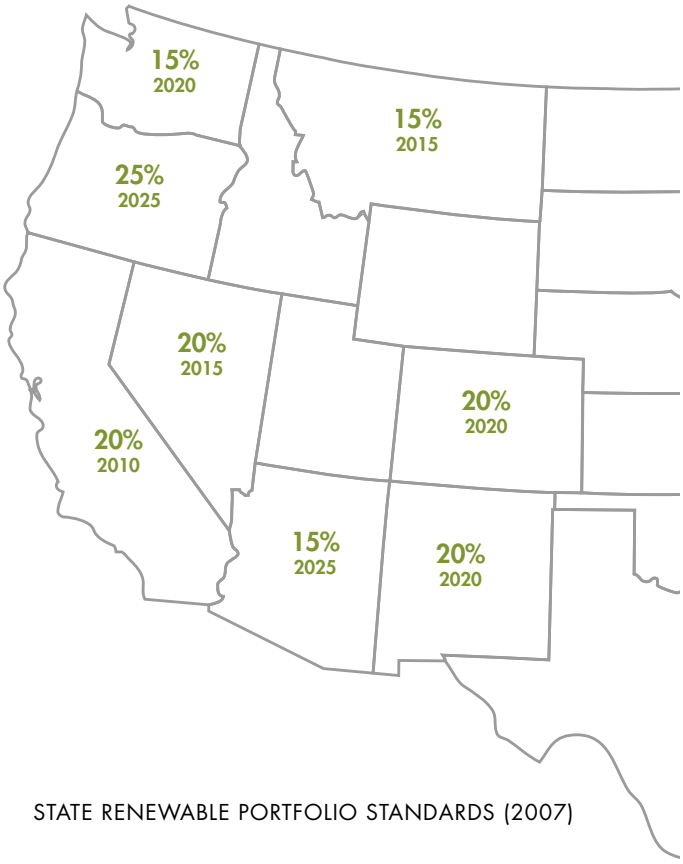
The dilemma is that suppliers cannot crisscross the West with a spaghetti map of new power lines. The resulting transmission network would fragment important wildlife habitat and scar some of the West's treasured landscapes and recreation areas. A poorly sited power line that unnecessarily impacts important public lands and wildlife resources is unacceptable—*even if it connects people to renewable energy resources*. Transmission planning therefore needs to be careful, thorough and comprehensive in nature.

The following four transmission planning principles are essential to ensure we build only Smart Lines for the new West.

STEP ONE—EFFICIENCY FIRST

The smartest transmission line is the one we do not need to build. Decreasing energy demand in our cities through efficiency and other demand-side measures can reduce the need for transmission lines. Alternatives to building new power lines should be exhausted before new projects advance.

One Western Governors' Association study suggested that aggressive investments in efficiency could eliminate the need to build more than 1,150 miles of 4,000 miles of new power lines, a reduction of nearly 30 percent. [5]



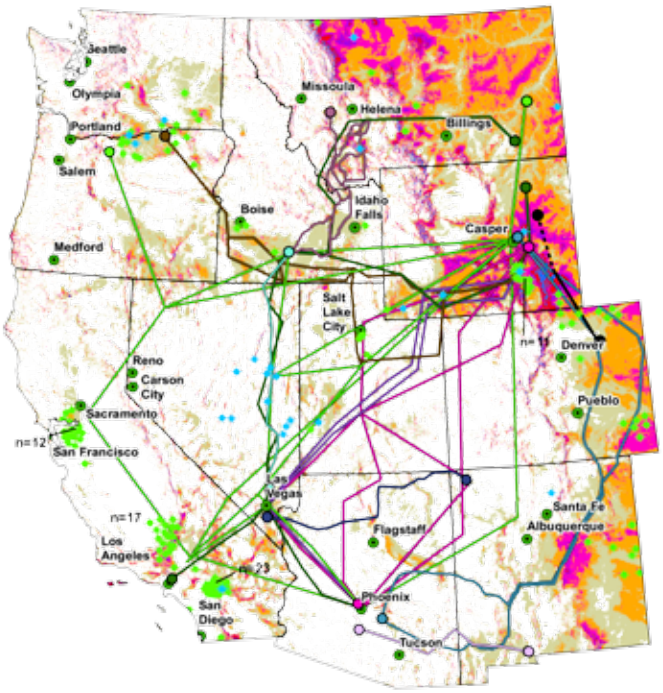
STATE RENEWABLE PORTFOLIO STANDARDS (2007)

STEP TWO—MAXIMIZING THE POWER GRID

More than 100,000 linear miles of high-voltage power lines already exist in the West. Before building new lines, planners should evaluate cutting-edge engineering upgrades for the existing grid, including voltage-class upgrades and more efficient power lines. These technological solutions can reduce the need for some new power lines and their right-of-way clear zones, resulting in fewer impacts to Western landscapes and important wildlife habitat.

STEP THREE—CONNECTING CLEAN, RENEWABLE ENERGY RESOURCES

New or upgraded power lines should be planned and configured to facilitate the development of clean and renewable energy resources. The Western Renewable Energy Zone initiative will help identify the best areas in the West for renewable energy production and transmission. This initiative is important to help set the stage for major renewable energy and supporting transmission projects in the western United States over the next decade.



WIND POWER RESOURCES IN THE WESTERN UNITED STATES AND MAJOR REGIONAL TRANSMISSION PROPOSALS

STEP FOUR—SMART ENERGY CORRIDORS TO PROTECT LAND AND WILDLIFE

New power lines for renewable energy resources must avoid the iconic landscapes of the American West. The current federal proposal for "west-wide energy corridors" in 11 western states would impact national parks, monuments, wildlife refuges and other wild places. Westerners will not accept new power lines bisecting public treasures such as Arches National Park, Grand Staircase-Escalante National Monument and the Sevilletta and Desert National Wildlife Refuges, for example.

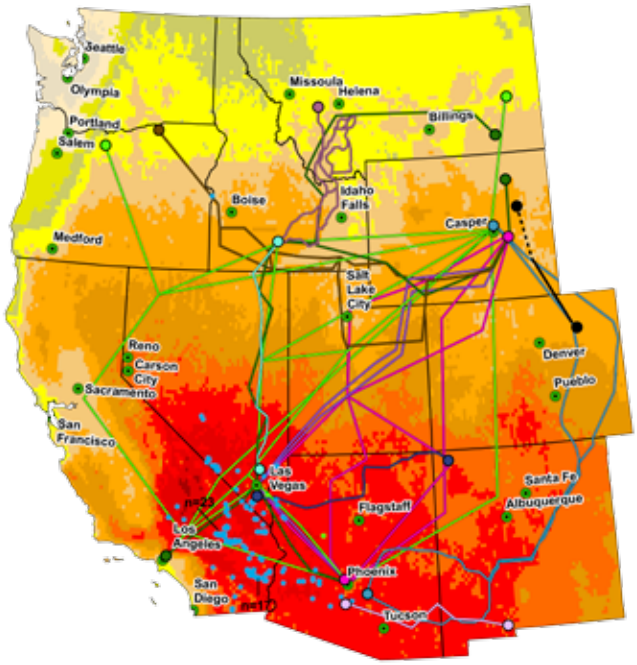
Where new power lines must be located in proximity to critical landscapes, permitting agencies should require industry to use best management practices, such as burying lines to protect visitor experiences or limiting capacity expansion to the upgrade of existing infrastructure, in order to minimize impacts on land and wildlife.

In short, to capture the benefits of the new energy economy and protect the unique resources of the West, planners should exploit demand-side management and existing corridor upgrades to the maximum extent before building new lines to areas of high renewable potential. The smartest line is always the one we don't have to build. For new or upgraded power lines to bring renewable energy resources to market, proper planning and mitigation are essential to ensure long-lasting protection of public lands and wildlife resources.

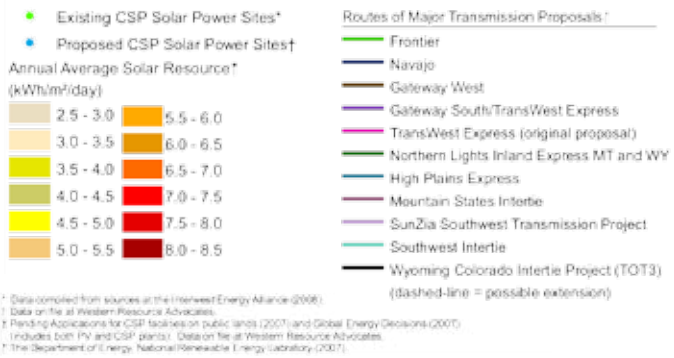
Part V: Transmission planning in the West

UNDERSTANDING THE BASICS

The planning and development of new transmission lines is a complex process that can last 10 years from project inception to commercial operation.



SOLAR RESOURCES AND TRANSMISSION PROPOSALS



* Data compiled from sources at the Interwest Energy Alliance (2008).
† Data on file at Western Resource Advocates.
‡ Pending Applications for CSP facilities on public lands (2007) and Global Energy Decisions (2007).
Includes both PV and CSP plants). Data on file at Western Resource Advocates.
* The Department of Energy, National Renewable Energy Laboratory (2007).

The planning phase of transmission development offers Westerners a critical, early opportunity to help shape well-conceived projects that will serve the new energy economy while protecting the region's unique landscapes and resources. Decisions being made today will determine which resources will connect to transmission lines over the next 10 to 20 years.

Building new transmission generally follows a five-step sequence consisting of the following phases:

- Planning
- Siting and routing
- Permitting, land acquisition and design
- Construction
- Operations, reclamation and decommissioning

Understanding the process will help identify key entry points for conservationists to effectively advocate for smart lines. Focusing on transmission planning and route permitting, here are some key points to remember.

TRANSMISSION PLANNING

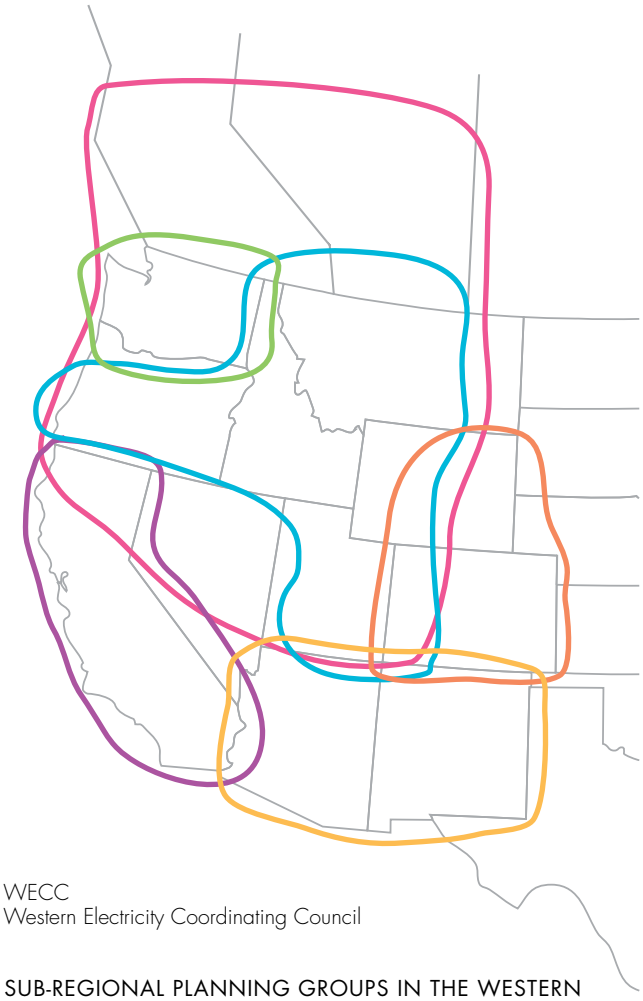
Transmission planning in the West is influenced and facilitated by federal, regional, state and utility initiatives, all of which provide opportunities for stakeholder input. The Federal Energy Regulatory Commission requires transmission planning to proceed in a coordinated, transparent and public manner. Transmission projects are typically announced in the trade press and in public transmission planning venues, each with their own project websites.

The role of regional and sub-regional transmission planning within the Western Electricity Coordinating Council is important to understand. WECC is the largest regional council of the North American Electric Reliability Council, which coordinates and promotes electric system reliability and transmission planning. Most of the western United States falls within WECC's jurisdiction. WECC is further subdivided into "sub-regional" planning groups (see map) where major transmission proposals are vetted, coordinated and analyzed.

PERMITTING

Many long-distance transmission projects in the West will involve private, state, federal and even tribal lands. Multi-jurisdictional projects must win approvals from local, state, federal and other authorities. While there is considerable variability in permit approval processes among Western states, state public utility commissions often retain authority for transmission siting. Power lines that would cross over federal public lands must first comply with regulations administered by the National Environmental Policy Act before obtaining a right-of-way.

Subsequent to finalization of corridor routes, permits are applied for with applicable county, state and/or federal regulatory agencies. Such permits include requirements to avoid, minimize and/or mitigate the impacts of construction and associated activity, based on studies and input from concerned parties. Once permitted, transmission projects move to the final design, land acquisition, construction, operations and reclamation phases—all important entry points for input on the protection of land and wildlife values.



WECC
Western Electricity Coordinating Council

SUB-REGIONAL PLANNING GROUPS IN THE WESTERN INTERCONNECTION

- NTAC- Northwest Transmission Committee
- Columbia Grid
- NTTG- Northern Tier Transmission Group
- CSPG- California Sub-Regional Planning Group
- CCPG- Colorado Coordinated Planning Group
- SWAT- Southwest Area Transmission

Part VI:
Facts about clean energy

EFFICIENCY, WIND, SOLAR AND GEOTHERMAL

Before talking about clean energy generation, it is important to recognize that the cheapest and cleanest megawatt is the one we can avoid using.

FACTS ABOUT EFFICIENCY

- America is becoming more efficient: Between 1996 and 2002, the economy grew by 21 percent, while energy consumption grew just 2 percent.[6]
- According to the Western Governors' Association, the western United States could easily improve energy efficiency by 20 percent as of 2020 with cost-effective investments in new technologies.[7]
- A 20 percent gain in efficiency could eliminate the need for up to 100 coal plants and associated transmission.[8]
- In addition to new technology savings, individuals can reduce their natural gas use by 20 percent to 30 percent with a comprehensive energy efficiency retrofit.[9]

In certain states, efficiency proposals compete with new generation in state utility bid processes, leading some to describe capacity freed up by efficiency as "negawatts." But it's no gimmick: Demand reduction through efficiency decreases the amount of new bulk power generation and transmission needed, which in turn creates opportunities to minimize or avoid environmental impacts. Aggressively integrating efficiency investments with renewable capacity initiatives should be the foundation of smart energy infrastructure planning.

WIND POWER

A wind energy system captures some of the kinetic energy of the wind and transforms it into mechanical or electrical energy that can be harnessed for practical use. Mechanical windmills have been used for decades to pump water in rural or remote locations. Modern electric wind turbines generate electricity for homes and businesses and for sale to utilities.[10]

In 2006, the total electric generation capacity in the West was 190,000 megawatts. The following table produced by the National Renewable Energy Laboratory indicates that 750,000 megawatts of wind power could potentially be developed in the region.

WIND POWER PRODUCTION POTENTIAL BY CLASS
(IN MEGAWATTS)

STATE	CLASS 4 GOOD	CLASS 5 BETTER	CLASS 6 & 7 BEST	TOTAL DEVELOPABLE POWER CLASS 4–7
AZ	1,670	440	200	2,310
CA	11,900	4,830	4,300	21,030
CO	65,560	3,510	4,060	73,130
ID	2,380	635	395	3,410
MT	237,030	38,860	15,620	291,510
NV	3,700	1,140	720	5,560
NM	62,260	8,980	1,800	73,040
OR	7,130	1,540	850	9,520
UT	2,310	770	410	3,490
WA	7,140	1,590	790	9,520
WY	140,980	59,630	57,040	257,650
TOTAL	542,060	121,925	86,185	750,170

(Source: National Renewable Energy Laboratory 2007)

FACTS ABOUT WIND ENERGY

- Wind farms comprised more than 30 percent of new generation capacity in the United States in 2007, making wind energy the second largest source of new power generation in the nation behind natural gas.
- At the end of 2007, wind farm capacity totaled about 17,000 megawatts, or less than 1 percent of the country's electricity consumption.[11]
- According to the U.S. Department of Energy, the United States could garner 20 percent of its electricity from wind by 2030 — if government agencies and the private sector cooperate.[12]
- Hitting this target would reduce CO_2 emissions by 25 percent and natural gas prices by 20 percent, while creating about 500,000 new jobs and a new source of revenue for private landowners.[13]

SOLAR POWER

The sunny American Southwest offers some of the best potential for large-scale solar power plant development in the world. Arizona, California, Nevada and New Mexico have the greatest number of "premium" solar sites in the country.[14] Even when limiting estimates to areas of the highest solar potential, more than 7 million megawatts of solar generation capacity could be developed in the Southwest, according to an analysis by the National Renewable Energy Laboratory in Golden, Colorado. Many of these lands are in proximity to Phoenix and Tucson (Arizona) and Las Vegas (Nevada) and to the energy grid supplying Los Angeles and San Diego (California). While the NREL estimate did not screen out sensitive lands and resources that are unsuited for development, it is clear there are still vast opportunities for solar development across the region.

Solel and FPL Energy operate the 354 megawatt Solar Energy Generating Systems in California's Mojave Desert

HOW SOLAR POWER WORKS

Broadly speaking, there are two types of solar technology: concentrating solar and photovoltaic.

- Concentrating solar power converts the sun's heat into energy with an array of trough-like mirrors that reflect sunlight onto a pipe containing heat-conducting fluid. The fluid drives a conventional turbine connected to an electrical generator.
- Photovoltaic systems (a key source of local or distributed power generation) convert photons in sunlight directly into electricity and are typically installed on rooftops or on land adjacent to buildings, providing electricity to the adjacent structure and sending excess power to the grid. PV systems also are being considered for utility-scale developments.

GEOTHERMAL RESOURCES IN THE WEST

Geothermal energy accounts for 17 percent of the electricity generated from renewable sources in the United States. Half of the nation's geothermal energy production occurs on federal land, much of it in California and Nevada, with 90 percent of potential resources located on public lands.

The Western Governors' Association estimates that approximately 5,600 megawatts of geothermal electricity could be developed commercially from some 138 sites around the West by about 2015. This estimate represents known resources. It does not include the potential of undiscovered resources nor does it assess environmental constraints. The infrastructure associated with a geothermal facility may preclude development in sensitive areas. But significant electrical generation potential will remain.

FACTS ABOUT SOLAR POWER

- In 2007, U.S. photovoltaic installations increased by 45 percent. More than 4,000 megawatts of installed capacity is scheduled to come online by 2018.[15] Rooftop solar avoids the need for new transmission.
- In Colorado's San Luis Valley, the Alamosa Photovoltaic Solar Plant, which came online in 2007, generates 8.22 megawatts, or enough power for about 1,500 homes.[16]
- Pacific Gas and Electric Co. (PG&E) announced in July 2007 that it had agreed to buy power from a 553-megawatt solar thermal power plant to be located in California's Mojave Desert. The new contract was the largest solar power agreement in the world at the time.[17]
- FPL Energy's seven-unit Solar Electric Generating System produces 310 megawatts from mirrors covering 2,000 acres of desert.
- Abengoa Solar announced a contract with Arizona Public Service Co. in February 2008 to build a 280-megawatt solar plant. The 1,900-acre facility would produce enough power to light 70,000 homes, displacing more than 400,000 tons of greenhouse gas emissions annually.[18]

HOW GEOTHERMAL POWER WORKS

Geothermal resources, such as steam and hot water, can be used directly to heat buildings and to power greenhouses and aquaculture. It can be used indirectly to generate electric power through steam-driven turbines.

RENEWABLE ENERGY: A BETTER FUTURE FOR THE WEST

Otero Mesa

The U.S. Bureau of Land Management estimates that development of Otero Mesa, in southern New Mexico, would yield approximately 68 billion cubic feet of natural gas, barely enough to supply the United States for one day. Developing all of this gas would take up to 20 years. Three new wind farms of 200 megawatts each could offset demand for all of the gas beneath Otero Mesa. Eliminating natural gas development would protect the irreplaceable aquifer beneath the mesa, which could provide water for 1 million people in this arid region for close to 40 years.[19]

GEOTHERMAL POWER RESOURCES IN THE WESTERN UNITED STATES AND MAJOR TRANSMISSION PROPOSALS

* Data compiled from sources at the Interwest Energy Alliance and Geothermal Energy Association (2008).
‡ Data compiled from sources at the Geothermal Energy Association (2008).
† Southern Methodist University, Western United States Geothermal Database, available at http://www.smu.edu/geothermal.
† The Department of Energy, available at http://www1.eere.energy.gov/geothermal/geomap.html.
↑ Data on file at Western Resource Advocates.

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Part VIII: References

ENDNOTES

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