

# Clean Energy At The Crossroads

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Charting The Potential For  
Renewable Energy In Los Angeles

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# Clean Energy at the Crossroads: Charting the Potential for Renewable Energy in Los Angeles

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## Executive Summary

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Los Angeles is at a critical energy crossroads with unprecedented opportunities for the city to make a decided shift toward renewable energy.

Renewable energy, once thought of as a technology for tomorrow, has become a viable source of energy today. Renewable resources are lighting homes, running appliances, and powering functions for millions of California residences and businesses.

### **This report finds that Los Angeles is overly reliant on fossil fuels and nuclear power.**

- Fossil-fuel combustion makes up over 75% of the electricity supplied to Los Angeles: 50% coal, 25% natural gas.
- Nuclear power makes up 12% of the electricity generated for Los Angeles.
- Compared to a statewide average of 12%, Los Angeles generates just 2% of its electricity from renewable resources.

### **CALPIRG's research shows that Los Angeles could generate up to 20% of its electricity from renewable energy by 2012.**

This report assumes Los Angeles maintains its expected growth in demand, remaining at 10% of statewide demand. The report then takes a look at the statewide potential for new renewable energy development and assumes Los Angeles could feasibly develop, or contract with, 10% of this new development.

- Wind is the fastest growing energy resource in the world with the biggest growth potential in California over the next decade. Los Angeles could meet 12.2% of its energy needs from wind by adding 460 MW by 2012.
- Geothermal plants are the largest source of renewable energy in California. Los Angeles could meet 6.4% of its energy

needs by adding 250 MW of new geothermal capacity at a price competitive with natural gas.

- Solar thermal power plants could theoretically generate enough energy in a 100 square mile patch of desert to power the entire country. Los Angeles could easily generate 0.8% of its 2012 expected demand through solar thermal with a new capacity of 60 MW.
- Los Angeles is one of the most insular regions in the country. By developing just 3% of its solar photovoltaic potential citywide (117 MW), Los Angeles could power twenty thousand homes, or 0.6% of its energy demand, by 2012.

### **2012 Potential New Renewable Energy Development for Los Angeles**

	MW	GWh	% of Demand
Wind	460	4000	12.2
Geothermal	250	2100	6.4
Solar Thermal	60	260	0.8
Solar PV	117	180	0.6
Total	887	6540	20

### **Moving to an energy mix more reliant on renewables will have a number of economic and environmental benefits.**

- A diversified energy portfolio reduces the risk of price spikes and blackouts due to market manipulation and supply shortages.
- Renewable energy creates four to eleven times as many jobs as conventional technologies.
- Los Angeles could reduce its smog-forming pollution by 1,000 tons each year and its global warming emissions by 3.7 million tons – the equivalent of removing 700,000 cars from the road.

**Many states and municipalities are already taking advantage of these renewable energy resources.**

For example, California recently passed a law mandating 20% of the energy sold by investor owned utilities come from renewable resources by 2017. San Francisco is installing 90 MW of new solar and wind power developments.

**Los Angeles is in a unique position to shift its current energy policy toward renewable energy.**

- The City of Los Angeles owns and manages the largest public utility in the country, the Department of Power and Water (DWP).
- Los Angeles is the third largest user of electricity in California.
- Los Angeles can enter into long-term contracts or use other pricing structures to spread startup costs over a long period of time to realize all the benefits of renewable energy.

**Policy Recommendations**

Based on the findings of this report, CALPIRG recommends the City of Los Angeles become a world-wide clean energy leader with policies that clearly put it on a clean, efficient and renewable energy path.

1. Los Angeles should start by establishing an enforceable baseline goal of generating 20% of its electricity from renewable resources by 2012. Once this 20% floor is set, the city has many other policy options that will help lower demand, minimize dependence on foreign fuel supplies and protect public health and the environment.
2. Conservation and Efficiency: Los Angeles should exploit all cost-

effective conservation and energy efficiency technologies with a minimum goal of meeting all growth in demand through conservation, energy efficiency, and renewable energy.

3. Phase Out Fossil Fuel and Nuclear Power: At a minimum, Los Angeles should refrain from investing in, or signing contracts with, new or expanded fossil fuel or nuclear facilities.
4. Government Purchasing: Los Angeles should build new renewable energy resources in the City to directly provide electricity for municipal buildings.
5. Promote Micropower: Los Angeles should remove all barriers to, and expand incentive programs for, renewable micropower such as solar PV, fuel cells and small wind turbines.
6. Environmental Performance: Los Angeles should issue an environmental performance report documenting the average level of pollution per megawatt of power sold and establish a goal of reducing these emissions over time.
7. Public Education: Los Angeles should expand upon its programs to educate the public on the need for, and the benefits of, renewable energy.

## Introduction: The Need for Renewable Energy

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Los Angeles is at a critical energy crossroads. The choice facing Los Angeles consists of staying on a path of dirty, unsustainable and dangerous energy resources or, shifting to a clean energy path that exploits the abundant, renewable and reliable energy resources available today.

Los Angeles currently relies heavily on fossil fuels and nuclear power. As we have seen statewide, these resources lead to unstable prices, environmental damage and a dangerous reliance on foreign supplies of fossil fuels.

- Los Angeles emits over 1,000 tons of smog-forming pollution from power plants located in the Los Angeles air basin each year.<sup>1</sup>
- Over 18 million tons of greenhouse gases (CO<sub>2</sub>) are emitted each year as a result of Los Angeles' heavy reliance on fossil fuels such as coal.<sup>2</sup>
- Almost 100 million curies of radioactive waste is generated each year through Los Angeles' reliance on nuclear power.<sup>3</sup>
- Plant shutdowns were the primary reason for blackouts during the 2000-2001 Energy Crisis. Outages of 12,000-14,000 MW caused power shortages of 300-500 MW.<sup>4</sup>

Los Angeles could, in contrast, supply its energy needs through available energy technologies such as wind, geothermal and solar. Doing so would benefit Los Angeles in several ways:

- Renewable energy is inexhaustible, and beyond construction and maintenance costs, free. It is less susceptible to market manipulation and supply shortages.

- Renewable energy is environmentally friendly, creating no pollution at the point of generation.
- Renewable energy technologies generate more jobs per kilowatt-hour than conventional energy technologies such as natural gas power plants.
- Development of renewable energy technologies could attract new investment capital to Los Angeles.

Despite the many advantages of renewable energy, a few factors have kept Los Angeles from exploiting these energy resources.

In the past, renewable technologies were still developing, and were less reliable than conventional sources. Renewable energy often carried higher price tags than the highly subsidized fossil fuel and nuclear industry.

In recent years, however, these obstacles have begun to fade away. Renewable energy such as wind and geothermal have become cost competitive with natural gas and widely viewed as a critical piece of a diversified energy strategy.

This report examines the sources that currently provide Los Angeles with electricity and the near-term potential for increased reliance on renewable energy.

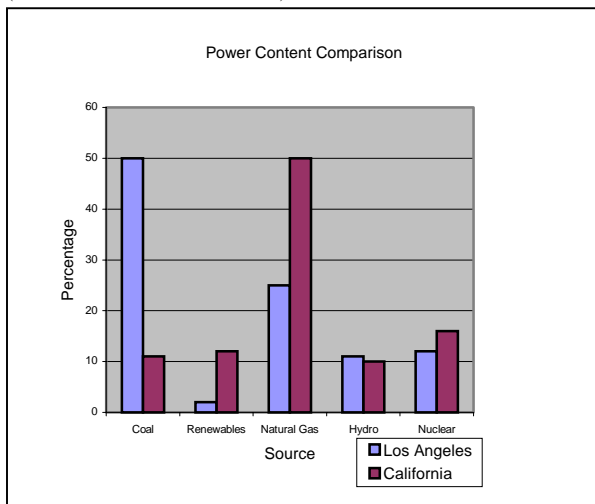
The report is divided into three sections. *Chapter One* examines Los Angeles' current energy mix and its environmental and public health impacts. *Chapter Two* reviews the renewable energy resources available to Los Angeles. *Chapter Three* outlines the economic and environmental benefits of shifting toward clean, renewable energy. Lastly, the report offers policy options available to Los Angeles to increase its use of renewable energy and become a worldwide leader of efficient, innovative and clean energy policy.

# Chapter 1: Current Electric Generation in Los Angeles

## 1.1 Current Energy Resources

The City of Los Angeles owns and operates the Department of Water and Power (DWP), the largest municipal utility in the country. Charged with the responsibility of providing electricity and water for Los Angeles, net profits from the sale of electricity become revenue for the City. Through the approval of annual reports and plans, the Los Angeles City Government helps guide the future policy direction for the Department.

**Figure 1-A: 2001 DWP and CA Generation Mix**  
(Source: DWP Power Content Label)



In 2000, DWP generated 27,389 Gigawatt hours (GWh) of electricity, servicing over one million residential and commercial customers.<sup>5</sup> 75% of this energy came from burning fossil fuels: 50% from coal and 25% from natural gas. Approximately 12% came from nuclear power and 11% from large-scale hydroelectric power. Biomass and small-scale hydroelectric power accounted for approximately 2% of DWP's total electric generation.<sup>6</sup>

By comparison, the California statewide energy resources average is 61% from fossil fuels (predominantly natural gas), 16% from

nuclear power and 11% from large-scale hydroelectric power. A combination of solar, wind, geothermal and small-scale hydroelectric power makes up 12% of the state's renewable energy resources.<sup>7</sup>

### Note on Units

Megawatts (MW) is a unit of measurement indicating how fast a plant can put out electrons. This is the standard measure of the generating capacity of a power plant. It is also used to determine if the total generating capacity on the grid is enough to satisfy demand at any one time. Megawatt-hours (MWh) is a unit measuring the total amount of electrons produced over some time frame. A 50 MW power plant operating at full capacity for one hour produces 50 MWh of electricity. This is the appropriate unit for talking about how much of the city's electricity was produced by various sources in a given time frame. To measure how much such a plant operating at full capacity would produce in one year, simply multiply the capacity by the number of hours in a year (50 MW x 8,760 hrs/yr = 438,000 MWh/yr). 1,000 MWh equals one gigawatt-hour (GWh).

### Coal

DWP uses less renewable energy and more coal power than is averaged throughout California. DWP's electricity comes from three coal-fired power plants: Intermountain Power Plant near Delta, Utah, Navajo Generating Station near Page, Arizona, and Mohave Generating Station in Laughlin, Nevada. DWP owns a share of each of these power plants giving it a combined generating capacity of 1,744 MW.<sup>8</sup>

**Table 1-1: DWP Coal-fired Generation Capacity**

(Source: DWP 2000 Integrated Resources Plan)

Name of Plant	Location	Share	DWP Capacity
Intermountain	Utah	66.8%	1109 MW
Navajo	Arizona	21.2%	477 MW
Mohave	Nevada	10%	158 MW
Total Capacity			1744 MW

## Natural Gas

DWP owns and operates four natural gas-fired power plants within the Los Angeles air basin: Harbor, Haynes, Scattergood, and Valley. These four plants have a combined capacity of 2,925 MW, more than DWP's coal-fired capacity. Several of these units, however, do not run fulltime; they operate as "peakers", meant for use only during extreme peak periods of demand such as hot summer afternoons.<sup>9</sup>

**Table 1-2: DWP Gas-fired Generation Capacity**  
(Source: DWP 2000 Integrated Resources Plan)

Name of Plant	Location	Capacity
Harbor	Wilmington	267 MW
Haynes	Long Beach	1532 MW
Scattergood	Playa Del Rey	803 MW
Valley	Sun Valley	323 MW
Total Capacity		2925 MW

## Nuclear

DWP has a partial interest in the Palo Verde Nuclear power plant located in Tonopah, Arizona. Through a combination of direct ownership and participation in the Southern California Public Power Agency (SCPPA), DWP gets 12% of its energy from 368 MW of nuclear power.<sup>10</sup>

**Table 1-3: DWP Nuclear Generation Capacity**  
(Source: DWP 2000 Integrated Resources Plan)

Name of Plant	Location	Share (ownership + SCPPA)	DWP Capacity
Palo Verde	Arizona	9.4 % (5.7% + 3.7%)	368 MW

## Hydroelectric, Biogas and Solar PV

DWP currently generates less than one percent of its electricity from a mixture of small-scale hydroelectric dams, biogas and solar photovoltaic panels. The small hydropower comes mainly from generating units located along the Los Angeles Aqueduct system. DWP generates electricity from a biogas plant located at the Hyperion Waste Treatment plant. A total of 1 MW of electricity is generated through solar photovoltaic panels located throughout the

City of Los Angeles.<sup>11</sup>

**Table 1-4: DWP Hydroelectric, Biogas and Solar PV**  
(Source: DWP 2000 Integrated Resources Plan)

Source	Location	Capacity
Small Hydro	Los Angeles Aqueduct	54 MW
Biogas	Hyperion Waste Treatment	20 MW
Solar	Distributed Generation	1 MW
Total Capacity		75 MW

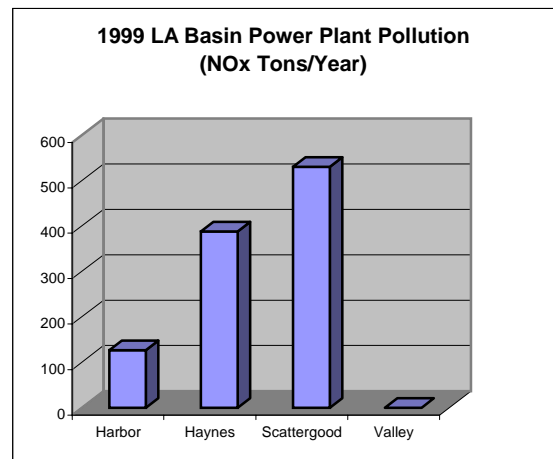
## 1.2 Public Health and Environmental Impacts of DWP Power Generation

### Air Pollution

DWP's four natural gas power plants contribute to Los Angeles' persistent and severe air quality problems. Prior to the re-powering of certain units, the California Air Resources Board (CARB) reports the following 1999 emission statistics:<sup>12</sup>

- 1,045 tons nitrogen oxides (NO<sub>x</sub>), the leading smog-forming pollutant in Los Angeles.
- 10.5 tons sulfur dioxide (SO<sub>2</sub>) that causes asthma attacks and premature death.
- 47.5 tons particulate matter (PM), also known to trigger asthma attacks and cause death.

**Figure 1-B: DWP In-Basin NO<sub>x</sub> Pollution**  
(Source: California Air Resources Board, 1999 Data)



DWP's coal-fired power plants also negatively impact air quality. In 1997, the Department of the Interior sent a letter to the Federal Environmental Protection Agency stating its belief that air visibility in the Grand Canyon was impaired, due in part to emissions from the Mohave Generating Station.<sup>13</sup>

In 1999, DWP emitted 18 million tons of CO<sub>2</sub>, the primary global warming gas.<sup>14</sup> This is equivalent to the emissions produced by approximately 3.6 million cars.<sup>15</sup> The electricity delivered to L.A. releases 75% more greenhouse gas emissions than the generic electricity sold to the majority of Californians.<sup>16</sup>

The potential impacts of climate change in Los Angeles include:

- Severe weather patterns, including droughts and floods
- Coastal erosion
- Crop failures
- Increased fires, especially at rural-urban interfaces

#### *Sensitive Areas*

Dependence on fossil fuels necessitates ongoing land exploration and resource extraction. As the easy-to-access areas dry up, more and more sensitive areas are opened for additional reserves.

Areas that the fossil fuel industry would like to open for drilling:

- California Coast
- Arctic National Wildlife Refuge
- Rocky Mountains
- Arches National Park

#### *Nuclear Waste*

Nuclear waste is considered the most dangerous substance known to humans. The process of splitting atoms to generate

electricity creates thousands of curies of radioactive waste that remain deadly for over 100,000 years.

Radioactive waste poses ongoing and unresolved security and safety issues surrounding its storage, transportation and disposal. There is currently no safe method of disposing nuclear waste. The Bush Administration backs a plan to transport nuclear waste to a storage site in Yucca Mountain, Nevada. This site faces insurmountable problems such as 33 known earthquake faults and an underground drinking water aquifer.

The Palo Verde Generating Station annually produces 200 fuel assemblies containing 88 metric tons of uranium and a fission product inventory of 990 million curies.<sup>17</sup> As a partial owner and contractor of this nuclear power plant, DWP is responsible for generating 9% of this waste, or 89 million curies of highly radioactive waste.

## Chapter 2: Potential for Renewable Energy in Los Angeles

Los Angeles is surrounded by an abundance of renewable energy resources. Instead of relying on foreign and out-of-state fuel supplies<sup>18</sup>, Los Angeles could tap into the region's growing supply of renewable resources, generating 20% of its energy from renewable energy by 2012.

### 2.1 Local and State Energy Loads

The California Energy Commission (CEC) reports that the statewide energy load in 2000 was 263,493 GWh.<sup>19</sup> During this same year, Los Angeles generated around 27,000 GWh – approximately 10% of statewide energy load.

The CEC predicts, under the most likely scenario, that statewide consumption will rise to approximately 327,000 GWh in 2012 without further advances in conservation or energy efficiency.<sup>20</sup> A conservative estimate, therefore, of DWP's energy load in 2012 would be for it to remain approximately 10% of the state energy load, or 32,700 GWh. Based on conservative estimates, this demand could require an additional 600 MW of new capacity for a total generating capacity of 5,725 MW.<sup>21</sup>

This report assumes Los Angeles maintains its expected growth in demand, remaining at 10% of statewide demand. The report then takes a look at the statewide potential for new renewable energy development and assumes Los Angeles could feasibly develop, or contract with, 10% of this new development.

In other words, this report shows that by 2012 there will be 65,480 GWh (8870 MW capacity) of new potential renewable energy development in California. The report then assumes that Los Angeles could be expected to develop at least 10% of that total, or 6,548 GWh (887 MW).

### 2.2 Potential for Renewable Energy by Source

**Table 2-2: 2012 Potential New Renewable Energy Development for Los Angeles**

	MW	GWh	% of Demand
Wind	460	4000	12.2
Geothermal	250	2100	6.4
Solar Thermal	60	260	0.8
Solar PV	117	180	0.6
Total	887	6540	20

#### *Wind*

A wind turbine consists of a rotor, an electrical generator, a speed control system, and a tower. When the wind blows and spins the propellers of the turbine, the kinetic energy of the wind is converted to mechanical power that drives the electrical generator. Wind turbines can operate alone to satisfy the electrical needs of a home or they can be grouped together in a wind farm to feed electricity to the utility grid.

Individual turbines vary in size. A small one stands about 30 feet high with propellers between 8 and 25 feet in length. The largest ones stand 20 building stories high with propellers over 300 feet in length.

In 1998, scientists at the Lawrence Berkeley National Laboratory (LBNL) analyzed all previous wind resource studies and found that California's 36 best wind sites could generate an average of 10,000 MW. An economic analysis of potential development demonstrated that construction could come sooner rather than later. By the year 2010, 3,000 MW of new wind power could be operational at less cost than other energy resources. At an added cost of 2 cents/kWh over conventional power, an additional 1,600 MW of wind power could be developed for a total of 4,600 MW of new capacity.<sup>22</sup>

A capacity of 4,600 MW of new wind power would generate approximately 40,000 GWh/yr of electricity by 2010. If Los Angeles

developed 10% of this potential by 2012, or 4,000 GWh/yr, it could meet 12.2% of its projected 2012 load with 460 MW of new capacity.

Since this LBNL analysis, the outlook for natural gas has changed dramatically, with expected increases in volatility and prices. For this reason, these predictions for wind should be taken as very conservative estimates. It is likely that there will be no price premium for this amount of wind power development in the next decade.

CASE STUDY: The Tehachapi Pass, 100 miles North of Los Angeles, has some of the best wind resources in the world. Home to approximately 5,000 wind turbines, Tehachapi Pass generates approximately 1,400 GWh of electricity a year, making it the world's largest wind farm. The energy from Tehachapi is currently sold to Southern California Edison. With minor upgrades in transmission lines, this energy could be available to Los Angeles.<sup>23</sup>

### *Geothermal*

Geothermal plants are the largest source of renewable energy in California. Geothermal energy is the heat that flows constantly from the center of the earth where temperatures are believed to reach about 4,000° Celsius. The thermal energy in the uppermost six miles of the earth's crust amounts to 50,000 times the energy of all oil and gas resources in the world.<sup>24</sup>

Hydrothermal resources are reservoirs of steam or hot water. Dry steam geothermal power plants tap reservoirs of steam and feed the steam directly to an electricity-generating turbine. Flashed-steam geothermal power plants are more common. Hot water from the reservoir is delivered through a well to the surface. As the pressure is reduced, most of the hot water "flashes" to steam. The steam is fed to the turbine, and the remaining fluid is pumped back into the reservoir.

The California Energy Commission estimates that the state has the potential for an additional 4,000 MW of geothermal generating capacity using current technology. As technology

increases, so will the amount of energy generated from geothermal sources. Already, the best resource areas can be developed at a cost lower than natural gas power plants.

According to the Geothermal Energy Association, California has the potential to boost output from existing plants in the near term by 300-600 MW and can develop up to 1,000 MW at known but undeveloped reserves at each of three locations – the Salton Sea, northern California, and the Geysers area north of San Francisco – for a total of 3,600 MW which can be practically developed using today's technology.<sup>25</sup>

CASE STUDY: The Geysers Power Plant in Northern California has been operating since 1960. The plant has a capacity of 1,700 MW, making it the largest geothermal generation facility in the world. At the Geysers, energy is sold for approximately 3 cents/kWh, one of the country's lowest energy prices.<sup>26</sup>

Given these predictions and the low cost of geothermal energy production under favorable conditions, it is reasonable to expect at least 2,500 MW to come online by 2012, generating 21,000 GWh/yr.<sup>27</sup> If DWP contracted for 10% of this (250MW), or 2,100 GWh/yr by 2012, Los Angeles could meet 6.4% of its energy needs with geothermal energy at a cost of 3-7¢ per kilowatt/hour – a price that is competitive with natural gas.<sup>28</sup>

### *Solar*

Los Angeles' solar potential is enormous. The southern portion of the state has some of the nation's best resources for concentrating solar power and effectively using photovoltaic systems.

Solar energy is an ideal resource for Los Angeles, since solar power peaks at the same time Los Angeles' energy demand peaks – in the heat of summer afternoons. Every increase in solar energy capacity will directly help the City when it needs it most. By addressing peak demand, increases in solar energy capacity will avoid unneeded electricity production from polluting plants that often have to operate beyond peak hours

due to slow start-up and shutdown procedures. Solar also helps prevent expensive transmission and distribution infrastructure costs.

*Solar Thermal*

Solar thermal plants use parabolic trays to focus the sunlight and turn it into heat that is used to drive turbines. These plants could theoretically generate enough sunlight in a 100 square mile patch of desert, such as southern California’s Mohave Desert, to generate enough electricity for the entire country.<sup>29</sup>

CASE STUDY: The SEGS (Solar Energy Generating Station) Plants sit in the Mojave Desert. The plants range in size from 4 to 80 MW, with a combined capacity of 354 MW. This constitutes over 90% of the solar thermal electricity generation in the world.<sup>30</sup>

Solar experts believe that a workable size for solar thermal plants by 2012 will be 200 MW per plant. Just three new plants, therefore, would produce 600 MW by 2012. If DWP owned 10% of these resources, they could generate about 260 GWh/year (60 MW capacity), or 0.8% of 2012 demand.

*Solar Photovoltaic*

Photovoltaic panels (PV) convert sunlight directly into electricity without the use of any moving parts. The basic building block of this technology is the photovoltaic cell, which is made of semiconductor materials. Cells can be connected together to form modules, and modules can be connected to form arrays.

A few PV cells will power a hand-held calculator or wristwatch while interconnected arrays can serve as a power plant contributing electricity to a city through an existing infrastructure of power lines. PV is a truly unique technology with many advantages.

- **Simplicity** – With few to no moving parts, operation and maintenance costs are minimal and breakdowns are rare.

- **Versatility** – PV can connect to the existing grid infrastructure or can operate remotely; many systems are easily transported.

- **Reliability** – First developed for U.S. satellites in the 1950s and now with over 40 years of technical advances improving performance, PV is considered to have “unmatched reliability.”

- **Sustainability** – PV shares the two advantages common to all renewable energy sources: it has a low environmental impact and the fuel is free and limitless.

The potential for solar energy in Los Angeles can be measured by approximating the number of buildings in the city and the size of systems they could support. The LA County Assessor reports in their 2002 Annual Report over 750,000 buildings in Los Angeles.<sup>31</sup>

**Table 2-2: Number of Buildings in Los Angeles**  
(Source: 2002 LA County Assessor report)

Single Family	Residential Income	Commercial-Industrial	Total
579,708	107,417	67,016	754,14

The National Renewable Energy Laboratories (NREL) estimates that residences can support a 1 kW system, and commercial-industrial buildings can support a 50 kW system, on average.<sup>32</sup> Thus, Los Angeles buildings could support 3,900 MW of PV.

Los Angeles, with its annual daily average of 5.5 hours of available sunlight, could produce 6,000 GWh of electricity/year (mostly produced at during hours of peak demand).<sup>33</sup> If just 3% of this capacity were developed by 2012, it would produce around 180 GWh/year (117 MW) of electricity in Los Angeles. This would provide another 0.6% of the city’s load demand, powering 20,000 houses. These are conservative numbers compared to the California Department of Water Resources figures estimating that 100,000 rooftop PV systems could be installed by 2010 in Los Angeles.<sup>34</sup>

### **2.3 Los Angeles Transmission Capacity**

DWP owns extensive transmission lines connecting Los Angeles with energy resources throughout the west. These transmission lines transport power from generation areas to DWP customers. The DWP transmission system currently has the capacity to transmit an additional 800 MW into the Los Angeles basin without incurring other system reliability issues.<sup>35</sup>

DWP's transmission system is connected to resources and electricity grids in Utah, Nevada, Arizona, Southern California, Northern California, California-Oregon border, and Owens Valley. This transmission system allows Los Angeles to tap into the abundant renewable resources available in these regions.

### **2.4 Current Renewable Energy Capacity in California**

Renewable energy, once thought of as a technology for tomorrow, has become a viable source of energy today. Renewable resources are lighting homes, running appliances, and powering functions for millions of California residences and businesses. In fact, the energy from renewables currently provides California with about 12% of all its energy demand at competitive prices.

#### *Wind*

Wind power is the fastest growing energy source worldwide. New wind power capacity grew by 24% annually throughout the 1990s, with a growth rate of 37% in 1999 and 28% in 2000. California now has more than 16,000 wind turbines that generate an average of 400 MW of electricity.<sup>36</sup>

The largest operating wind farms in California are located on Altamont Pass, San Geronio Pass, and Tehachapi Pass.

#### *Geothermal*

Geothermal plants are the largest source of renewable energy in California with a current

capacity of 2,200 MW, producing nearly 6% of the state's electricity. The geothermal industry includes fifteen companies and associations with operations in California, six of which own more than 100 MW of generating capacity. Geothermal fields produce electricity in Lassen County, Lake County, Coso, Mammoth, and the Imperial Valley.<sup>37</sup>

#### *Solar*

The market for photovoltaic (PV) panels and solar thermal technology has been growing since the 1990s. The market for PV modules grew by 15% annually in the 1990s and by 40% in 2000, reaching \$1 billion in sales annually.<sup>38</sup>

In California, there is approximately 15 MW of installed solar PV capacity, including 7 MW in the Sacramento Municipal Utility District (SMUD), and another 8 MW scattered throughout the state.<sup>39</sup> Solar panels in Los Angeles currently total approximately 1 MW of generating capacity.

California has nine parabolic trough solar thermal plants, all in San Bernardino County, operated by three separate companies. The plants range in size from 4 to 80 MW, with a combined capacity of 354 MW. This constitutes over 90% of the solar thermal electricity generation in the world.<sup>40</sup>

### **2.5 State and Local Renewable Energy Initiatives**

A number of cities and states are moving to increase their investments in renewable energy. State and municipal governments have adopted varying strategies, including direct procurement, rebates and incentives, and renewable portfolio standards.

#### *State of California*

On September 12, 2002, Governor Davis signed into law the most aggressive renewable energy strategy in the country. The law requires that by 2017, 20% of all energy

provided by the state's Investor Owned Utilities (IOUs) come from renewable resources.<sup>41</sup>

#### *City of San Francisco*

In March of 2002, the voters of San Francisco approved two measures, "B" and "H," to increase investment of renewable energy in San Francisco. Measure B calls for San Francisco to issue bonds to install 40 MW of renewable energy in the city: 30 MW from wind and another 10 MW from solar PV. Measure H will provide financing and incentives to purchase and install another 50 MW of solar power on San Francisco rooftops. Together, these measures will provide approximately 90 MW of renewable power.<sup>42</sup>

#### *City of San Diego*

The City of San Diego was among the hardest hit during the California energy crisis of 2000/2001. San Diego spent \$18 million more on energy in FY 2001 than in FY 2000 as a result of the sudden increase in energy prices.<sup>43</sup> Investing in renewable energy and efficiency measures is one way to stabilize prices, save money, and achieve energy independence. The City of San Diego has decided to invest in these energy options, and is currently conducting a feasibility study to determine the extent of its potential investment.

#### *City of Seattle*

On July 20, 2001, the City of Seattle's public utility, Seattle City Light, adopted a program to meet 100% of its demand growth through efficiency and renewables. Seattle City Light has already divested its share of a coal-fired power plant, and will purchase 100 MW of new renewable energy throughout the next decade. Through its promotion of efficiency and renewables, Seattle City Light hopes to triple the goals set out by the 1997 Kyoto protocol and reduce CO2 emissions by over 20%.<sup>44</sup>

#### *City of Chicago*

The City of Chicago has moved to increase the renewable energy used by municipal facilities. Already, 10% of the city's energy comes from renewable sources, a proportion that will rise to 20% by 2005.<sup>45</sup>

#### *State of Texas*

In 1999, then Governor George W. Bush signed a Renewable Portfolio Standard that mandated 2,000 MW of clean energy be sold in Texas by 2009. As utilities have begun to purchase this renewable energy, primarily from wind farms, they have realized its cost-effectiveness and reliability. Already, Texas is more than halfway to its goal, and has become one of the largest wind users in the world, and is ahead of schedule.<sup>46</sup>

## Chapter Three: Benefits of Renewable Energy

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Renewable energy benefits the environment by minimizing the release of pollution into the air and water. Developing renewable energy has economic benefits, as well, in terms of creating new jobs, attracting new investment, and ensuring greater energy reliability and independence.

### 3.1 Emissions Offsets

Increasing renewable energy to 20% by 2012 in Los Angeles would significantly reduce air pollution.

In 1999, DWP's emissions of CO<sub>2</sub>, the primary global greenhouse gas, totaled 18 million tons.<sup>47</sup> If DWP continues to meet expected demand with its current energy mix, CO<sub>2</sub> emissions would increase to approximately 21 million tons by 2012.<sup>48</sup>

Furthermore, if DWP were to meet its expected demand growth by constructing new gas plants, Los Angeles could see 600 MW of new gas-fired capacity emitting an additional 998,000 tons of CO<sub>2</sub>.<sup>49</sup> (This number assumes Los Angeles replaces increased demand with natural gas as opposed to new coal.)

If, however, Los Angeles chooses to phase out dirty resources and move toward renewable energy it could meet new demand and replace current generation, reducing CO<sub>2</sub> emissions to 17.3 million tons. This is an annual reduction of 3.7 million tons/year and equivalent to removing around 700,000 cars from the road.<sup>50</sup>

Increasing the use of renewable energy would also reduce smog-forming pollution. The California Air Resources Board estimates that every MWh of energy generated in California produces an average of .37 lbs of NO<sub>x</sub>. If DWP uses traditional sources to meet new demand, this would result in an increase of 925 tons of NO<sub>x</sub> emitted every year.<sup>51</sup>

In contrast, generating 20% from renewables would avoid these new emissions, replace existing capacity, and reduce overall emissions by over 1,000 tons per year.<sup>52</sup>

### 3.2 Increased Jobs

Investing in renewable energy technology can generate jobs locally. These jobs can provide employment in areas such as construction, maintenance, operations, and the high-tech sector.

In general, renewable energy technologies provide more jobs per MW than gas-fired power plants. For example, wind power typically provides 70% more jobs than gas, and solar technologies provide twice as many jobs. Job creation from geothermal energy is 11 times higher than from natural gas.<sup>53</sup>

### 3.3 Lower Generating Costs

Investment in renewable energy has been hampered by relatively high upfront capital costs. For example, a natural gas plant is less expensive to construct than a wind farm of equivalent capacity. However, in the long run renewable energy is extremely cost competitive for a number of reasons:

- After the initial capital investment, the fuel is free.
- Unlike fossil fuels, renewable "fuel" cannot be manipulated, reducing the potential for extreme price spikes.
- Generating energy from fossil fuels and nuclear power puts an external strain on the economy in added health and environmental costs from pollution, reduced production of crops and fisheries, degraded structures, and lost recreational opportunities. Taking these externalized costs into account can add almost 3 cents/kWh to the cost of

natural gas and 6 cents/kWh for nuclear energy.<sup>54</sup>

Spreading out costs over the long-term and including externalized costs in the price of conventional energy sources makes renewable energy a more attractive investment.

Los Angeles has the capability to enter into long-term contracts or use other pricing structures to spread startup costs over a long period of time and realize all the benefits of renewable energy.

### 3.4 Increased Reliability

The best strategy to improve long-term reliability in any investment is to have a diversified portfolio. This approach is essential, regardless of whether the portfolio consists of stocks or of energy resources. In California relying too heavily upon a single fuel source leaves the state open to manipulation by suppliers. Adding renewable energy sources to Los Angeles' portfolio will lead to a higher overall diversity, decreasing the impact of potential price spikes or supply shortages.

Additionally, renewable resources have a higher availability factor than do natural gas or nuclear power plants. The availability factor measures the percentage of time a generating unit is available to produce power. Natural gas plants have an availability factor of 90%, while nuclear plants have a factor of just 86%. Renewable sources, in contrast, have availability factors of 98% for wind, 95% for geothermal, 96% for solar PV, and 93% for solar thermal.<sup>55</sup>

### 3.5 Decreased Construction Time

It takes less time to build a renewable energy generation facility than a conventional power plant of equivalent capacity. Renewable energy plants can come online and begin generating energy in under two years compared to three years for natural gas plants or nine years for nuclear power plants.<sup>56</sup>

**Table 3-1: Construction Times For Energy Sources**

Technology	Time needed to put 300 MW onlin
Wind	1.5 years
Geothermal	2 years
Natural gas	3 years
Solar	4 years
Coal	5 years
Nuclear	9 years

## Policy Recommendations

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Los Angeles is at a critical energy crossroads with unprecedented opportunities for the city to make a decided shift toward renewable energy.

On September 12, 2002, Governor Gray Davis signed a bill requiring the investor owned utilities, Southern California Edison, San Diego Gas and Electric, and Pacific Gas and Electric, to double their investments in renewable energy over the next fifteen years.

Other California cities, such as San Francisco, are beginning to seriously invest in solar power, energy efficiency and wind turbines in order to save money, increase energy independence and protect the environment.

These activities are creating a newly burgeoning market for renewable energy. Instead of being an exotic and expensive resource, renewable technologies such as wind, geothermal and solar are widely available, affordable and reliable.

Los Angeles is in a unique position to choose this smart, clean energy path. Unlike most California cities, Los Angeles has complete control of its electricity supply. As the largest municipal utility in the country, and the third largest utility in California, Los Angeles can improve its economy, the environment and public health, and increase its energy independence. Rather than getting left behind, Los Angeles should move now to increase its renewable energy investments.

### *Renewable Energy Investments*

CALPIRG recommends the City of Los Angeles set an enforceable goal of generating at least 20% of its energy from renewable resources by 2012.

DWP could meet this standard through a mix of Department-owned resources, long-term contracts, and incentives for customer-owned generation.

Once this 20% floor is set, there are a number of other policy options Los Angeles could adopt to reduce its reliance on dirty energy sources and continue to make its overall energy program more efficient, clean and reliable.

### *Conservation and Efficiency*

Los Angeles should identify and implement all cost-effective ways to increase conservation and energy efficiency. At a minimum, Los Angeles should meet 100% of its growth in demand through a mix of conservation, energy efficiency, and renewable energy. This will increase the percentage of renewables relative to other energy sources, and benefit overall portfolio diversity.

### *Phase Out Fossil Fuel and Nuclear Power*

Los Angeles should not invest in, or contract with, any new or expanded fossil fuel or nuclear facilities. It should begin to phase out its investments in existing coal and nuclear investments.

### *Government Purchasing*

Los Angeles should build new renewable energy generating facilities, such as solar panels and windmills, to directly power municipal buildings and facilities.

### *Promote Micropower*

Small-scale renewable energy resources, such as solar PV, have a new capability that no traditional energy source to date has ever had. Not only can they operate like traditional power plants dispatching their power through the transmission system, they can also generate power for on-site use. This is a tremendous benefit that will reduce energy lost through transmission and prevent expensive upgrades in transmission and distribution infrastructure.

DWP should remove all barriers to and increase incentives for these emerging, renewable sources of micropower. Such policies would include streamlining the interconnection process, provide for lower rates and eliminate fees that create disincentives for the cleanest sources.

In addition, DWP should allow customers who generate their own electricity through solar PV or wind to transfer credits earned in one time period to offset consumption in another.

### *Environmental Performance*

DWP should issue an annual environmental performance report that documents the average level of air pollutants per megawatt of power sold. This report should provide data for NO<sub>x</sub>, PM, SO<sub>2</sub>, CO<sub>2</sub>, and radioactive waste and be available to the public. Additionally, DWP should set goals for steady reductions in each of these pollutants, and report annually on progress in meeting more goals for improved environmental performance

### *Public Education*

Los Angeles should continue to invest in public outreach and education of the benefits of, and opportunities for, purchasing renewable energy.

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<sup>1</sup> Department of Water and Power, *2000 Integrated Resource Plan*, B-1.

<sup>2</sup> Department and Water and Power, *2000 Integrated Resource Plan*, 17.

<sup>3</sup> APS, *Environmental, Health, and Safety Report*, downloaded from <http://environmental.aps.com/performance/waste.asp>.

<sup>4</sup> From CEC, Statewide Average Daily Forced or Scheduled Megawatts Off-Line by Month, 14 May 2001; Total capacity is 42,113; from CAISO 2001 Summer Assessment, 22 March 2001. Historic average from CEC, California Summer 2001 Forecasted Peak Demand – Resource Balance, 8 February 2001.

<sup>5</sup> Department of Water and Power, *Energy Services Facts In Brief*, downloaded from <http://www.ladwp.com/finance/esfib.htm>.

<sup>6</sup> Department of Water and Power, *Power Content Label*, downloaded from <http://www.ladwp.com/power/contentlabel.htm>.

<sup>7</sup> California Energy Commission, 2000 California Power Content Label.

<sup>8</sup> DWP, *2000 Integrated Resource Plan*, B-1.

<sup>9</sup> Ibid.

<sup>10</sup> Ibid.

<sup>11</sup> Ibid.

<sup>12</sup> California Air Resources Board, *1999 Facility Information*, downloaded from <http://www.arb.ca.gov>.

<sup>13</sup> EPA, *Air Pollution Programs*, downloaded from <http://www.epa.gov/region09/air/mohave>.

<sup>14</sup> Department and Water and Power, *2000 Integrated Resource Plan*, 17.

<sup>15</sup> ICF Consulting, *Emissions Factors, Global Warming Potentials, Unit Conversions, Emissions, and Related Facts*, 9.

<sup>16</sup> David S. Freeman, *Making Los Angeles A Green Municipal Role Model*, in *Clean Power Journal*, Summer 1999.

<sup>17</sup> APS, *Environmental, Health, and Safety Report*.

<sup>18</sup> The California Energy Commission estimates foreign and out-of-state imports total 84% for natural gas alone. Information downloaded from [www.energy.ca.gov/html/energysources.html](http://www.energy.ca.gov/html/energysources.html)

<sup>19</sup> California Energy Commission fact sheet, 2000 Electric

Utility Consumption by Sector. Downloaded from [www.energy.ca.gov/electricity/consumption\\_by\\_sector.html](http://www.energy.ca.gov/electricity/consumption_by_sector.html).

<sup>20</sup> California Energy Commission, *Electricity Outlook Report*, 21. Downloaded from [http://www.energy.ca.gov/reports/2002-06-10\\_700-01-004F.PDF](http://www.energy.ca.gov/reports/2002-06-10_700-01-004F.PDF).

<sup>21</sup> Assumes equivalent run-time and reliability as 2000.

<sup>22</sup> O. Sezgen, C. Marnay, and S. Bretz, Lawrence Berkeley National Laboratory, *Wind Generation in the Future Competitive California Power Market*, March 1998.

<sup>23</sup> Downloaded from <http://www.tehachapi.com/wind/>.

<sup>24</sup> U.S. Department of Energy, *Geothermal Energy... Power from the Depths* (fact sheet), December 1997.

<sup>25</sup> B. Heavner, M. Zugel, D. Jacobson, *Affordable, Reliable Renewables*, CALPIRG Charitable Trust, 8.

<sup>26</sup> Downloaded from [www.eren.doe.gov/geothermal/geofaq.html](http://www.eren.doe.gov/geothermal/geofaq.html).

<sup>27</sup> *Affordable, Reliable, Renewables*, 7.

<sup>28</sup> \$26 billion Geothermal: U.S. DOE, *Geothermal Energy Program: Frequently Asked Questions*, downloaded from [www.eren.doe.gov/geothermal/geofaq.html](http://www.eren.doe.gov/geothermal/geofaq.html), 31.

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<sup>29</sup> *Affordable, Reliable, Renewables*, 10.

<sup>30</sup> Downloaded from [www.eren.doe.gov/troughnet/deployed.html](http://www.eren.doe.gov/troughnet/deployed.html).

<sup>31</sup> LA County Assessor, *Annual Report*, downloaded from <http://assessor.co.la.ca.us/news/rollrls.pdf>.

<sup>32</sup> Personal Correspondence with Heather Mulligan, DOE, 4 November 2002.

<sup>33</sup> Solarbuzz, *Consumer Facts*, downloaded from <http://www.solarbuzz.com/consumer/fastfacts.htm>.

<sup>34</sup> Lynn O'Dell, "Bright Spots on the Grid," *Los Angeles Times*, 17 June 2001.

<sup>35</sup> Department of Water and Power, *2000 Integrated Resources Plan*, F- 1.

<sup>36</sup> American Wind Energy Association, "Repowering California Wind Power Plants," *California Energy Commission 1994 Biennial Report*, 27 May 1993.

<sup>37</sup> CEC, *Database of California Power Plants*, 17 January 2001

<sup>38</sup> The Solarserver Forum for Solar Energy, *Intersolar 2001 Press Release*, 5 March 2001.

<sup>39</sup> Donald Osborn, "Putting the Sun to Work in Sacramento," *Solar Today*, May/June 2001.

<sup>40</sup> KJC Operating Company, *Recent Improvements and Performance Experience at the Kramer Junction SEGs Plants*, 1996.

<sup>41</sup> California SB 1078

<sup>42</sup> California Solar Center, downloaded from [www.californiasolarcenter.org/sfbond2001.html](http://www.californiasolarcenter.org/sfbond2001.html).

<sup>43</sup> City of San Diego Mayor's Office, *Dick Murphy's 10 Goals*. 7 March 2002. Downloaded from

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<sup>44</sup> City of Seattle, *Press Release, July 20, 2001*,

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<sup>45</sup> City of Chicago, *Press Release, 8 August 2002*, downloaded from [http://www.ci.chi.il.us/Mayor/2002Press/news\\_press\\_energycosts.html](http://www.ci.chi.il.us/Mayor/2002Press/news_press_energycosts.html).

<sup>46</sup> Public Citizen, *What Renewable Energy Means to Texas*, downloaded from <http://www.citizen.org/documents/ACF44D.pdf>

<sup>47</sup> Department of Water and Power, *2000 Integrated Resources Plan*, 17.

<sup>48</sup> *Ibid.*, 17.

<sup>49</sup> California Air Resources Board, *1999 Facility Information*, downloaded from <http://www.arb.ca.gov>.

<sup>50</sup> *Ibid.*

<sup>51</sup> *Ibid.*

<sup>52</sup> *Ibid.*

<sup>53</sup> B. Heavnor, S. Churchill, *Renewables Work*, CALPIRG Charitable Trust, 5.

<sup>54</sup> *Affordable, Reliable, Renewables*, 17.

<sup>55</sup> *Ibid.*, 13.

<sup>56</sup> *Ibid.*, 19.