Energy Choices:
Non-fossil vs. Fossil
The California Global Warming Solutions Act of 2006
Energy Policy Brief
Rich Ferguson, PhD
Research Director, CEERT

Updated 2/11/07
California has taken the first step toward limiting climate change by passing Assembly Bill 32 in 2006.

“By January 1, 2008, the state board [CARB] shall .... determine what the statewide greenhouse gas emissions level was in 1990, and approve .... a statewide greenhouse gas emissions limit that is equivalent to that level, to be achieved by 2020.”

• Part 3, § 38550 (Division 25.5, CA Health and Safety Code)
California emissions of greenhouse gases must decrease – not increase – to limit global warming.
Energy from fossil fuels causes 70% of California’s greenhouse gas emissions.
To meet California’s greenhouse gas reduction goals, the use of fossil fuels must decline.
Greenhouse gas emissions from electricity generation have grown rapidly since 1990.
Demand for electric energy will grow as California’s population increases.
How can California reduce the use of fossil fuels to meet its global warming goals while continuing to supply needed energy for its growing population?

California must increase reliance on its non-fossil energy resources. There is no other technically feasible and cost-effective option.
More of California’s electricity must be generated from non-fossil energy resources.

California Electricity by Fuel Type
AB 32 scenario - equal CO₂ emissions from coal and gas
(Billion Kilowatt-hours)

- Non-fossil
- Fossil
California electricity from non-fossil resources must increase rapidly to meet the AB 32 goals.
Commercially available non-fossil energy resources are:

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling water</td>
<td>Hydroelectricity</td>
</tr>
<tr>
<td>Atomic nuclei</td>
<td>Nuclear</td>
</tr>
<tr>
<td>Sunlight</td>
<td>Solar</td>
</tr>
<tr>
<td>Wind</td>
<td>Wind</td>
</tr>
<tr>
<td>Earth</td>
<td>Geothermal</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Biomass</td>
</tr>
</tbody>
</table>
Additional hydroelectricity or nuclear power is unlikely in California before 2020.

California rivers have already been dammed, and future water resources are at risk from climate changes. California has prohibited new nuclear plants until a solution is found to the radioactive waste storage problem. Permitting and construction of new hydroelectric or nuclear facilities could not be accomplished by 2020, even if these resources were available.
To limit climate change, California’s electricity increasingly will come from the sun, wind and the Earth.
Scenario sensitivities:
Increasing end use efficiency can reduce growth in electricity consumption.

This scenario assumes that the slight downward historical trend in per capita consumption continues.
Increasing efficiency decreases the new for new generation resources.

Adoption of electric vehicles would increase electricity demand but could reduce emissions from the transportation sector.
Scenario sensitivities:
Coal-fired power may decrease more rapidly than assumed.

This scenario assumes that emissions from coal and natural gas are reduced equally.
Greater reductions in the use of coal would allow more natural gas to be used while still meeting the climate change goals.
Scenario sensitivities:
The efficiency with which natural gas is used to generate electricity may increase.

This scenario assumes that 8,500 BTU of gas is required to generate one kilowatt-hour of electricity on average, and that that heat rate remains constant.

More efficient gas-fueled generation technologies are commercially available.

Widespread deployment of efficient fuel cell technologies could reduce emissions substantially.

Combined heat and power applications could reduce emissions in sectors other than electricity as well.
Sensitivities:
Carbon dioxide emissions from new coal-fired generation may be captured and ‘sequestered’.

This scenario assumes that emissions of greenhouse gases per kilowatt-hour of electricity from coal-fired plants does not change. New technologies are being demonstrated for coal-fired power plants to capture and permanently store the carbon dioxide created.
The challenge facing California is to develop its non-fossil resources quickly enough.

California Electricity, Non-fossil Resources
AB 32 scenario - equal CO₂ emissions from coal and gas
(Billion Kilowatt-hours)

- Biomass
- Geothermal
- Wind
- Solar
- Nuclear
- Hydroelectricity
California Has Chosen Non-fossil Energy
The California Global Warming Solutions Act of 2006

California has chosen wisely.
In the future, the people of California will have –
- More energy from the sun, wind, and the Earth.
- Less energy from coal, oil and natural gas.

Working together, we can limit global warming.