



Energy Solutions

Renewable Energy

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David L. Stone
Senior Vice President
Chevron Energy Solutions

Chevron's Views on Energy

The "New Energy Equation"

Demand growth > supply growth

- Promote energy efficiency and conservation
- Promote new economic energy sources such as Renewable Power

Energy Efficiency and Renewable Power also reduce greenhouse gas emissions (globally)

Chevron's Renewable Energy Focus

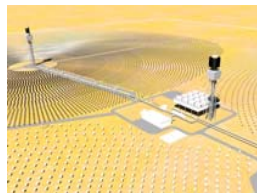
Invest in renewable energy technologies



CTV: Ocean Energy



CTV: Non-Conv Geothermal



CTV: Solar-to-Steam



CES: Fuel Cells



Global Power: Geothermal*



CTV: Biofuels



CES: Solar PV



Global Power: Wind

Chevron Energy Solutions

A business that helps other businesses and institutions improve energy efficiency and utilize alternative energy sources



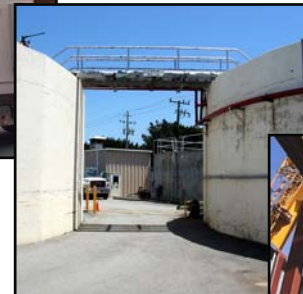
Wind Power



Solar Energy



Fuel Cells



Biomass



Cogeneration

Renewable Energy: Wind Power



Wind Power

- Economic if wind >15mph (24 kph)
- Large units 1,000 to 3,000kW each
- “Micro” units at 2kW each
- Can be issues with birds or bats
- Zero emissions

Renewable Energy: Solar Power



*Solar Power
(Photovoltaics)*

- Economic if there are good incentives or if used for remote power (no utility grid available)
- Photovoltaics are modular so can be **any** size
- Can be mounted on roofs or on the ground
- Zero emissions

Utility-Scale Solar PV Power Plants

- Large amounts of Solar PV can generate many Megawatts of power like a Utility Power Plant
- However, Concentrating Solar Power (CSP) is likely to be more economic for Utility-Scale solar power plants



Concentrating Solar Power



Solar Two, Source: Wikimedia Commons



Solucar Energia, Source: Solucar.es

- Concentrates the sun's rays on a collector tower using array of heliostat mirrors
- Thermal energy storage using molten salt can allow plants to run continuously during the summer
- Steam generated by tower can be used to create electricity
- Strong potential for long-term cost-effectiveness

Project Example: California

- 1,000kW solar photovoltaics
- 1,000kW fuel cell
- Energy Efficiency



Photo courtesy of PowerLight Corp.

Economics of Solar

- 1,000 kw Solar PV system example: California
 - Installed cost = \$7 million
 - Annual electricity production = 1.3 million kWh/yr
 - Annual savings = 1.3 million kWh/yr x \$0.15/kWh = \$195,000/yr
 - Simple payback = 36 years

- But with both the State and Federal Government incentives:
 - California Solar Incentive = ~34 c/kWh for 5 years = \$2 million
 - 30% Tax Credit & accelerated depreciation = \$2 million

Incentives can cut the cost in half

Future is **BRIGHT** for Renewable Energy

