

# Protecting San Diego County Wilderness through Underground Power Lines (Part 2)



**Bankhead Springs California, 3220 feet elevation, overlooking Interstate 8 west**

**Anthropological Nature Reserve, Research Center and Campgrounds. Proposed location for 160 foot high pylons to carry 500,000 volt power lines, in spite of the fact that underground power line alternatives are available that cost less to install than the high-impact, environmentally destructive overhead high-power lines being proposed, and the over 700 roads and clearings that would be bulldozed through this wilderness along the entire 150 mile route to establish maintenance routes. The damages to this exceptional wilderness could never be restored.**

# Protecting 22 miles or all of San Diego County's remaining Wilderness areas, Underground Power Line Alternatives

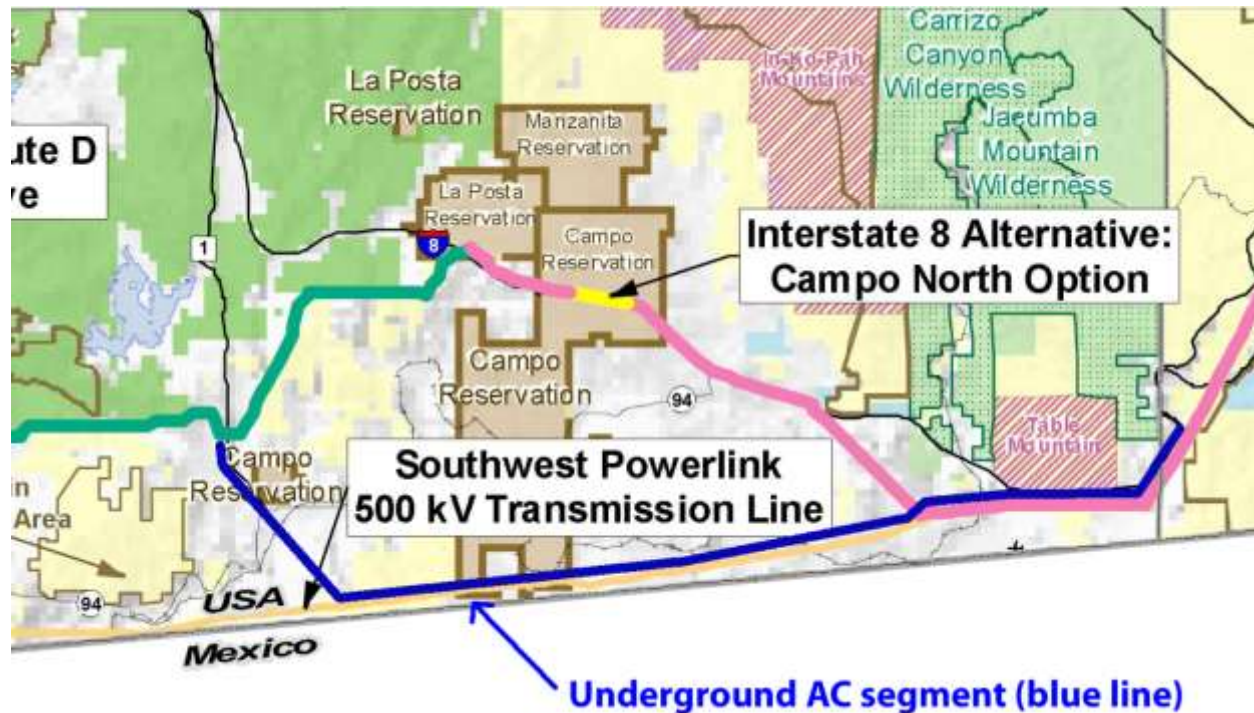
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## I. Saving the Last 22 miles of southeast San Diego County with one underground AC segment

While an underground DC power line for the entire 150 mile length of Sunrise Powerlink could provide extraordinarily lower environmental impacts at a considerably lower overall cost, as well as allow for triple the capacity of the Powerlink, nevertheless if the southern route, which apparently has not been environmentally reviewed, is an option then just one underground AC segment spanning the last 22 miles of San Diego County could protect the towns of Jacumba, Bankhead Springs, Boulevard, Manzanita, Tierra Del Sol, Live Oak Springs and Campo, in addition to the Campo and La Posta Reservations, the BLM's McCain Valley, the Anza Borrego Desert State Park, Cleveland National Forest, and the Anthropological Reserve; all of which would be otherwise seriously damaged, made uninhabitable, bisected and permanently degraded by huge pylons supporting an array of hot sagging 500,000 volt overhead power lines.

Fortunately, there is an alternative to the more costly overhead AC power lines which provides for greater efficiency and safety, lower maintenance and installation costs, along with inflicting negligible environmental damages and no permanent losses to any businesses, communities or property along the entire 150 mile route, all of which can save well over \$20 billion dollars in damages for short term losses. The underground DC power line alternative has been proven in over 50 major projects worldwide, and with economic savings that can provide for considerably lower cost installations, by placing 2 six-inch diameter cables underground in one continuously excavated trench that is 1 foot wide and 5 feet in depth. Underground DC offers extraordinary environmental, medical and property protection advantages, all at a lower cost than overhead AC power lines. (See underground DC details in section II, pages 81-86.)



## A) Southeast San Diego County 22 mile Underground AC power line Route

This direct underground AC route could protect 7 towns, 2 reservations and 5 wilderness preserves, along with approximately 20,000 acres of homes, business and wilderness recreation areas within the last 22 miles of San Diego County. This underground segment would begin east of San Diego County's eastern border, then extend west 22 miles and connect to the Modified Route D (shown in green at the left side of the map) and continue to extend westerly on overhead AC lines. This route could minimize EMF exposures to regular highway traffic by avoiding excavation under or along any highways, as well as provide a completely fireproof underground route that eliminates wildfire threats, along with minimizing all categories of threat, and almost all security requirements over a significant portion of eastern San Diego County. Further, underground high power lines have been both encouraged and financially supported by Homeland Security funds, that apparently have not been requested by SDG&E.



SOURCE: California Public Utilities Commission

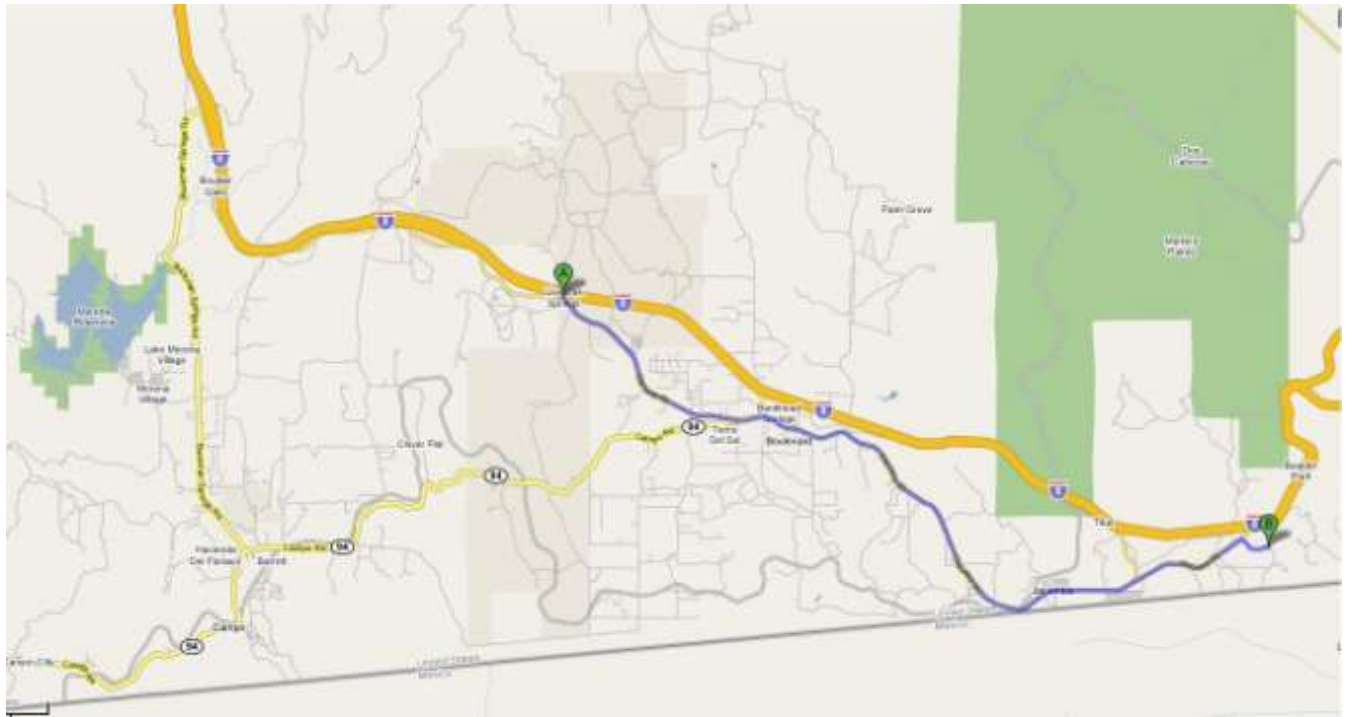
UNION-TRIBUNE

The 22 miles between the Imperial County line to a connection northwest of Campo, or the New Modified Route D Route, could be maintained as underground AC, protecting communities and habitat between Jacumba and Campo, including Bankhead Springs and Boulevard, as well as wilderness and paleontological sites. However underground DC could protect the entire 150 miles of the route, as well as provide 3 to 5 times the capacity, all at a far lower cost, without the massive environmental and property damages that would otherwise occur with overhead AC power lines.

<http://www.signonsandiego.com/news/metro/20070522-9999-1m22route.html#name>

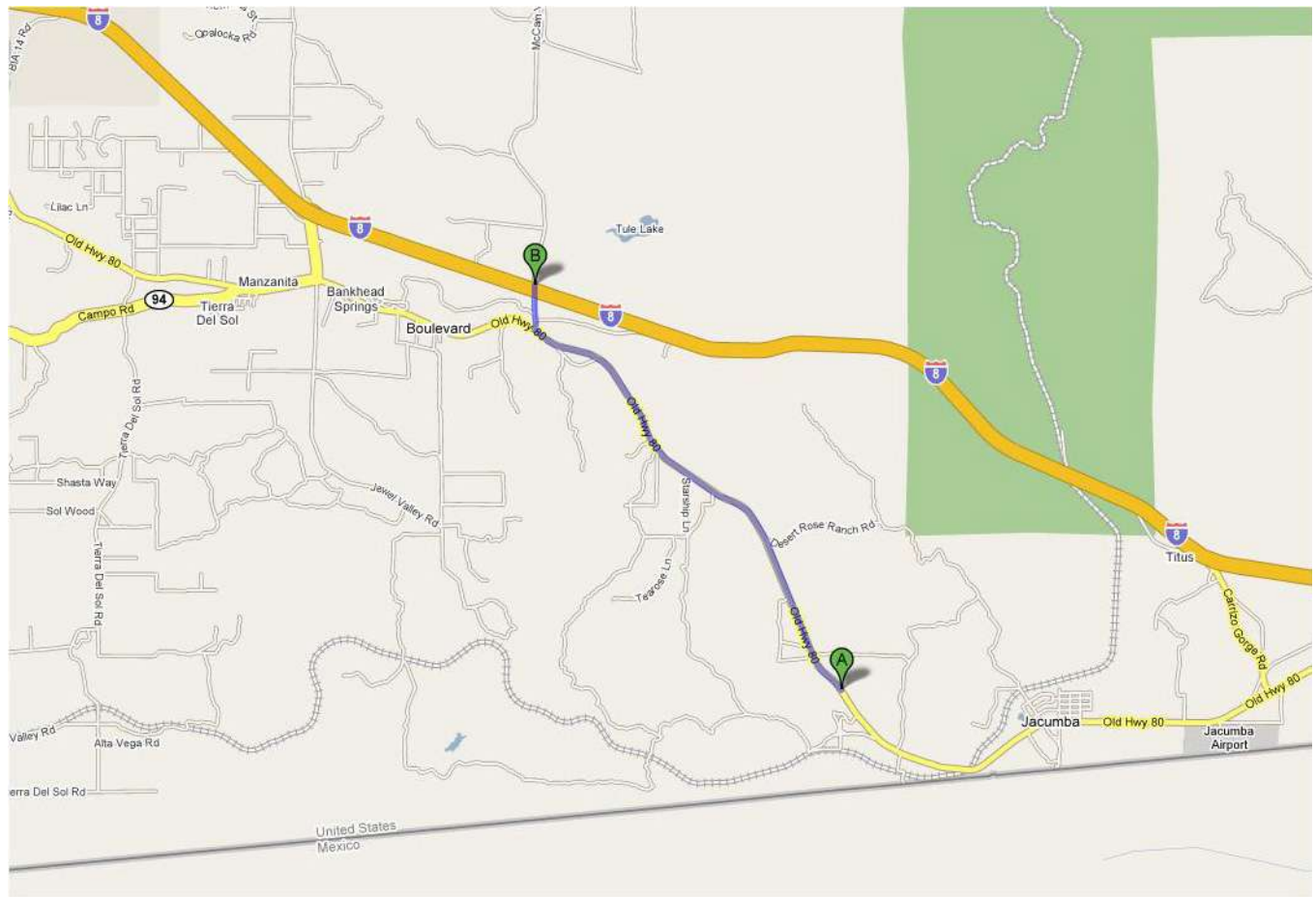
The image on the following page is an aerial photo (rotated 90 degrees, north is left). The proposed underground AC power line route is shown in red, which extends from a point east of the San Diego County line, westerly past Campo California to connect to the Modified Route D overhead AC power lines, naturally allowing for route variants to avoid private property and keep excavation primarily under existing unpaved roadways and within existing utility right of ways.





## **B) Southeast San Diego County 18 mile Underground Route Alternative 2, and related problems, (not recommended, although preferable to overhead power lines)**

Map of an underground AC power line (shown as a blue line between points A and B) beneath Old Highway 80, beginning at the San Diego County line and ending at Interstate 8 northwest of the Campo Acorn Casino. Unfortunately this 18 mile route would provide a potent EMF discharge to anyone driving on this section of Old Highway 80. Further the northwesterly direction and windiness of Old Highway 80 make this an inefficient route, providing inadequate or incomplete protection for the region compared to the prior described, more southerly route, which runs in more of a straight line from the county line westerly past Campo California. This route would no doubt cost more than option/plan A, however with greater highway construction difficulties and EMF health related impacts to vehicular traffic.



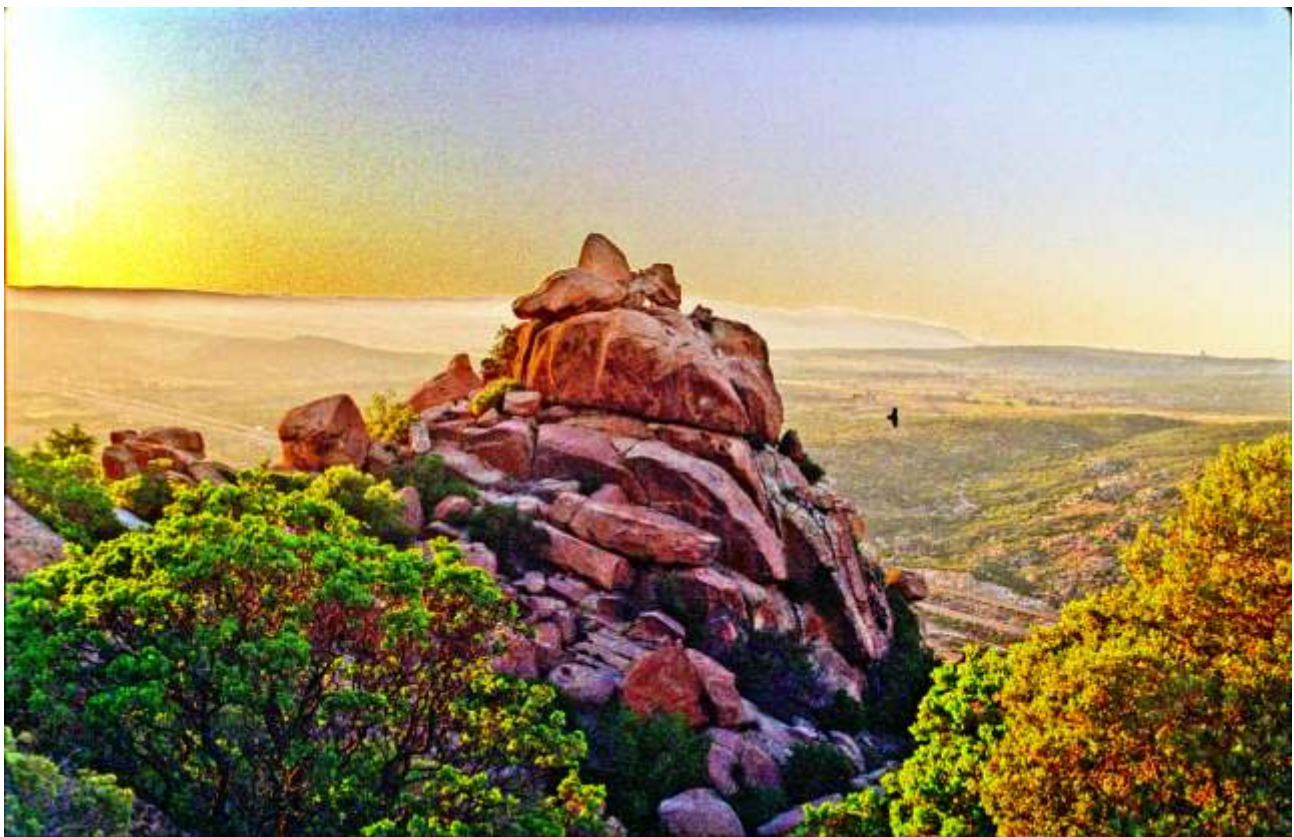
### **C) Southeast San Diego County 4.3 mile Underground Route Alternative 3, and related problems, (not recommended, although preferable to overhead power lines)**

Map of a limited 4.3 mile underground AC power line (shown as a blue line between points A and B) starting at the point where existing high power lines cross Old Highway 80 west of Jacumba, then northerly under Old Highway 80 to McCain Valley Road north and under Interstate 8 to overhead power lines to desecrate the beautiful McCain Valley BLM property as shown in the picture below. While this short underground AC segment would afford some protection for the anthropological preserve and many ranches and homes in Bankhead Springs, between Jacumba and Boulevard, still a great deal of exposure and destructive impact would remain for the region, along with high EMF levels under Old Highway 80. Consequently the first and more direct route between the county-line to a point northwest of Campo could provide considerably more protection for the region.



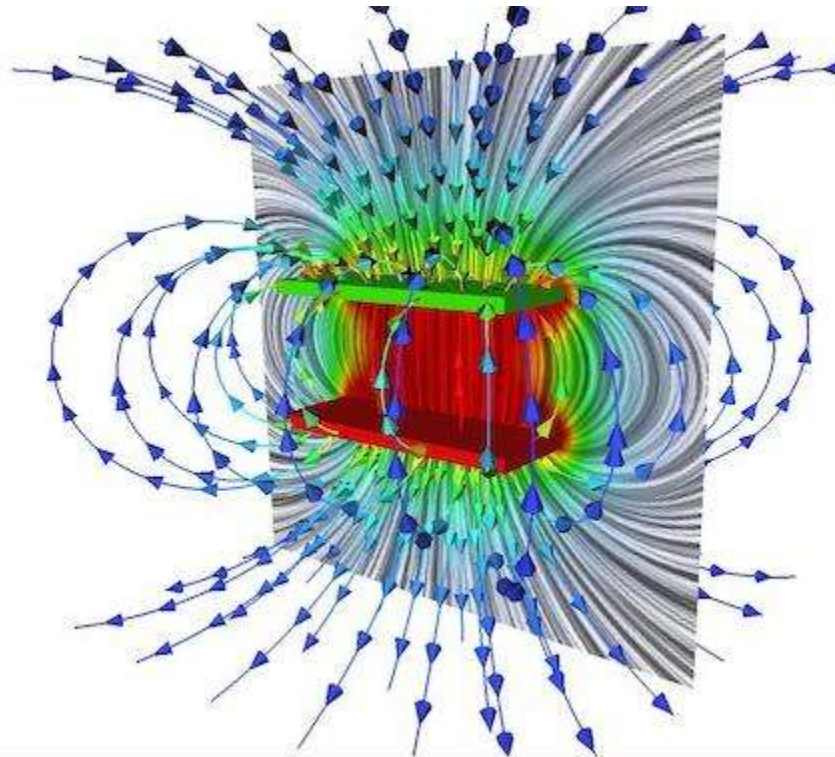
## EMF Notification

If AC cables are placed under highways with EMF levels greater than 2 milligauss (mG), then warning signs indicating the EMF levels and health implications relative to developmental and carcinogenic effects need to be posted at the beginning and end of those cable segments, so that travelers at risk to damages including pregnant women, children, older individuals or anyone with a family history of cancer can avoid those roads. Naturally, overhead power lines should be provided the same consideration.



Anthropological Nature Reserve, Research Center and Campgrounds, overlooking the BLM's McCain Valley, each targeted for the destructive impacts of 500,000 volt high-power lines on numerous 170 foot tall pylons, which would end the protection and uses of the nature reserve, in spite of the fact that lower cost, environmentally benign alternatives are available, that have not been offered any consideration. Under what legal principles is it possible that reservations are afforded protection from destructive impacts but nowhere else?

## EMF and risks



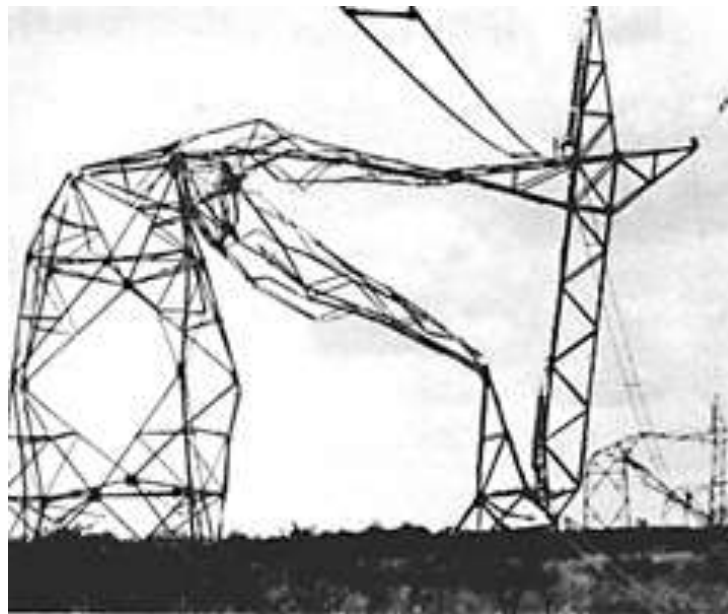
Electro Magnetic Fields have been used in medicine for over 25 years to align the nucleus of the hydrogen atoms throughout our bodies, so that they will be energized and act as trillions of radio frequency transmitters so that the interior of our bodies can be observed without surgery. However, these electro-magnetic fields are typically delivered to a specific region of our body for just a few thousandths of a second, and all the nuclei of the atoms in our cells will continue to measurably ring for up to 2 seconds. Our molecular structures respond to the effects of electro-magnetic fields or EMF, which does influence our intracellular processes, including regulation, growth, repair and replication, as well as carcinogenic activation. However, since nearly everybody has been exposed to EMF it becomes impossible to find a local population that would be the control group in any study, which has not already been exposed to EMF. Naturally the electrical industry uses this as an argument to declare that damages resulting from EMF exposure cannot be conclusive; much as the tobacco industry had done for over a century. Nevertheless, medical scientists in Europe, in large studies have determined that Leukemia rates in children can increase by 70% by simply residing in a home which is a little closer to ordinary power lines. Extra high power lines such as the proposed Sunrise Powerlink can provide hundreds of times greater impact, however it may take a politically influenced organizations perhaps another century to consider the details of the currently available medical studies. From the perspective of history the loss of thousands or millions of lives is not particularly relevant when economic issues are being considered.

Large scale underground DC power line installations, which do not radiate EMF in France, Australia and Sweden indicates that the difference in cost between installing underground DC and overhead AC, can be considerably less costly for underground DC technology. If environmental damages, cancer deaths, business and property losses were included as a part of the cost of evaluating overhead AC high-power lines, then a project such as the Sunrise Powerlink could immediately save at least \$6 billion by implementing underground DC power lines instead of AC, and the short to medium term savings could easily exceed \$20 billion. But apparently such massive losses have never been experienced by the installer, because the damages are passed on to the people through eminent domain or increased rates, typically as a result of being kept uninformed or sabotaged by extremely costly and overly complex judicial procedures, while politically influenced agencies have the option of avoiding consideration of any issues critical to the environment, health or the economic survival of a region. Any adversarial process that perpetuates misunderstandings or damages is a comparatively new and untested economic theory that can inflict massive and unrecoverable damages to any region, which has been thoroughly researched by historians and archeologists, unfortunately with little effect on our review or decision making process, or any help in avoiding needless damages, nor resolving any interest in providing for full restitution, or even calculating the full extent of the damages being proposed.



Hundreds of vertical fluorescent lights are electrified and illuminated, by proximity to overhead power lines, due to large losses, in excess of 6% of all power generated during transmission

The small increase in hardware cost needed for underground DC has frequently been exaggerated by several hundred percent in order to discredit this option. However using underground DC has several other installation advantages, such as a significant increase in transmission efficiency which can more than cover any cost difference between overhead AC and underground DC power lines, along with providing 300% greater transmission capacity, by eliminating the need to replicate the Sunrise Powerlink every few years, particularly since plug-in hybrid vehicles have a long term potential of requiring over 20 additional 1000 megawatt Sunrise Power links during the next few decades. Apparently, cost, safety or environmental advantages of underground DC that can deliver billions in savings and improve profits for Sempra Energy have not been reviewed or Sempra simply insists on inflicting needless and massive damages to the people of California. If we can't review the undisclosed intentions that are determined to inflict needless environmental damages at even greater cost to SDG&E, then there may be little hope of ever obtaining any beneficial or a cost effective result.

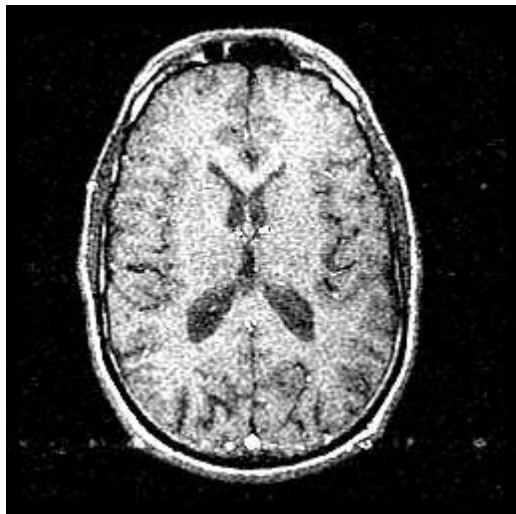


**Wind damages above. Hot sagging cables on pylons increase community dangers, accidents, fires, power outages, environmental, business, medical and insurance losses. What are the benefits? They cost more to erect and maintain than to dig a 1 foot by 5 feet deep trench with two cables. During the night of October 21-22, 2007 wind velocities in excess of 110 MPH were recorded in many parts of Southern California.**

- So, why would consideration of local solar or underground DC alternatives be avoided, unless it was predetermined that avoidance of environmental damages, cancer deaths and property loss was of no interest and exempt of liability?

- If that is the position, which is clearly being repeatedly demonstrated, then what is the engineering, economic or legal alternative to perpetuating intentional damages? Does it cost more or less, and if it cost less to avoid damages then why would a beneficial approach be avoided?
- What justification is there for any applicant to assert or deny almost all environmental, property, business and medical damages along a 150 mile route, as well as assert an almost complete disregard for well over \$20 billion in personal, business and real estate losses that thousands of others could incur, all without providing for the full restitution of all their losses, including the full and complete replacement of all property, environmental damages and economic losses proposed and inflicted?
- What sort of review would avoid assigning responsibility or an economic evaluation of the losses, or worse encourage massive and needless personal and economic damages, as well as allow for irreplaceable environmental losses, as if it were a right?

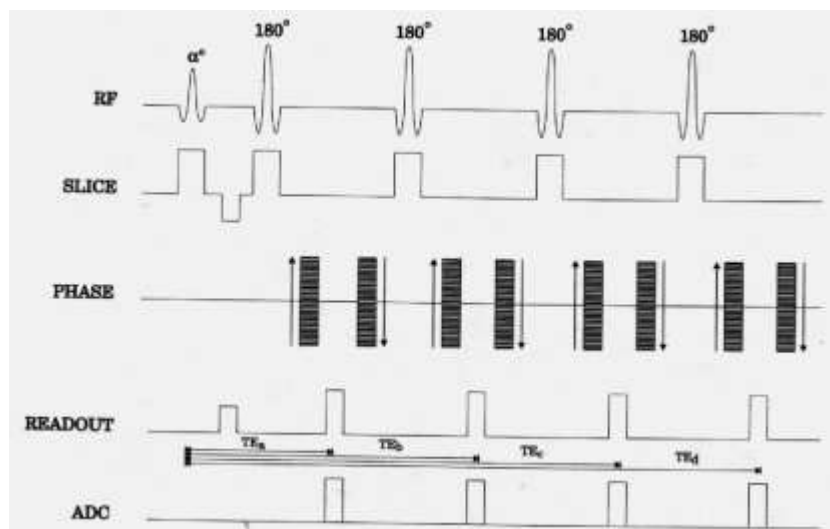
## Magnetic Resonance of Atomic Nuclei



20 millisecond electro-magnetic image of the brain

The basic phenomenon of nuclear magnetic resonance has been known since the 1940s ([Le Bihan, 1995](#)), and MRI has been developed over the last 30 years ([Cohen & Bookheimer, 1994](#)). Magnetic resonance can be adequately understood in terms of electromagnetic theory, as follows. All atomic nuclei spin on their axes; nuclei have a positive electronic charge; and any spinning charged particle will act as a magnet with north and south poles located on the axis of spin. In magnetic resonance studies, an

object is put in a strong, externally-imposed magnetic field ("main magnetic field"); the spin-axes of all the nuclei in the object line up with the field, with the north poles of the nuclei pointing in the "southward" direction of the field. This creates an average vector of magnetization of the object that points parallel to the magnetic field (the main magnetic field is conventionally referred to as pointing along the z-axis) ([Horowitz, 1995](#)).



As the nuclei relax, each becomes a miniature radio transmitter, giving out a characteristic pulse that changes over time, depending on the local microenvironment surrounding the proton. For example, hydrogen nuclei in fats have a different microenvironment than do those in water, and thus transmit different pulses. Due to these differences, in conjunction with the different water-to-fat ratios of different tissues, different tissues transmit different radio signals. These miniature radio transmissions can be used to form MRI images ([Horowitz, 1995](#)).



Childhood leukemia in the advanced stage

EMF, Pulsed and oscillating electrical fields do significantly impact the fundamental structure of our biology and interfere with the molecular functioning of cells and tissue structures, which have been shown to be directly related to human cancer formation in large scale epidemiological studies. A large scale study including 29,081 children has shown a 70% higher incidence for childhood leukemia as a result of proximity to power lines. However, the power industry claims that, "The evidence is not conclusive yet", nevertheless they are unable to point to any other cause.



Roger Ebert during 2006 after four surgeries to remove cancerous growths from his salivary gland, which has been linked to RF radiation and levels of cell phone usage. The tobacco industry spent over 100 years denying any linkage between smoking and cancer, or any increased health risks. Attorneys are still being paid to protect the profitability of extreme hazards by blaming the victims or denying the risks. However, perpetuating damages does not save money or protect wealth.

<http://www.neuroguide.com/gregg.html>

<http://www.mriontheweb.nl/Joomla4/en/Spinecho-2.html>

<http://www.cis.rit.edu/htbooks/mri/chap-8/chap-8.htm>

# Fires started by overhead power lines have burned thousands of homes in California, without restitution (including our home)

After over 2000 homes were burned during the fall of 2007, once again the Los Angeles County Board of Supervisors determined that during high winds, high-power lines were responsible for most losses, which burned homes up to \$17 million in value and totaled \$2.26 billion in insurance company losses alone, and have identified high power lines as being the cause of over 351 fires per year in California. As a result Los Angeles County Supervisor Zev Yaroslavsky announced in a televised news conference that he was requiring that the Southern California Edison place all high-power lines in the Santa Monica Mountains and Malibu underground as a fire security requirement. Currently litigation is required to address the existing engineering risks in order to reduce hazards and losses due to fire and high speed winds which have exceed 110 miles per hour (during the night of October 21-22, 2007) and have resulted in extreme fire risks from overhead power lines, smoke acting as a conductor and flames commonly between 100-200 feet in height.



San Diego County





San Bernardino County (Green Valley Lake)



Riverside County (Lake Arrowhead mansions)

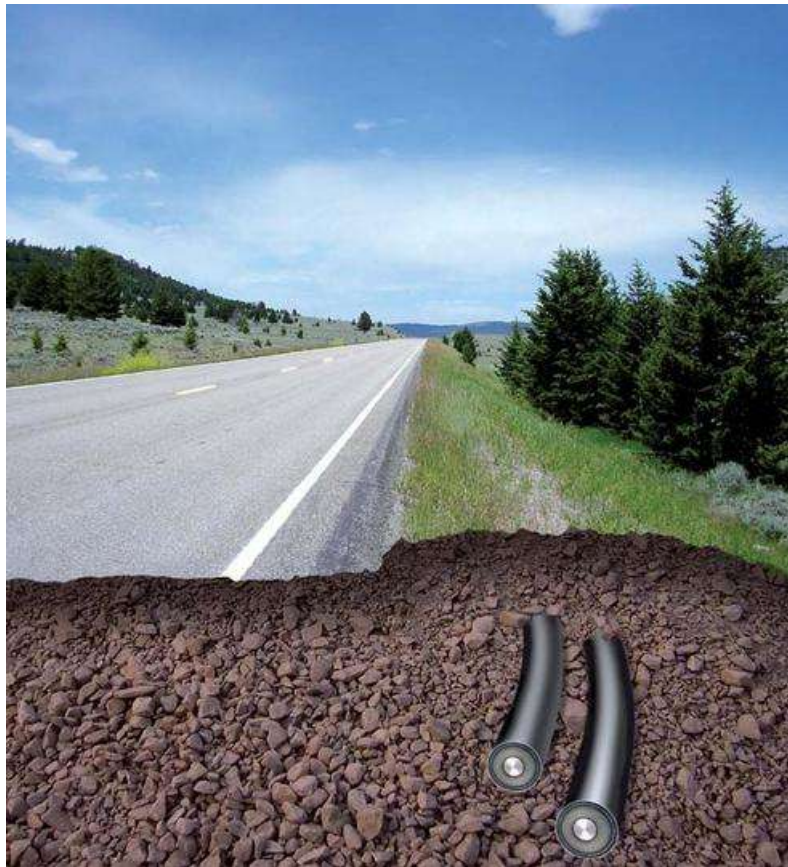


Orange County (Irvine)



The underground engineering solutions recommended by LA County are far less costly than needlessly perpetuating fire risks and massive insurance losses. Utility company habits, such as preferring overhead AC for long distance transmission, need to change to provide protection to homes and the environment, as well as save millions in installation costs, compared to more economical underground power line installation and maintenance costs. <http://www.cadesertco.org/news/LA%20Times%20Nov%204.pdf>

## II. An underground DC powerlink that saves 150 miles of San Diego County and the Anza Borrego Desert State Park, at Lower cost than overhead AC power lines



Two 6 inch underground DC cables can provide 4 times the capacity as the overhead Sunrise Powerlink. The trenching depth for underground cables is typically 5 feet by 1 foot in width with a protective cap and no conduit being used for the direct burial cables.

More than 50 long distance high-voltage, high-capacity underground and under ocean DC power lines have been installed worldwide, with higher capacity, greater efficiency, better

safety, better reliability, vastly lower environmental impact, far lower property and economic damages, and at a significantly lower cost than overhead AC power lines.

The BritNed UK-Netherlands powerlink can deliver 1300 megawatts over 161.5 miles for a cost of 600 million Euros, or \$870 million, all of which is higher in capacity and longer in distance than the Sunrise Powerlink and provided at a considerably lower cost than the overhead AC power lines being proposed. With a cost of \$870 million for the 161.5 mile BritNed Powerlink, then the \$1.4 billion Sunrise Powerlink would cost an additional \$530,000,000 (or 1.6 times more) in order to build approximately 700 huge pylons 160 feet in height, all in order to avoid a vastly more benign underground DC option.

<http://www.nationalgrid.com/NR/rdonlyres/88FF9856-8D4E-47F9-85DB-B8BDB3CCF24B/17288/BRITNED2.pdf>

Table: Selected project examples

Project	Country	MW	Year	Main purpose
SwePol	Sweden-Poland	600	2000	Subsea cross-border inter-connection
Italy-Greece	Italy-Greece	500	2001	Subsea cross-border inter-connection
Murraylink	Australia	220	2002	Underground merchant grid inter-connection
Troll A	Norway	84	2005	Power to offshore gas platform from shore
Estlink	Estonia-Finland	350	2006	Underground/subsea cross-border inter-connect
NorNed	Norway-Netherlands	700	2008	Subsea cross-border inter-connection
Nord E.ON 1	Germany	400	2009	Underground/subsea offshore wind park
SAPEI	Italy	1000	2009	Subsea island connection
BritNed	UK-Netherlands	1300	2009	Subsea cross-border inter-connection





161.5 mile, 1300 megawatt BritNed DC powerlink (\$870 million construction cost)

## DC Converter Stations

Based on the Norway-Netherlands DC link (shown below) a 1000 megawatt DC converter station could fit on less than 3 acres (not 40 acres as was claimed by consultants) and would cost an estimated \$125 million (not \$250-500 million as claimed), which could reduce the overall construction costs by up to 38% based on actual construction data. However, underground DC could also save an additional \$20 billion or more in short term environmental damages, business and property losses, along with providing at least a 300% increase in transmission capacity, higher transmission efficiency, lower maintenance, better security, along with the elimination of EMF and related medical liabilities.



580 kilometer (360 mile) 700 megawatt 450,000 volt DC underwater cable between Norway and the Netherlands



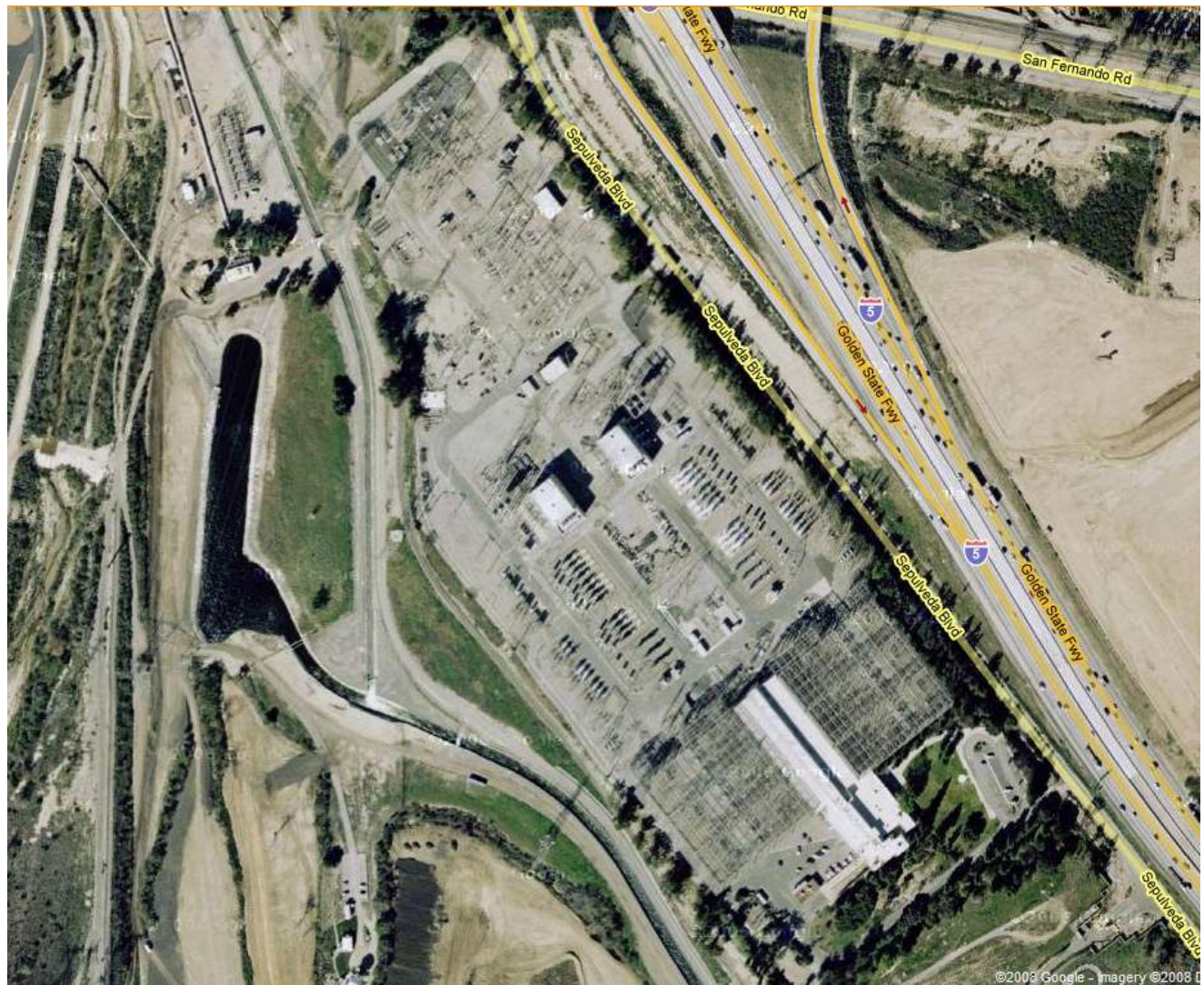
700 megawatt 450,000 volt DC to AC Converter station on a 3 acre parcel, using approximately 2.75 acres (2007)

## Los Angeles began construction of the 850 mile Pacific Intertie to deliver 3,100 megawatts over DC power lines in 1965, from the Washington – Oregon border



The LADWP's 850 mile 500 kV DC Intertie delivers 3100 megawatts using pairs of pylons carrying 2 cables each, 2 cables on one pylon for positive and 2 cables on the second pylon for negative. Each cable is steel reinforced aluminum 1.8 inches in diameter (ACSH 2312 mil designation). The DC to AC converter station and the AC to AC transformer distribution facility is located together in the San Fernando Valley near where the 210 and 5 Freeways meet. The DC to AC facilities are much smaller now. 500 kV DC is equivalent to the capacity of 1000 kV AC since there is a positive and negative difference on DC cables. The LADWP converter station and its large AC distribution facility for the city of Los Angeles and its 3100 megawatt lines are widely distributed over about 33 acres (in a area approximately 2400 feet by an average of 600 feet) west of the 5 freeway (or west of Sepulveda Blvd) and south of San Fernando Road, with a smaller portion being used for DC conversion. For a facility with less than 1/3 the capacity with newer hardware, approximately 5 acres would be sufficient for DC to AC conversion on a

project the scale of the Sunrise Powerlink. In an urban setting such converter facilities have been placed completely underground, under a park or under a parking structure. To observe the considerably larger and older, 1965-70, LADWP facilities use Google Maps to find: San Fernando Rd & Sepulveda Blvd, Sylmar, CA 91342, then select satellite view.



LADWP distribution facility in Sylmar California. DC to AC conversion supplied by ABB of Sweden represents a small portion of this proven facility that has been functioning efficiently for approximately 40 years, delivering 3,100 megawatts 850 miles from Oregon and Washington State hydroelectric dams on the Columbia River. Similar DC converter facilities have been built on less than 3 acres.

### **Electrical Grid Stabilization based on unpredictable renewable resources**

"The growing market activities and the fast and successful development of regional intermittent energy generation with low predictability (wind power) led to [a] significant increase [in] cross-continental power flows. Even though the grid was originally developed for mutual assistance, it has now become the platform for shifting ever increasing power volumes across the continent. Against this background, grid operation has become much more challenging." from the UCTE Union for the coordination of transmission of electricity <http://www.abb.com/cawp/db0003db002698/55622466a2d2c488c12572c700568a95.aspx>



**On a long-distance DC power line a savings of 2.5% or 25 megawatts, compared to overhead AC transmission losses can save \$90,000 at .15/kWh every 24 hours or \$32,850,000 per year, which can make up for any difference in cost of DC conversion in just a few years.**

Erroneous information provided to the CPUC had suggested that DC converter stations would cost \$250 or 500 million each, instead of estimates we obtained of \$125 million, compared to \$65 million for AC transformers, or \$60 million extra. However, that is only the greatly exaggerated price of one component in a DC system that could cost \$530 million less to build, or save building 2 additional overhead powerlinks, since the capacity of underground DC can triple the output at 500 kV, since its +500 to -500, or the equivalent of 1,00,000 volts in AC, as designed in the 2005 Siemens Tasmanian link (295 km) or the BritNed (260 km).

Additional criticisms claimed that DC converter stations required 40 acres. We examined DC converter stations of similar size that occupy less than 3 acres. We have been also informed that such facilities have also been placed underground below a parking structure.

Further criticisms indicated that DC was only suitable for extremely long distance applications, such as the 850 mile Pacific Intertie. However, links as short as 24 miles have been proven to be cost effective applications of underground DC, such as the Cross-Sound Cable connecting New Haven Connecticut with Long Island New York during 2003.

[http://www.energy.siemens.com/cms/us/US\\_Products/Portfolio/HVSystemsupto800kV/HighVoltageDCTransmissionSystems/Documents/HVDC\\_References.pdf](http://www.energy.siemens.com/cms/us/US_Products/Portfolio/HVSystemsupto800kV/HighVoltageDCTransmissionSystems/Documents/HVDC_References.pdf)

## **High Voltage DC provides 25% lower line losses than AC**

Most of the transmission lines that make up the North American transmission grid are high-voltage alternating current (HVAC) lines. Direct current (DC) transmission offers great advantages over AC, however: 25% lower line losses, two to five times the capacity of an AC line at similar voltage, plus the ability to precisely control the flow of power. Historically, the relatively high cost of HVDC terminal stations relegated the technology to being used only in long-haul applications like the Pacific DC Intertie, which connects the vast hydro power resources of the Columbia River with the population centers of Southern California. Currently High Voltage DC transmission is now being utilized in much shorter distances. The Cross-Sound Cable connecting Long Island and Connecticut is one example of this technology.

### **Energy Efficiency in the Power Grid**

[http://www02.abb.com/global/seitp/seitp202.nsf/c71c66c1f02e6575c125711f004660e6/64cee3203250d1b7c12572c8003b2b48/\\$FILE/Energy%20efficiency%20in%20the%20power%20grid.pdf](http://www02.abb.com/global/seitp/seitp202.nsf/c71c66c1f02e6575c125711f004660e6/64cee3203250d1b7c12572c8003b2b48/$FILE/Energy%20efficiency%20in%20the%20power%20grid.pdf)

## III. Electric Vehicle Power Requirements, at 10 kWh / day, could require 20,000 megawatts

### Electric Transportation



GM Volt, 161 horsepower electric car, 0-60 in 8.5 seconds, 600-700 mile range.

#### **Impact of Plug-In Hybrid cars on electrical transmission capacity**

General Motors Chevy Volt plug-in hybrid is estimated to require 240 watt hours of charging to travel one mile, or about 1 kWh to travel 4 miles and 10 kWh to move 40 miles, which is its expected all electric range. At 5½ cents per kilowatt hour (.05569) for peak summer rates to charge an electric vehicle, then each mile would cost about 1.4 cents in electricity costs through SDG&E. At the highest residential rates of 15¼ cents per kilowatt hour (.15267) the cost would be 3.8 cents per mile driven, which is still well below gasoline costs. At \$3.60 per gallon, a 30 MPG vehicle would cost 12 cents per mile for

fuel, as well as require far greater maintenance, labor and parts expenses than an electric vehicle, which could amount to at least 10 cents per mile in addition, or totaling approximately 22 cents per mile, excluding depreciation of well over \$1000 per year for the lower cost vehicles, which can easily exceed the cost of the gasoline, plus insurance which can range from \$600 to well over \$2000 dollars per year. Nevertheless, saving 20 cents per operating mile can cut transportation costs to less than ½ for most people. So if 1 million people drive their plug-in electric cars an average of 40 miles per day, and need to use 10 kilowatt hours to charge their vehicles over a 10 hour period, that would amount to an additional demand of 1000 megawatts. Naturally, when people notice that they could easily afford to move away from 1 ton vehicles and drive 3 ton trucks again, then electric consumption would rapidly grow for three reasons. 1<sup>st</sup> there would be no incentive to drive a gasoline powered vehicle so nearly all domestic and small business vehicles would shift toward plug-in technology. 2<sup>nd</sup> Since plug-in electric is considerably more efficient than gasoline, then heavy vehicles would no doubt once again replace conventional automobiles, perhaps tripling electric vehicle charging consumption. 3<sup>rd</sup> Since there is a continuing rapid population influx across California's borders, with a population that doubles every 20 years, then far greater electrical capacity will have to be provided for. So is the proposed electrical capacity for the Sunrise Powerlink capable of charging 3 to 6 million cars which require 30 kilowatt hours of charging capacity every day? That would amount to between 10,000 and 20,000 megawatts, or about 10 to 20 times the proposed Sunrise Powerlink for San Diego County alone, and about 60 to 80 times the capacity of the Sunrise Powerlink to charge all the household vehicles in 5 Southern California counties. How could any overhead power line system carry cables heavy enough or voltages high enough to address such a demand, without covering over Southern California with 80 additional Sunrise Powerlinks? Obviously weight is not an issue with higher efficiency DC copper underground cables, which can already quadruple the capacity of the Sunrise Powerlink, operating at 600 kV DC using only two 6¼ inch cables in a 5 foot deep trench, 1 foot in width. Why would underground DC transmission be avoided? Because there is more familiarity with the AC transformers at SDG&E? So far not one reason based on fact, overall cost savings and environmental protection has been offered which supports overhead power line construction.

### **Photovoltaic Automotive Charging**

If solar panels were used to charge a plug-in hybrid car such as a Chevy Volt, then 1 kW of photovoltaic panels during 10 hours could fully charge the car to run 40 miles. If Nanosolar's panels were used, at a cost of \$1 per watt, then the cost of the panels would be \$1000 which would pay for itself in fuel savings alone within 10,000 miles of driving, which would typically occur well within 1 year, with panels that could last well over 30

years. Apparently photovoltaic panels can power a car over 50 times cheaper than gasoline, so spending \$50 at a gas station could be replaced by a \$1 solar investment.

### **Autos, SUV's and pickups registered for 2006 in Southern California**

San Diego County	2,295,324	(autos 1,875,748 + (trucks 503,511 * .83 = 419,576)
Orange County	2,281,798	(autos 1,926,712 + (trucks 426,120 * .83 = 355,086)
Riverside County	1,417,570	(autos 1,091,918 + (trucks 390,798 * .83 = 325,652)
Los Angeles County	6,912,168	(autos 5,917,189 + (trucks 1,194,022 * .83 = 994,979)
Ventura County	650,085	(autos 524,605 + (trucks 150,582 * .83 = 125,480)
Total:	13,556,945	cars, SUV's and pick-ups

*From California DMV*

## **Nanowire Battery Technology**

- **Increasing the range of an affordable electric car beyond 400 miles**
- **Providing solar electric storage for night and days of reserve capacity**

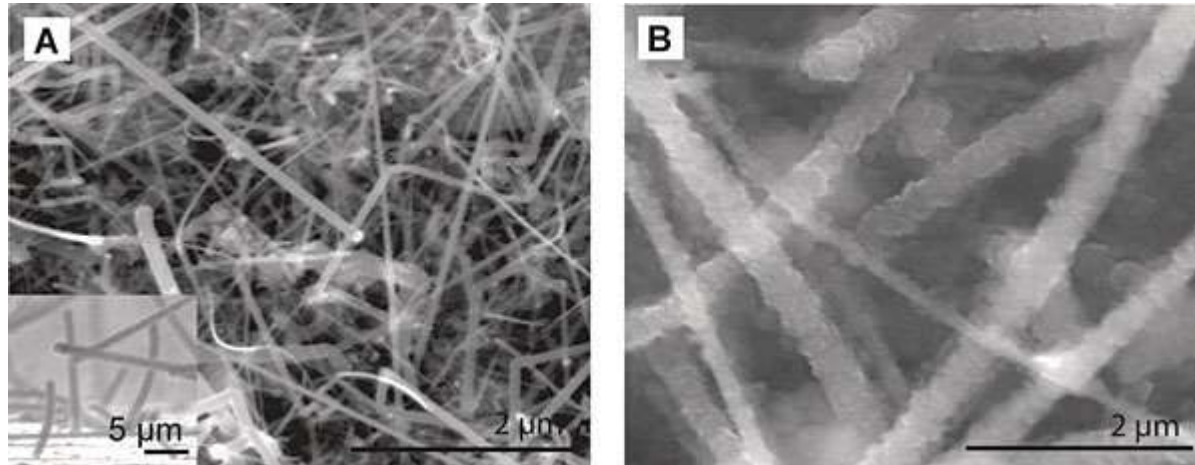
Stanford researchers have found a way to use silicon nanowires to reinvent the rechargeable lithium-ion batteries that power laptops, iPods, video cameras, cell phones, and countless other devices.

The new technology, developed through research led by Yi Cui, assistant professor of materials science and engineering, produces 10 times the amount of electricity of existing lithium-ion, known as Li-ion, batteries. A laptop that now runs on battery for two hours could operate for 20 hours, a boon to ocean-hopping business travelers.

"It's not a small improvement," Cui said. "It's a revolutionary development."

The breakthrough is described in a paper, "*High-performance lithium battery anodes using silicon nanowires*," published online Dec. 16 in *Nature Nanotechnology*, written by Cui, his graduate chemistry student Candace Chan and five others.

The greatly expanded storage capacity could make Li-ion batteries attractive to electric car manufacturers. Cui suggested that they could also be used in homes or offices to store electricity generated by rooftop solar panels.



Photos taken by a scanning electron microscope of silicon nanowires before (left) and after (right) absorbing lithium. Both photos were taken at the same magnification. The work is described in "High-performance lithium battery anodes using silicon nanowires," published online Dec. 16, 2007 in Nature Nanotechnology.

### Reference links:

Stanford: <http://news-service.stanford.edu/news/2008/january9/nanowire-010908.html>

Nanowire Battery (Yi Cui): <http://www.gm-volt.com/2007/12/21/gm-voltcom-interview-with-dr-cui-inventor-of-silicon-nanowire-lithium-ion-battery-breakthrough/>

GM Plug-in hybrid charging: [http://en.wikipedia.org/wiki/Battery\\_electric\\_vehicle](http://en.wikipedia.org/wiki/Battery_electric_vehicle)

SDGE Vehicle rates: [http://www.sdge.com/tm2/pdf/ELEC\\_ELEC-SCHEDS\\_EV-TOU-3.pdf](http://www.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_EV-TOU-3.pdf)

SDGE Residential rates: [http://www.sdge.com/tm2/pdf/ELEC\\_ELEC-SCHEDS\\_DR.pdf](http://www.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_DR.pdf)

Nanosolar photovoltaics: <http://www.nanosolar.com/about.htm>

Nanosolar Wikipedia: <http://en.wikipedia.org/wiki/Nanosolar>

DMV Vehicle count: [http://www.dmv.ca.gov/about/profile/est\\_fees\\_pd\\_by\\_county.pdf](http://www.dmv.ca.gov/about/profile/est_fees_pd_by_county.pdf), 5/6 (approx. 83%) of the trucks listed are pick-up trucks typically for household use according the California DMV statistical division, or about 1/6 are higher capacity and long-haul highway vehicles.

## IV. Solar Electric Generation at \$1 per watt equals ½ cent per kilowatt hour

The first choice alternative to the Sunrise Powerlink was gas fired powerplants. While that is a vastly more attractive option than overhead extra high voltage power lines, it's also evident that the printed [copper indium gallium diselenide](#) photovoltaics being used on homes, carports, office buildings and large scale power plants, with panel costs at \$1 per watt,<sup>8</sup> can be completive with gas powered power plant construction, particularly for peak demand generation purposes.



Nanosolar's photovoltaic panels are being priced at \$1 per watt, which amounts to ½ cent per kWh, or 30 to 80 times less costly than from utility companies.

<sup>8</sup> NanoSolar in San Jose California and Berlin Germany, <http://en.wikipedia.org/wiki/Nanosolar>  
<http://www.nanosolar.com/index.html>

## Nanosolar Photovoltaic Panels

Solar panels that could deliver 1000 watts would cost \$1000 and deliver approximately 12 kilowatt hours of electricity per day, for more than 40 years, delivering a total of over 175,200 kWh, at \$.0057 per kWh or about ½ cent per kWh. With electric companies charging 15 to 40 cents per kWh, then the newer panels can generate electricity at 30 to 80 times less cost, which would mean that the power companies could ultimately supply most of its power at night and during rainy weather, so that anyone on the electrical grid wouldn't need batteries or a back-up system. However, it may ultimately be less costly to charge high capacity Nano-Lithium-Ion batteries at home. Nevertheless, we live in a service oriented society that may not be interested in participating in their own electrical generation, unless installers can make the solution reliable and effortless. While it may take a while for a few homes to be adapted, or for parking lots to be covered with solar panels, companies are being created in California to address the installation of photovoltaic systems, along with the implementation of large scale 50 to 100 megawatt solar installations in China and Europe, utilizing the same panels.

While large numbers of people are not prepared to adapt to roof top solar, higher cost natural gas and petroleum may change that perspective. 1<sup>st</sup> long life solar panels are now able to provide far higher capacities at \$1 per watt, and 2<sup>nd</sup> companies are being developed to provide professional installation and maintenance at affordable prices. Which is very different than what occurred during the 1970's when uneducated and often incompetent construction workers who didn't understand the technology and couldn't find the parts, simply ripped out solar heating systems in new homes and replaced them with the old technology they understood.



154 megawatt solar concentrator power station in Victoria Australia, at the higher cost of \$2.70 per watt, potentially located on a farm, (solarsystems.com).



1.6 megawatts of solar generation on the roof of Google's offices



153 kilowatt from a solar carport in Vacaville California





**Solar tree in Styria Austria (70 panels on 5 branches, occupying a little over 1 square foot on the ground)**

**Recipients:**

The information herein was presented as testimony and in written form to the CPUC with Commissioner Grueneich and Steven J. Weismann Administrative Law Judge, in Ramona California on February 26, 2008 7-9:30pm, at the Charles Nunn Performing Arts Center, 1521 Hanson Lane, Ramona CA 92065

Service list: [http://docs.cpuc.ca.gov/PUBLISHED/SERVICE\\_LISTS/A0608010\\_71846.HTM](http://docs.cpuc.ca.gov/PUBLISHED/SERVICE_LISTS/A0608010_71846.HTM)

CPUC Public Advisor, 505 Van Ness Avenue, Room 2103, San Francisco, California 94102  
866-849-8390, 415-703-2074, [public.advisor@cpuc.ca.gov](mailto:public.advisor@cpuc.ca.gov)

Aspen Environmental Group, 235 Montgomery St, Suite 935, San Francisco, CA 94104-3002  
Tel: 415-955-4775, [sunrise@AspenEG.com](mailto:sunrise@AspenEG.com) or [aspen@aspeneg.com](mailto:aspen@aspeneg.com)

*:cpucSunriseUnderground Southern Routes © 2008 cbh/upa*

## V. Review (re: Sunrise Powerlink A.06-08-010 and the Southern Route Alternatives)

Last month we resubmitted our motion for party status, based on comments provided to us by the CPUC, and based on an earlier filing recommendation by the CPUC and Aspen. Unfortunately during the past 3 months there has been no response. We are asking for the opportunity to provide a few questions regarding environmental aspects of the Sunrise Powerlink particularly along the proposed Southern Route, which has not been reviewed by the CPUC, SDG&E or Aspen, which we know would be critical to reducing the environmental impacts of the power line particularly along the Southern Route.

We also noticed that practically no environmental protection has been provided along the Southern Route (in the Environmental Draft of January 3, 2008), and that no protective options have been offered, as has been done for the Northern Route. Apparently none of our comments have been reviewed or understood at all, through the process of meetings or by submitting written comments, which we have verified in person. As a result, we believe that it is extremely relevant to have a few specific issues addressed, which we would be available to provide in whatever form is preferred or allowed; in writing only if that would be more convenient or timely for your process.

Individuals at the CPUC, Aspen and SDG&E recommended that we rapidly address these issues as a Party to this case, since we have researched the issues extensively and are familiar with the critical engineering and environmental details, which have not been addressed to date. Further, SDG&E has postponed an environmental review of our area, and its nature reserves, which we do not take as any lack of intention to bulldoze our region. However, it may well suggest the recognition of a larger view of these issues that needs to be accommodated along the proposed Southern Route, which was recently noticed and commented on by SDG&E.

Could a Southern Route be chosen without an environmental review, that is clearly needed to help reconsider a number of lower impact options that are available; or could a continuing delay in any environmental review for the Southern Route simply be a perfunctory procedure which is done in order to avoid any actual consideration whatsoever prior to the needless bulldozing our region, -- as has been noted in our San Diego County newspapers, and by residents of the region?

I understand that your review process is intended to be both fair and thorough. However, if it could somehow completely fail to notice or avoid major environmental issues along the Southern Route the results could be disastrous and the damages completely unnecessary. Unfortunately, these are issues that are being completely overlooked by SDG&E, and very significantly they are not more costly to resolve in a mutually beneficial way, both for SDG&E and for this entire region.

Our central question remains: Can we present specific questions which are relevant to the Southern Route as a part of this proceeding? -- The information we have provided here is primarily introductory in nature, and we will continue to participate by providing additional information essential to addressing CEQA requirements. -- Thank you for all your consideration and efforts in this and related matters.

**SDG&E indicates damages to southern route are greater**

**TABLE 6-3: SDG&E's Enhanced Northern Route Affects Fewer Significant Lands**

\*Area affected presented in acres, unless noted otherwise

Land Designation	Enhanced Northern Route	Aspen's Southern Route
Bureau of Land Management	753.6	993.9
National Forest Service – Cleveland National Forest	8.9	352
Tribal Land	0	70.2
California State Parks – ABDSP	271.7***	0
Agency Designated Viewshed	27.7	322.8
Scenic Highways, Byways, or Trails (number of)	18	10
Off Road Vehicle Area	10.0	105
Open Space	65.8	51.2
Preserve or Reserve Land	151.2	330.2
Designated Critical Habitat	292.5	413.8

\*\*\*Because SDG&E's Enhanced Northern Route would be Constructed within existing disturbed areas, there are zero acres of newly disturbed lands within the ABDSP transmission line corridor.

**SDG&E's Enhanced Northern Route has Greater Potential to Avoid Significant Cultural Resources.**

**Table 6-3  
Active Renewable Generation Projects in the CAISO Queue  
As of February 29<sup>th</sup>, 2008**

LOCATION	MW	RENEWABLE TYPE
East County	201	Wind
Imperial Valley Sub	1112	Solar
Imperial Valley Sub	3000	Wind
Border Substation	27	Biomass
SWPL	1980	Wind
Miguel Substation	500	Wind
SWPL	375	Solar

## SDG&E indicates that demand is 7 times greater than Powerlink capacity

### B. The Enhanced Northern Route Will Allow SDG&E to Access Those Renewables to Meet Its RPS Mandate.

There are currently over 6,600 MW of interconnection requests by renewable resource projects that could be assisted by Sunrise. SDG&E currently has renewable energy under contract for about 60% (2000 GWH) of its 2010 RPS energy goals (of approximately 3500 GWH). Approximately 731 GWH will deliver through the Imperial Valley substation and are thus reliant on Sunrise. These deliveries more than double in 2011. SCE has another 250 MW of renewable wind generation located in Mexico under contract contemplating interconnecting to the SWPL. An 1150 MW dispatch limit currently exists on the SWPL between the Miguel substation and the Imperial Valley Substation, potentially stranding thousands of MW's of proposed new renewable generation based on the CAISO's existing standards. Thus, without Sunrise, the CAISO has determined that only a small fraction of the more than 7000 MW of renewable generation that is currently in the CAISO queue could be developed and simultaneously dispatched. Given that Sunrise will add 1,000 MW of transfer capability out of Imperial Valley to San Diego, Sunrise is necessary for SDG&E and the state to meet their and the state to meet their respective RPS goals. As demonstrated in this Chapter, the Enhanced Northern Route permutation of the project would serve this need best.

[http://www.sdge.com/sunrisepowerlink/filings/cpuc/031208/Chapter6SDGE\\_S\\_Enhanced\\_Northern\\_Route.pdf](http://www.sdge.com/sunrisepowerlink/filings/cpuc/031208/Chapter6SDGE_S_Enhanced_Northern_Route.pdf)

While SDG&E has shown that there is an extraordinary demand for transmission capacity in order to carry renewable resources, which is currently estimated to be 7 times the capacity of the proposed Sunrise Powerlink. However, the estimated environmental impact on the Southern Route of 2,649.1 acres, which is visible to millions of people per year, would create the highest environmental impact, creating in excess of 4.14 square miles of impact and damages to an extraordinarily significant wilderness region which would incur habitat and geological restoration losses in the billions,<sup>9</sup> with combined property, health, restoration and replacement costs, as well as business damages, of at least \$20 billion for relatively short term impacts. Unfortunately, the project reviewers had

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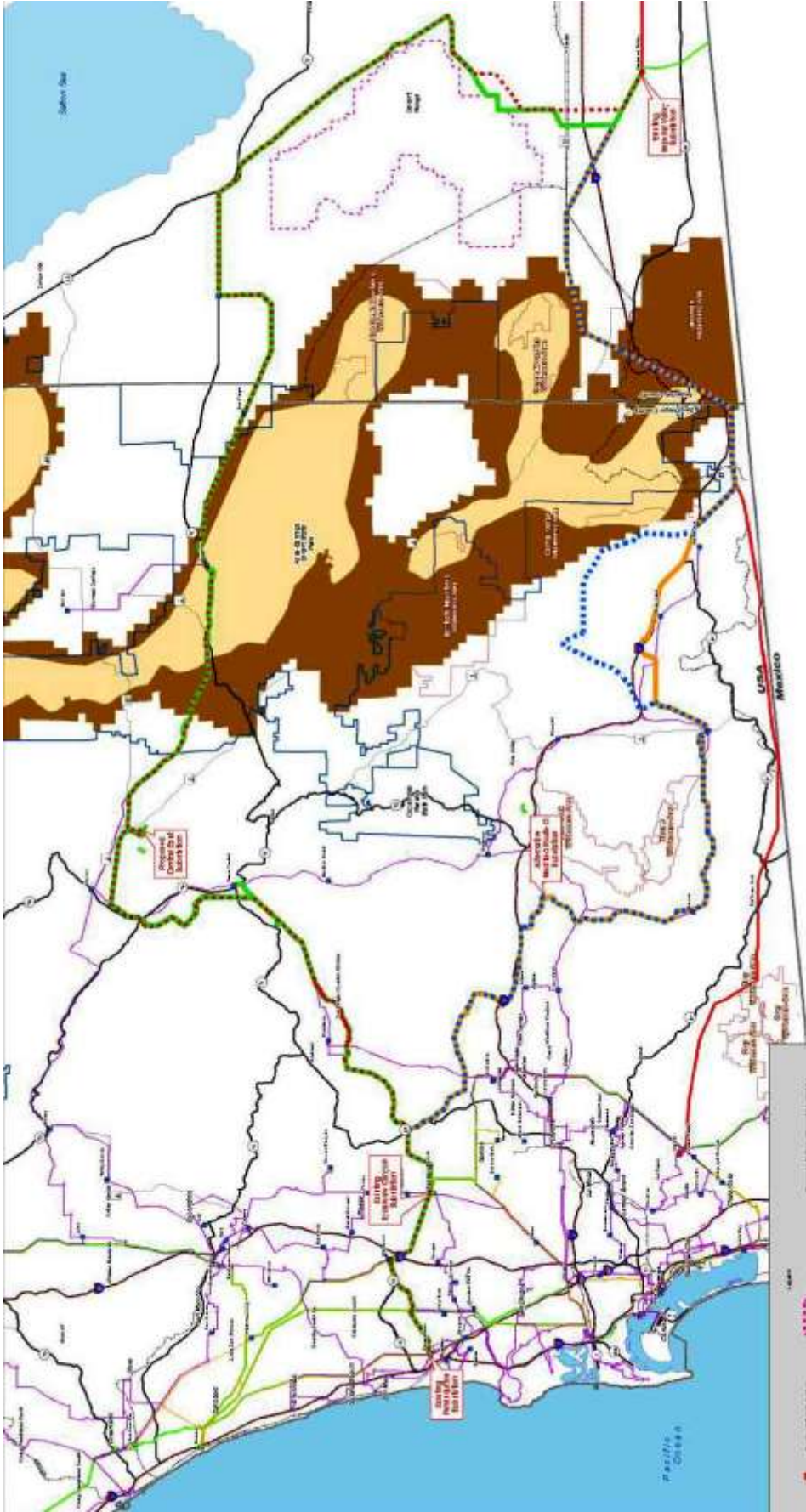
<sup>9</sup> If damaged the areas amounted to 2,649.1 acres (115,394,796 sqft) with full restoration efforts being accomplished over a 40 years period at \$25/sqft (or 62 cents per year or 5.2 cents per month) the cost would then be only \$2.9 billion (2,884,869,900); which does not include residential, ranch and business property losses in the region, nor include replacement costs for nature reserves and recreational areas which offers payment for property which has equivalent wilderness habitat, geological landmarks, viewshed, access, utility resources, and urban proximity, not to disregard growing medical evidence based on molecular cell biology which continues to demonstrate disruptions of the cellular development process, including carcinogenic developments, which are over 70% greater, based on airborne ionization and electromagnetic fields (EMF) created by high power lines.

decided that it was too complicated to enumerate the full economic impact and the full range of losses that would be inflicted on the people and the wilderness of this region, and so have avoided analysis and the use of data that is known and is publicly available. Accurate data could have been assembled by analyzing all known cost and impact issues, particularly if a strategy for data collection and analysis was developed. Will the lack of a detailed analysis then be the basis for using eminent domain and an excuse to inflict many billions of dollars in losses, while paying less than 1% of the damages, in violation of state, federal and constitutional requirements?

SDG&E's data shows that 1,000 megawatts would be immediately inadequate to deliver 7,000 megawatts of renewable power to San Diego, Los Angeles or Orange County. Unfortunately the cable cross sections required to deliver such capacities would be far too heavy for the pylons proposed and the cables being suspended, so many more such power lines would have to be developed. Besides as oil prices rise significantly, a dependency on plug-in hybrid vehicles would require more than 20 such 1,000 megawatt power lines for San Diego alone, and over 85 such power lines for Southern California. Overhead power line technology can not address the growing energy demands nor the engineering problems being created in California, and it would cost far more to continue with overhead AC than the considerably higher capacity underground DC systems being installed in Europe and Australia, which inflict practically no damages to the environment or any communities. The other decentralized alternative, printed solar panels, can also deliver the enormous capacity required to ultimately power the region's transportation system, at \$1 per watt, or about 1/2 cent per kilowatt hour.

So how could SDG&E or the CPUC object to a lower cost underground DC transmission, that can deliver 3,000 megawatts on 2 six-inch cables in one trench 1 foot wide by 5 feet deep, that can eliminate massive damages and be continuously and rapidly installed? SDG&E's data regarding transmission capacity now required (7000 megawatts) and the cost of environmental damages are not supported by their own design, while higher capacity solutions, that are far safer and have no significant environmental impact, and cost far less to install, have all been rejected. Unfortunately only the damaging alternatives are now being evaluated, with the most damaging, being the Southern Route (either Aspen's Southern Route or SDGE's Modified Southern Route). Clearly the massive damages proposed may well be disregarded because the CPUC, Aspen and SDG&E have avoided calculating the damages and avoided evaluating the losses. No total has been provided for environmental losses, geologic damages, habitat restoration costs, property devaluations, equivalent property replacement costs, medical and personal losses resulting from cancer and related health hazards due to EMF and downwind pollutant ionization exposures, the viewshed losses, a proportional loss to California's \$90 billion per year tourism and recreation industry, nor losses to ranches, businesses or to development.

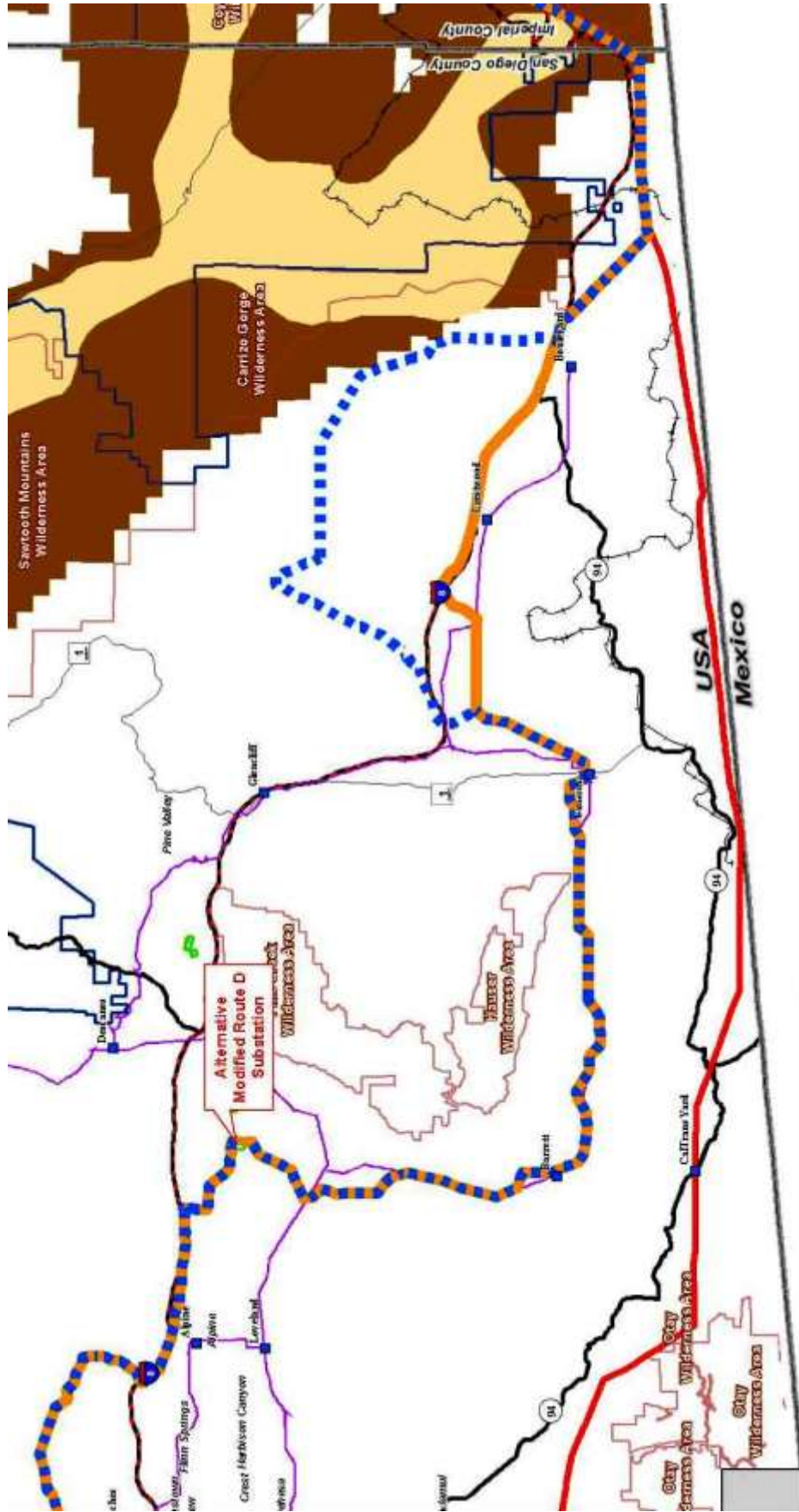
# Northern and Highest Impact Southern Overhead AC Power Line Routes



G0014

Northern Project Route (green line), SDGE's Preferred Route (red dashes)

# Southern Route: Maximum Damages and Higher Costs



Southeast San Diego County, Aspen's Southern Route (orange line), SDGE's Route (blue dashes)

## Northern vs. southern route evaluation



SDGE Northern and Southern AC Routes, Power Line Map (page 114):

[http://www.sdge.com/sunrisepowerlink/filings/cpuc/031208/Chapter\\_1\\_Rebuttal\\_Testimony\\_SDGE\\_CBD\\_SierraClub.pdf](http://www.sdge.com/sunrisepowerlink/filings/cpuc/031208/Chapter_1_Rebuttal_Testimony_SDGE_CBD_SierraClub.pdf)

**CHAPTER 1, PREPARED REBUTTAL TESTIMONY OF SAN DIEGO GAS & ELECTRIC COMPANY IN RESPONSE TO PHASE 2 TESTIMONY OF THE CENTER FOR BIOLOGICAL DIVERSITY AND THE SIERRA CLUB (BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA) March 28, 2008, Updated on April 15, 2008**

The choices for power line routes have in several significant instances been decided based on incomplete and inaccurate data, which has resulted in several erroneous conclusions, all without considering the significantly less damaging alternatives which are available and without evaluating the cost of the damages being inflicted. That offers the possibility of a needless, massive and a very costly disaster. The alternatives available for the Southern Route, including underground DC and the cost of the alternative approaches to installation, as well as the environmental and economic damages have not been evaluated for the Sunrise Powerlink, nor have the most significant alternatives been considered, particularly for the Southern Route.





**24 cable, high-capacity pylon in Kuala Lumpur Malaysia, 689 foot height**

Power line capacity can also be increased by stacking 500kV AC cables on taller pylons such as this 210 meter (689 foot) tall pylon in Kuala Lumpur Malaysia, carrying 24 conducting cables, or others reaching 346.5 meters (1137 feet) in height in China. Fortunately these strategies don't save money, don't improve reliability or capacity, don't protect the environment or anyone's health, not in Malaysia, not in China, nor in San Diego County. So why are these overhead systems even considered as even vaguely reasonable, and why do thousands of people have to sacrifice their property, watch the degradation of their environment and endure serious health risks; because some engineer on the board of directors is more comfortable with AC and won't bother to consider underground DC?

<http://members.tripod.com/~aberkers/>

## Transmission Line Tradeoffs, Overhead AC vs Underground DC

Issue	Overhead AC	Underground DC
<b>Installation Cost</b>	\$9.3 million per mile	\$5.3 million per mile
<b>Damages: environmental property and business</b>	\$40 million per mile	negligible
<b>Fire hazards</b>	Can be extremely costly	negligible
<b>Aircraft hazards</b>	Occasional fatal accidents	negligible
<b>Maintenance cost</b>	Requires system replacement	low
<b>Reliability</b>	Moderate reliability	high reliability
<b>Weather hazards</b>	Moderate risk	negligible risks
<b>EMF and Ionization risks</b>	Significant	negligible risks
<b>Carcinogenic risks</b>	Significant	negligible
<b>Capacity per power line</b>	Approx. 1,000 megawatts	3,000 – 5,000 megawatts
<b>Phase synchronization</b>	Significant to avoid failure	nonexistent problem
<b>Terrorism risk</b>	Significant problem	low risk

<b>Easement requirements</b>	Complex and costly	use highway right of way
<b>Eminent domain impact</b>	Massive, damaging and costly	negligible use
<b>Community response</b>	Extreme opposition	minor concerns
<b>Medical litigation</b>	Increasingly larger risks	negligible
<b>System condemnation</b>	A future risk	negligible issue
<b>Scenic degradation</b>	Significant losses	nonexistent problem
<b>Transmission efficiency</b>	Significant losses	save 25% on losses
<b>Power line length</b>	Much longer, less direct	can save 49 miles on hwy
<b>Transformer connection</b>	Simplifies multiple connections	usually point to point
<b>Converter station</b>	Less costly transformers	more costly converters
<b>Converter station size</b>	No significant difference	no significant difference
<b>Losses to the people</b>	Over \$40 million per mile avg.	negligible
<b>Technological maturity</b>	In use since 1893	since 1881, revised 1950's

The Los Angeles Department of Water and Power has proven over the past 40 years that an 850 mile, 500,000 volt, 3,100 megawatt DC power line eliminate phase synchronization offering greater reliability, greater transmission efficiency, as well as higher capacity than AC power, with no cable weight limitations for underground lines. There are currently over 50 large scale underground DC power lines in operation, with a significant growth in new large scale installations, which are more economical over a wide range of distances and power capacities.

Ramona California, February 26, 2008

CBH participant  
 PO Box 1032  
 Hemet, California 92546





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