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Comment on:
Committee Draft 2008 Integrated Energy Policy Report Update (2008 IEPR Update)

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Renewables, Wind and Solar for California's Energy Future

The California legislature and the California Energy Commission recognize that renewables, primarily solar and wind, are clean sources of energy. They both however, have ignored the physical facts about these sources that limit their use to the extent it is physically impossible for California to meet the goals established for the percentage of the states electrical energy from wind and solar. The average capacity factor for solar and wind energy sources is 20% in California.

If we adjust the CEC estimated electrical energy usage for the year 2020 for the increase in the use of electrical energy for transportation and an efficiency decrease of 2% per year the approximate energy level for 2020 will be 445,000 GigaWatt hours. In order to get 20% of our electrical energy from wind and solar we must install 5 times that amount. Then when the sun is shining and the wind is blowing all other sources must be shut down. This is an impossibility so what must be done is have storage for the excess energy produced at peak times so it can be used at other time to level out the use of the renewable energy.

If we assume that we get 20% of our 445,000 GigaWatt hours from renewables that is 89,000 GigaWatt hours. If we put 20% into the grid and store 80%, that means we store 71,200 GigaWatt hours of energy. To do this we need total storage facilities of 8,130 megawatts. If we use the most efficient, safest and most reliable storage it will be water pumped storage. If so we need 4 storage sites the size of Hoover Dam with 2 huge reservoirs at each site.

In 2030 our estimated total electrical usage will be 765,000 GigaWatt hours. If we use wind and solar for 33% of our electrical energy that will total 252,450 GigaWatt hours. If our plan is to use 33% while peaking then we must store 67% which is 169,142 GigaWatt hours. This means storage facilities totaling 19,308 megawatts. This would

require10 pumped storage sites the size of Hoover Dam with 2 huge reservoirs at each site. Where can we put these sites in California?

One thing that is physically certain is that if we come even near our goals for renewable energy sources we must develop efficient, safe and reliable storage. Pumped water storage is the system that is used the most around the world. It is the most efficient, safest and the most reliable source known today, but it cannot be used by California for any significant quantity of energy.

High pressure stored air is another possible source for storing energy. There is a small amount of history of systems where a high pressure air source has the air heated with gas which then powers a gas turbo-generator. When air is pumped up to around 1000 psi much of the energy used to pump it is stored as heat. When the stored gas looses the heat the energy left for generating electricity is much lower than the energy used to store it. There are some development plans in place for compressed air storage, but the efficiency is determined to be less than 50%. One possible use for it would be for California to install wind turbine farms over the Pacific and have them pump air into bottomless tanks underneath. This stored air is then used to provide electrical energy when it is needed. The low efficiency will make it expensive.

Batteries are not good sources for storage of large megawatt levels of energy.

One other source for storage is large rotating wheel storage. Not much actual usage has been recorded. One major problem is that a wheel large enough to provide storage for hundreds or thousands of megawatts has a significant safety problem. If it is in a community and its axel fails and it breaks loose it can destroy square miles of property and many lives. If it is used as a large source it must be sited in an isolated where there are no buildings or people for miles around.

Molten salt is another storage source and has been used for a few years for solar energy storage. It looses energy by cooling and does not have a high efficiency if it stores for any long time. To date it has not been an efficient and economical system. There are new development efforts underway which will define its validity in the next few years.

Summary Statement: Since Solar and wind renewables are a clean source of energy the California Energy Commission must provide support for development of efficient, safe and reliable energy storage because meeting our goals for use of renewables depends completely on it.

Nuclear Energy for California's Future

The California legislature has been anti-nuclear since 1976. A proposition to prevent any more nuclear plants being built in California was placed on the ballot in 1978. It lost by more than 65%. Immediately after the California legislature passed the Warren Alquist act which stated that no more nuclear plants could be built in California until there was a licensed federal storage facility like Yucca Mountain and a licensed reprocessing facility.

Knowing the majority of the California citizens favored nuclear power they said they did not inhibit it they just provided the requirements for any more nuclear plants to be built.

Over the last 50 years nuclear power plants have demonstrated being the safest, most economical, most reliable and most environmentally clean power source in the world. There is an average of 24,000 people killed around the world by fossil fuel accidents every year. Millions of people die of lung disease caused by exhaust from fossil fueled plants. There have been no people killed by standard nuclear fission power plants. People must know that the reactor at Chernobyl was not a standard nuclear power plant with the safety designs required. It was a plutonium production reactor like the US reactors at Hanford, Washington and Savannah River, South Carolina. They did not have the safety features of the licensed nuclear power plants.

It is obvious that the source of the Assessment of California's Operating Nuclear Plants is antinuclear. The report stated Diablo Canyon and San Onofre nuclear generating stations could have a major disruption because of an earthquake or plant aging. While this is a possibility for any energy plant source in California, based on the world experience the probability of this happening to Diablo Canyon and San Onofre is extremely low. Around the world the cause of shutdown of a nuclear plant is not a problem of the basic reactor system. It is usually caused by a problem with the electrical system, such as transformer fire, turbine problem, heat exchanger, steam generator, cooling system, etc. The earthquakes in Japan have proven the basic PWR and BWR reactor system designs can survive a 7 level earthquake with no significant harm. If there were an opening a few feet wide directly under the reactor it would require the plant be shut down forever. Any damage to other buildings and facilities at any power plant, nuclear, hydro, gas fired or coal fired, solar and wind will cause the plant to be shut down for a while and take about the same time to return to production.

The majority of nuclear plants in the US are being upgraded and extending their life for another 20 years. The great amount of experience in this process during the last few years should be taken advantage of by California to do the same thing with their nuclear power plants. There is a huge economic advantage for the utility users and the utilities.

In the section of spent fuel storage facilities there is the comment that spilled water in one reactor building leaked into the Sea of Japan. The details determined that the water had very low levels of radioactive isotopes, not much more than the natural isotopes in the sea. People read the media instead of the scientific details.

There is little danger of having the cooling water loss from the pools and even if it does leak a fire hose can put enough water on the spent fuel to keep it from burning. There is very little probability of any incident causing any significant amount of radioactive isotopes getting into the environment so that there would be any harm to the public. In a metric ton of spent fuel there are only 3 kg of radioactive isotopes, Sr90, Cs137, Cs135, I127 and I129 that are volatile and could be absorbed and retained in the human body. Of these only the iodine isotopes provide any concern since they migrate to the thyroid gland. Strontium and cesium isotopes released by Chernobyl into the atmosphere

because of the fossil fuel fire in the open reactor have not had any definite harm to people.

Dry cask storage is not a good target for terrorists, compared to hundreds of other targets. Fear of storage of used nuclear fuel by the public is generated by lack of technical knowledge of what it really is and by the fear generated by the media.

Most people are afraid of radiation because of their lack of technical knowledge of the radiation factors. The most radioactive element in the solar system is potassium. The next highest one is vanadium. If a person is standing along the curb and a truckload of new fuel for a nuclear plant goes by and a truckload of bananas goes by the bananas will give them the most radiation. There are 25 naturally radioactive elements in the 92 natural elements in the world. There are one half million natural radioactive isotopes decaying and irradiating our cells in our body every minute. We are naturally radioactive so that invasion of a few atoms of isotopes from a nuclear power plant will have an insignificant effect.

A study of the commercial value of used nuclear fuel was recently completed. The commercial value of the used fuel coming from a 1000 megawatt reactor after a year is worth over 20 million dollars. If we could start reprocessing and recycling our stored spent fuel in fifteen to twenty years the commercial value will be about 3 billion dollars. By reprocessing and recycling the used fuel it also provides more fuel for nuclear power without nearly as much mining.

The future economical recycling of used nuclear fuel will depend on having fast breeder reactors. This will have a significant effect on the future of California. The California Energy Commission should have a study program in place to guide the future of fast reactors in California and their effect on our long range economy.

The amount of waste with no commercial value in a metric ton of used nuclear fuel is about 400 grams. This can be put back in the reactors and transmuted to either non-radioactive or short lived isotopes that will decay and can be put back into the environment in about 200 years with no harm If every citizen in California has all of their energy produced by nuclear fission, including transportation, industrial, heating and electricity for one year the amount of waste isotopes per person that must be processed for return to the environment is the size of one M&M candy. There is no source of energy more environmentally friendly than that.

Summary Statement: Nuclear fission used in modern nuclear plants with the used fuel reprocessed and recycled and the fission products separated and refined for commercial use and non useable isotopes transmuted for short storage and return to the environment is the most safe, economical and environmentally friendly source of energy that can be used by California for the future. The California Energy Commission must give it full consideration for the future economy of California.

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