Atomizing Desalination Process Development And California Drought Relief Plan

The following article outlines a proposal presented today at a special press conference at the Sacramento State Capital by Calvin G. Larson, California Staff member of the Fusion Energy Foundation and U.S. Labor Party candidate for Mayor of Santa Clara. Mr. Larsen is a registered civil and agricultural engineer, with 10 years specialized experience in water resources. Working in collaboration with Dr. Lloyd Motz, Professor of Astronomy at Columbia University and member of the Science Advisory Board of the Fusion Energy Foundation, Mr. Larson has designed a plan for immediate application of an atomizing desalination process which if adopted would alleviate the drought stricken state of California. In a unique application of simple hydraulic principles, this laboratory-demonstrated process can provide a cheap, low-energy, and highly practical method of seawater desalination. The implications for agricultural development are tremendous not just in the U.S. but other water short areas of the Mideast, Africa, and Latin America.

The Drought Problem

If Californians demanded their economic rights, a low-cost, energy efficient, and laboratory-proven system of seawater desalination would break the death grip of the worst drought in history by the spring of 1978. Life-saving rains in the western U.S. cannot be expected next year due to a northerly 15 to 20 degree shift of the metastable high and low pressure zones in both northern and southern hemispheres. This shift was caused by the desperate denudation of over 100,000 square miles of Brazil's Amazon rain forests, encouraged by the debt-hungry Wall Street financial cabal and their lackey economists to establish primitive ranches for displaced city dwellers. (A similar de-urbanization is proposed for New York City by these same Big MAC controllers!) Continuing rains carried the exposed and fragile humus to the delta, leaving barren, untenable land. Deprived of about one-tenth of its heat absorbing vegetative energy-pumps (photosynthesis, oxygenation and evapo-transpiration), the once dominant Amazon system passed a critical threshold, lost its capacity to maintain a metastable low, and thus shifted meteorological patterns polewards. Until the self-perpetuating drought in the Amazon is reversed by sound re-forestation methods, all the empty reservoir capacity in the world will not help California.

Incredibly, some people in California, alienated from a sense of their own self-worth, still deny the impending energy and water crisis. Without green grass, alfalfa or other cheap forage available, beef herds, including breed stock in California and throughout the west are now being sold for slaughter at a loss to ranchers and at temporarily reduced prices to consumers. Without snow pack in the Sierra, both hydroelectric power and surface water for irrigation will be drastically curtailed, forcing "roving blackouts" on cities, industries and agriculture. Without the 2000 megawatt Diablo Canyon nuclear fission power plant, hounded by "environmentalists," there will not be enough power to pump from the deep groundwater basin in the Central Valley, where 20 percent of this nation's vegetable and truck crops are produced.

California's urban economy is not immune to the effects of severe cutbacks in crop and meat production. Not only will prices double or triple (if certain items are available at all) but reduced farm income means mass bankruptcies in the energy-intensive, debt-burdened, low-profit margin agri-business industry which represents a net worth of 8 billion dollars a year — more than half of California's gross state product. The shock effect on California's banking institutions, support industries (fertilizer, pumps, pipes, farm machinery, etc.) and transportation sector (shipping, rail and trucking) will dry up purchase orders, shipping consignments and regular or anticipated employment of industrial workers, farm workers and support service personnel.

What about sanitation and health conditions? State health authorities are warning the public about rodents in the Sierra — 2 cases of bubonic plague occurred last year, one man died. The increasing rat population infesting San Francisco's sewers boldly roam the trash cans at night — the bedrooms of the city's itinerant winos. Intensified by water conservation programs, the preconditions are ripe for outbreaks of marine typhus, Weil's disease, trichinosis, and bubonic plague.

And what solutions do the small-minded President Carter and Governor Brown propose? Long-term austerity, conservation, and solar power (which has recently been openly ridiculed by competent energy scientists in Congressional testimony) are their "answers." Such "answers" blatantly reject the real motivating force behind a healthy economy — the continuing research, development and assimilation of higher ordered technology with a corresponding increase in labor

skills. Carter's budget cut of 18 western dam projects for so-called "environmental reasons," many nearly completed, and Brown's insulting rejection of the "cowboy ethic" of agricultural water supply expansion and his table top demonstration of toilet tank "dams" at the recent western governors conference emphasizes that these men and their advisors (the purveyors of the Brazilian "miracle") are not working on the solution — they are part of the problem.

Californians correctly sense that their present standard of living is integrally tied to new technological developments. The electronics and computer industries are continuing to produce higher quality mini-computers and hand-held calculators at less cost for more and more routine industrial and household applications. Let's apply that methodology to energy and water problems before it's too late.

The Atomizing Desalination Process

In the early 1970s Dr. Lloyd Motz, Professor of Astronomy at Columbia University and now a member of the Science Advisory Board of the Fusion Energy Foundation, worked with a group of scientists in developing a new desalination process. This process uniquely utilizes the properties of water's liquid to vapor phase change under ambient temperature and atmospheric pressure conditions. The process is driven by a judo-like application of Bernoulli's principle.

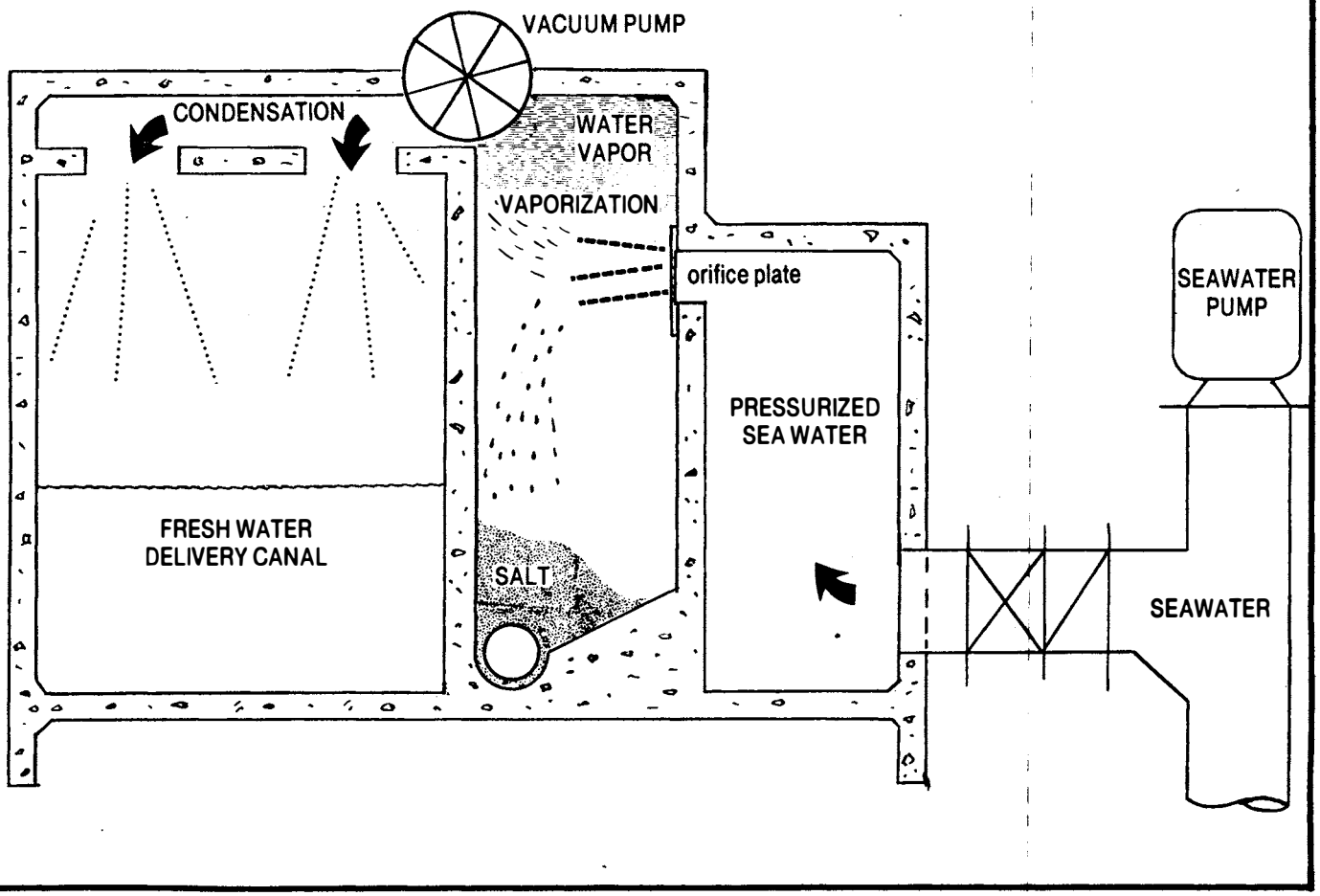
Seawater is pumped at high velocity and extremely low pressure through a series of specially machined nozzles into a vaporization chamber (Figure 1). The turbulent jet atomizes into small droplets about 10 microns in diameter with high surface area to volume ratios. The droplets rapidly evaporate as long as their pressure is below the liquid-vapor line (Figure 2). This is assured by the Bernoulli principle for all droplet velocities in excess of 1400 cm-sec (46 ft-sec).

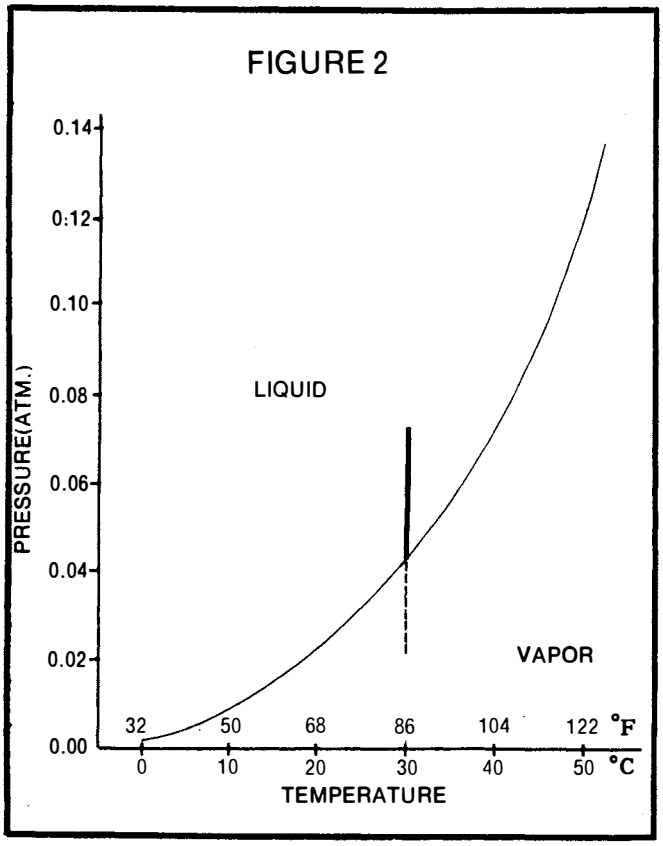
As droplets reduce in size, sodium and chloride ions are brought together by coulomb attraction. When the size of solid particles exceed the size of their droplet, all solids in suspension rapidly drop out. In their laboratory model Dr. Motz and his colleagues found that 76 cm (30 inches) from the nozzles liquid droplets could no longer be detected on a glass surface.

Two keys to the exceptional efficiency of this process should be noted. One is that the entrance of the nozzle

FIGURE 1

ATOMIZING DESALINATION PROCESS





orifices will be designed and machined to conform with the shape of the contracting stream from the pressurized chamber. This virtually eliminates contraction losses and can cut energy use and design pump horsepower in half. The other key is that as the ratio of surface area to volume of the atomized water droplets increases, the rate of evaporation increases. This interrelated process continues exponentially until the droplet is entirely vaporized.

The salt collected from this process will be automatically drawn from the vaporization chamber to nearby storage where trucks or barges can transport it for marketing. A trace element of this process, lithium, will be important as a fuel component for controlled nuclear fusion power.

The remaining elements of the desalination process are stock equipment and standard civil and mechanical engineering designs. To expedite installation the vacuum pump, condensing coils (with refrigerating unit if cooling water is unavailable), seawater pump and all electromechanical controls and telemetry equipment can be pre-ordered during final design of each site-specific application.

The versatility of these units is amazing. They can be installed as individual units at inland groundwater wells with high concentration of dissolved solids, as modular units for municipal or industrial use or as units connected in series along a coastline or estuarine levee, creating a virtual river of fresh water for cities, industries and agriculture.

The cost of the system is indeed nominal, even when compared to conventional reservoir water systems. For municipal systems in the San Francisco Bay Area, units can be advantageously located along the water front with regard to existing water treatment facilities. A group of 3 desalination units — one for standby reserve during normal maintenance — was used to demonstrate costs, excluding bacteriological treatment and conveyance from the site. With a capacity of 1.42 cubic meters per second (cms), each unit (Figure 1) will cost roughly $500,000, including site preparation. Assuming a 2' percent water loss factor (which would be very high for an efficiently designed unit) the total annual water delivery of the system would be 58,000 acre-feet. This system would supply 52 million gallons per day, sufficient for a city of 230,000 at 225 gallons per day per capita. The following tabulation shows the estimated energy requirements and annual cost per acre foot of this system:

Capital: $1,500,000 (20 years at 7%)	$142,000
Energy: 12,700,000 KWH at $0.05	635,000
Maintenance at 6% of Capital	93,000
Total Annual Cost at Site	$870,000
Unit Cost at 58,000 AF-Year	$15.00-AF

For agricultural systems, extra units are needed to offset peak summer demands and capital costs would be about 15 percent higher, unless the system contains reservoirs that could be used to equalize delivery and demand. The overall cost of such systems would be about 7 percent higher than shown, or $16.00-AF.This compares favorably with current multi-flash desalination with a cost of $400.00-AF.

Design Development

The provisions of 2 federal laws must be immediately implemented to save California's vital agricultural industry. The Saline Water Act of 1952 provides funding for the development of prototype models of low-cost desalination methods. The U.S. Office of Saline Water in conjunction with the California Department of Water Resources must be authorized and directed to expedite the development of the atomizing desalination process without delay. Firm and immediate authorization of 2.0 million dollars will assure viable design development prototypes. All relevant elements of government and industry must be alerted and mobilized in this effort. Dr. Lloyd Motz has indicated his willingness to participate fully.

The powers of the National Defense Production Act must be immediately invoked to assure that all material, equipment and engineering services are available for large scale implementation without delay. This means assuring that metal working, pump, pipe, valve, electromechanical companies and supporting infrastructure nationwide are guaranteed an adequate energy supply, skilled labor force, materials and support services to gear up for full capacity production when large scale orders and specifications arrive for the California Emergency Plan. The impetus of this plan will spark similar plans throughout the western and midwestern U.S. wherever saline surface or groundwater is available in sufficient quantity for either crop irrigation or livestock water.

If vigorously initiated in March, the design development of the atomizing desalination process can be completed in June. Concurrently, site specific applications throughout the state should be studied in rigorous detail.

California Emergency Plan

California's vital agricultural industry — representing 8 billion dollars a year, or more than half the gross state product — must be aggressively defended by pro-growth political, civic, industrial and agricultural leaders. The following immediate and near term plan proposed by the U.S. Labor Party must be vigorously initiated to ward off an impending economic and environmental holocaust beginning in California this summer.

In the immediate term the following measures will reduce the damage to a fraction of the present scope:

1) The State and Federal government should exhaust all means of assuring that the Central Valley in particular and all other agricultural areas of the state are provided with sufficient pumps, motors, pipe and ancillary equipment for drilling new or deepening existing irrigation wells. An inter- and intra-state inventory of well drilling firms, equipment, materials and sources of funding should be initiated and made available to all farmers and ranchers. All efforts to expedite institutional constraints, industrial back-logs and transportation should be made.

2) The huge Lake Powell and Lake Meade Reservoirs on the Colorado River should be depleted by 2 to 3 million acre-feet to ensure adequate irrigation, municipal and industrial supplies to the Imperial Valley, Los Angeles and San Diego counties.

3) Immediately authorize the licensing and expedite the completion of the Diablo Canyon nuclear fission plant. Its 2000 megawatt capacity is absolutely essential for the groundwater pumping in the Central Valley. Negotiate new or increased sales of electric energy from Canada.

4) Initiate the design development of the atomizing desalination process. This process is the only viable solution by 1978 in the face of the deteriorating meteorological condition caused by the immense deforestation in the Amazon rainforest.

Near Term: In the near term or by the spring of 1978, prototype-tested modular units of the atomizing desalination process will be designed and installed at pre-selected locations on the California coastline and estuarine systems. The 2 most important facilities would be located just west of Stockton — one near the Clifton Court Forebay pumping plant of the state-operated California Aquaduct and one near the Tracy pumping plant of the federally-operated Delta Mendota Canal. The capacity of these facilities should be sized to supply this year's estimated irrigation shortfall of about 7 million acre-feet. Modular units of the atomizing desalination process would be installed along the levees approaching the existing state and federal pumping plants. The units would draw both riverine and intruded tidewater from the waterways of the delta and deliver fresh water to the existing pumping plants.

The estimated cost of this combination of facilities is 350 million dollars. A total of 700 units with capacities of 1.42 cms would be required. They would use 1,230 MWH of electricity during this year and require 250 megawatts of electrical capacity during the peak month.

Another important location for a desalination plant is in Rock Slough near the intake works of the Contra Costa Canal. This system supplies most of the urban area of Contra Costa County. Tidewater intrusion now has caused the intake quality to exceed minimum state health standards. This condition is being used as a club by the Environmental Defense Fund to stop the San Felipe Project which is planned to service Santa Clara, San Benito and Monterey Counties. The Contra Costa Canal desalination facility would cost about 6 million dollars.

Other potential locations for municipal, industrial and-or agricultural desalination plants are:

1) In Tomales Bay near Dillion Beach on the coast about 40 miles north of San Francisco to supply central Marin County between Santa Rosa and Petaluma.

2) In Monterey Bay at Santa Cruz, Watsonville, Castroville, Seaside and Monterey to supply both municipal and agricultural water for lands threatened by seawater intrusion of present aquifers.

3) In San Luis Obispo Bay to supply the San Luis Obispo Santa Maria area.

4) On the coast near Lempoc for municipal and agricultural supply.

5) On the coast near Ventura and Oxnard to alleviate seawater intrusion in the Santa Clara River.

6) Select locations between Fresno and Bakersfield where stagnant groundwater high in dissolved solids may be reclaimed for irrigation.

7) Any other coastal or inland area that needs a fresh water supply.

The development of this revolutionary new desalination process will have a jack hammer effect on the California Water Plan as presently conceived. Previously regarded as infeasible, desalinated seawater will soon provide the long term firm water requirements of California's coastal cities, industries and agricultural land, freeing inland reservoirs and conveyance systems for other operating plans.