

## **A Sustainable Energy Plan For The USA Starting With Sustainable Air Conditioning Systems**

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When the temperature in the USA rises above 100°F in the summer, air conditioning systems stretch the electrical grids beyond their limits while cars and trucks choke the air in towns and cities. Politicians and Energy Companies want to build a "more robust" electrical grid and build "safe nuclear" and "clean coal" power plants (classic oxy-morons), costing \$Trillions and creating more greenhouse gasses.

Let us envision a world 20 years in the future when most homes and buildings are electricity generators rather than users, and most public and private transport runs on clean electricity. The electrical grid redistributes surplus electricity from sustainable buildings to energy intensive buildings and public transport during the day, and recharges electric cars and trucks at night.

This vision has buildings using little electricity, and most buildings producing more electricity than they use during hot weather. Electric utilities use solar fields generating plants and transportation uses little gasoline. U.S. greenhouse gas emissions have been reduced by 90%.

This may seem a fool's paradise, a shimmering vision of a future technological utopia. But such a vision is the kind that we need: Better to aim for a 100% reduction and fall short by a few percent than to aim for a 30% reduction and achieve our goal.

Can we create this sustainable energy future now? The truth is: Yes We Can!

We have the technology to achieve this vision today. We can make electric vehicles. Sustainable buildings could be built except that air conditioning systems are moving in the opposite direction, increasing electricity use, particularly at high outside temperatures.

The Problem With Air Conditioning (a/c) Systems:

The 1970's oil crises caused a stifling of a/c systems instead of innovative solutions. Engineers jumped at any solution that promised to save energy, no matter how poorly conceived. Building Owners panicked every time energy costs spiked and relaxed when the prices dropped.

All the threats for a/c solutions have failed so far. A 1988 report by Amory Lovins, founder of the Rocky Mountain Institute, revealed that newer a/c systems performed poorer than older systems in every aspect: being less energy-efficient, costing more to install and maintain, and providing poorer comfort. This report came after the 1973 and 1979 oil crises and is really a critique of its failures.

However, Lovins' report failed to uncover *why*. Worse, he asked the culprits who developed the systems for their solutions. Asking the fox to guard the henhouse is always a very bad idea. Since then, a/c systems' performance have continued in a downward spiral, causing 80% of today's buildings to have deferred maintenance, costing owners \$Billions every year.

The engineering and architectural institutions that should have prevented this failure, ASHRAE and AIA, are, ironically, spearheading a coalition for high performance buildings. We are letting the fox guard the henhouse again. "Green" initiatives leave much to be desired and most green buildings encompass only partial, short-term solutions that are not part of a whole life cycle plan.

None of the government agencies responsible for developing efficient and effective buildings have even recognized the problems with a/c systems. In fact, they are promoting poor systems, including Variable Refrigerant Flow (VRF) that is not only all electric but it pumps toxic refrigerants throughout the building. Doesn't this sound crazy when it's analyzed like this? A most successful Lobby group on K Street is the Ground Source Heat Pump Consortium, promoting Ground Source Heat Pumps (GSHP) that create all electric buildings. In both older and new larger buildings, variable air volume (VAV) systems prevail, the umpteenth version that is supposed to eliminate the problems of the last iteration. The commissioning and maintenance of VAV systems has been fundamental problems for over 50 years. All the above systems greatly increase electricity use during hot weather and are the cause of electric brownouts and blackouts.

One explanation for promoting poor a/c systems is that they are a gravy train for all involved, doubling the money made for everyone except the building owner and causing a very poor and sometimes dangerous indoor environment for the occupants. Sustainable buildings stop the gravy train. Sustainable buildings earn money from the utility company; something utility companies are against. Sustainable buildings need 70% less construction throughout a long life, causing a ripple effect through designers and contractors, and they need 70% less maintenance that deny lucrative maintenance contracts. The building owners and occupants are the only beneficiaries, but in a broader sense, the country and planet also benefit.

There are similarities between the global financial system and a/c systems. Complicated financial products built a house of cards that collapsed in 2008, leaving many people poorer and a few richer. Complicated a/c systems have made a few people rich and millions of building owners poorer and occupants uncomfortable.

Why haven't solutions to the electrical grid and transportation appeared? Haven't we realized that the maintenance on a gasoline car triples the worth to a dealership that electric cars can't? A/c systems are causing electric brownouts and blackouts that are totally preventable.

Should we stay on our current path – building new power plants and increasing electric, gas and oil use? Must we wait for a catastrophic meltdown similar to the financial system or should we redirect our ideas to allow a truly green economy to the forefront?

These are the choices we face today. We are at the tipping point on many global issues including climate change, pollution, and the economy. We could continue installing poorly performing a/c systems and build more power plants or we could develop sustainable a/c systems and electric transport for less cost with all the rewards for building owners, the US and the planet.

The A/C Solution:

We need a/c systems with minimal electricity use during hot weather and buildings that generate more electricity than they use during hot weather. Sustainable buildings produce more electricity than they use annually, repaying the energy used for construction and maintenance. These concepts should be the primary requirements for defining a sustainable building.

A broad solution lies in developing a Facility Master Plan (FMP) and Energy Master Plan (EMP) for every building and facility. The FMP is a sustainable plan for the facility and environs. The EMP is a plan for moving the energy systems of new or existing buildings, facilities and communities toward a sustainable future.

An EMP develops a complete plan toward sustainable, high performance end goals: a zero carbon footprint, minimum, easy maintenance, and maximum occupant comfort and productivity, with extended life cycles. To achieve a zero carbon footprint, the a/c systems should be able to make full use of renewable sources such as ground source heat exchange, solar thermal, solar PV, wind and water. All this is achieved while saving money and making more money from the buildings, making it an economic success.

Three strategies will drastically reduce electrical use in a/c systems and, when implemented on a large scale, will take us very far along our path to a sustainable energy future. These strategies are: utilizing ground source heat exchangers for cooling and warming, eliminating electric refrigeration; using liquid desiccant systems for humidity control; and using radiant systems for cooling and warming.

There is an economic opportunity for real change to solve many long-term problems. EMPs are a formula for short-term *and* long-term sustainability that will change buildings from being a problem into solving problems and turn them into sustainable, high performance facilities.

As the world becomes more crowded and competitive, sustainability is quickly becoming not only important for success, but will also become essential for survival.