

Virtual Power Plants

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Abstract—America is too dependent upon foreign energy sources, but it has the capabilities to free itself, while saving money and preserving the environment. If the U.S. Government increased its R&D (Research & Development) spending on renewable energy via Virtual Power Plants (VPP), America could be energy independent; converting foreign energy dependency into America's renewable freedom. Sustaining and developing a cleaner, safer, more efficient world by implementing and developing VPP's.

Index Terms—America's Energy Freedom, Combatting Global Warming, Cultivating Natural Resources, Gas and Oil Dependency, Renewable Energy, Sustainable Energy, Virtual Power Plants

1 INTRODUCTION

RENEWABLE energy can be found in many forms - all of which can be harvested and used by VPP's to generate power for electricity, to create heat, and to use as transportation fuels. Renewable energies are in abundance, America just has to cultivate them. The more America relies on its own vast variety of renewable energies, the less it will be dependent upon foreign liquid gases and oils.

America is too dependent upon foreign energy sources, but it has the capabilities to free itself, while saving money and preserving the environment. This paper questions the advantages of Virtual Power Plants and the need for renewable energy sources. Virtual Power Plants (VPP, hereinafter) are collective generators of renewable energy sources that can store and adjust energy output on demand and at will. VPP's can be employed to co-generate with current grids or operate solely to produce reliable, efficient, cost-effective energy while reducing costs and global warming (Encorp, 2011). My hypothesis suggests that VPP's can create substantial and sustainable energy from renewables, as it helps to reverse the destruction of our planet and ourselves. We can create and

produced by the sun's radiation, which relies on photovoltaics and heat engines; biomass from plant residue created by the sun through the process of photosynthesis; biofuels and biodiesels produced by bioalcohols, which is produced by the fermentation of plant materials, bioethanols created via recycled greases; and geothermal energy extracted from the Earth's core, drawn up by dry steam plants, flash plants, and binary plants. All of these methods can be employed, harvested, and used by VPP's to generate power for electricity, to create heat, and to use as transportation fuels. This is not an exhaustive list as renewable energies are in abundance, America just has to cultivate them. The more America relies on its own vast variety of renewable energies, the less it will be dependent upon foreign liquid gases and oils.

By increasing energy efficient technologies, VPP's could set the stage for the "Missing Link" of the energy crisis by providing energy storage (Bush & Wolf, 2009). VPP's have the capabilities to store energy, with more R&D spending in this area, the U.S. could greatly improve its production of renewable energies more efficiently, more effectively, and ultimately reducing its costs with less waste (Alternative Energy Press, 2007). The whole country would benefit in many ways: economically, politically, environmentally, medically, and socially. The benefits resulting from the implementation of equal capture and distribution of all available natural renewable resources would be reaped by all of society, while conserving our planet. It's a coalition of the most available, least destructive, natural energy resources coming together to maximize America's energy output and minimize environmental damage.

America would benefit from increasing its R&D spending on VPP's and the renewable energy resources required to help sustain, maintain, and

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sustain a cleaner, safer, more efficient world by implementing and advancing VPP's to meet and possibly exceed our energy needs.

Renewable energy can be found in many forms: wind power via wind turbines placed at on-shore and off-shore farms; hydropower and hydroelectricity - inclusive of kinetic energy, ocean energy, marine current power, ocean thermal energy conversion, tidal power, wave power, and dams; solar energy

progress into the future. America would also benefit from the implementation of other cost reducing, energy efficient technologies that help to reduce energy imports, phase-out nuclear power, and reduce greenhouse gas emissions (Alternative Energy Press, 2007). Ultimately, by increasing R&D spending on VPP's for renewable energies, and employing clean-energy efficient technologies, America would be creating a substantial amount of sustainable energy for generations to come (Alternative Energy Press, 2007), while simultaneously combatting global warming in the United States (American Solar Energy Society (ASES), 2007).

Renewed environmental awareness has led to new methods of generating power (Newman & Mutale, 2009). VPP's would be beneficial as they reduce greenhouse gas emissions (Newman & Mutale, 2009), which would help preserve our planet. America can benefit in many ways from limiting its dependency on foreign energies by increasing the production of American energy renewables and creating efficient technologies, as it also addresses the issues and problems of global warming (American Solar Energy Society (ASES), 2007). Implementing VPP's greatly increases the probabilities of self-efficiency; promoting freedom, creating jobs, and reducing costs. If the U.S. Government increased its R&D (Research & Development) spending on renewable energy via VPP's, America could be energy independent; converting foreign energy dependency into America's renewable freedom.

2 METHOD

By examining a variety of independent studies, charts, and graphs - the validity of the true value of VPP's and renewable energies will allow America to be energy independent. Studies announce the benefits and costs associated with VPP's for renewable energy; and acknowledge the benefits of clean, efficient technologies that will promote sustainable energy for all of America, as well as promoting energy freedom and reducing global warming. It's a winning solution for all that cherish a world that is shared! The studies used to constitute the writings of this paper show the truth of the benefits and the costs; it also allows the promotion of energy freedom, offers solutions to global warming, and aides in the affordability of energy sources for American citizens.

3 RESULTS

From the data collected, the results provide that in 2007 renewable energy only provided 7% of the United States energy consumption and only 9.4% for

the total of partitioned electricity use (U.S. Department of Energy, 2011), while nuclear energies exceeded renewable energies by more than 25% for R&D spending in that same year (Energy Information Administration, 2007). The American Recovery and Reinvestment Act of 2009 vowed \$45.1 billion for the production and development of renewable energy, energy efficiency, and other related energy programs and incentives (Bullis, 2010), but yet, "...of the \$36.7 billion the U.S. Department of Energy has to spend, so far it has distributed just \$2.4 billion (although it's announced awards totaling \$25.4 billion)" (Bullis, 2010). Indicating that funds are available for government investment of VPP's, renewable energies, and new advanced technologies - they just have to take the initiatives to move in that direction.

In 2010, the U.S. Department of Energy provided a "Guide to Financing EnergySmart Schools" (U.S. Department of Energy, 2010), which seems to indicate that the U.S. Government is seeking new ways to implement renewable energy plans. Even small, conservative initiatives will provide great, extensive benefits. The "Guide" was issued to encourage the rise of new schools to be built in exceedance of the current code (ASHRAE 90.1-1999.2) by 50% or more, and promotes improvements of existing schools by at least 30 percent (U.S. Department of Energy, 2010). Which seems like a very good start to a hopeful future for renewable energies. "The program offers tools and resources to assist school decision makers in planning and financing energy efficient high performance schools as well as education and training for building industry professionals" (U.S. Department of Energy, 2010).

It's the collaboration of team efforts that will educate, change, and benefit communities, officials, and families for the better as they seek improvements to the physical world while protecting the environment - all while saving everyone a lot of money (U.S. Department of Energy, 2010), and that is very beneficial! Investing in renewables today, could promise a brighter, healthier, cleaner, more affordable, less wasteful world tomorrow - creating and transforming energy in ways that are innovative, feasible, and practical.

It's enlightening to know that companies like ConocoPhillips (<http://www.conocophillips.com/EN/Pages/index.aspx>) are also dedicated to researching and developing renewable energy, while improving performance, creating high-efficiency technologies, and reducing negative

environmental impacts. Research suggests that R&D spending and certain forms of subsidies should not be subsidized for companies that are taking initiatives to improve, preserve, and sustain natural renewable energy and efficient technology research and development, as it is very much needed to maintain our world as we know it, and to improve our planet's conditions for future generations.

Government subsidies "aren't a bad thing" (Kachan, 2007), without them many renewable energy sources could not exist (Kachan, 2007). America's biggest problem is not that it offers subsidies that can help with production and distribution of VPP's and renewable energies, but rather that it gives too much money away (Kachan, 2007). Offering subsidies is beneficial; but giving too much revenue away, or not collecting enough revenue from taxes that are due is what causes inflation, dead-weight loss, and increases the national deficit - causing more harm than good. Michael David (2008), said it best when he published the following: "Subsidies need to work for the American tax payer and limited to qualified and verifiable alternative energy research that yields production by the end of a fixed period - else the subsidy goes away." This would create extended benefits, increased productivities, and produce an efficient environment for subsidies that will reduce waste, fraud, and corruption, as well as promote the most effective use of funds, and ensure the proper distribution of revenues. Everyone can help to reduce, reuse, recycle, and repower America and its energy by visiting <http://www.repoweramerica.org/>.

4 DISCUSSION

The U.S. Government appears to be on the right track as they are implementing programs and using funds to increase awareness and production of renewable energy sources. Though they are progressing, it seems as though the progression is very slow in times of dire need. As non-renewable, non-sustainable energy resources are consumed to depletion on a global scale, the need for new technologies and increased renewable energy sources is significantly important to sustain the world as we know it. Pfeiffer (2010) acknowledges the global importance of an adequate supply of climate friendly, environmentally friendly, and cost effective sources of energy.

With the evidence presented, it seems logical to increase U.S. R&D spending on VPP's to include a wide variety of renewable energy resources, and to invest in the production of energy efficient technologies to increase America's energy freedom and eliminate American dependency on foreign

energy sources. Ex-President Bush is quoted as saying, "Today we make a major step toward reducing our dependence on oil, confronting global climate change, expanding the production of renewable fuels and giving future generations a nation that is stronger, cleaner and more secure" (Cannon, 2008, p.29), and that was on December 19, 2007 (Cannon, 2008, p.29). It's in America's best interest to implement and use its own natural, renewable energy resources to promote efficiency, to increase production, and to allow for affordable distribution of energy producing resources.

No one solution will eliminate America's energy dependency; it will take the collaboration of all available renewable energy sources to free America. Creating a sustainable development policy seems feasible by reducing non-sustainable energies (Schilling & Chiang, 2011). America needs to invest less capital in non-sustainable energies and increase its focus and investments in sustainable resources and advanced technologies. It is undeniable in the facts presented³, that it would be in America's best interest to seek sustainable, renewable energy sources and technologies that can and will help develop the VPP's that are very much needed to rectify America's energy crisis, as it has the capacities and capabilities of being successful at its venture!

Freeing America from its energy dependency on foreign sources will also increase American utilities as it lowers the price of production, distribution, and consumer pricing. The excessive amounts of revenue lost caused by the current overtaxed subsidizing of the oil industry (Kachan, 2007) could be used toward the R&D and production of new technologies and more efficient renewable energies. Ultimately, all renewable energy resources have grown over the years in production⁴, but there is still plenty of lead way for improvements, growth, R&D, and production of advanced technologies.

Global warming is a by-product of America's energy dependency; it is also a problem that is preventable - simply by increasing America's use of more efficient, more sufficient, safer, cleaner, natural, renewable energies and technologies. It's the freedom of winning solutions, and America has the power and resources to do it. Natural gas and oil consumption as not yet declined (U.S. Energy Information Administration, 2010), nor is projected to do so anytime soon, which only proves the need for America to implement changes to a dire situation. Improving the distribution of renewable energies today is important

to sustain America, its environment, and ultimately, the world - for generations to come!

VPP's are "truly an open-protocol end-to-end design" (Encorp), which has the ability to interact with other automated energy management and energy grid systems (Encorp). VPP's are beneficial because they allow utility companies and high-energy users to control the amount and source of power drawn from a network of power plants that distribute renewable energy sources as needed (Encorp). Encorp is the leader in Microgrid System Controller™ development, and has successfully implemented the New Energy Economy⁵ by offering cogeneration, as well as prime-generation of renewable energy sources (Encorp). Today is all we have to protect our

tomorrow; additional research should be warranted and conducted to address the specifics of the topics mentioned herein. Addressing such issues could provide clarity and understanding about VPP's and renewable energy, and how they offer solutions and/or suggestions that we can all partake in and learn from regarding sustainable energy, advanced technologies, and American freedom. This paper is limited by the constraints of time-frame given for this assignment. This paper does not include in-depth information of any given topic, but rather a general perspective of the many issues surrounding VPP's. Further, in-depth research would provide greater understanding, and perhaps speed things in the right direction.

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