INCREASING RENEWABLE ENERGY PRODUCTION
AND ENERGY EFFICIENCY IN DC
Report and Proposals

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SUMMARY

I try to estimate the current availability of renewable energy in DC and the potential for renewable energy and energy efficiency to reduce our dependence on fossil fuels.

I also propose ways to achieve that potential.

Key recommendations :

- **Start coordinated effort** involving environmental NGO's, unions, clean energy industries, government, utilities and financial institutions to increase the adoption of weatherization and renewable energy generation by residences and businesses
- Build the outreach by **putting emphasis on job creation** and **savings in energy bills**

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Motivation and Background

This effort was started because of a request from the energy committee, communicated by Larry Martin, to analyze the availability and potential for renewable energy in DC and to what extent it can help reduce our dependence on fossil fuels. DC gets a fair amount (>90%, with >50% from coal) of its electricity from fossil fuels. Pepco gets only about 5% from renewable sources, mostly from bioenergy (solid waste, captured methane, biomass) and hydroelectricity. At the same time as we try to reduce this dependency, we need to increase energy efficiency as well as renewable energy generation to offset the loss of capacity.

[On the particular issue of retiring the Mirant coal fired power plant in Alexandria, American Clean Skies Foundation (ACSF) has recently (July 20!) commissioned a report (available at its website **cleanskies.org**) that says we can retire the Mirant coal plant without disrupting power supply due to transmission and substation improvements completed by PEPCO. On their website you can also see a development plan for the area that would provide more jobs and more economic opportunities than the power plant].

I found that the current rate of adoption of renewable power generation and weatherization is very low and will take decades for us to make a significant dent in our effort to reduce dependency on fossil fuels at this rate. While the newly adopted **Distributed Generation bill** (aka DC solar bill) will certainly help accelerate this process, we need to start a coordinated campaign to make serious progress in the near future, given the urgent need to reduce greenhouse gases. This will fit well with Sierra Club's national campaigns such as Cool Cities and Beyond Coal (which recently received $50 million from Mayor Bloomberg). In recent blog posts Sierra Club Director Michael Brune has been asking for increased adoption of solar energy production, even wondering if we could not have solar panels on every rooftop. With a coordinated collective effort, we should be able to put DC on the forefront of the green energy economy. Right now we are well behind cities like San Francisco and New York. San Francisco is planning to be 100% powered by clean energy by 2020, with a combination of wind, solar, wave energy etc., Not only should the campaign be co-ordinated across Sierra Club, it must be co-ordinated across various environmental nonprofits. Moreover, I believe that it is important for this campaign to be well focused and have a simple and attractive message that the average person would find compelling.

In the following I describe the potential we have in DC for increasing renewable energy and the ways to attain that. While every effort has been made to ensure the accuracy of the data and my estimates are generally on the conservative side, I must add that I did not have the resources to conduct exhaustive research by any means. It is entirely based on all the articles I have read and the lectures I have attended on this topic, including the **recent International Green Energy Conference in Arlington, VA , July 28-29.**

RENEWABLES POTENTIAL IN DC

Based on the **report to the city council** prepared during the debate on the solar bill, currently we consume about 12000 gigawatthours (GWH) of electricity in DC. [Note that this is not the total amount of energy that we use. That would include energy for transportation in the form of gasoline and diesel power and so on. I did not include the possibility of a large number of electric vehicles being used as part of our transportation system in the future]. Of this close to 80% is used for commercial buildings and about 15% for the residential sector based on **energy use by sector data from USDOE**.

I considered solar, wind, geothermal and bioenergy along with weatherization. Of all the options, solar energy seems to me the easiest to promote and implement on a large scale. I believe that we should energetically promote solar energy and weatherization while also encouraging other sources of renewable energy and buying power from companies such as Cleancurrents that support renewable energy production. Here are my estimates for the maximum possible renewable energy production in DC.

SOLAR:

Considering our location and physical features, it seems to me that our main resource is the availability of a large amount of square footage on our rooftops and parking lots and the solar radiation that falls on them. Here I give a very conservative estimate of the maximum possible solar power generation from rooftops and parking lots.

DC has some 100,000 single homes and row houses, and about another 20,000 buildings (apartments, condos, etc.,) in the residential sector **based on data at quickfacts.census.gov**. Estimating that an average home can produce at least 3 KW and an average apartment building can produce 10 KW of solar energy, translating to about 3000 KWH and 10000 KWH per year, this amounts to a total of 500 GWH of the 2000 GWH approximately being consumed by the residential sector [1 KW of installed capacity generates about 1000 KWH per year in DC or 1 MWH per year; 1 GWH = 1000 MWH]. Note that this is a very conservative estimate. I have not included solar thermal installations since they normally do not generate electricity and many home heating systems use natural gas and so they would not be reducing electricity consumption, although they would certainly help reduce emissions as well as save money.

DC has about 120 million square feet of commercial office space according to website of **CB Richard Ellis Inc** . Assuming each building has 20 floors on average (in order to get a conservative estimate on the rooftop space) you get about 6 million sq. ft of rooftop space. Even if 3 million sq. ft is usable that would generate about 30 GWH. For an example, the Moscone convention center in San Francisco is to be fitted with solar panels on its roof to generate 675 KW [= 675 MWH = 0.67 GWH] per year.

There are also federal and district office buildings, universities, schools, hospitals, sports arenas, hotels and other non-commercial, non-residential buildings as well as parking lots. American university now has 532 KW of solar panels installed on seven buildings, saving millions over the 20 to 30 years of the lifetime of the solar panels. By opening day of 2011 season Fedex field will have 2 MW of solar power

from solar panels on its parking lots that provide shelter to tailgaters and power to the stadium. RFK, Nationals stadium and Verizon center along with their parking lots alone can produce from 15 to 20 MW together. While I do not have exact figures, I think one could safely say that a total of 30 GWH could easily come from this sector.

So finally I would put the total solar power generation capacity of DC from all rooftops and parking lots to be at least 560 GWH per year or 560 MW at the least. It is definitely much larger.

Solar panels along the roads: There at least 100 miles of wide avenues in DC along the sides (or medians) of which it should be possible to install panels of thin film solar cells that would not weigh too much or take up too much space and could be installed without too much effort or disruption. The state of Oregon has done a pilot project and is planning to install more solar panels alongside highways. Assuming about 75% of this length is covered, and each mile providing an area of about 25,000 square feet (about 5 feet of width—less than one lane -- being taken up by panels on the streets) it would generate about 10 MW or 10 GWH, noting that thin films provide half the power of regular panels. If instead, solar "trees" of the type produced by **Envision Solar** were used, covering more area and producing more power, this could produce about 50 MW or 50 GWH annually.

Speaking more generally and just for the sake of argument, each square mile of land area of DC if completely covered by solar panels can produce about 250 MW. So in order to produce 10 GW or about 83% of our consumption we would have to cover 40 square miles or pretty much all the land of DC except for parkland ☺

WEATHERIZATION

I was told by my friend Nils Petermann who works in the energy efficiency sector that the average home in DC could save about 20% of its energy use by weatherization. Assume that we could have at the most half of that savings from all the residences of DC (or half the residences in DC getting 20% savings) and that about 20% of the electricity use goes towards cooling. That would amount to a savings of about 40 GWH. A big boost would come from some of the larger commercial and office buildings becoming more energy efficient. More on this below. Where solar panels are not viable, **solar thermal systems, painting roofs with reflective white coating and green roofs** can be considered to reduce heating costs (among other things). [Thanks to Julie Locascio for this suggestion].

WIND ENERGY

This was more difficult to estimate. Unfortunately DC is not blessed with a lot of wind power. Based on the calculator program on Southwest wind energy's website (windenergy.com) I found that on the average wind energy could produce about 1 MWH per year for a 55 foot tower in DC. This is on ground level. One could perhaps get more power by installing on top of buildings. Unfortunately this output is too low to give a good return on investment, since such an installation would run to about 15000$ for the windmill purchase and installation. While specific groups (such as American University, where a Professor is designing his own) could perhaps design and build their own for less, I don't have a good estimate as to how much power can be generated. But certainly people who wish to incorporate this into their buildings should be encouraged to do so.

GEOTHERMAL ENERGY

DC also does not have a lot of geothermal sources of energy as far I know. One could, however, offset some of the heating and cooling costs through a geothermal heat exchange system working on pumps. Although initial costs are high and installation is a more complicated than solar power systems, according to **Geothermal Options, Inc.,** of VA the system pays for itself in 5 to 10 years. This would certainly reduce our electricity consumption and emissions. People who wish to incorporate this into their buildings should be encouraged to do so.

BIOFUELS

DC Biofuels LLC (see **dcbiodiesel.com and dcen.net**) has a plan to collect waste bioenergy material (cooking oil, animal fat, etc.,) and produce biodiesel at a plant with 25 million gallon per year capacity. American University also has a biodiesel program. Pepco gets some of its electricity from a methane captured from landfills (the facilities are not located in DC though). Some argue that composting is a better way to reduce emissions than using biofuels. Nevertheless, I think one should encourage biofuel use as long as composting on a large scale is not possible. The biodiesel is not used for power generation but mainly for transportation. DC Water does have a plan to produce up to 10 MW daily from biogas coming out of a sewage sludge digester (scheduled to go into operation in 2014).

SUMMARY OF RENEWABLE CAPACITY

Based on the above calculations the total renewable capacity of DC is atleast 700 GWh out of the total consumption of 12000 GWh. With more utilization of wind energy and geothermal energy it could be much higher.

After writing this, Jigar Shah of Carbon War Room (formerly founder of SunEdison) provided a reference to a study done on total rooftop solar panel capacity for DC (doesn't include parking lot solar panels, street light solar panels, etc.,) by the **Energy Foundation.**

This gives a much better estimate (although they used similar reasoning, they had more data). According to this study, the total rooftop space available in 2010 (study was done in 2004) will be 78 million square feet for residences and 81 million square feet for commercial buildings, and total solar photovoltaic electricity potential is about 2000 MW or 2000 GHh approximately**.** Again, this is maximum achievable capacity.

This study also predicts 2010 production for solar panel power. Under a price scenario of $1.25 per watt (production at peak solar generation) it predicts 23 MW ; at $2.5 per watt about 5 MW ; at $3 to $3.75 about 2 MW and at $4.25 (predicted price) about 1 MW. **Our current capacity (2 MW) is higher than predicted capacity, even though prices have stayed as predicted.** Nevertheless it is a very small percentage of overall capacity.

But because such a large portion of our energy use comes from the commercial sector that consumes 10000 GWh out of the total 12000 GWh, and DC is such a small place with limited capacity, making DC less dependent on fossil fuels would necessarily mean that two things would have to happen:

A. Our buildings would have to become much more energy efficient. This is not an impossible task. It is possible with existing technologies to retrofit buildings so that energy use is reduced by 50% or more. (Empire State Building is being retrofitted to consume 40% less energy).

B. The utilities need to get more of their energy from renewables and more homes and residences must sign up with companies such as **Cleancurrents** that use renewable energy credits to support renewable energy sources.

Of course there are many possibilities that I have neglected, and perhaps it would be possible at some point, just like San Francisco is planning, to get 100% of our energy from renewables, although a good portion of that energy would probably come from outside of DC.

WHAT WE CAN HOPE TO ACCOMPLISH

AND SOME PROPOSALS FOR DOING THAT

In what follows I will focus on what we can hope to achieve in the next 10 years or so and make some suggestions about we can go about doing that. I will focus on what I think are practical and realistic in terms of what we as citizens and environmental activists can work on.

There are many steps that we can take, but I want to highlight two key themes that I think should form a central part of any campaign:

1. **A MASSIVE, CO-ORDINATED CAMPAIGN**
2. **A FOCUSSED, STRATEGIC MESSAGE**

A MASSIVE, COORDINATED CAMPAIGN

There are many, many environmental groups working on different campaigns. Just in the area of renewable energy alone there are many different organizations doing really great things. But I believe that **unless we coordinate our efforts, pool our energies, resources and volunteers, it would be an uphill battle**. At some point the public would get activism fatigue with the constant barrage of myriad messages and activities, however crucial and well-intentioned. Even as an avid environmentalist sometimes I am conflicted about which activity I should pour my energy on. Also, when there are many different messages coming from many different directions, the impact is less because they are

scattered. Since there is a finite pool of volunteers, from the viewpoint of effectiveness of our activism also it would be advantageous to coordinate our efforts and resources. Different environmental organizations, renewable energy associations, government, unions and utilities should all work together. [More on utilities later].

We need a **massive campaign because the problems facing us are massive**. We have a massive unemployment problem; a massive energy problem; a massive climate change problem; a massive environmental degradation problem. The scale of the problems requires a solution equally large in scale. Various groups have tried to ramp up the scale of public involvement but as far as I can see, so far we have not succeeded in getting the public involved in the numbers that will make a critical mass**. Most of the time it seems like we are preaching to a choir**. Because of that reason, politicians do not feel compelled to act. On the other hand, the opponents of climate action have managed to get a majority of the public on their side. I am not sure that the only difference is that they have more resources and power.

Fortunately we can attack all these problems together with one coordinated, large scale effort. And if we shape our message properly, we can also **get a much bigger portion of the public behind us**. This would help not only with the renewable energy campaign but **also make them favorably disposed towards our other activities as well.** It also doesn't mean we need to abandon other activities or divert too many resources and energy. How can we do this? Here is my suggestion.

My proposal for a strategic message: **SAVE MONEY, CREATE JOBS, SAVE THE PLANET**

I believe this simple message (a la "Save money, Live better" for Walmart, although that is not my inspiration ☺) would draw more of the general public towards green energy and other environmental causes. While it is easy to convince the environmentally minded about the need to go for conservation, green energy, etc., I think it would be easier to get the rest of the population involved if we show the economic benefits. **Especially in these times of tight money and unemployment people are bound to respond to a campaign that saves money and creates jobs**. This is a great opportunity, actually.

My suggestions for a campaign plan: Emphasize solar and weatherization up front, encourage other forms of energy alongside.

Based on my experience with canvassing during each of the past 4 election cycles starting with the Kerry campaign, here is what I propose. We should broadcast the message broadly, in as many forms of media as possible. That should be combined with a canvassing effort. The central message should be

SAVE MONEY, CREATE JOBS, SAVE THE PLANET. This can lead to supplementary messages.

For instance if we meet somebody we first tell them that they can save money, create jobs and save the planet by going solar and / or weatherizing their home. If they are interested we can ask them about their interest in other programs, like wind energy, geothermal, biogas, recycling, sustainable buildings, local produce, water conservation, etc., that are of more interest to one's particular organization. If this were a website there would a main page with the main message that would lead interested readers to

other pages. [More on websites later]. Just as the Obama campaign helped many other candidates to succeed through its "coattails", a campaign to save money and create jobs by weatherizing and going solar would help many other campaign succeed on its coattails.

DETAILED PROPOSAL WITH CONCRETE STEPS

Here I list specific steps for running a campaign to get more homes and businesses to take conservation measures and install renewable energy. I start with the justification for basing this campaign on saving money and creating jobs.

JUSTIFICATION FOR CLAIMS OF JOB CREATION AND MONEY SAVING:

I don't really need to do this since all of you are well aware of it but here are the main points compiled from various sources:

1. Renewable energy is fastest growing sector of economy AND it creates the most jobs per unit of energy installed. [**Union of Concerned Scientists "Clean Power fact sheet"; Wei, Patadia and Kammen "Putting clean energy to work…"**]
2. Creates many local, manufacturing and rural jobs and sources of income. [UCS fact sheet]
3. Would save US economy several billions in reduced energy costs -- as much as $96 billion by 2030 [UCS fact sheet].
4. Jobs created are well paying, and range across a wide spectrum: manufacturing, construction, clerical, scientific, engineering, sales…[**American Solar Energy Society report** produced by Management Information Services]
5. Families and businesses can save thousands, even millions over several years by going with renewable energy. [Bit of self promotion: My small row house in Columbia heights with its 2.6 kw installation will soon be reducing our use of electricity from grid and save us about $5000 over its lifetime. We put only 1500 down as part of a leasing program]. BTW, it also increases value of the home, according to my real estate agent Bonnie Roberts-Burke.

Examples:

1. The Empire State Building retrofit (done with help from Clinton foundation) will reduce energy costs by $4.4 million a year—and created 252 jobs. Total cost of retrofit: $20 million.
2. American university gets 100% of its purchased electricity from wind power, and annually 637 MWH of electricity from solar panels and heat energy equivalent to 609 MWh of electricity from solar thermal systems. They plan to be a carbon neutral campus by 2020. [**American.edu**]. They would also save millions of dollars over the lifetime of these systems.

GET BUILDINGS TO GO GREEN

As mentioned earlier, a big part of DC's energy use is in commercial buildings, including the federal buildings. We should encourage buildings to go green [do weatherization, install renewable energy generators, practice conservation…] citing the examples above. Going green also adds to the prestige

factor. It is encouraging that DC has the most LEED certified buildings in the US. But many of these are new buildings, I believe. Federal government has plans to weatherize its buildings but we should give an added push. Everyone should talk to the authorities who run their own buildings [I will start by talking to the Howard University administration].

MEDIA CAMPAIGN

We should advertise in as many media forms as possible. TV, newspapers, social media, ads in public spaces…. Environmental NGOs, renewable energy associations, unions and government should combine their resources for the advertising campaign.

We should start a **facebook page** for this campaign. People can **share their stories**, and we can **run a count of how many people went solar**, weatherized their homes, etc., **Repower America** should be asked to make a page on their website for this campaign.

INVOLVEMENT OF UTILITIES AND FINANCIAL INSTITUTIONS

This seems to be a little more tricky, but if the utilities can be involved in this campaign that would greatly help in our efforts. Anya has mentioned some success in this regard with PEPCO on her website [**dcsun.org**]. If we could convince them that this would be in their interest, and get them involved in the media campaign as well as reaching out to their customers (which would make the advertising part very easy) that would give a big boost. They should also be encouraged to add more renewables to their portfolio. We should talk to many utilities, such as PEPCO, Exelon, etc., and see who responds best.

Since **financing is key** to starting many of these projects, we should enlist banks and other financial institutions as well. **Solar city** and **Sungevity** (Sierra club partner) are offering leasing options which are increasing demand but without leasing the tax incentives are critical. PPA's (power purchase agreements) become viable only around 15 KW or bigger sized units. Group discounts are possible if several residents in a block apply for solar power collectively. [More on block organizing below]. **One Block Off Grid** is a company working on such programs but it is mainly operational in NY, MA, NJ and CA. **Solar co-operatives** can be definitely a great vehicle for this. Perhaps Anya can tell us what they are doing and what can be done in this regard (i.e, getting group discounts). The expiration of DC government support is significantly affecting adoption of solar power in DC, according to a representative of Solar Solutions LLC (they hosted a recent solar party along with Anya). Perhaps the SEU could provide some funds?

CANVASSING AND PETITION DRIVE

Another arm of the campaign would be to go canvassing door to door and public places. This is where working together would be of great help. The impact of many volunteers from different organizations starting out with the same message would be much greater than different groups going on their own campaigns, I believe. Again, to use the analogy of the political campaigns, there is a main campaign that prominently pushes the main candidate, say Obama. Behind this main campaign different local campaigns, such as congressmen and state and county politicians push their message as well. The main campaign includes the other candidates in their outreach efforts. If the main candidate succeeds he or

she is able to boost the other candidates. Similarly each organization can push its own message on the side while it is pushing the main message of "save money, create jobs" by going solar and weatherizing.

The petition drive can also **recruit volunteers.** Early adopters in a block can be targeted to serve as information sources and recruiting engines for the neighborhood. **Petition drive can help in getting big organizations** such as the federal government or local government and other big organizations **to go green.** For example, the Milpitas county school dist in CA with its 3.4 MW system over 13 buildings reduces the district's energy costs by more than 22 percent, which translates to an estimated $12 million in savings to the general fund over the life of the project.

The canvassing drive can be supplemented with **block parties** where people learn about going solar, weatherizing, recycling, etc., Block parties could have a solar booth powered by solar panels, including power for the music system, to draw the attention of people. These booths can also provide **cellphone/laptop chargers** to attract interest.

Another possibility is **solar food vans** run completely with electricity from wind power or biofuels, along with solar panels for keeping the food warm (or cool) and powering music system and computers for providing solar consultation and sign-ups as well as cellphone/laptop chargers to attract interest.

Anya mentioned a **solar fair in September**. Solar energy + job fairs can be a big part of publicizing and increasing solar energy production.

Solar powered stages can be used for festivals such as Adams Morgan festival or Mt. Pleasant festival, to attract interest and create awareness. Such stages have been used in many music festivals all around the US. At Appalachian State University, student Jimmy Hunt used **solar powered stages** and other green measures to power the "**Music in the Mountain**" festival as well as publicize green technology. Austin based solar company "Sustainable Waves" produces trailers that can be transported anywhere and open up to become stages powered by solar panels on their roofs.

I believe that a massive, coordinated campaign will fuel the energy and enthusiasm of volunteers, especially young people, if it also means that we can create jobs and save the planet at the same time.

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