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FOUNDATION FOR RENEWABLE ENERGY AND ENVIRONMENT (FREE)

DEMOCRATIC FINANCE: ENERGY OF THE PEOPLE, BY THE PEOPLE, FOR THE PEOPLE

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"A generation from now, this solar heater can either be a curiosity, a museum piece, an example of a road not taken—or it can be a small part of one of the greatest and most exciting adventures ever undertaken by the American people; harnessing the power of the sun to enrich our lives as we move away from our crippling dependence on foreign oil." - Jimmy Carter on the installation of solar panels on the White House in 1977.

About this Policy Note

This Policy Note builds upon a proposal submitted to the 2014 Massachusetts Institute of Technology (MIT) Climate CoLab Energy Policy Contest.

The Note draws from previous work done by the authors and published on the website of the Foundation for Renewable Energy and Environment (FREE). The idea of repurposing "energy obese" citizens [1] to energy wise investors and position them as active participants in the energy transition is based on the concept of a Sustainable Energy Utility (SEU) in which the economic and governance dimensions of energy-society relations are transformed to reflect sustainability and equity principles. [2]

In brief, "democratic finance" of energy argues for citizens to become retail investors through crowdfunded rounds of photovoltaic (PV) system installations on federal buildings in order to accelerate the U.S. energy transition to renewable energy, elevate the visibility of sustainable energy use, lower pollution levels, and signal U.S. climate change action commitment to the rest of the world.

A full 37 years after President Carter's speech, the White House is finally once again the owner of a photovoltaic (PV) system installation. To continue on the road ahead, this Policy Note outlines a strategy that seeks to reconnect people to energy, redirect the U.S. towards a green energy economy, and reposition the U.S. as a global leader in green energy matters.

At the outset, the strategy realizes that conventional pathways to support green energy largely take place without meaningful levels of public participation as they are structured around the energy utility. Moreover, motivated by increasing energy sales, the conventional energy utility structures green energy pathways along 'bigger is greener' lines of reasoning. The strategy outlined here seeks to re-empower citizens and attract their participation in the energy transition. In addition, the strategy seeks to re-invigorate a public system of energy decision-making, allowing public representation to actively work for public benefits. These starting points originate from earlier work done on the Sustainable Energy Utility (SEU), as documented in the Foundation for Renewable Energy & Environment (FREE) Policy Brief Series. [3]

The strategy outlined in this Policy Note harnesses the power that exists in three ongoing global trends:

- The trend of rapidly falling PV system prices [4];
- The diffusion of the option of democratic finance [5]; and
- The global push for a new international climate change treaty in which the U.S. will need to demonstrate significant commitment to ensure success. [6]

To harness these three trends and move the U.S. towards a fundamentally new energy future, the democratic finance concept suggests tapping into two sources of overabundance:

- At an estimated 135 million sq. meters (1.4 billion sq. feet) of rooftop real estate, the U.S. government owns a vast and untapped resource [7]; and
- The vast potential of the multi-billion dollar market of retail (i.e. small-scale) investors.

1. Byrne, J., Martinez, C., & Ruggero, C. (2009). Relocating Energy in the Social Commons - Ideas for a Sustainable Energy Utility. *Bulletin of Science, Technology, and Society Vol. 29, Nr. 2*, 81-94.
2. For more background information, please see the FREE Policy Brief Series and other FREE Policy Notes available at: http://freefutures.org/free-policy-briefs/policy-briefs.
3. See Note 2.
4. REN21, 2014. Renewables 2014— Global Status Report. Renewable Energy Policy Network for the 21st Century. Paris, France.
5. Best, J., Neiss, S., Stralser, S., & Fleming, L., 2013. How Big Will the Debt and Equity Crowdfunding Investment Market Be? Comparisons, Assumptions, and Estimates. Fung Technical Report No. 2013.01.15.
6. Bailer, S., & Weiler, F. 2014. A Political Economy of Positions in Climate Change Negotiations: Economic, Structural, Domestic, and Strategic Explanations. The Review of International Organizations.
7. For the methodological approach used, please see Byrne, J., Taminiau, J., Kurdgelashvili, L., & Kim, K. (2015). A review of the solar city concept and methods to assess rooftop solar electric potential, with an illustrative application to the city of Seoul.Renewable and Sustainable Energy Reviews, pp.

The centerpiece of the strategy is the creation of a project-based investment platform for solar energy by the federal government that opens up existing rooftop real estate for the installation of people-funded PV systems. As such, the strategy has several key components:

1. The reliance on democratic finance, employing 'crowd-funding' or 'crowd-investment' techniques, solicits the general public for capital thus allowing retail investors to participate for as little as $25.
2. A project-based investment platform on which investors can browse for interesting investment opportunities.
3. The opening up of federal rooftop real estate for PV system use.
4. The delivery of a range of benefits in addition to environmental benefits.

Federal Rooftop Real Estate

At a total floor space of 2.87 billion square feet, the US federal government has the most building space in the US. In fact, the building stock owned or used by the federal government equals almost 1% of U.S. residential and commercial floor space.[8]

The total floor space is calculated to correlate to about 1.4 billion sq. feet of rooftop space. However, not all of this rooftop space is available for PV system implementation due to factors such as architectural and solar suitability limitations, ground coverage ratio, and PV maintenance requirements, among others.

Following several literature-based assumptions,[9] our calculations arrive at enough space for the installation of an 8 GWp system divided over the many rooftops of the US federal government building stock. Such a system size corresponds to about 9.4 billion kWh/year. [10]

Initial applications of the strategy can be directed at a selection of several states. Figure 1 shows that some states have a considerably higher amount of rooftop space available and contribute much more in terms of final output. However, other conceptualizations of the strategy could include a form of competition between states, enticing investors to invest in their own state to advance local job creation, pollution reduction, and climate change mitigation. This could spur a form of a "race to the top".

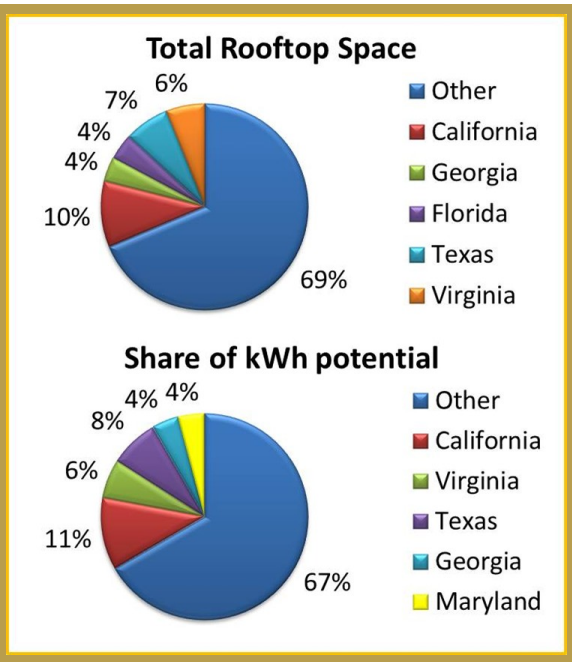

Figure 1. Rooftop area and share of kWh potential for a selection of states.

Considering the available rooftop real estate and their emission pattern, a logical first selection of states where projects can be developed is a focus on Maryland (MD), Virginia (VA), District of Columbia (DC), Texas, (TX), and California (CA). Targeting these states potentially allows for an optimization strategy.

8. United States, Department of Energy, "Table 2.2.1 Total Number of Households and Buildings, Floorspace and Household Size," and United States, Department of Energy, "Table 3.2.1 Total Commercial Floorspace and Number of Buildings,"
9. The assumptions that we followed to arrive at these numbers are:
   A. The federal building stock averages 2 floors;
   B. 65% of rooftop real estate is suitable (following Denholm and Margolis, 2009).
   C. 70% of the 65% can actually be usefully applied towards the generation of electricity due to GCR and maintenance and service requirements.
   D. A 5 degree tilt of the panels is assumed. Panels are assumed to be 13.5% efficient.
10. For a more detailed overview of the methodological approach, see footnote 7.

Democratic Finance

Title II of the JOBS Act creates the opportunity of general solicitation. However, the provision is limited to 'accredited' investors - a small sub-set of investors. A similar provision of the JOBS Act, Title III, is slated to enter into effect later this year and will open the option of general solicitation to non-accredited investors: the general population will be allowed to make equity-based investments. In contrast to current forms of "rewards-based" crowdfunding, where investors receive rewards in the form of certain perks (a ticket to an opening show, for example), Title III will allow for an actual financial rate of return on investments (here called democratic finance).

Considering the experience with rewards-based investments, high hopes exist for democratic finance. For instance, one of the leading rewards-based investment platforms, Kickstarter, recently crossed the billion-dollar mark with the help of over 5.7 million people, demonstrating the vast potential that exists.[11]

Market industry reports further detail the multi-billion dollar crowd-funding market.[12] The transformative power of crowdfunding is detailed by the World Bank in their estimate of $96 billion crowd-funding market for the developing world alone.[13] In fact, rapid industry growth is expected to continue (Figure 1).

In contrast to rewards-based crowdfunding, democratic finance is expected to produce much larger opportunities. A recent paper by the University of Berkeley, California, estimates that a $4 billion market could rapidly establish itself in the United States with more potential to grow after that. [14] Research additionally shows that such expansion is accompanied by rapid job growth and can leverage additional investments from professional investors. [15] It is no surprise that many nations around the world, including the European Union, pursue the implementation of crowdfunding regulation to capture this transformative promise. [16]

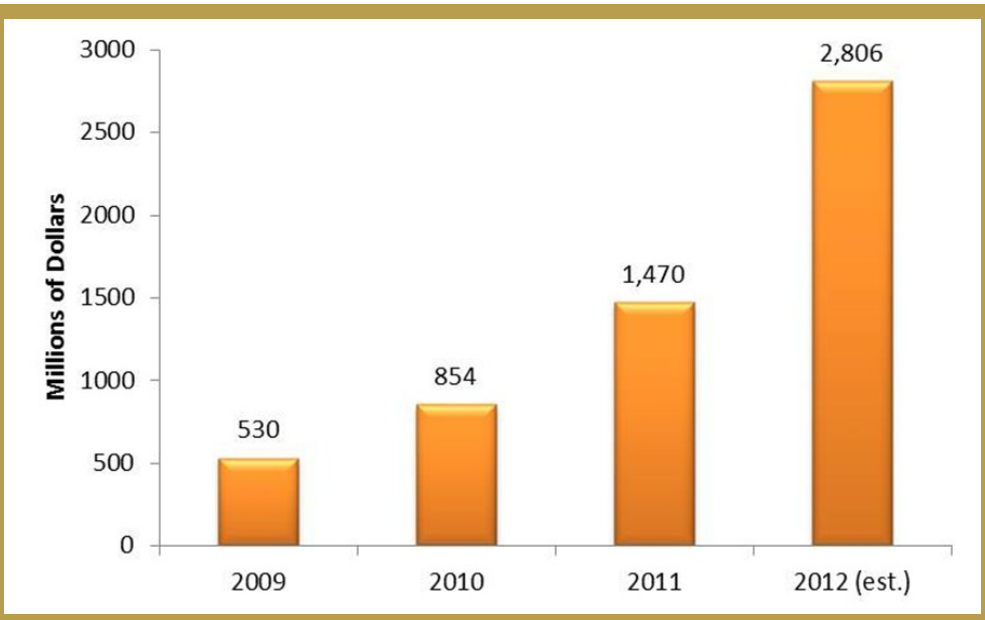

Figure 2. Growth in Worldwide Rewards-Based Crowdfunding Volume.

11. Crowdsourcing, 2012. Crowdfunding Industry Report - Market Trends, Composition, and Crowdfunding Platforms. Research Report by Crowdsourcing, LLC. Document can be obtained from: research@crowdsourcing.org
12. Crowdsourcing, 2012. Crowdfunding Industry Report - Market Trends, Composition, and Crowdfunding Platforms. Research Report by Crowdsourcing, LLC. Document can be found at: research@crowdsourcing.org
13. World Bank, 2013. Crowdfunding's Potential for the Developing World. World Bank: Washington, DC
14. Best, J., Neiss, S., Stralser, S., & Fleming, L., 2013. How Big Will the Debt and Equity Crowdfunding Investment Market Be? Comparisons, Assumptions, and Estimates. Fung Technical Report No. 2013.01.15. http://www.funginstitute.berkeley.edu/sites/default/files/Crowdfund_Investment_Paper.pdf
15. Crowdfund Capital Advisors, 2013. How Does Crowdfunding Affect Job Creation, Revenue Growth, and Professional Investor Interest?
16. CEC, 2014. Unleashing the Potential of Crowdfunding in the European Union. Communication from the European Commission.

A National Investment Platform

Reconnecting people to the issue of energy by allowing them to invest in the energy future of the nation requires an investment platform. The creation of a national investment capability can direct the transformative promise inherent in the innovative character of democratic finance towards a fundamental energy transition. To do so, the platform details investment opportunities in the form of PV projects similar to the UK-based Trillion Fund or US-based Mosaic. Such a platform details the prospectus of different projects, the expected rate of return, the location of the projects, their lifetime, etc. The general public can then browse these projects and decide in which they want to invest. Similar to the other already existing platforms, investments can start at a low level (for instance, $25) to allow for a high level of participation.

The projects consist of a federal building - or a group of federal buildings - in which the investor can invest. For example, Mosaic recently completed an investment round for the installation of a 12,270 kW system on US military housing in Fort Dix (NJ). The promise of the strategy here primarily rests on the vast rooftop space the federal government has available. Figure 3 offers a hypothetical illustration of such an investment platform, inspired by the platform developed by Mosaic.

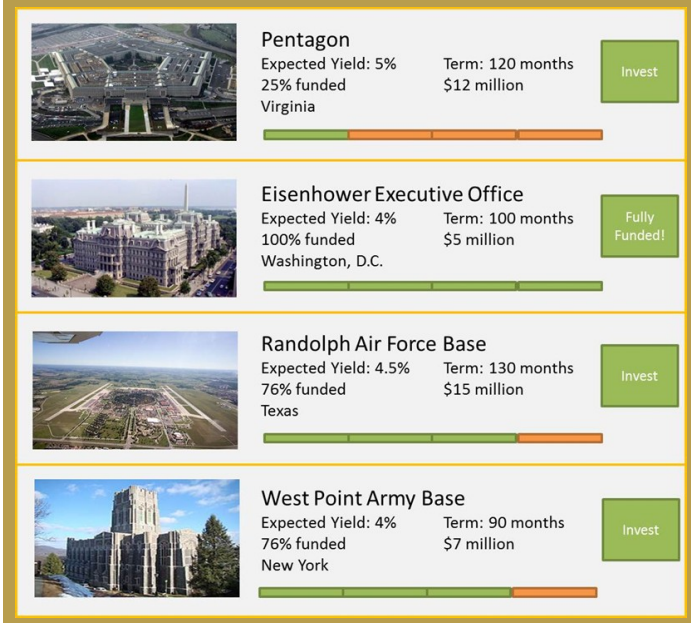

Figure 3. Illustration of Project-Based Investment Platform. Example focus on the Department of Defense.

What are the Strategy's Costs?

According to the Solar Energy Industry Association, commercial scale solar PV systems costs are approximately $2.5/Wp.[17] At 8 GWp max potential solar, the total installed cost is approximately $20 Billion. Most transaction providers/portals provide a 1% fee, resulting in transaction service revenue for the facilitator of $200 Million. Given this large service revenue, facilitating this large program will receive competitive bidding at potentially no upfront cost for the public. In other words, the earnings potential of the program facilitator will provide enough incentive for a financial institution to build the program without an upfront cost.

In other words, there is no need for federal allocation of capital. Investors are repaid through the electricity sales agreements and the third-party operator levies its transaction fee for continued operation of the platform. This advantage eliminates the need to engage with elaborate and burdensome capital allocation processes of the federal budget, saving time and money in the process. Congressional budgetary approval, for instance, can take considerable time and effort.

The capital allocation process uses money already collected from taxpayers to fund government projects. Our proposed strategy seeks to move away from using tax dollars and towards using investment dollars to fund the solar installations. A direct investment by the 'crowd', furthermore, has the added benefit of avoiding citizen perceptions of government inefficiencies. Thus, we propose a way of funding this project in a new and different manner, one not using tax monies.

17. Solar Energy Industries Association, 2014. http://www.seia.org/research-resources/solar-market-insight-report-2014-q1

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Benefits Associated with this Strategy

The energy strategy reconnects the general public to the now far-off topic of energy. Current interaction with energy is limited to a pattern of consumption, restricting participation by the general public to a monthly bill. The strategy outlined here re-purposes every eligible inhabitant of the US from a consumer to an investor, together building a new energy future for the US.

The PV projects will be installed on publicly-owned buildings. By law, these federal buildings appropriate a portion of their budget to pay for energy services. As such, reducing the need for these energy services opens up a portion of the budget, which can be used to repay the up-front capital costs as provided by the investor. One particular benefit that arises from this construct, commonly detailed through power purchase agreements (PPAs), is the low-risk investment climate that is created: default of energy service payment is highly unlikely. The PPA can detail payments to the investor in much detail and much experience has been gained so far with these types of constructs. Relying on such a well traveled road further reduces risk.

The PPA can further detail an attractive investment rate of return. Notably, however, this attractive rate of return does not necessarily have to equal conventional market rates. The crowdfunding experience suggests that the emotional benefit associated with participating in projects that investors support is significant. In fact, the rewards-based platforms of Indiegogo and Kickstarter largely rely on this emotional response. In terms of actual financial returns instead of perks, Mosaic, similarly, has found considerable investment appetite at relatively low investment rates of return. These lines of evidence suggest that a 4-6% rate of return should be sufficient to attract large numbers of investors.

PPA agreements tend to outline a certain lifetime of the agreement. The agreement, therefore, outlines how long investors will be participating in the project (e.g., 10 years). After that, the PV system becomes publicly owned and any revenues from that system can be directed at other uses. Considering the long lifetime of PV system installations (typically, about 25 years), this could involve a considerable contribution. For instance, such revenues can be directed at a reduction of the cost-of-government. A federal government with fewer costs could translate to lower taxes or additional repayment of foreign debt. Another example of how such revenues can be usefully deployed is to use it to fund low-cost student loans or to otherwise bring down education costs.

The strategy will be a very visible step toward a more sustainable energy future. In addition to NO2 and N20 emission reductions, the program can result in a decrease of over 9 million tons of CO2 emissions per year or 0.37% of U.S. wide annual electric power emissions. More importantly, the program motivates and inspires others to act as well.

Where Can These Actions be Taken?

One of the major challenges includes regulatory hurdles associated with strategy implementation. Specifically, working across different utilities and public service commissions, the program will have to navigate varying incentives and net metering policies. Nonetheless, despite this 'patchwork', solar installations have succeeded in every state, bolstering optimism for our chances of success. Further, similar to any building owner, the federal government is ultimately the decision maker in determining how to maximize solar potential of its current rooftop space.

Considering the patchwork, a potential hurdle is avoiding a dominance of installation in more solar-friendly states versus non-solar friendly states. If this happens, investors in non-solar friendly states may have a more difficult time investing in locally sited projects. For example, the solar rebate was just recently discontinued in Missouri. The third-party operator, therefore, may decide to avoid Missouri as investment attractiveness could be much less than other states. In fact, states vary significantly with their regulatory requirements for solar PV. States with high federal building property, such as Georgia and Florida are located in states without a solar carve-out whereas federal buildings located in North Carolina have a minor solar carve-out.

Who Will Take These Actions?

Federal procurement rules and federal law are complex, oftentimes prohibiting third-party financing or prohibiting temporary ownership of facilities. Practical implementation of the strategy outlined in this Policy Note is, therefore, also complex. Perhaps a role could be filled by the General Services Administration (GSA), the independent agency of the U.S. government charged with the management of the basic functioning of federal agencies including cost-minimization strategies, but this likely requires legislative change giving GSA the authority to treat rooftop real estate on designated facilities where security and other risks are not considered an issue and could be eligible for PV democratic finance.

A more promising route, perhaps, lies with the Federal Energy Management Program (FEMP) which has been able to successfully experiment with long-term energy management strategies at federal buildings through its Energy Service Performance Contracts Program. [18] Sidestepping traditional appropriation issues – and, importantly, their limitations in a budget-constrained world and political climate – FEMP has been able to successfully navigate the implementation of innovative financing strategies across the Federal government in a manner which some believe has responded effectively to the complexity of federal procurement rules and laws. More research is required to identify the practical implementation pathways of the strategy documented here.

Questions for Further Research

This Policy Note conveys a conceptual idea with significant potential. However, the pathway to implementation of this idea is long and there are a number of questions that still need to be resolved. Examples of these kinds of questions are:

- *Grid instability at high-penetration rates of PV installations:* studies show the potential for relatively high penetration rates without too much difficulty. For instance, in the western U.S. states, a 25% solar energy penetration rate is technically and operationally feasible and a similar result is produced for the east coast, additionally noting that solar PV is a favorable way forward compared to other renewable energy technologies.[19] This concern is, therefore, not immediately threatening to the strategy documented here.
- *Storage requirements:* the strategy relies on the notion that federal government buildings have a load energy curve that is most pronounced in the day-light hours (when people are at work), precisely when PV is most productive. As such, storage requirements, as long as PV systems are carefully planned to contribute to 'peak shaving', need not be included in project design.
- *Federal Procurement:* Federal procurement policies for equipment installed on federal facilities and grounds can pose an important obstacle. More research will be needed on how to meet principles underlying these policies while also opening up federal facilities owned by the citizens of the U.S. to democratic finance.
- *Project Financial Management:* Because crowdfunding encourages an investment stream based on potentially millions of citizen-investors, factors related to project financial management can be complex, including the assurance of crowdfunded revenue streams to support capital investment. If, for example, the projects cannot begin until full the capital requirement is in hand, what happens when investors deposit monies but the project is not met? If the option of shifting the funds is built into the platform, is the 'vote' of funding by each 'stranded' investor? Will delays needed to complete the shift of funds to another affect the interest of project developers? An alternative approach is to debt-finance the projects and use crowdfunded revenue as a source of repayment. Of course, this approach has its own challenges, including the credit worthiness of the crowdfunder pool. Again, research will be needed to find a satisfactory path(s) to realize the concept of democratic finance.

The authors are currently working on finding answers to these questions and to outline an appropriate implementation pathway and, ultimately, establish a real-world application of the proposed innovation.

18. Schafer, Z. B. (2012). *The future of federal energy efficiency finance: Options and opportunities for a federal Sustainable Energy Utility.* Newark, DE (USA): Center for Energy and Environmental Policy (CEEP). University of Delaware.
19. Lew, D., Miller, N., Clark, K., Jordan, G., & Gao, Z. (2010). Impact of High Solar Penetration in the Western Interconnection; GE Energy Consulting (2014). PJM Renewable Integration Study.

About the Foundation for Renewable Energy and Environment (FREE)

The Foundation for Renewable Energy and Environment (FREE) is a non-profit, international organization established to promote a better future based on energy, water and materials conservation, renewable en-ergy use, environmental resilience, and sustainable livelihoods. Guided by experts and distinguished aca-demics, FREE sponsors research, supports graduate education and consults with organizations on strate-gies to create new sustainability models, to advise policy makers and other societal leaders, and to provide outreach to communities seeking to transform energy-environment relations. Managing an active agenda of conferences, films, exhibitions, seminars, and publications, FREE works with cities, non-profits, govern-ments, businesses, and academic institutions around the world on environment and renewable energy is-sues.

Founded in 2012, a unique feature of FREE is its ability to harness the creativity and wide band-width of expertise of an evolving network of experts active in over 40 countries. Many were educated in the first U.S. graduate program in the field of energy & environmental policy at CEEP (University of Delaware). These FREE Minds are a vital re-source enabling the Foundation to address the pressing issues of our era with the sort of in-depth and diverse think-ing they require.

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