A "Solar" Solution to the Energy Crisis in Lebanon

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I - Introduction:

The Lebanese energy crisis has persisted for long but it was given a new lease on life by the outbreak of the financial crisis in 2019. The energy sector has always been the primary source of government debt with large, unsustainable budget deficits. The main cause of the energy crisis goes back to the fact that EDL, the monopoly electricity firm in Lebanon, is a state-owned firm and as such subject to all kinds of inefficiencies. And as the government has the upper hand in terms of energy provision, wasteful entitlements and corrupt practices in the sector has denied citizens their right to benefit from steady, reliable energy consumption. As a result, the dire energy situation in Lebanon requires immediate, sustainable solutions. On the demand side, there is still skepticism concerning the use of renewable energy, although some are currently switching over to this more viable source, especially solar energy that is actually experiencing a mini boom at the moment.

However, the fact remains that large segments of the population are unaware of the advantages of switching to solar, especially among underprivileged groups who are not sufficiently educated on this matter. These groups still have faith that electric power will be restored in their

houses in the near future, and that the energy crisis as a whole will be rectified. But what they are currently subsisting on is unbearable and practically inhumane; and worse, this is bound to persist as Lebanon is nowhere near a resolution of its energy crisis. Moreover, by sticking with this "waiting" option, they suffer long hours of total blackouts . Aside from solar panels, the next or only available solution lies in resorting to private generators' usage, a system that is relatively costly to the majority of Lebanese citizens. Many, for instance, can only afford to have their refrigerator on for a short period of time and keep one or two lamps turned on for a few hours.

Hence, it is imperative to find solutions that would help rectify the inequality in awareness, and by extension the inequality in opportunities relating to energy provision that unfortunately seems to be widening over time. And, as important, it is not only a question of demand, as it is equally crucial to take measures on the supply-side, in order to ensure that supply is fully equipped to efficiently and productively respond to the growing uptake in demand for solar panels as an alternative energy source.

We will tackle these issues by firstly presenting the cost and benefits that arise from using solar energy; then discussing and evaluating the demand and supply policies that favor its adoption.

II - Cost-benefit and efficiency analysis[1]

● Cost-Benefit

What is truly remarkable is that the off-grid cost of solar panels has declined substantially over the years due to technological advances, by perhaps close to 90%. Currently, the cost of a 7 Kilo Watt

[1] All data in this section are from the Lebanese Solar Energy Society (LSES) : *www.lses-lb.com*

Peak (kwp) system installed for a representative household and providing adequate electric power of about 945 Kilo Watt Hour (kwh) per month is about $9,500. On the other hand, private generators cost $0.5 per kwh. In order to lay the basis for a sound comparison between the cost advantages of solar panels over private generators, we need to compare the two for the same energy uptake. To start with, the cost of private generators' use per month per household is 945kwh x 0.5$ = $472.5. As such, the break-even period -- the point at which the cost of installing solar panels just out-competes the cost of resorting to private generators -- can be calculated as follows, assuming that X is the number of months at which we just break even in terms of cost:

$472.5 X = $9,500

X = 9,500 / 472.5

X = 20.1 months.

Therefore, we can simply argue that the average household will break even in just over 1 and a ½ years after the initial purchase. And, of course, the benefits accrue later, as the average lifetime of solar panels is about 25 years, so the cost of electric generation for the remaining 23 and ½ years will be "presumably free". But given that the lifetime of (lithium) batteries is about 8 years, and the lifetime of inverters is half of that of solar panels, current estimates put the cost of electricity from solar panels to the average household at 7.8 cents per kwh compared to 50 cents per kwh from private generators – in other words, almost 7 times cheaper, which no doubt guarantees that solar panels is a worthwhile investment.

Additionally, with enough storage capacity, the solar system will be operational all year round, most importantly in this respect in winter, as the country receives almost 300 days of full sun in the year with an average of 8 hours of sunshine daily. The advantages also accrue in the case of on-grid systems, or a grid system tied or connected to the national network, which is almost half cheaper than the off-grid system and, with battery storage and connectivity to the electrical

supply from EDL, consumers can still be able to obtain the 945 kwh per month if and when the partial EDL supply is available.

● Green Efficiency

Perhaps more important, with solar energy there are tremendous green benefits. As the average fuel consumption of a diesel generator is 0.33 L/kwh, the CO2 emission generated by a diesel generator is estimated to be 0.8-0.93 kg CO2/kwh. Assuming that the generators in Lebanon generate 0.86 kg CO2/kWh, a middle value, we can calculate the amount of CO2 per month their use entails as 0.86 x 945 = 812.7 kg CO2 per month per household.
In comparison, a solar panel emits 50 g, or 0.05kg, of CO2/kwh. Similarly, the amount of CO2 produced per month if a household entirely relied on solar energy would be 0.05 x 945 = 47.25 kg CO2 per month. So the difference in carbon footprint between these 2 alternatives is 812.7 kg - 47.25 kg = 765.45 kg of CO2 saved.

It is evident that there is a huge difference in carbon footprint, and hence a huge impact environmentally. Solar panels therefore fit perfectly into the definition of a merit good. Not only they are beneficial but they also have a significant positive spillover on third party, as the Lebanese society as a whole will benefit from a cleaner and more sustainable environment.

III - Demand-side measures to nudge people to adapt their energy uptake into renewable solar energy

Though the use of solar panels is getting more widespread, it is still important on efficiency and fairness grounds to strengthen demand-side measures to make the switch to renewable energy as broad and equitable as possible, by bringing awareness and support to those most in need.

Direct Provision:

The solution of direct provision consists of the government directly allocating resources, namely solar panels in this case, to families most in need. This reallocation of resources can help bridge the inequality gap between households of different income levels, and increase the demand for solar panels.

The major drawback of this measure is that it involves a significant fiscal cost for the government, which incurs opportunity cost as well as risks involved with deficit spending. This corresponds to the next best alternative that is foregone when providing households with solar panels. This could be investments in merit goods such as education or healthcare. In addition, this adds to the immense debt the Lebanese government finds itself welded into, estimated at around $40 billion or more than 175% of GDP[2].

Nudging:

The concept of nudge theory is extremely useful in prompting individuals to behave in a specific way, and in a manner that they can overcome their lack of rationality. There are numerous ways of approaching nudging. In our case, nudge theory can be molded into a feasible solution to the energy crisis in Lebanon. We will briefly discuss below two nudging initiatives: one that is already in action; and the other we will newly propose.

The first, is the viable nudging initiative RESTART. It involves training specialized engineers, who then go to visit houses and examine different houses' configuration, before establishing detailed reports on the best use of energy for each house. This initiative nudges households into adopting solar energy as it brings in advice by credible specialists who should have the best interests of households

[2] Blominvest Bank, Research Department, *Blominvest Blog.*

in mind, especially those from low income backgrounds.

The second, is one we propose and has as its aim spreading awareness and benefits on a wider communal basis. As such, we would suggest installing solar panels on an iconic building in the heart of Lebanon. That way, the technology would to be presented to a big audience at all times. One such building might be the Rose House on Bliss, a prized monument located in the center of Beirut, on one of its busiest streets. The house itself would then be used as an information center on the benefits of solar and how it beats quite convincingly energy from fuel generators; it could also be used as an exhibition for solar energy firms to showcase their products and offers at hand. In fact, and as important, this nudging initiative could be repeated in houses in major cities and towns across the country, and its cost (rent plus operational expenses) could perhaps be funded equally by NGOs in conjunction with Solar Energy companies.

Eliminating Tariffs/Providing Tax Credits on Solar Panels:

A tariff is a tax placed on imported or exported goods in an economy. As solar panels are not produced locally in Lebanon yet, all of the panels are imported at a tariff rate of around 6%. The fact that solar panels are not produced domestically is itself an incentive to demand and use solar panels so as to stimulate local production and employment in solar panels in the future. But abstracting from this possibility now, eliminating the 6% tariff would reduce the cost to $8930 (down from $9,500). As a result, the breakeven number of months would fall to 18.8. Though not very substantial, this reduction in the number of breakeven months could act accordingly as an incentive for further use of solar energy. In fact, if we consider the elimination of tariffs on other inputs used in solar energy – most importantly inverters and batteries – the incentive to adopt solar would be noticeably higher.

Another interesting demand policy, which would affect companies, is to provide tax credits to

companies so as to use solar energy to power their businesses or factories. So far our analysis has focused on households but if we also include businesses as potential users, the demand for solar energy and the benefits accruing from its use will be magnified. In this respect, tax credits would be given in the total or partial amount of solar investments by companies and should act as a stimulant for companies to adopt it, as it does with other investments in equipment and technology.

Providing subsidized loans:

The government should seriously contemplate providing subsidized loans for consumers to install solar energy. It would be a different approach to tariffs/tax credit, as it would specifically target low-income households. The government had provided such loans through BDL before the crisis, but they have been discontinued. Currently, there are a few commercial banks along with Banque de l'habitat who provide loans for solar energy, but though the interest rates are reasonable, they are however not subsidized. That is why a new initiative of subsidized solar loans backed anew by BDL would add momentum and urgency to these schemes, and would be a huge step in the right direction as it would prioritize the economic well-being of low-income earners, and would be additionally justified by the social gains from cleaner air.

IV: Supply-side policies to complement the incentives brought forth by demand-side measures

In parallel to developing the demand-side measures needed to make this switch to solar energy successful, it is vital to reform the deficient system on the supply-side so that it is prepared to meet the demand for electricity in general, including the capacity to provide more solar panels.

Privatization:

On the supply-side, the preeminent solution would relate to privatization of the energy sector. Privatization is the transfer of government services or assets to the private sector. As we

know, the economy of Lebanon is subject to unparalleled levels of corruption and government mismanagement. According to the World Bank, Lebanon has consistently ranked higher in terms of corruption levels than most developed and developing countries – scoring 76 on its corruption perceptions index. A case in point relates the unfortunate Port of Beirut explosion on the 4th of August 2022, which in the words of Human Rights Watch argued: "'The very design of the port's management structure was developed to share power between political elites….It maximized opacity and allowed corruption and mismanagement to flourish."[3]

Given that EDL, the monopoly electricity company in Lebanon, is a state-owned company, it is not surprising that it is prone to major inefficiencies tainted by corruption. Enabling private firms to take up EDL's energy burden would be synonymous to a significant increase in productive and allocative efficiency. Moreover, this would undermine the government's control over the energy sector, making sure in the process that needed solar panel systems would be provided to the Lebanese adequately and at reasonable cost rather than lost in the clutch of corruption.

Deregulation:

A related supply-side measure is deregulation. The current scarcity of distributors of renewable energy would benefit from looser rules for their production processes, which will drastically increase the amount of solar panels that are traded. It will also lower the barriers to entry in the solar panel market and encourage new firms to enter the solar market and compete in it for the benefit of the consumer, both households and businesses. More generally, this measure could help raise the potential output of the Lebanese economy, as it acts as a market-based supply side policy which lays the foundation for higher levels of innovation through a better use of factors of production, including the nascent solar energy sector that might even see more production locally.

[3]https://www.hrw.org/report/2021/08/03/they-killed-us-inside/investigation-august-4-beirut-blast

Another main advantage of such a measure is the job creation that should come along with it. In parallel to the energy crisis, unemployment is currently a major problem in the country as it is extremely difficult to find a full-time job, especially given the lack of hiring (as it should rightly be) in the public sector. Hence, an abundance of private energy firms, including solar, would help decrease unemployment in Lebanon, in addition to ameliorating the severity of the energy crisis.

New distribution model:

Currently, as the uptake of solar panels accelerates, it is imperative -- as we highlighted earlier -- to make resources and information available for low-income households, as it appears that higher income households take up a much bigger share of solar panel purchases. One such system – as adopted for instance in Jordan – is an on-grid solar system with net-metering where any excess of electricity is offset by recording bidirectional energy flows. Though net-metering has been introduced in Lebanon, it is still in its early stages and should be more widely applied in connection with EDL (or its private equivalent), so as more consumers will be able to sell their excess electricity to EDL and have their bills reduced without the transferring of any cash. And, of course, the fact that it would reduce energy bills makes solar attractive to adopt especially by low-income households.

Lastly, this system also means that excess energy will not be wasted and, in the process, will increase the flow of supply. Barring privatization, the downside of this measure lies in the difficulty of rendering it effective due to corruption and government inefficiency, and in the fact that people might not be willing to surrender their energy in government's hands.

V – Conclusion

Unfortunately, the energy crisis in Lebanon has become a human crisis. With the dearth of public electricity from EDL and the high cost of private generators, poor households were left to fend for themselves and to have extremely limited access to electricity, on top of their painful living conditions. What we have tried to do in this paper is to advance an alternative energy system that is based on solar. It is a system that is not only cheaper to use but also environmentally cleaner. This latter property, being a positive externality, justifies the use of subsidies to encourage the use of solar panels. As a result, we have proposed in our demand policies measures such as income support and subsidies, especially to the poor, to spread the use of solar; that is in addition to nudging, taxation and commercial measures. But demand is only one half of the market picture; so to complete the picture, we have also proposed supply-side policies to stimulate the provision and even the local production of solar panels, based on privatization and deregulation of the energy sector, in addition to innovative measures such as net-metering. Perhaps, as important, it would be ideal if all or part of these measures are applied within a comprehensive framework of reforms in the Lebanese economy that includes public-sector or governance reforms besides the needed financial and fiscal reforms. That way their impact would be felt sooner and larger.

Lastly, we have left out the discussion of hydroelectric power, which in Lebanon up until the late 1960s used to provide more than 65% of energy supplied. This is especially the case as Hydro is both cheaper and cleaner than fuel (but not so compared to solar) and can be re-used and re-developed again as a viable and additional energy source. We leave it for perhaps a future research project.

VI – Suggested Bibliography

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