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SUSTAINABLE ENERGY FOR LEBANESE VILLAGES AND COMMUNITIES:

THE VILLAGE 24 INITIATIVE

September 2018

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Note: The information contained within this document has been developed within a specific scope, and might be updated in the future.

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Disclaimer:
The present booklet has been developed by the EU – funded UNDP CEDRO project based on the experience of the first community-led initiative implemented in Kabrikha, South Lebanon.

The implemented process, legal documents and project itself have been completed in close coordination with the Net – Metering Committee of the National Utility Company (EDL) and the LCEC team.

This booklet is a first draft and is thus open to future edits and updates based on lessons learnt from the Kabrikha implementation and changes / upgrades to the electricity situation in Lebanon (both infrastructure, production and distribution). The booklet provides sequential recommendation and/or guideline to how the process of community net metering can be carried out and in no way does it represent an official endorsement by the Government of Lebanon and/or the UNDP.

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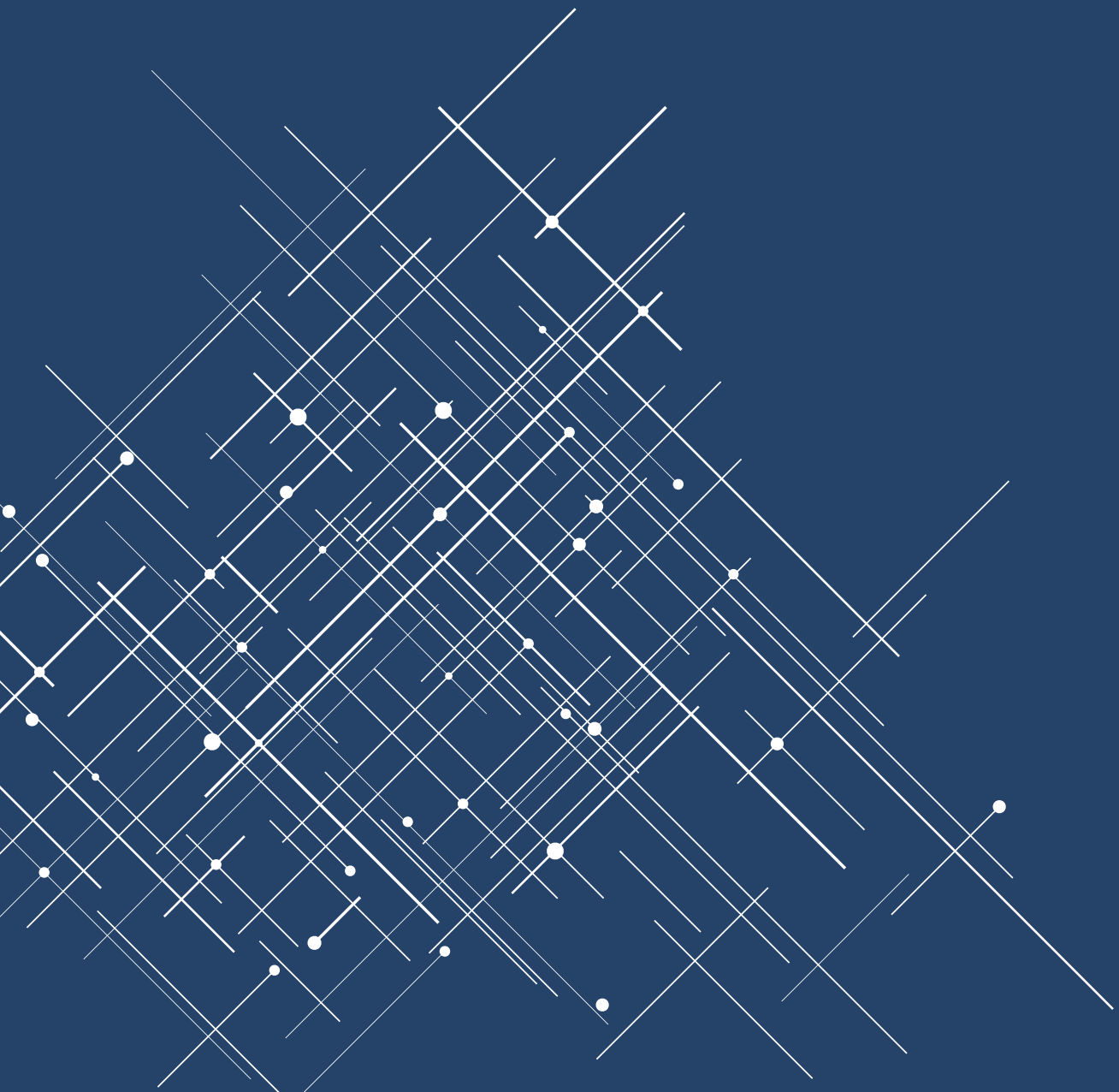
List of Abbreviations

A	Ampere
AC	Air Conditioner
AFD	Agence Francaise du Development
APS	Alternative Power Supply
ATS	Automatic Transfer Switch
BDL	Banque Du Liban
CD	Compact Disc
CEDRO	Community Energy Efficiency and Renewable Energy Demonstration Project
CO_2	Carbon Dioxide
CSS	Community Scale Solar
CV	Curriculum Vitae
DC	Direct Current
DCU	Data Concentrator Unit
EE	Energy Efficiency
EDL	Electricite du Liban
EIB	European Investment Bank
ESCO	Energy Service Company
EU	European Union
EUR	Euro
Genset	Generator Set
GHG	Green House Gas
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IPPs	Independent Power Producers
ITB	Invitation to Bid
JV	Joint Venture
kW	Kilo-watt
kWh	Kilo-watt hour
kWp	Kilo-watt peak
LBP	Lebanese Pound
LCEC	Lebanese Centre for Energy Conservation

LEEREFF	Lebanon Energy Efficiency and Renewable Energy Finance Facility
LED	Light Emitting Diode
LV	Low Voltage
MEW	Ministry of Energy and Water
M2M	Machine – 2 – Machine
N	NO
NEEREA	National Energy Efficiency and Renewable Energy Action
NGO	Non – Governmental Organization
NPV	Net Present Value
O&M	Operation and Maintenance
PBP	Pay Back Period
PPA	Power purchasing agreement
PLC	Power Line Communication
PR	Performance Ratio
PV	Photovoltaic
RE	Renewable Energy
SAL	Societe Anonyme Libanaise
SARL	Societe a Responsabilite Limitee
SIR	Savings – to – Investments Ratio
UNDP	United Nations Development Programme
UPS	Uninterruptible Power Supply
USD	United States Dollar
V	Voltage
VAT	Value Added Tax
V24	Village 24
W	Watt
W/m²	Watts per square meter
w.r.t.	With respect to
WTP	Willingness to pay
˚C	Degrees Celsius
%	Percent

INTRODUCTION



1.

Introduction

One of the main objectives of the European Union (EU) funded and United Nations Development Program (UNDP) implemented CEDRO IV project, is to find innovative, cost-effective, and environmentally beneficial pathways to transform our power system. In partnership with the Ministry of Energy and Water (MEW), the Lebanese National Power Utility (EDL), and the Lebanese Center for Energy Conservation (LCEC), this booklet presents all the required information necessary, based on lessons learned and newly established protocols, in implementing a community and/or village led renewable energy system, including all the requirements and caveats that need to be taken into account when establishing such a system by a municipality and respective community.

It is hoped that a community led renewable energy system, whether based on solar power (as done in Kabrikha, South Lebanon), wind power, bioenergy, and/or any other means of sustainable power generation, will have the advantages of:

- Economies of scale: meaning that the costs of renewable energy provision will be significantly reduced from combining households and institutions together instead of each institution and/or household doing it alone
- Community cooperation: a community led sustainable energy initiative will empower the sense of community cooperation and spirit, and will indirectly lead to more sustainable offshoot initiatives
- Environmental benefits: a community led sustainable energy initiative can enhance the local environmental performance of villages and/or communities, especially in relation to local air pollution and greenhouse gas (GHG) emissions
- Energy security: a community led sustainable energy initiative, if replicable in a sufficient number of villages and towns, has the ability to assist Lebanon in reducing its reliance on expensive imported oil, enhancing energy security

This booklet presents a recommended solution to initiate, construct, and connect a renewable energy system for a Lebanese village. This solution (as implemented in Kabrikha) will be closely monitored and evaluated (in terms of impact to and from the grid) by the National Utility, EDL, for a maximum period of up to 12 months, before which EDL will allow out similar initiatives to take hold.

The main premises of the agreed upon process highlighted in this booklet – and any future versions / upgrades – is that the process must be:
- Agreeable and manageable to EDL
- In line with any existing rules and regulations targeting the electricity sector
- Has the potential to evolve and be subject to modifications that will make it easier and more replicable

These premises – imperative to the success and acceptance of such a project - may not render the process that is established herewith best or ideal, however, it is a workable starting point that would be subjected to a lot of lessons and experiences learned from the current and any future implementations which will lead, hopefully, to its gradual enhancement – in line with the electricity situation in Lebanon - to make it more successful, replicable, and anchored as one of Lebanon's main distributed sustainable electricity options or pathways.

The process/scheme will be termed 'Village 24 Initiative' (V24 Initiative).

TECHNICAL OVERVIEW OF THE VILLAGE 24 INITIATIVE

2.

Technical Overview of the Village 24 Initiative

The Village 24 Initiative aims to install a renewable energy (RE) system for any given village. The initiative is constructed taking into account the below parameters and/or assumptions:

1. The Lebanese power system, especially in rural areas, is subjected to long hours of blackouts that are expected to continue, at least in the short-term

2. In the medium to long term, national power provision is expected to improve up to the provision of 24 hour electricity from the national grid

3. Many Lebanese villages have adapted to the above reality by establishing their own power generation (based on diesel gensets) and distribution network and/or centralizing the management (including often the ownership) of the diesel gensets and distribution network (including control of billing of power) officially under the municipality

4. Every institution and household in Lebanon can install, independently, a renewable energy system on their respective roof and/or premises and apply to a net metering scheme. The net metering scheme has been approved by EDL through Decision No. 318-32 / 2011. The Village 24 initiative takes into account this Decision as the platform and foundation of the provided village-scale solution

5. Installing a community renewable energy system will have to, therefore, be compatible with the short-term electricity situation and adaptable enough to be viable under the longer-term power situation

The technical description of the Village 24 Initiative, which can be considered a hybrid (dually operated on the local genset with the associated network and the utility grid) microgrid, is outlined in Figure 1a (national utility power is not present in the village) and 1b (national utility power is present in the village).

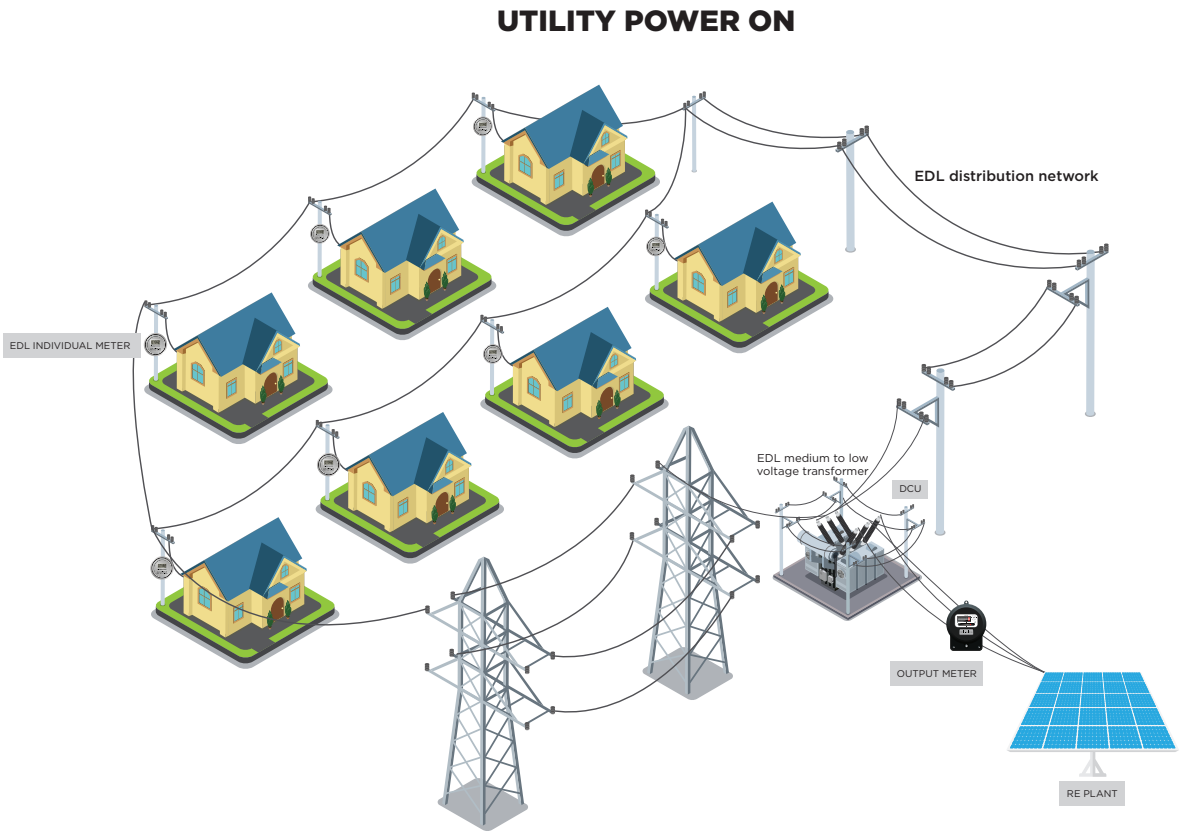


Figure 1a. Utility power not available

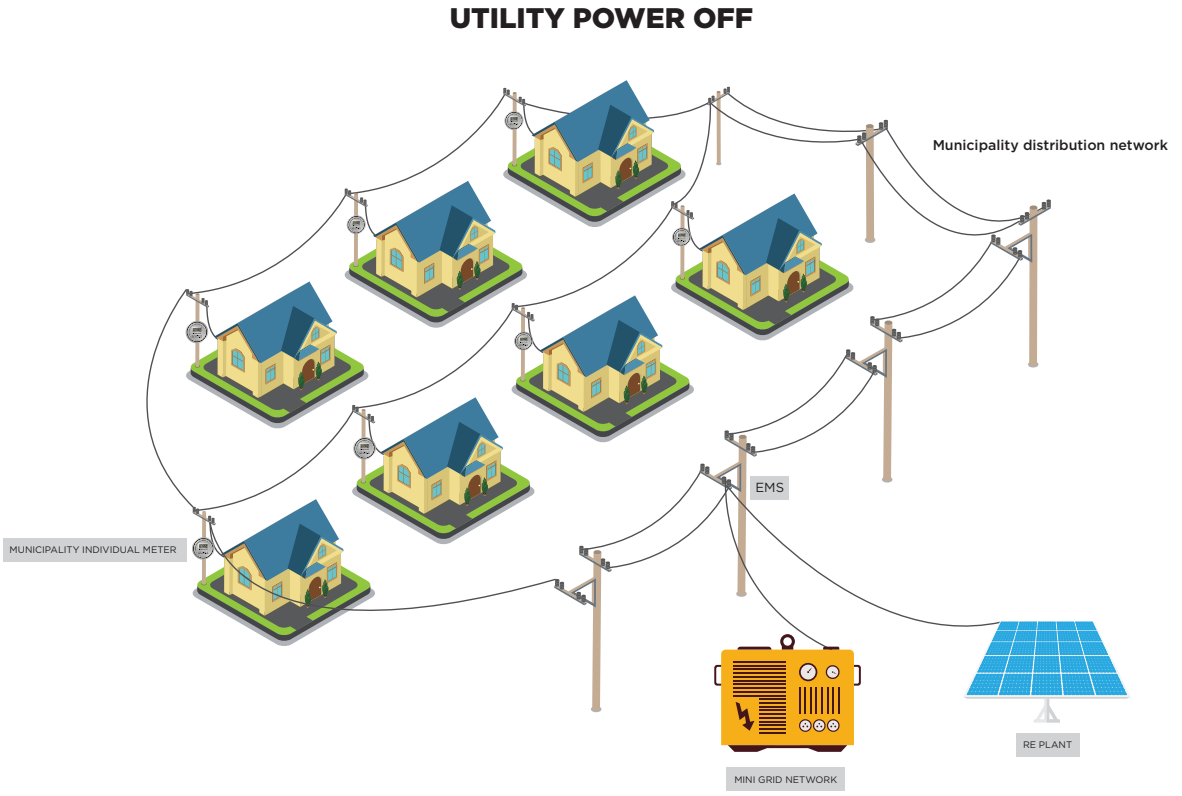


Figure 1b. Utility Power is Available

Figure 1: The Village 24 initiative: a hybrid (Genset & Utility) microgrid concept

When national utility power is not present, the municipality is feeding the renewable energy power into its own independent distribution network, in synchronization with its diesel generators. Injecting the RE power into the municipal grid, if the RE power is well sized and implemented (see Annex 1 on sizing a solar photovoltaic system to hybridize with the municipal diesel genset and utility network), will have the dual benefits of enabling the municipality to:

(1) Operate a smaller generator; and
(2) Reduce the fuel consumption and costs for its diesel generators.

Including a central battery storage at the moment is costly, however this may change in the near future and thus merits future assessment (see section 5.3).

The conditions required to launch the Village 24 scheme are:

- The municipality has its own network and that network is well constructed to deliver power at the voltage and frequency levels required for all the village institutions and households that may aim to be part of the V24 scheme (see Annex 2 on important distribution network caveats and required conditions)

- The municipality bills the institutions and households, within its jurisdiction, on power consumed (i.e., on each kWh consumed) as opposed to power capacity rented (i.e., as opposed to having lump-sum payments for each kW or Ampere rented out)

- The municipality has land and/or roof space to install the required RE system

When utility power is present (Figure 1b), an automatic transfer switch (ATS) will immediately divert and transmit the RE power into the national grid, connected to a low to medium voltage transformer (kindly see Chapter 2 for the administrative requirement of the Village 24 scheme). An advanced smart meter, that has to be approved by EDL (see Annex 3 on general technical specifications – Annex 3 Section 3.4.2), is connected at the point of injection of the RE power into the national grid. This is considered the total power output of all the households and/or institutions that are part of the Village 24 Initiative in any respective village (see Chapter 2). In turn, all the households and/or institutions that sign up to the Village 24 Initiative will have to install a smart meter, also approved by EDL, which will record and transmit data on each institution/household's electricity consumption (input power). The smart meters will transmit the data on electricity consumption in 2 ways that have to be both catered for in the scheme, either:

(1) Via power line communication (PLC), through installed data concentrator units (DCUs) and from there to the server of EDL (and backed up in a server at the municipality), and;

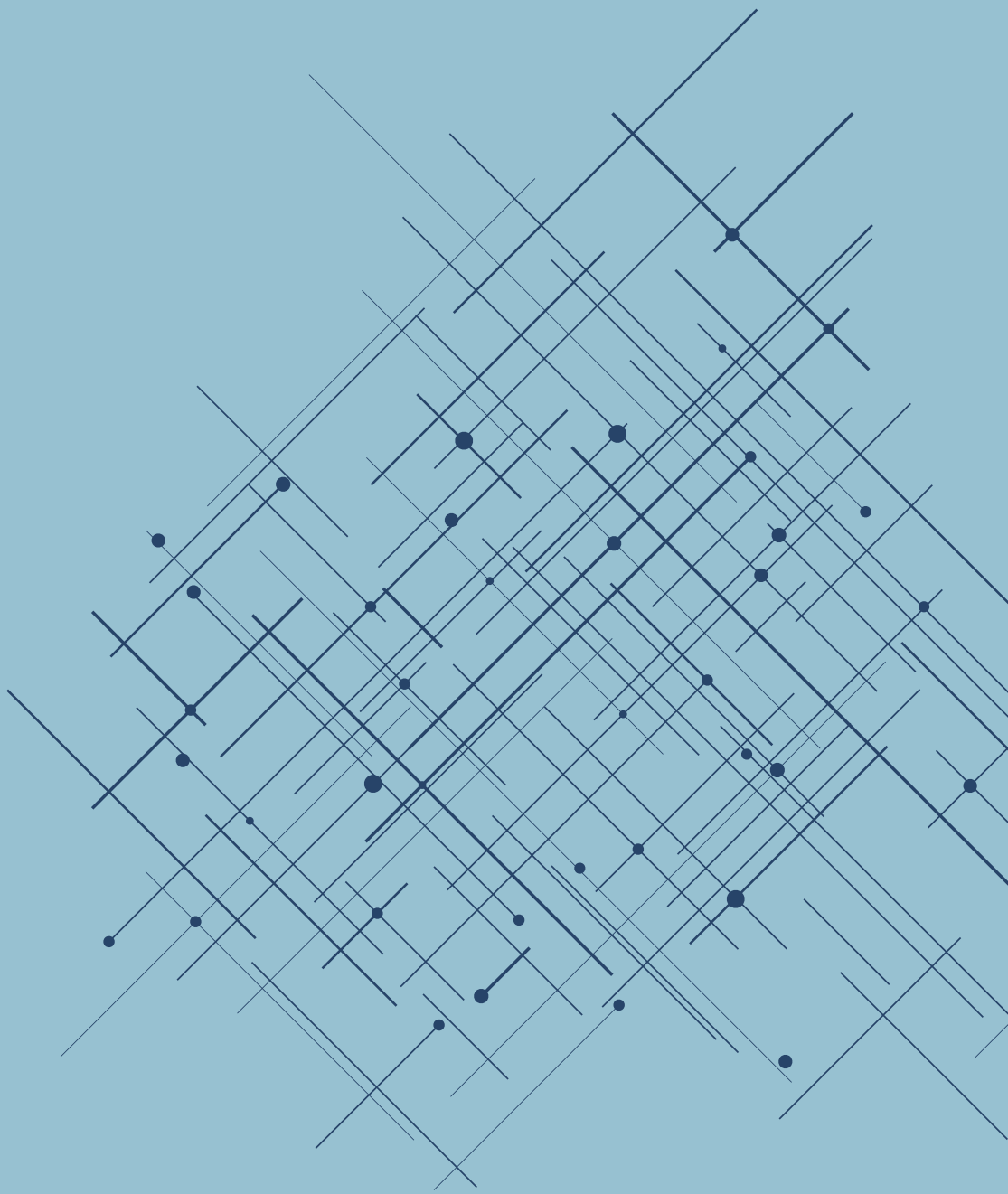
(2) Via infrared optical reading where the EDL and/or designated service provider personnel will obtain the electricity consumption data semi-manually from each facility and/or household independently

EDL will then implement the protocols of decision No. 318-32 / 2011, whereby EDL will bill each household and/or institution for the net electricity consumed, per billing period. This cycle occurs from January to December, where in each billing period (expected to be every two months) each institution or household will be billed the net amount of power, calculated by EDL (See Annex 4 for an overview on single net metering and the V24 Initiative).

If the amount exported by the household or institution (which is equivalent to the share of that household or institution's ownership in the RE plant's power output for that same period - as outlined in the Energy Committee – See Annex 4 on single net metering and the V24 Initiative) is greater than the power consumed, the surplus is rolled over to the next billing period. This will be the case until the end of the year where any surplus (i.e., net exported power from the household or institution to the national utility EDL) will be considered as granted without compensation to the utility, EDL. This clause may be subject to change in the future upon the discretion of the national utility EDL.

Furthermore, EDL has the discretion, as per the existing EDL net metering Decision 318-32 / 2011, to cancel the household and/or institution's billing subscription fee if the renewable energy power exported to the national grid, estimated per household and/or institution, is at least 75% of the power imported from the national grid.

ADMINISTRATIVE OVERVIEW OF THE V24 INITIATIVE: SETTING UP THE SCHEME



3.

Administrative Overview of the V24 Initiative: Setting up the Scheme

The administrative process to develop a Village 24 initiative has been established herein based on the experiences learned from the 250 kWp Kabrikha community solar photovoltaic (PV) plant (see figure 2), implemented by the EU funded UNDP CEDRO 4 project, in coordination with the Ministry of Energy and Water, EDL, and the LCEC.

Figure 2: 250 kWp system implemented at Kabrikha, South Lebanon

Figure 3 illustrates the detailed process of the Village 24 Initiative, while the following sub-sections explain each of these steps independently.

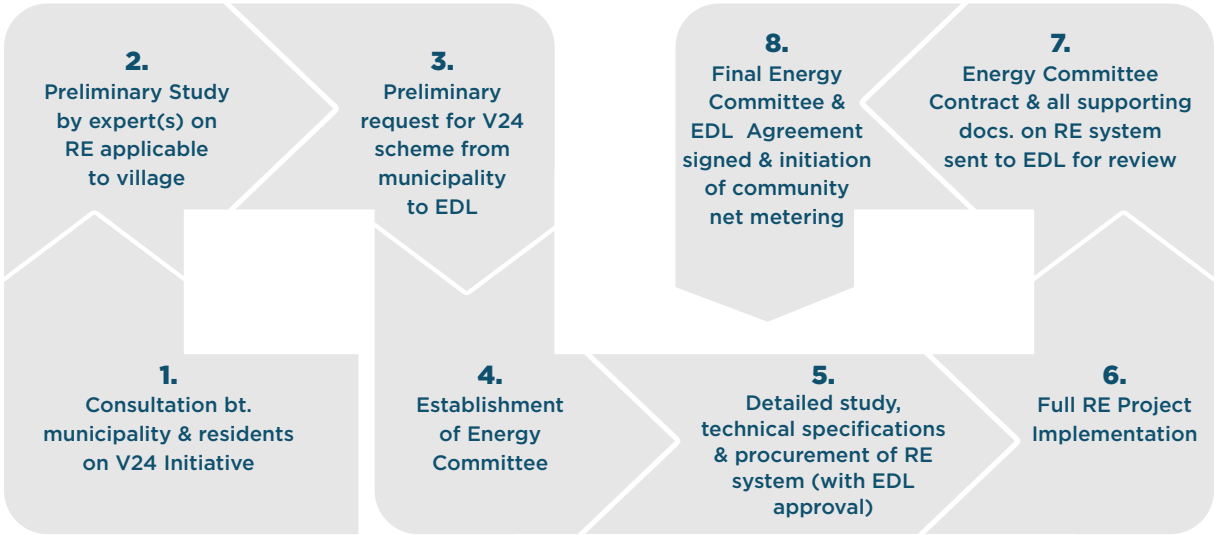


Figure 3: The complete V24 initiative

A summary check-list of all the necessary steps that the municipality and champion residents have to take can be furthermore found in Chapter 4.

Step 1.
Consultation between municipality and respective residents on V24 initiative

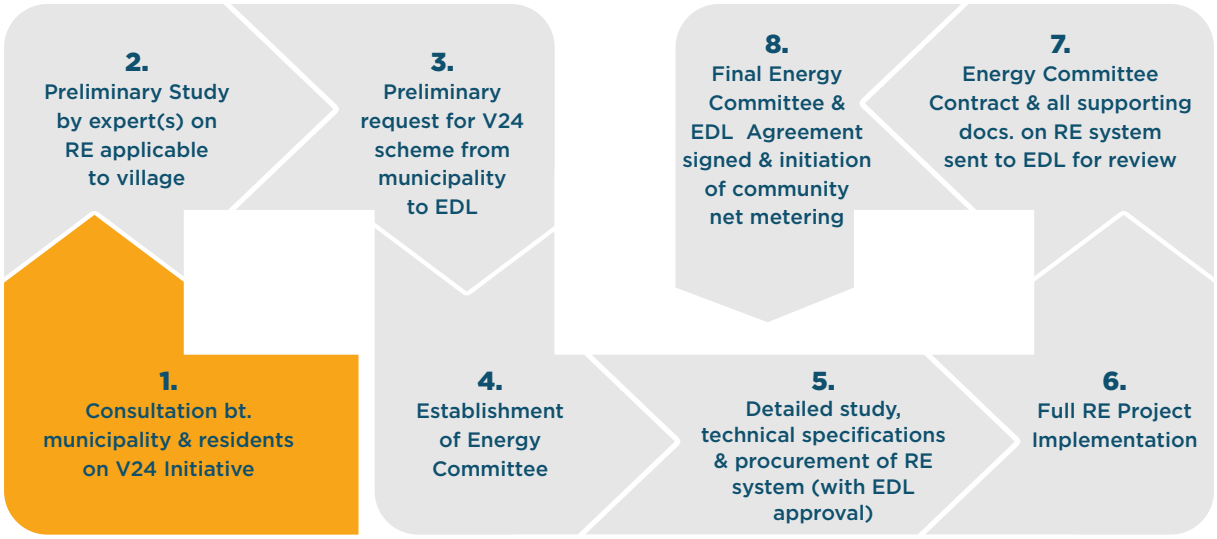


Figure 4: Step 1 of the V24 initiative

The first step of the Village 24 Initiative is to launch an expression of interest in establishing a community renewable energy system for the residents and institutions of the community itself.

Step 1 has to be led by the municipality and should be done through an official public hearing and/or consultation. Any concerned member of the community, or non-governmental organization or local group, and/or any private sector entrepreneur(s) that wish to work towards implementing such a scheme will have to go first through the municipality channels and/or be endorsed by the municipality. This is particularly the case given that it must be assumed that the municipality has already its own distribution network and diesel gensets and/or is willing to construct/expand one.

It is beneficial that the municipality sends out leaflets on the public hearing meeting objective and its intentions (to set up a renewable energy system for the community) before at least 1 week from the set date of the hearing/meeting.

In the official public meeting, the municipality will discuss with the residents and institutions within its legal vicinity its intention on implementing a RE system and the expected costs and benefits (see Annex 5 for an overview of the benefits of community scale renewable energy systems). It will then illicit the preliminary interest of its citizens, listing all those who have expressed this interest.

The municipality, if the majority of households and/or institutions agree to investigate this opportunity, will then move to step 2 of the process.

Step 2.
Preliminary study on RE system and applicability

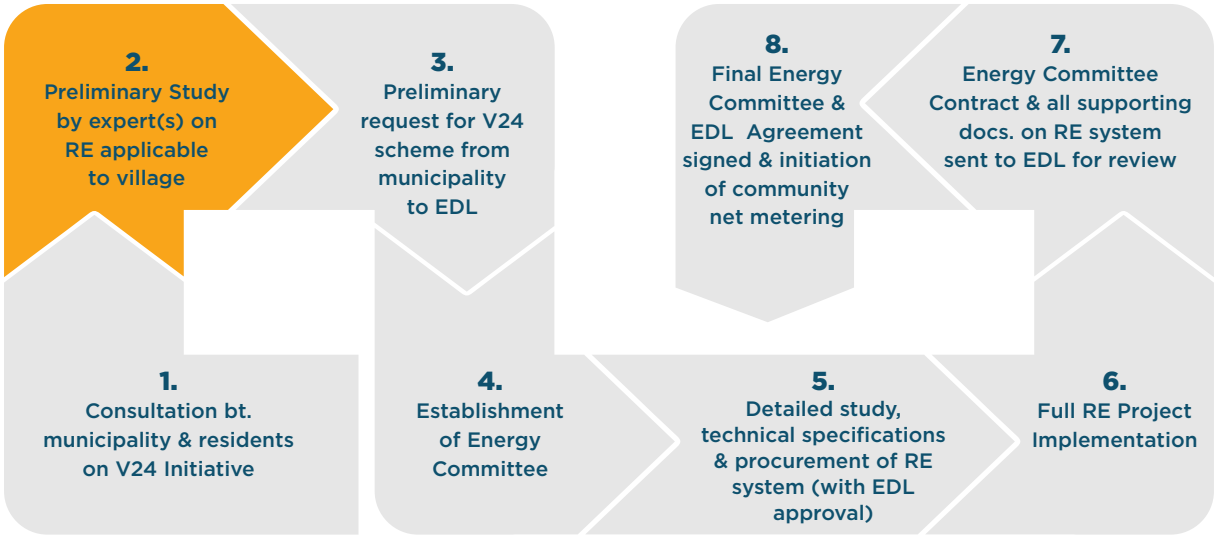


Figure 5: Step 2 of the V24 initiative

Step 2 requires the expertise of a renewable energy and/energy generation expert to determine the most suitable applicable option(s) for the municipality.

The preliminary study should gather/include the following information:

- Electricity consumption information about the households and/or institutions that have expressed willingness to be part of the Village 24 Initiative in their respective village (based on consultations in Step 1)

- Gather expectations from the households and/or institutions about their appetite (and ability and willingness) to invest, capacity and power desired from the RE system, and when they need the power mostly (their approximate electricity load profile)

- Check the availability of meters (i.e., legal connection) in the households and/or institutions that want to take part of the Village 24 Initiative and their sound legal status with the utility company; this is a pre-requisite for connection

- Assess the availability of the current generation system of the municipality, i.e., the genset(s) present, their ability to cater for the village, their ability to synchronize with the RE system suggested or alternatively present a rough estimate of the required investment to set up the required conventional generating units

- Assess the possibility(ies) of location, availability of land/roof space, resource, and connection point of any suggested RE system

- Assess the quality and capacity of the distribution network set up by the municipality to cater for a new RE source or alternatively present a rough estimate of the investment required to set up/or expand this network.

- Assess the possible connection points of the RE plant to the EDL distribution network and the diesel genset network, and provide a preliminary network proposal to ensure quality power delivery (See Annex 2 for important network considerations)

- Other data depending on renewable energy choice and location specificities

Upon gathering of the above information, the consultant(s) will decide, in coordination with the municipality, what is the required and optimal RE system, the possible capacity, and all the approximate associated costs of undertaking this project. It is also advisable to inflate the assumed costs by a margin of 20%, in order to ensure that any future contingency will be sustainably dealt with. If this additional 20% margin on the budget is not used, it can be refunded to the respective households and institutions or be kept for maintenance reserve.

Furthermore, it is advisable for the RE consultant(s)/experts(s) and the municipality to share the outputs of this study again with the residents to get their feedback and reassess their willingness to continue with the Village 24 Initiative.

If enough residents and/or institutions are interested still after the preliminary study results are communicated, then the municipality moves to Step 3.

Step 3.
First communication between municipality and EDL

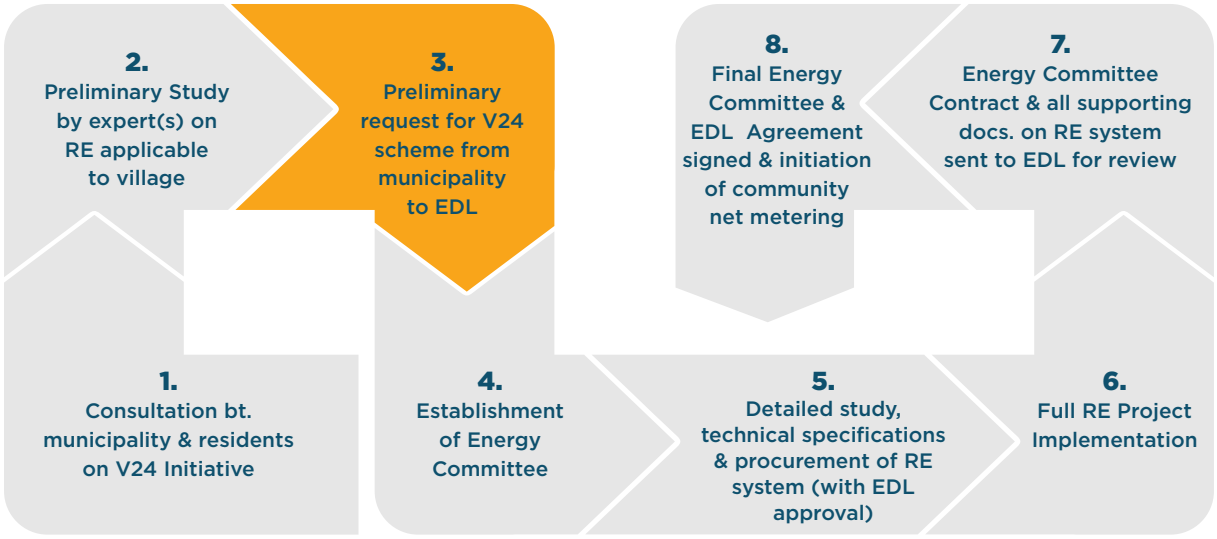


Figure 6: Step 3 of V24 initiative

Upon successful completion of Step 2, the municipality should seek official approval from EDL in an official letter, presenting the following minimum information:

- The name and location of the municipality
- The number of residents and institutions that will likely enter the Village 24 Initiative
- The type, capacity and power output expected from the RE system
- The possible points/options of connection of the RE system to the national grid

The municipal council has to agree officially and address this letter to EDL, expressing the above elements, and request an approval to move forward with the process of generating clean and renewable energy (See Annex 6 for a template letter based on a Municipal Decision Document to be sent to EDL).

Only upon the official and positive written response of EDL that the municipality can move ahead with the Village 24 Initiative, can the municipality and residents move to Step 4.

Step 4.
Establishment of the Energy Committee

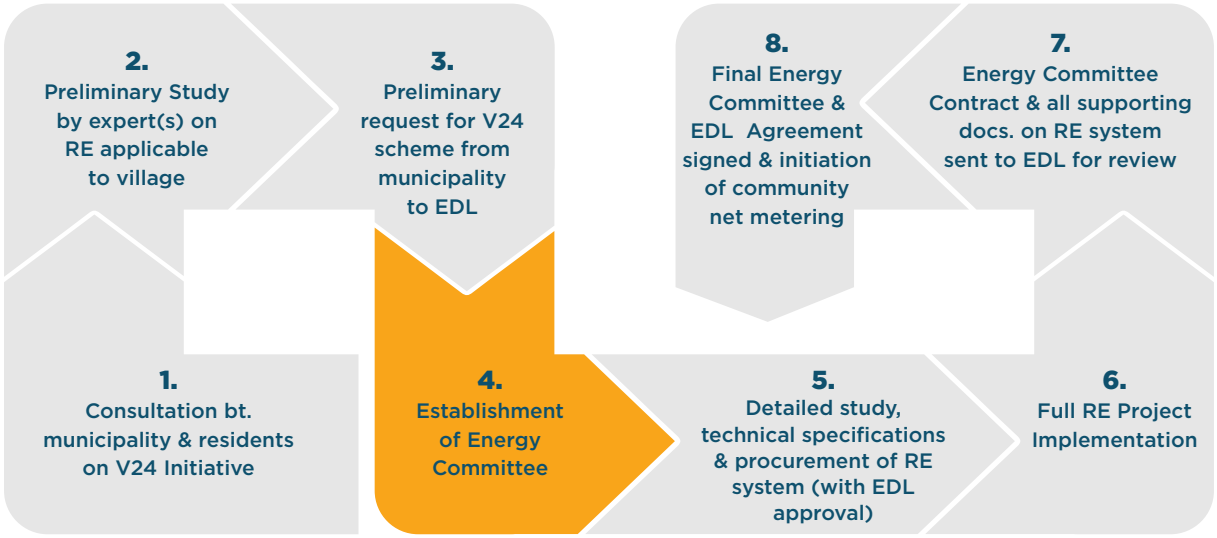


Figure 7: Step 4 of the V24 initiative

The next step is to establish the Energy Committee that will be the Committee responsible for the ownership and management of the Village 24 Initiative*.

Upon the preliminary and positive response of EDL to the municipality's official letter/ communication to establish an RE system, the Municipal Council should proceed to establish the Energy Committee. All the management and authority of the Village 24 Initiative will be now under the ownership and the responsibility of the Energy Committee.

First, the Municipal Council must meet and identify the shareholders and shares. The shares are calculated based on the amount of money to be paid per participant, in line with the indicated power expectations that that particular participant indicated in Step 2. This will be validated in step 5. Annex 7 gives an example of the expected costs of such a scheme using a hypothetical 100 kWp solar PV system.

Second, the Municipal Council shall proceed to set up the Energy Committee; annex 8 indicates the Committee Contract and by-laws form that must be approved and signed by the founders (the board) and all of those who have enlisted to be part of the Village 24 (and who will put up their share of the capital and installation costs). This established ordinance should be ratified by the public notary and saved in the municipality. The contract is renewed every year allowing participants to opt in or out of the scheme.

After which, a bank account is set up with the committee's president and secretary being the two signatory parties. The households and/or institutions that are signatories to the Village 24 Initiative must eventually dispense their dues, in accordance with their respective shares – as listed in the Energy Committee contract attachment - of the RE power plant and the RE power plant's supply and installation costs (that will be known in Step 5) into this bank account directly (they will be given the account number by the Energy Committee signatory representatives).

It is worthwhile to note the presence of various micro-finance facilities that may assist certain households and/or institutions in obtaining their required capital costs through soft loans (see Annex 9 for a brief on existing micro-finance institutions).

** The Energy Committee manages all assets that it has directly paid for; whereas the municipality would be still responsible for the already existing assets of its local network.*

Step 5.
Detailed study, technical specifications & procurement of RE system

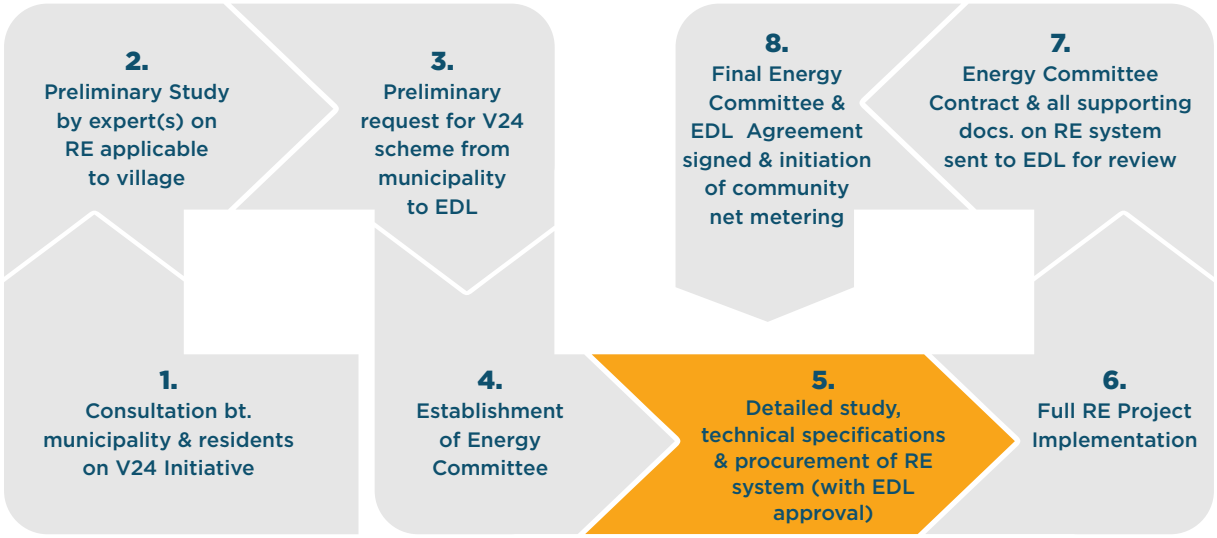


Figure 8: Step 5 of the V24 initiative

Upon the official original positive response of EDL and the establishment of the Energy Committee, the Energy Committee can move forward in undertaking the detailed study with the related bill of quantities (BOQ) and procurement process.

The study will focus on the technical specifications for the system that best fits the community's specificities and those residents and/or institutions that have expressed their willingness to join and have signed up to the Energy Committee. This requires the consultant(s) to revisit, in coordination with the municipality officials, all the households and/or institutions and to record their demand for RE power, including their willingness to pay (as a one-time upfront payment) for the RE power capacity that they think they need (and/or that they are advised to acquire by the consultant(s)). A template questionnaire can be found in Annex 10 that can be used to illicit this information.

As an example, if there were 100 homes and each home expressed the need for 1 kW of capacity to cover 30 – 50% of their total electricity needs, and if there is space available (in general a solar PV needs 10 m2/kW) where a solar PV plant can be easily installed and relatively easily connected to both the municipality gensets and to a low to medium voltage transformer of the national utility grid (EDL grid), then the study will incorporate the complete technical specifications of the 100 kWp solar PV system, related smart meters (using EDL specifications – See Annex 3 for the specifications), and related municipality network reinforcement (if needed), as well as all the administrative and legal requirements for contractors, including the required guarantees. It is important that the municipality indicates that all prices of bidding contractors be valid for a period of at least 6 months. It is also advisable in order to expedite the process, time-wise, that each bidder submits one hard copy and two soft copies (on CD) of the submission files. Annex 3 indicates the general technical specifications of components that can be used for the community solar project, including specifications for solar panels, inverters, and other balance of system components. Annex 11 indicates administrative issues to consider and the guarantees required. Furthermore, it is advisable for the municipality to consult the Ministry of Energy and Water and the Lebanese Center for Energy Conservation (LCEC) for a short-list of qualified contractors and any advice in the tendering phase.

It is advisable that at least 3weeks are given for prospective tenders and that the tender is well communicated via social media and other means.

Figure 9 indicates a recommended evaluation pathway that the municipality should take to ensure a successful implementation of the RE project.

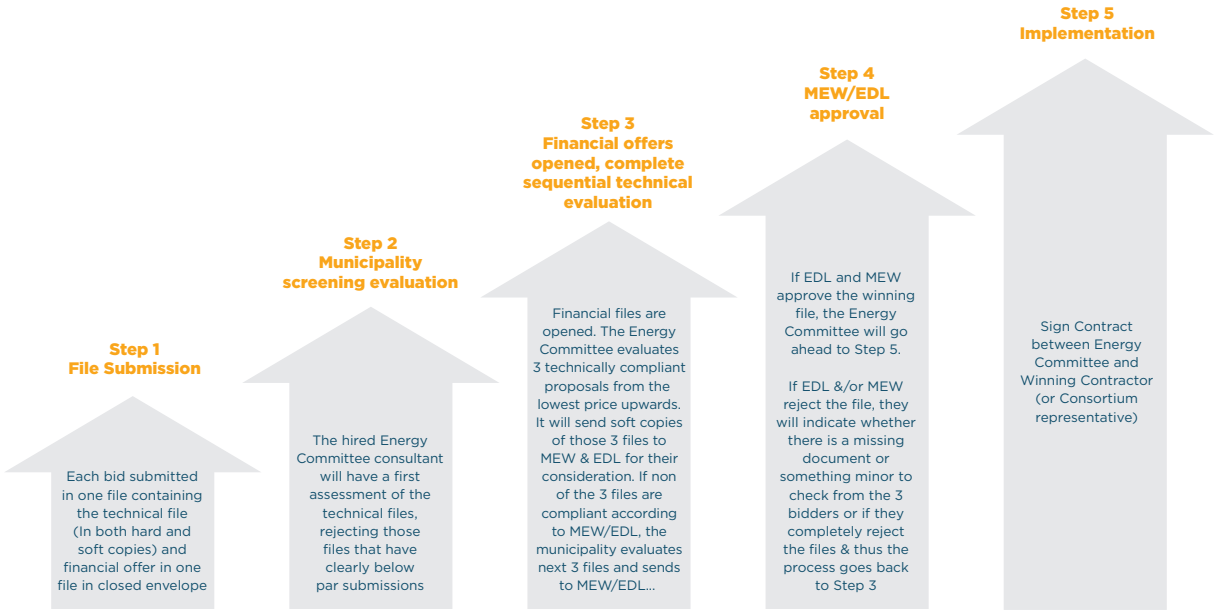


Figure 9: Recommended procurement and evaluation process

In Step 1 of the procurement and evaluation process, the Energy Committee will receive the submissions in both hard and soft copies as to render the process more flexible for the reviewing stakeholders (the consultant(s) / expert(s), EDL and MEW). The technical consultant(s) of the Energy Committee will filter the technical submissions in Step 2 (of the procurement process outlined in Figure 9), leaving those that meet all the pre-requisite evaluation criteria. Annex 11 indicates a sample of technical criteria that may be used. The Energy Committee may ask any bidder for missing documentation or clarifications if needs be. Once the technically compliant files are selected, the Energy Committee opens the financial files. In order to ensure transparency of the process and technical quality / compatibility of the system as per MEW and EDL's rules and regulations; Step 3 requires that the municipality then send the first three technically compliant (according to the municipality hired expert) and lowest price bidders' technical file to the (1) Ministry of Energy and Water and the LCEC and (2) to the EDL Net Metering Committee. The Ministry of Energy and Water (MEW) / LCEC will review the submissions from a technical perspective to ensure all products meet the required specifications, and EDL reviews in particular the smart meters and data concentrator units that will be installed. If MEW and/or EDL reject any file, the municipality must then send the second batch of three offerors in accordance with their prices (if available), and so forth, until one winner is selected.

As soon as the procurement process is done, i.e., as soon as the award (based on the recommended process detailed above) is issued, the municipality should undertake another public hearing for only those that have indicated that they would like to enlist in the Village 24 Initiative.

Once the final and complete price is known (the Energy Committee can add the fees of the consultant(s) herein too that assisted in the above procurement process), this price can be communicated to the participants (it is advisable to keep a 20% margin on the submitted price to spend if any contingency occurs that was not foreseen during the time of the bid proposal and bidding – and if this contingency amount was not used during the construction and commissioning of the RE plant it can be immediately reimbursed). At this point, the Energy Committee demands that the participants transfer their required share of the cost to the Bank Account of the Energy Committee within a deadline of 4 – 6 weeks.

Step 6.
Full RE Project Implementation

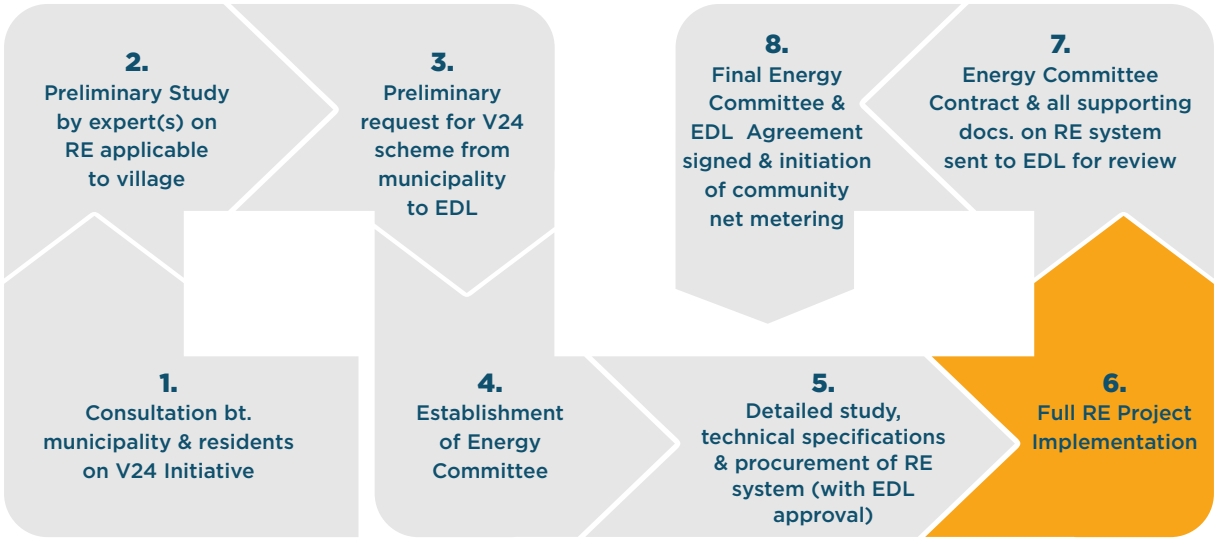


Figure 10: Step 6 of the V24 initiative

Once all the required budget is in the Energy Committee's Bank Account (along with the recommended 20% margin), the Energy Committee can sign the contract with the winning contractor. It may be necessary to obtain a letter from the Bank that will ascertain the availability of these funds, backed up by a commitment letter from the Energy Committee that these funds will solely be used for the RE project. This would give the winning contractor the guarantees that he/she may require.

Implementation of works should be expected to happen over a period of 5 – 8 months, depending on the complexity of the selected system and the required civil and electrical works.

During and in parallel to the implementation phase of the RE system, the contractor must purchase the meters and deliver them to EDL and/or whoever EDL contracts for their installation. The Energy Committee must stay in constant communication with EDL in regards to this issue until all smart meters and related communication systems and data transfer protocols are set up. This will also require a computer to be designated or bought and installed by (and in) the municipality for data storage and transfer, as well as an internet subscription for both the public network to enable the file transfer protocol of the data.

Step 7.
Full Documentation Transferred to EDL

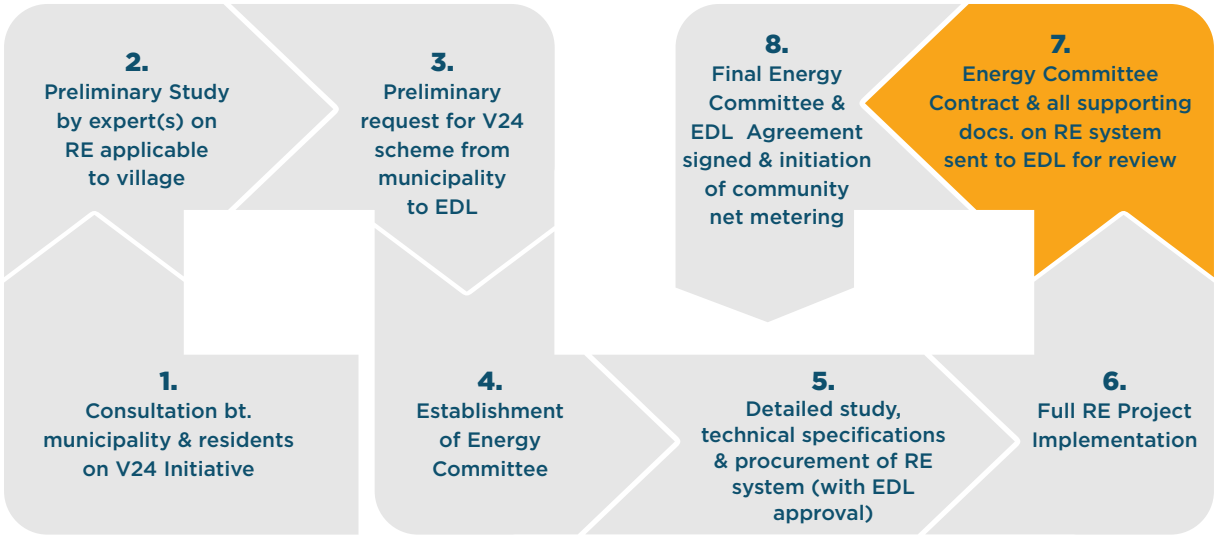


Figure 11: Step 7 of the V24 initiative

Once the project is fully implemented and configured, including any municipality network reinforcement and smart meters (including the DCUs and the servers) for each Village 24 participant – where applicable, the Energy Committee will send EDL the following documentations:

The Energy Committee Contract, including:

a. A full list of the shareholders complete with the meter ID (the existing one – whether electromechanical or digital / smart)

b. The newly installed smart meter ID (in cases where the existing meter is electromechanical or requires replacement as per EDL's recommendations)

c. The old index (last read index before replacement of the meter)

d. Subscription number, branch number, and subscription capacity

e. The full details (study) of the RE implementation undertaken, including:
- Plant's detailed electrical and mechanical technical drawings
- Performance simulation
- Single Line Diagrams
- Data sheets for all installed components complete with the relevant compliance with international standards and testing reports.
- Operation methodology and expected yearly profile (with hourly resolution) of the energy back-fed into the utility network including any reactive power compensation

f. A request for validation w.r.t the connection point to the EDL network

EDL will review the files and may send out a team to inspect the RE power plant and the connection point.

Step 8.
Final Contract Agreement (EDL & Energy Committee) Signature

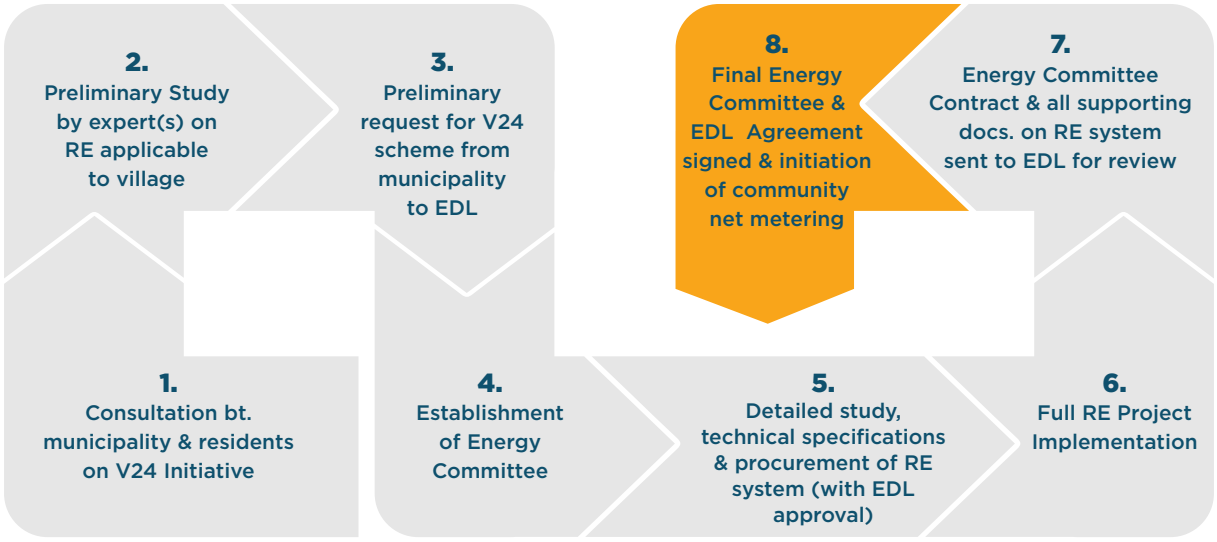


Figure 12: Step 8 of the V24 initiative

Once EDL has reviewed the file and if all is agreeable to EDL and approved by its Board, a final contract agreement between EDL and the Energy Committee is signed.

A draft template of this Agreement Contract between EDL and the Energy Committee can be found in Annex 12.

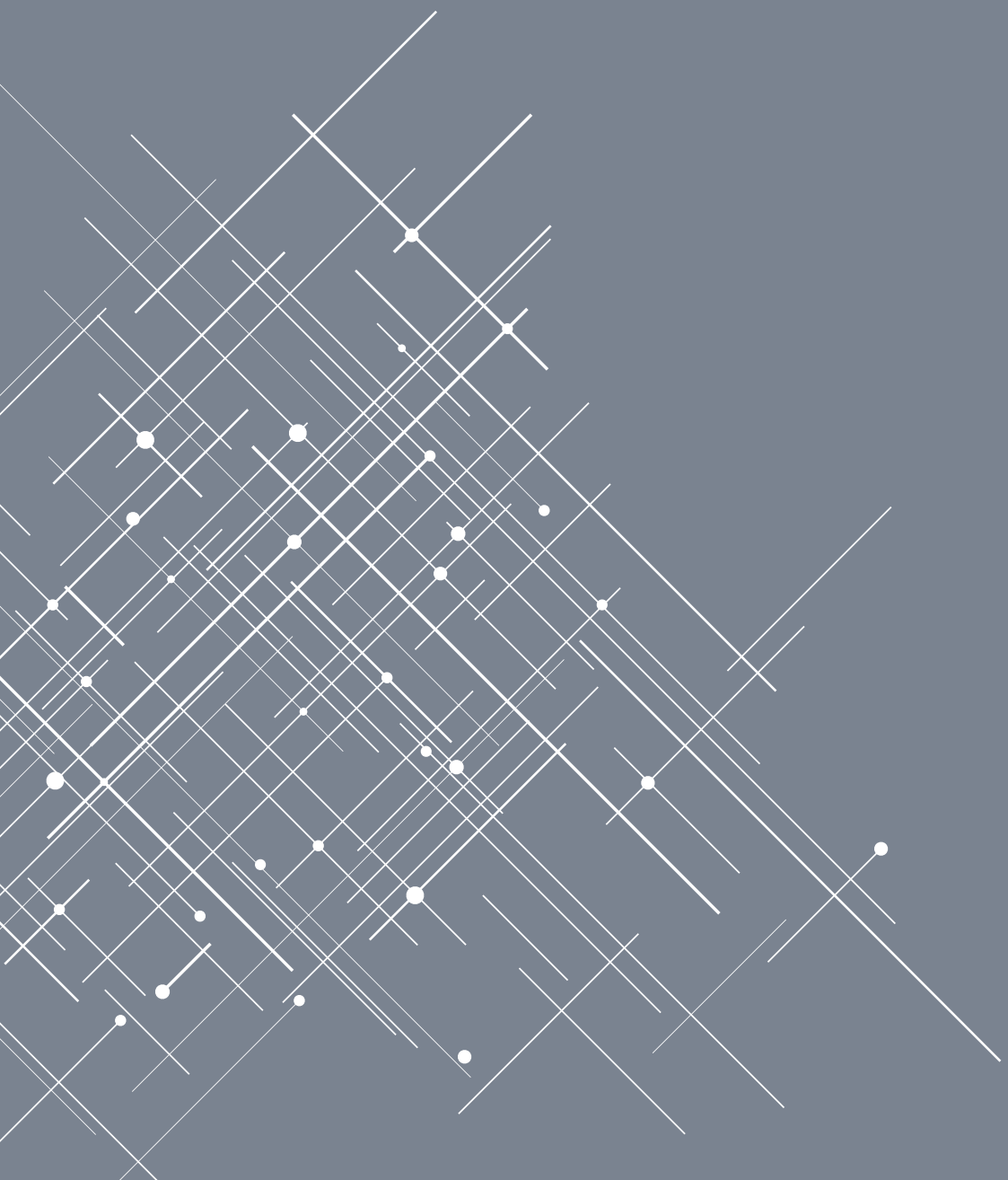
Once this is signed, EDL will ensure that the project is then able to connect to its low-to-medium voltage (or other) transformer or the transformer connection point, and will begin the community net metering initiative from the next opening window, which is effectively from January 1st of every year. A copy of this contract is filed at EDL and the second copy is kept at the municipal building for reference.

The contract is renewed every calendar year allowing participants to remain part of or leave the Energy Committee and thus the Village 24 Scheme, as well as allowing other participants to join. Participants have until the end of October of every year to express their intentions, after which it would not be possible to update the participants' list. This is because when new participants enter or leave the Scheme, the shareholder distribution will have to be re-inputted into the EDL software. Leaving and entering the Village 24 scheme, with all the transactions required between the incumbent and new participants (e.g. selling of shares of incumbent subscriber to new participant), is left to the discretion of the participants themselves and the Energy Committee. What is important to note is that any new participant that wishes to enter the Village 24 Scheme must be allowed to do so if:

(1) The Energy Committee can increase the capacity of the renewable energy system in accordance with the new participant(s) required demand for power and willingness to pay, or;

(2) Through having the payment of the new participant be divided to all existing participants pro-rata, given that their respective shares will now be slightly diluted. This must have the agreement of all the members, or, alternatively, the money paid by the new participant(s) will be given only to those members who are willing to sell a part of their shares to the entering participant(s), in accordance with their requested capacity.

SUMMARY CHECK-LIST



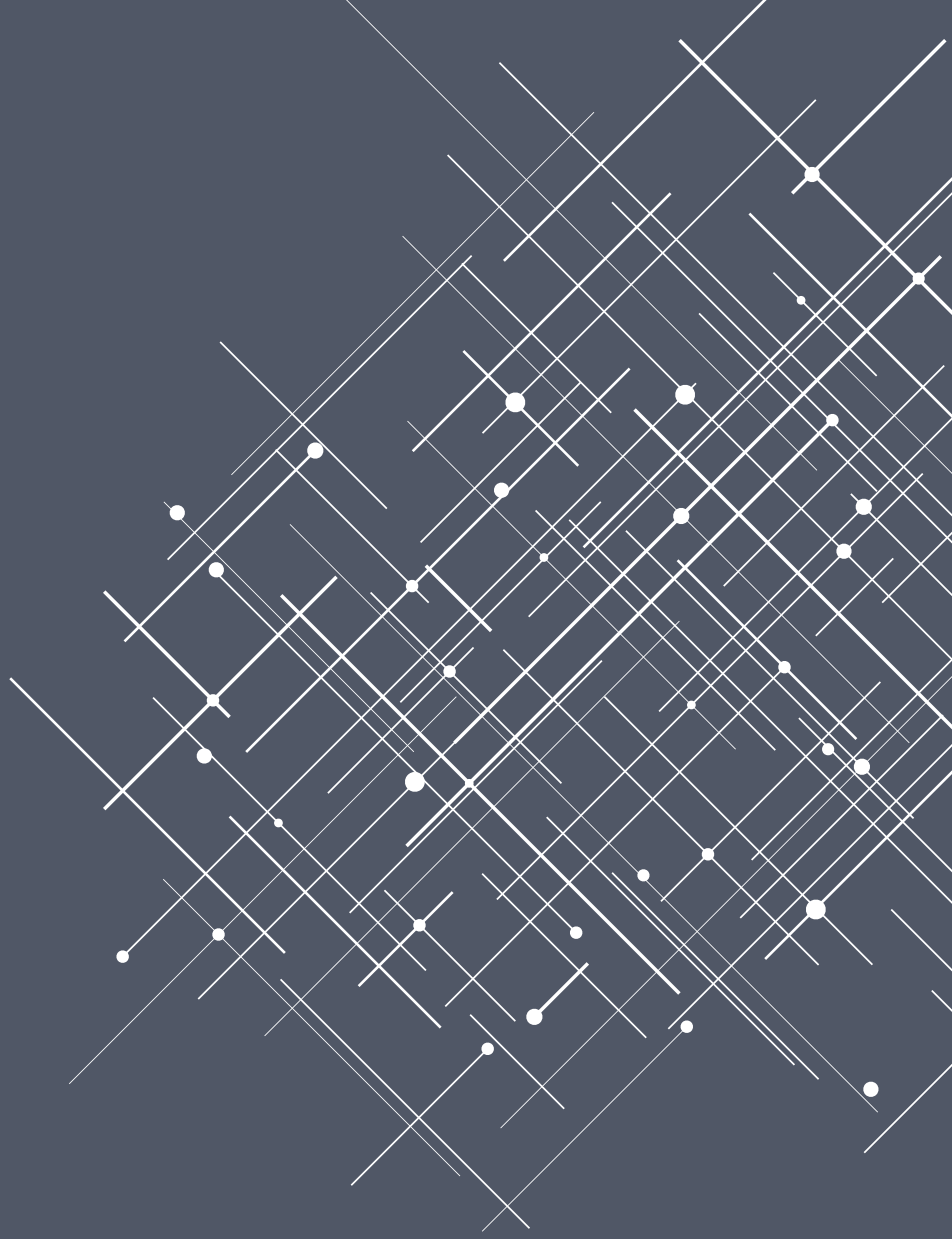
4.

Summary Check-List

Below is a summary check-list to be followed by a municipality and eventually the Energy Committee.

Table 1: Check list

Action	Check
1. Call for a town meeting to consult on the implementation of an RE plant	☐
2. Present the benefits of the system's implementation as opposed to more traditional implementations	☐
3. In coordination with a hired expert, conduct the survey and collect the latest EDL bills for interested residents to come up with preliminary vision of the RE plant required (including location of plant and connection options)	☐
4. Submit the preliminary letter requesting the implementation of the V24 scheme to EDL & receive EDL response	☐
5. Establish the Energy Committee; Sign the contract by the board members. Compile the list of interested members along with the required information Create a bank account for the Energy Committee	☐
6. Hire the consultant(s) and acquire detailed consumption data for the interested members	☐
7. Coordinate information sharing with the consultant(s) (possible members, available network complete with the components, quality of the grid, etc…)	☐
8. Validate the detailed study, and launch the bidding process	☐
9. Conduct in coordination with the consultant(s) and potential bidders a site visit. And provide clarification when and if needed	☐
10. Evaluate received technical and financial offers; evaluate until there are three lowest price technically responsive files	☐
11. Share the three files with MEW / LCEC and EDL for recommendations. Share three files at a time, until the lowest (financially) three technical offers are approved by the stakeholders.	☐
12. Sign the contract with the winning bidder	☐
13. Announce the details of the approved implementation, the winning bidder along with the price to the committee members	☐
14. Collect the money in accordance with shares into Energy Committee Bank Account	☐
15. Sign contract & start implementation complete with all its components (plant, network upgrade – if needed -, meters, DCUs, servers, etc…)	☐
16. Finalize the contract complete with all members' signatures and supporting documents; Get it approved by the notary	☐
17. Send out to EDL for final approval complete with all final (as – built) documents	☐
18. Launch the 'virtual net metering'	☐



FUTURE CONCERNS AND FUTURE OPTIONS

5.

Future Concerns and Future Options

In this chapter variations to the detailed Village 24 Initiative are presented in the form of 'concepts' that would require further refinement both from a technical / architectural design and the legal / administrative perspectives. It is highly recommended that the municipal board, in the first steps of the Village 24 Initiative, and the Energy Committee board, once established, refer to an expert for the detailed design of the renewable energy plant itself and the sub-sequent financial / business models required to make the entire scheme financially attractive to the independent households and/or institutions investors/participants.

5.1 Large villages and towns

The Village 24 scheme is based on a single centralized system installed in one plot and connected to the dual available networks of the national utility grid and the local grid through one connection point, respectively. For this architecture, the village must have one network, which in the case of large villages with irregular geographical boundaries and construction development concentration, might not be feasible.

In this case, future amendments to the Village 24 Initiative need to be taken into account. These amendments could be that each village and/or town be allowed to submit more than one Village 24 initiative. Each submitted application will have its own separate renewable energy power station connecting to a separate point to the EDL network (i.e. to another low to medium voltage electricity transformer), separate houses and/or institutions that fall within its vicinity, and separate data storage and communication hardware.

Further detailed investigation as to the connection points with particular focus on the effects – if any – on the utility grid, namely in terms of harmonics and grid (distribution) readiness / capacity to take on any additional variable generation, would be required.

The distributed systems could be connected together through a fiber optic information and communication technology (ICT) network should the municipality wish to have a consolidated reading of their production and hence performance. However, in no way does connecting the systems result in it being viewed by the utility network as one complete system and hence does not reduce the components needed to initiate the V24 Initiative separately (in other words the DCUs, the PV meters, and the individual meters).

5.2 A public-private partnership

Public-private partnerships (PPPs) may be defined as a long-term contracts between a private party and a government agency, for providing a public asset or service, in which the private party bears significant risk and management responsibility. PPPs have been used extensively worldwide for their ability to leverage private capital and competencies in supporting and successfully implementing sustainable development projects in infrastructure (energy, water, transport, and ICT). In the case of renewable energy, many countries including Lebanon are trying to adopt energy policies and laws to encourage green energy sources. They are also trying to find legal and financing frameworks which facilitate the employment of public private partnerships (PPPs) in this sector, as the case of independent power producers (IPPs) where the design, construction, financing, operation and maintenance of the renewable energy projects are mostly performed by private partners selling their power to the national utility through power purchasing agreements (PPAs).

The Government of Lebanon (GoL) has recently established Law 48, dated 07/09/2017, establishing the regulations that will dictate public-private partnerships. Within this Law, it is indicated that the 'High Council for Privatization and Partnership', along with the concerned Ministry (in this case Ministry of Energy and Water) and the Ministry of Finance, can administer public-private proposals and partnerships.

The provisions of this law shall govern all PPP Projects undertaken by the State and public institutions and all moral persons of public law, with the exception of municipalities and unions of municipalities, which may choose to subject their PPP Projects to the provisions of this law.

In 2002 the Lebanese parliament ratified law 462 which regulates the Electricity sector, and creates an authority body called "The Electricity Regulatory Authority (ERA)" to organize and control electricity affairs, having the ability to issue licenses effective through public tenders or offerings for the purpose of producing and distributing electricity. This law unfortunately has not come into force and to date the ERA hasn't been established. The 462 Law, especially article 7 of it, was subject to several amendments through different laws (lately by laws 288 in 2014 which states that temporarily, for a period of two years, and until the appointment of members of the Authority and giving them their tasks, the production permissions and licenses will be granted by a decision of the Council of Ministers upon a proposal of the Ministers of Energy and Water, and Finance. Law 54/2015 extended the application of Law 288/2014 until 30/4/2018).

Applying in one way or another any of the above laws, with certain required amendments, to the Village 24 Initiative has the possibility of radically transforming the way the initiative is designed and administrated. For example it could be possible that the Government of Lebanon issue a feed-in tariff for Village 24 Initiatives of a certain value ($c/kWh) that is set depending on the technology location, choice, design, and scale, over a certain number of years (e.g. 20 years). Therefore, when electricity is not present from the national utility grid, the renewable energy system feeds into the local network as the originally described Village 24 Initiative, and will be managed by the Energy Committee. However, when the utility power is present, the renewable energy system 'sells' its power to the national utility at an agreed upon connection point. When the national utility and/or other guaranteeing public agency pays for the power sold, the money will be transferred to the Energy Committee (or perhaps in this case a company established or any other legal structure more in tune with PPP arrangements) and distributed to the individual owners according to their shares. However the legality of this and the implementing decrees need to be established.

5.3 Electricity Storage prospects

The Village 24 Initiative, as described, is based on the solar PV technology which produces clean electricity during the day. Pushing the boundaries of the system a step further through the installation of a battery storage bank could further alleviate the dependence on the diesel generators. This is especially the case during night-time blackout hours where the demand becomes lower and thus can be possibly catered for more cost-effectively by battery storage.

However, including battery storage in the current market prices would considerably increase the upfront investment cost. In Lebanon, considering the technology maturity to date, it is more common to find low maintenance lead-acid batteries which would cost on average 150-180$/kWh, while lithium ion batteries – a promising alternative – costs between 200 -250 $/kWh. As for the balance of system costs, including inverters, wiring, switches, battery bank, charge controller, etc., prices can vary between 1,000 and 1,200 $/kW.

Including a battery bank requires re-designing the system in terms of capacity in order to account for the batteries' capacity – autonomy dependent – and introduces new parameters to the system as it is an additional source of electricity. When doing so, it is highly recommended to have an expert on board and complete a detailed study with accurate data collection. The system would require additional space for the centralized battery storage, the additional dual mode inverters for the battery bank and most importantly an advanced monitoring system that would be able to communicate between the utility grid, the diesel generators, the battery system and the demand and manage priority feeding at all times.

5.3.1 Storage decentralization

Under the Village 24 Initiative, end users could opt to install storage systems in their residences to which part or all of the household could be connected. Going the decentralized route would also require a slight revision of the renewable energy system's sizing in order to accommodate for the batteries. However, with this set-up, an additional parameter is taken into account which is space availability in the households. Therefore the battery size /capacity is not only accounted for in terms of the needed / requested load and autonomy but also in terms of the available space. The latter is far more restrictive than with the centralized storage system, as including battery storage in existing houses may entail taking up space from other commodities / utilities. In parallel, the additional parameters will have to be accounted for in the management system.

5.3.2 Island mode

Lebanon's electrification rate is approximately 100%; which translates into the physical utility network being available on all Lebanese land. However, the quality of electricity in rural areas, in terms of the voltage and frequency levels, is far from ideal when available. To this end, residents can opt to invest in a renewable energy system that would cater for their peak consumption under an 'island mode' architecture until the utility network's quality is improved. This system storage capacity would not just cater for the evening operation but also for time slots throughout the day in order to perform regular O&M tasks on the generators.

The here presented system will include: the renewable energy source (solar PV, Wind turbine, Biogas, etc...), the diesel generators and the battery storage. System sizing is done to meet the maximum peak demand and the needed hours of battery autonomy, however when sizing the battery bank, critical or selected loads should be used as to keep the required space and eventual cost reasonable.

5.4 Energy Co-operatives

Energy Co-operatives run the largest number of shared solar projects worldwide. The cooperatives law in Lebanon was established in 1964 under decree law 17199. The Cooperatives General Directorate under the Ministry of Agriculture, oversees and regulates cooperatives in Lebanon. For this reason existing cooperatives are mostly confined to agricultural cooperatives. Recent efforts have been made to kick start the process of introducing energy cooperatives and setting up the required legal framework and rules and regulations. Relevant articles of the law are summarized below:

- Article 1: states that the cooperative does not seek profit but seeks improving the social and economic livelihood of its members.
- Article 4: states that the cooperative needs to operate within a strict geographical area and cannot establish branches outside the area.
- Article 5: states that the two cooperatives serving the same purpose cannot operate in the same geographic area.
- Article 7: The cooperative is a legal entity that can own property, open bank accounts, receive grants and apply for loans
- Article 21: the one person one vote principle applies to all cooperatives, voting weights does not change in respect to share ownership.
- Article 24: payment of the shares can be paid in small installments over a period stated in cooperative bylaws; the ownership of the shares cannot be transferred without the approval of the board.
- Article 25: One member cannot own more than 20% of the shares.

The bylaws stated above give the members of the cooperatives a clear legal framework to comply with this decrease contract risks. The energy cooperatives protect members' rights with clear regulations aimed at organizing the financial obligation of its members in a democratic organizational structure. Furthermore, cooperatives can apply to subsidized energy loans where cash flow are in most cases positive throughout the duration of the project.

Investigating the initiation of Energy Cooperatives in Lebanon is recommended.

5.5 Peer to peer energy trading

The future electric grid is characterized by increased energy sharing between prosumers (i.e. both producers and consumers), consumers and electric utilities. Optimizing energy resources, optimizing the usage of infrastructure and system assets and ensuring that accurate and secure records of all energy related transactions are kept, many companies and utilities are opting to use blockchain-based distributed ledger technologies as an enabling

backbone for operation. Blockchain technology can allow decentralized prosumers to safely buy and sell electricity between each other at negligible marginal costs. Accounting becomes decentralized and shared by everyone on the network. In this context, decentralized energy storage systems will play a vital role thanks to their high flexibility and the fact that they could respond quickly to dynamic price signals. This opens a variety of business models and use cases where these systems can be applied.

Peer-to-peer energy trading has significant importance in optimizing the synchronization of energy production/consumption by exploiting electric storage and demand-side management, thus, stacking the benefits of battery storage and increasing its financial returns. Members of the community could increase self-consumption of their solar energy resource, support with frequency regulation and ancillary services to the distribution network and allow users to exchange solar energy, stored in a battery bank or produced and directly fed to the distribution network, when resource and demand mismatch between consumers is present. Consumers can also purchase energy from neighboring prosumers, the utility company or community diesel generators.

In Lebanon, rural areas host a highly versatile pool of residents, some of which are expatriates that only use their said residences during summer and extended holidays, while others spend their weekdays in the city and their weekends and extended vacation days in their home-town. Optimizing demand and supply becomes a more complex challenge in this context, and the blockchain platform could offer forecasting potential for the local energy system and integrate various sources of energy supply (shared PV-diesel micro-grids, rooftop solar, decentralized storage systems like batteries and electric vehicles).

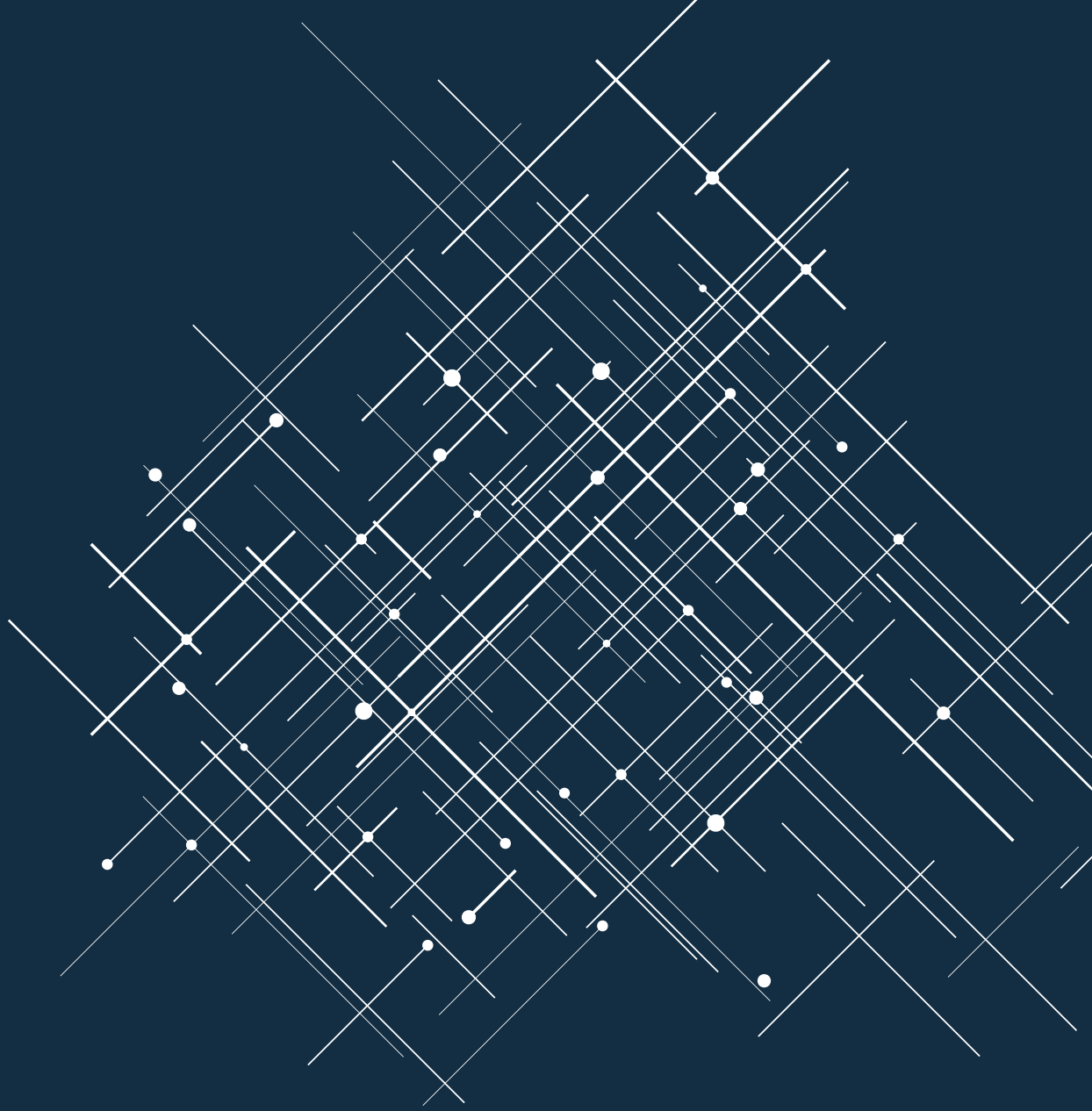
For this ‘scheme’ to function, further investigation into the business model under which the scheme could be monitored and operated is needed, including the required technical infrastructure related to information and communication technology. Furthermore, a detailed legal study must be performed to fully understand the implementation of this de-regulation model in Lebanon.

5.6 Other technologies

Community scale renewable energy is not only limited to solar energy. Other types of renewable power generation can play a vital role in the transition towards sustainable energy. Wind turbines are being implemented through shared community schemes all over the world, bioenergy plants are also very suitable for municipal scale power generation. These types of developments are still lacking in Lebanon and there is still huge untapped potential in expanding the solar model to other technologies.

This is particularly important to wind energy in terms of social acceptance; recent studies have shown that local attitudes about wind energy concerns such as intermittency and visual impacts can become more positive if wind turbines were owned by local communities.

Furthermore, community scale biogas can benefit from the community scale virtual net-metering scheme in the sense that it can combine different waste streams and respond to both heat and power demands.



THE ROLE OF THE NATIONAL CONTROL CENTER

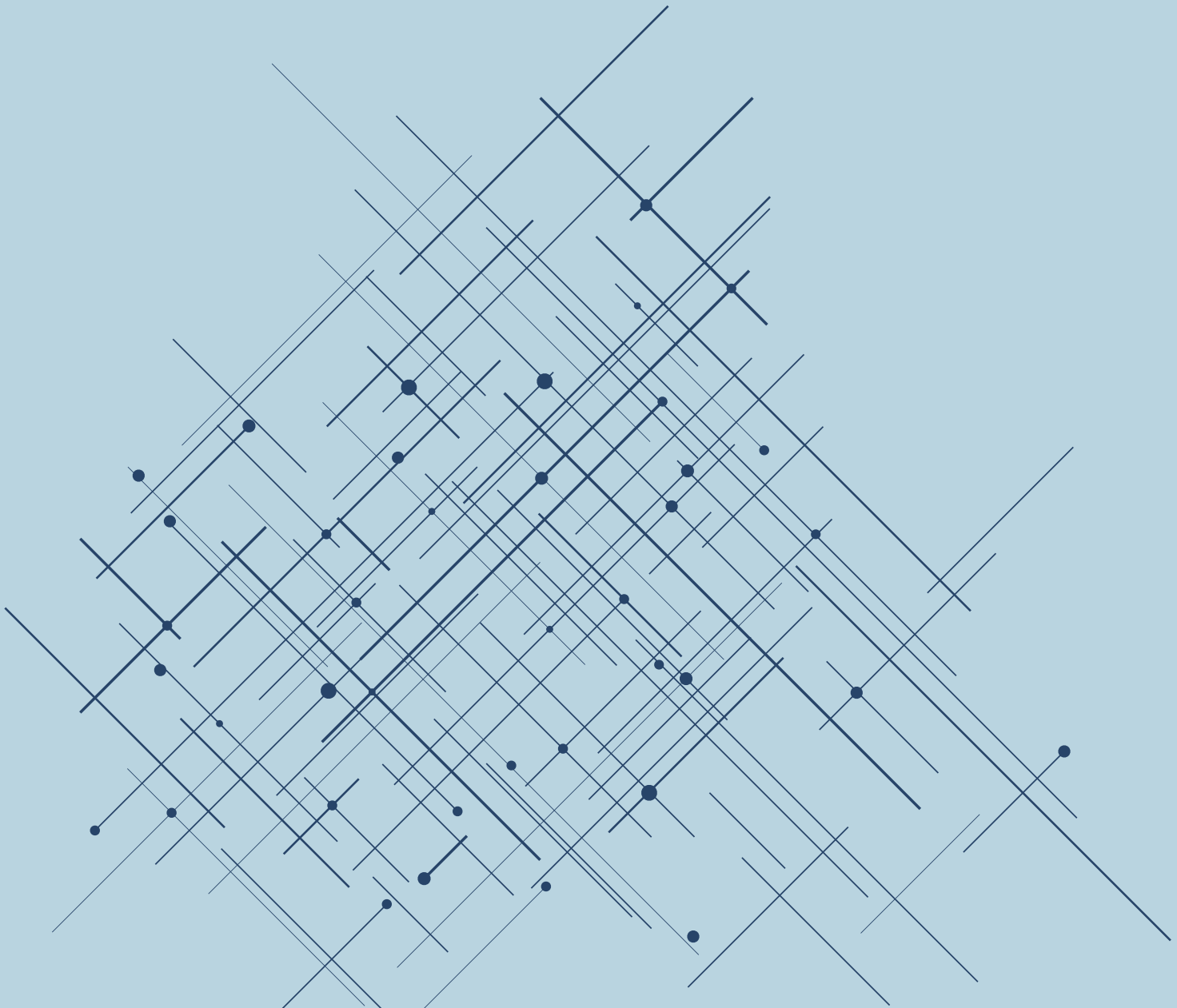
6.

The Role of the National Control Center

With the increased adoption of distributed and centralized commercial and utility scale variable renewable energy generation systems and the expansion of the business models and architectural schemes under which they are implemented, it is important to highlight and bring forth the need of intervention of the local National Control Center in monitoring and controlling the distributed systems all over the country. This is quintessential for the effective integration of variable generation into the utility grid as imposed by the nature of such variable technologies that solicits the requirement of a central control authority to ensure proper operation when it comes to reactive power compensation, primary control, ancillary services and meeting unit commitments and spinning reserve or inertia requirements.

It is recommended that the National Control Center intervenes at an early stage and adopts a strategy to implement the needed ICT infrastructure and operate the geographically and technically diverse systems to ensure reliability of the national electrical system.

CONCLUSION



7.

Conclusion

This present booklet detailed the steps of the implementation of the innovative solution entitled V24 Initiative developed and implemented in close collaboration with EDL and MEW. The draft process is subject to updates based on lessons learnt, experienced gained, and/or upgrades /changes to occur on the electricity production and distribution networks.

The report provides the steps of the implementations from both the technical – complete with the caveats to consider along the way - and administrative / legal – complete with template documentation perspectives.

From a technical perspective, the process builds on:

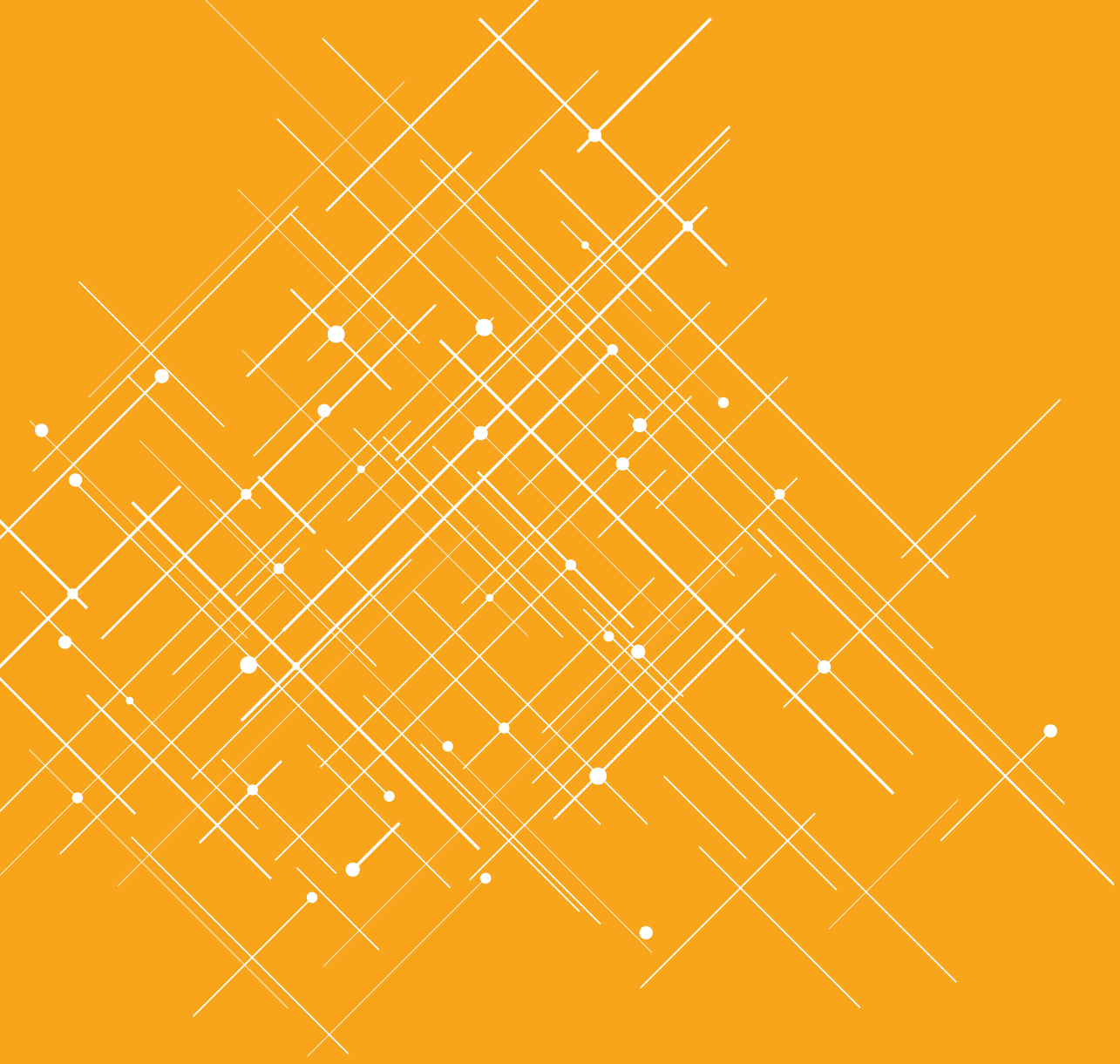
- The interest / willingness of the residents to pursue such an implementation
- The availability of renewable energy potential in the village
- An existing / dynamic and efficient parallel low – voltage network, owned and operated by the municipality
- A properly sized system to meet the average needs of the subscribers / shareholders

From a legal perspective, the process builds on:

- The preliminary approval of EDL to implement the V24 Scheme
- The establishment of the Energy Committee to legally represent the village vis-à-vis EDL matters

From a financial perspective, the process builds on:

- The economies of scale rendering the initial investment acceptable by all parties
- The available micro-financing options that could alleviate the payments (both initial / down payment and instalments)



ANNEXES

Annex 1.

Sizing a Solar Photovoltaic System to Hybridize with the Municipal Diesel Genset and the National Utility Network

Sizing of solar PV systems in a microgrid such as that discussed for the Village 24 Initiative is a task that must be undertaken by an energy engineer and/or expert. However this section gives the general considerations that need to be taken into account, so that the municipality and/or other concerned entities can take note of them.

The solar PV system under the V24 initiative scheme operates in two modes:

1. Net metering mode with the EDL network allowing the subscribers to reduce their monthly utility bills.

2. Fuel reduction mode with the local network allowing the municipality and subsequently the residents to reduce the diesel consumption and O&M costs on the backup generators. These two operation modes dictate certain constraints to be considered while sizing the system:

• EDL net metering constraints: The currently available net metering scheme implemented in Lebanon allows the subscriber to reduce his/her monthly bills through 'net consumption' payments which are rolled over to the next billing cycle – in case of surplus – until the end of the fiscal / calendar year. In which case, any surplus is not financially remunerated, but is considered as a contribution to EDL's electricity production. Therefore, sizing the system larger than the maximum yearly energy consumption would increase its upfront / investment cost while not increasing its financial benefits and returns to the correlated extent. This will result in an increased payback period as the return on investment is fixed (the yearly consumption). If and when EDL modifies its net metering scheme to allow a payment at retail rate for the excess of renewable energy power at the end of a given year, the above constraint can be readdressed.

• The available diesel generators with which the system will synchronize and operate in fuel reduction mode. The latter mode ensures that the generators do not cycle below 30% of their rated power capacity in order to preserve the integrity of the generator's mechanical components. Any excess PV production that will risk the generator going below 30% will thus have to be curtailed through the energy management system. Therefore, the rated capacity of the diesel generators and acceptable curtailment percentage of the total theoretical PV energy produced are constraints to be adopted in system design and sizing. It is important to note that the higher the PV energy curtailment, the larger the PV plant capacity and the lower the relative consumption of PV energy. Thus an increased upfront / investment cost of the system and its payback period is witnessed.

• Data collection: the sizing of the solar PV system is done based on the number of residents that will be part of the Village 24 Initiative and their actual electrical loads while adding the above constraints as limiting factors. It is highly recommended that the municipality installs meters in at least a sample of the interested subscribers' households in order to collect accurate consumption data with higher resolution. In the absence of such data, the PV sizing is done based on the total subscribers' average load over a year or a survey-based estimate demand profile, which in theory should be close to the smaller generator size (refer to Annex 2 on important distribution network caveats and required conditions in section 1 for more details). Next step is optimizing the system capacity based on the maximum curtailment constraint to keep it within economic carrying capacity limits.

• Spatial availability: solar PV requires considerable roof and/or marginal land space. For each 1 kWp capacity, an approximate surface area of 10 m2 is required. However, this value needs to be validated by the consultant given its sensitivity to other variables like land inclination and solar PV design (e.g. Inclination, single-axis tracking, etc.).

• It should be noted that in times of intermittence (during off-grid operation), the synchronization system along with the system's controller will ensure that the optimal generator(s) is(are) dispatched so that to match supply and demand while incorporating spinning reserve requirements and minimizing the need for solar PV energy curtailment.

Having in mind the process flow of implementing a Village 24 Initiative presented in Chapter 3, it would be optimal and a better practice if the sizing and optimization process of the solar PV system is divided into two sequential steps:

1. During step 2 (preliminary study) of the process flow, an optimization process is undertaken so that to obtain a preliminary maximum feasible PV system capacity based on the maximum allowable curtailment percentage (usually less than 15%), the spatial availability, the available generator capacity (or the generator that will/may be purchased) and the total yearly load demand. A sample optimization sheet is available on CD with this present booklet where the user inputs the constraint parameters, the hourly load profile for a typical year and the hourly generation profile for a PV system at the specific location for a typical year. The sheet takes into account 12 hours of daily power cut-off under the alternating on and off scheme over a 48 hours period. This will be 6 hours on – 4 hours off – 4 hours on – 4 hours off – 6 hours on – 6 hours off - 4 hours on – 4 hours off – 4 hours on – 6 hours off. The optimization procedure can be described by the below formula:

$$\text{Maximize } \left(\sum_{i=1}^{8760} Yi\right) \text{ by varying the PV capacity}$$

$$\text{Subject to: } \sum_{i=10}^{8760} Ci \leq \text{Curtailment limit}$$

$$\sum_{i=1}^{8760} Yi \leq \text{Yearly demand}$$

$$\text{Space required} \leq \text{Spatial availability in } m^2$$

Where “Yi” is the solar PV energy produced in hour ‘i’ and is calculated by multiplying the mapped hourly specific yield by the PV capacity. Ci is the curtailed energy in hour ‘i’ during off-grid operation and is calculated as the excess solar PV energy in hour ‘i’ considering the minimum loading ratio of 30% on the diesel generator.

Since this is an early stage sizing model, and due to the possibility of unavailability of the needed hourly generation and consumption data, the user has the option to input the yearly average load and the PV system’s specific yield at the set geographical location to output a typical hourly profile for the load and PV production (information can be found online on website such as http://globalsolaratlas.info) by mapping the inputted data to a typical consumption and generation profile in Lebanon. The model then outputs the maximum PV capacity while respecting the constraints which then can be used as the capacity top boundary for steps 3, 4 and 5 in the process flow.

Individual shares to subscribers can then be distributed under the conditions that **(1)** the share size does not yield energy greater than the annual energy consumption of that subscriber, and **(2)** the sum of all the shares is less than or equal to the maximum PV capacity calculated in the optimization model.

2. During step 5 of the process flow (detailed study), the renewable energy consultant(s) and system designer(s) should have accurate data in regards to the number of subscribers, their consumption profile and hence the maximum feasible PV system capacity. In this step, it is highly recommended that the consultant(s) simulate the system using an integrated energy system modelling software that provides the tools for the optimization of PV-diesel hybrid systems in order to verify the sizing calculations, the optimal operation and the financial and technical feasibility of the designed system. It is worth noting that obtaining an accurate load profile at this stage and running accurate simulations will reduce the risk of over-designing the PV system that has a 25-year lifetime. In other words, reducing the risk of having excessive curtailment (above the designed for limit) and/or not meeting the yearly financial returns.

Annex 2.

Important Distribution Network Caveats and Required Conditions

One of the assumed existing parameters for the Village 24 Initiative listed in Chapter 2 is the existence of a unified low voltage network to which the renewable energy plant would connect during utility blackouts. On the one hand, this initiative falls under the legal responsibility of the Energy Committee that will enter into contract with the National Utility Company (EDL), and is thus responsible for managing, operating and maintaining the local backup generation network. On the other hand, the renewable energy system synchronizes with the locally installed LV network during EDL blackouts through a fuel reduction device / energy management system. The energy management system monitors the instantaneous demand, the generator(s) load and the instantaneous PV production and manages and controls the solar PV penetration into the generation mix while ensuring a minimum loading ratio of 30% on the diesel generators and catering for the set spinning reserve.

The section below lists important parameters to address when considering the installation of a renewable energy system for a community.

A2.1 LV network design

Villages that have a distributed backup service network will have to consolidate this network under the auspices of the municipality. Hence the network will consist of:

• Diesel generators; in order for the network to be dynamic and efficient, at least two generators must be installed
1- The first generator is sized based on the maximum village demand. This value could be provided from EDL bills or based on the EDL circuit breaker installed per household / institution
2- The second generator is sized based on the average village demand

• Power cables; cables need to be properly selected and sized as to provide the required current carrying capacity within the respected voltage drop limits

• Synchronization panel; to synchronize the operation of the diesel generators

• Individual meters; meters are installed at the households / institutions providing the kWh consumption reading per subscriber

During peak hours and seasons, the former coinciding typically in early mornings, and early afternoons to early evening where most of the family members are active in the households, while the latter being the result of an increase in the village residents or individual demands notably during the summer, the larger generator is operated. During off-peak hours, typically during the day, the smaller generator is operated. The switching between both generators depending on the demand and its safety operation has to be supervised and managed through synchronization.

An optimal scenario would be if three diesel generators are installed and operated under a synchronization system. This would allow sizing one of the generators to operate with the solar system during daytime, sizing a small generator to meet the load during night time when it is at its minimum and sizing one generator to operate in synchronization with one of the other two in order to meet the demand during peak load hours.

A2.2. LV network Caveats

- **Existing grid quality**

Some villages in Lebanon have taken on the initiative of centralizing their backup generations through the installation of a parallel Low Voltage (LV) network supplied by diesel generators to cater for the village's power demand during utility cut-off times. These networks including the generators are usually owned, operated and maintained by the local municipality that bills the residents based on a tariff of 300 LL / kWh ($c20/kWh). A new decree (number 135/1/A.T) dated 28 July 2017 requires backup system providers (diesel operated generators) to charge the user based on his/her kWh consumption as opposed to billing based on the permissible peak power (circuit breaker capacity). To this end, all backup system providers have to install digital energy meters for the subscribers and will have to follow the Ministry of Energy and Water's pricing for billing the customers connected to the diesel operated generators.

As a first step, when collecting information about the electricity demand and current available models, both in terms of business models and backup solutions, the existing established network should be looked into thoroughly. The main elements to investigate include:

a. The distribution network

Village geography plays a major role when setting up the LV network; optimally, the generators would have to be installed equidistantly from the available households/consumers as to avoid oversizing cables in order to keep the voltage drop within acceptable limits (up to 8%).

Branches emanating from the generators' network should be balanced in terms of connections. In other words, dense neighborhoods should have more than one branch supplying the residences with electricity. This would also eliminate the need for oversized cables and a poor power quality in certain neighborhoods. Now that the new decree imposes the backup generators' sector to charge the customers as per their consumption and not by trenches, the limit on peak power supplied is alleviated, rendering a possible increase in demand or even decrease in some cases on the diesel generator's network and branches. Therefore sizing cannot take a limited power consumption but has to account for the maximum the household / institution might consume which is limited by their EDL subscription capacity. Therefore, a critical aspect to consider when installing the network or investigating it later is cable type and size; for the same voltage drop (a factor of cable length), aluminum cables have a higher cross sectional area than copper ones, as shown in table A2.1 below.

Table A2.1: Equivalent standardized cross sectional area at equal voltage drop

Copper (mm^2)	Aluminium (mm^2)
6	10
10	16
16	25
25	35
35	50
50	70
70	95
95	150
120	185
150	240
185	300

b. Grounding system and protection

In most Lebanese areas, when acquiring a backup connection from the neighborhood diesel generator, the provider usually uses one (1) phase of the three (3) phases to connect one or several households in a way as to keep the balance between the phases. Grounding and earthing are usually absent or sometimes connected haphazardly, by connecting to the national utility ground or neutral, rendering no provision of safety measures. By doing so, whenever any fault occurs on the phase in question, there is no safe path to discharge any fault currents which may cause damage to appliances or components and possibly result in electrocution.

When integrating the renewable energy source into the mix, system protection from the available networks both EDL and the LV diesel network should be taken into account. Any faults resulting from the 'common practices' would cause the system to keep disconnecting and not properly synchronize with either network thus resulting in a decrease in system performance and solar energy yield.

c. Reservations for future expansion

Some neighborhoods might experience an increase in demand, whether through the available households that have additional residents, more activity requiring increased electricity consumption, or through newly built households. Cables used in the network should be oversized by a minimum factor of 1.2 as a safety margin and a contingency for future expansion.

In dynamic villages, where construction and residents' occupancy are changing, network design / distribution needs to be constantly checked so to make sure the quality of the electricity does not fall below the recommended level.

- **Current Switching methods (between different diesel generators)**

An efficient micro-grid / local grid should have a generator sized to provide the village peak demand when needed – namely during evenings, holidays, summer seasons – and another generator to cater for the average demand.

Ideally, generators would be synchronized and connected to an automatic transfer switch rendering the network fully automated. The system would switch between generators to cover the instantaneous village consumption while making sure that the optimal generator is running under a high efficiency loading ratio to reduce unnecessary diesel and possible O&M costs. The available network should be designed for dynamic usage and hence has a flexible supply capacity to meet the somewhat flexible or changing demand based on seasons and time of day. In such a case, switching between the two available sources of electricity would be done automatically through a smart synchronization system that would be able to sense the demand and turn on the right generator (size).

Should the switching be done manually, in which case the generators are not synchronized, synchronizing the generators and connecting them to a Programmable Logic Controller is required. The Programmable Logic Controller would be capable of monitoring the instantaneous demand, the renewable energy plant production and then control the operation of the generator in order to ensure the optimal performance of the whole system.

Annex 3.

General Technical Specifications of the Solar PV system Complete with Metering Components

A3.1 PV modules

PV modules must be crystalline silicon PV modules that comply with the norm IEC 61215 edition 2 and shall be qualified to and be classified by Class according to IEC 61730. PV modules shall also comply with the requirements of IEC 62716 (Ammonia Corrosion test).

The modules shall also be tested through at least one of the following quality and durability programs:

- Fraunhofer's PV Durability Initiative (PVDI) testing
- Atlas 25+ PV durability testing program
- PVEL's vendor qualification test program
- NREL's Qualification Plus for PV module reliability
- VDE Durability Testing Program
- TUV Sud Thresher or equivalent

A3.2 Inverter

For grid-connected operation, inverters are multi-string inverters. The inverters control the current into the grid to meet the requirements for connection functionality. These standards include a voltage and frequency range and requirement for "anti-islanding" to ensure that the inverter disconnects from the utility grid if the latter is not within the specified conditions.

It is recommended that each PV generator with similar physical and radiation characteristics (tilt, temperature, radiation, etc.) are connected to one single MPPT.

The grid-dependent inverter requirements shall also include the following:

- Dynamic compensation of Reactive Power
- Inverter automatic reconnection conditions
- Linear output power control from a third device (read and write capabilities)
- Utility-Interactive Photovoltaic inverter system

They should also have the following certification:

- Harmonic Current (IEC 61000-3-2 and / or IEC61000-3-4), IEC 62109-1/2
- With anti-islanding protection as per VDE 0126-1-1 or similar

A3.3 PV Plant controller

The PV plant controller unit shall be a fuel-reduction device, tested with successful experience of at least 1 year in operation in similar conditions and shall be compatible with the Genset Control Unit and communicate with the inverters to guarantee the proper operation of the existing and / or new gensets (genset efficiency, minimum part load, spinning reserve, reverse current protection, etc.).

If the available genset does not include an embedded Genset Control Unit, then the Contractor shall supply and install a third party meter on the genset power lines to read the genset's operational parameters.

The PV plant controller unit should integrate communication protocols compatible with:
1. Reading capabilities: current and voltage sensors and Genset Control Unit
2. Writing capabilities: Inverters

The controller should be able to communicate with the system's components through RS485, Ethernet and/or RS232 (compatible with grid-connected inverter, existing Genset Control Unit, environmental sensor and electrical meters)

A3.3.1 Monitoring sub-system and data logger

It is recommended to have a complete monitoring sub-system that would have the following equipment:

- Irradiance Sensor: Reference PV solar cell with voltage output.

- DC Current and Voltage Transducers: Internal or external DC current transducers to measure: Electrical energy from PV generator, electrical energy to inverter.

- AC Meters: Digital three phase meters with output pulse signal (open collector 1,000 p/ kWh); class II; 230V-50Hz; input: current (depending on rated power), Dimension 1-DIN module, compatible with monitor system.

- Temperature Gauge: External ambient and PV modules temperature sensor (IP65).

- Communication and Signal Interface: Device for real time visualization and download of stored data. A communication protocol compatible with external sensors, meters, inverters and Genset Control Unit should be used. A data logger can be a separate device or it can be included in the PV plant controller unit and should store current and historical data while having a data logging capacity that computes averages or integrates at least the following hourly values: Month, day, hour, irradiation, PV energy generation, inverter energy output to loads, AC consumed by the building, AC delivered to the grid, average voltage. Additionally, the logger shall allow remote monitoring and shall have at least the capacity to store two years of data.

- Energy Display Unit: Energy management computing with display at least of: power values of PV generator, power in/out from the inverter (W); temperature (ºC) and voltage (V); irradiance (W/m2); ambient temperature (ºC); installation reference number.

• Evaluation software: Software PC compatible to perform monthly evaluation reports with at least the following indicators: year, month, energy values (kWh), in plane average daily reference yield, average daily PV generator normalized yield, average daily final normalized yield, performance ratio (%), solar fraction (%), AC energy consumed from the grid, and AC energy delivered to the grid.

The software shall enable alarm configuration.

A3.4 Smart Meters and Data Concentrator Units

A3.4.1 Household / Institution Smart Meters

General Specifications

Description	Value
Current Reference Value (Iref)	5A
Starting Current (Ist)	20mA
Minimum Current (Imin)	0.25A
Maximum Current (Imax)	80A
Current Surge Withstand Capability	100A (continuously) | 2,400A (during 0.01s)
Power absorbed by the current circuit (at Iref)	< 0.3 VA
Voltage Rated Value (Un)	127 – 230V
Voltage Operating Limit (Un)	± 20%
Voltage Thermal Capability	400V
Voltage Circuit Load	< 4.5 VA (without PLC transmission)
Active Energy Measuring Accuracy	Class B (EN 50470-3)
Reactive Energy Measuring Accuracy	Class 2 (IEC 62053-23)
Test Constant Measuring Accuracy	1,000 pulses / kWh (kvarh)
Temperature and Humidity	25˚C to 70˚C
Operating and Sorting Range	25˚C to 85˚C
Humidity Limit	95% (non – condensing)

Power – free Output (optional)

Description	Value
Maximum Switching Voltage	280 Vac (DC switching not possible)
Current (continuously)	0.5 AacMax

Switching elements

Description	Value
Maximum Operating Voltage	250 Vac
Nominal Load	60A
Switching capacity	20,000 VA
Operating time	< 30ms
Number of Operations	10^5

Communication Link

Description	Value
Optical Port	According to EN62056-21
Used signals	RX/TX
Implemented Communications protocol	EN 65056-46
Speed	9,600 bauds

PLC port

- PLC modem within the A band according to CENELEC EN 50065 – PRIME
- RS 485 port (2 wires)
- 2 identical RJ11 connectors internally united; used signals:
    1. GND
    2. UP (a)
    3. UN (b)
    4. UN (b)
    5. UP (a)
    6. GND

A3.4.2 PV Plant Export Smart Meter

Description	Value
Current Reference Value (Iref)	5A
Starting Current (Ist)	40mA
Minimum Current (Imin)	0.5A
Maximum Current (Imax)	80A
Current Surge Withstand Capability	100A (continuously) | 2400A (during 0.01s)
Power absorbed by the current circuit (at Iref)	< 0.1 VA
Voltage Rated Value (Un)	127 – 230V
Voltage Operating Limit (Un)	± 20%
Voltage Thermal Capability	400V
Voltage Circuit Load	< 5 VA (Phase A & B) < 16 VA (Phase C)*
Active Energy Measuring Accuracy	Class B (EN 50470-3)
Reactive Energy Measuring Accuracy	Class 2 (IEC 62053-23)
Test Constant Measuring Accuracy	1,000 pulses / kWh (kvarh)
Temperature and Humidity Opertaing Range	- 25˚C to 70˚C
Operating and Sorting Limit Range	-25˚C to 85˚C
Humidity Limit	95% (non – condensing)

* Multifunction meter, consumption requirements per EN 62053-61

Power – free Output (optional)

Description	Value
Maximum Switching Voltage	280 Vac (DC switching not possible)
Current (continuously)	0.5 Aac Max

Switching elements

Description	Value
Maximum Operating Voltage	250 Vac
Nominal Load	60A
Switching capacity	20,000 VA
Operating time	< 30ms
Number of Operations	10^5

Communication Link

Description	Value
Optical Port	According to EN62056-21
Used signals	RX/TX
Implemented Communications protocol	EN 65056-46
Speed	9,600 bauds

PLC port

- PLC modem within the A band according to CENELEC EN 50065 – PRIME
- RS 485 port (2 wires)
- 2 identical RJ11 connectors internally united; used signals:
    1. GND
    2. UP (a)
    3. UN (b)
    4. UN (b)
    5. UP (a)
    6. GND

Complete with Resin encapsulated Cable Passing Measuring Current Transformers

Description	Value
Operating frequency	50/60 Hz
Resin encapsulating	synthetic thermosetting
Insulation reference voltage	0.72 kV
Test voltage	3 kV x 50 Hz (per phase)
Continuous overcurrent	1.2 In
Rated short thermal current (I th)	80 In
Rated dynamic current	2.5 x Ith
Safety factor	N ≤ 5
Maximum Power Dissipation (max range value)	≤ 8W
Short Circuit Current	35 kA x 1 sec.
Operating temperature	-25 + 50˚C
Storage temperature	-40 + 80˚C
Manufactured according to	IEC / EN 60044-1, VDE, BS, UTE

A3.4.3 Data concentrator units

Power Supply

Description	Value
Rated Voltage	Vn = 3x230 / 400 Vac
Operating range	0.4 to 1.1 Un
Maximum Power Consumption (normal conditions)	7W total / 37 VA per phase
Maximum Power Consumption (forced conditions)	12W total / 37 VA per phase
Insulation	10KV / 1 min between Ethernet and the other circuits 2KV / 1min between the other circuits

Meter Parameters

Description	Value
Nominal Voltage	3x127 – 230 / 400 Vac
Current	3x5 (10) A
Frequency	50 Hz
Accuracy	- Active: Class B or 1 (EN 50470-3 or IEC 62053-21) - Reactive: Class 2 (EN 62053-23)

Communications

- 3 Low Voltage PLC Communication Lines
- Connectors:
  - 1 V.A – 1V.N
  - 1V.B – 1V.N
  - 1V.C – 1V.N
- Characteristics: PRIME signal according to version 1.3.6. – 3 independent channels in Tx and Rx – 1 Vrms signal over an impedance of 2 Ohms – Dynamic range 65dB
- Ethernet port: TCP / IP Protocol - Ethernet (standard) 10Mb / 100Mb – Auto MDI – X (crossover) – Insulation: 10KV / 1 sec
- 3G / GPRS module: PH8: Five band, 800/850/AWS1/1900/2100MHz – Double SIM
- Serial Port RS485/RS232 SRV

Measurement characteristics

Description	Value
Current	3x5(10)A
Reference Voltage	3x127 – 230 /400 Vac
Frequency	50 or 60Hz (according to model)
Energy Accuracy	Class B active (EN 50470-3) Class 1 reactive (EN 62053 – 23)

Battery

- When disconnected: 500 days
- When connected and supercap charged, interruptions of 1hour are possible without using the battery

Environmental characteristics

Description	Value
Operating range	-25˚C to 60˚C (outside the cabinet)
Storage range	-25˚C to 70˚C
Humidity	< 95% (non – condensing)

Built-in antenna

• Built-in omnidirectional antenna or built-in directive antenna, including a fixing accessorize to guarantee the insulation of 10KV.

IP / IK classification

• IP 65 / IK 09

Cover Protection

• Class II and double isolation

A 3.5 Private internet connection for remote reading

A3.5.1 M2M Alfa SIM cards

Machine 2 Machine (M2M) Alfa SIM cards will be installed on the existing public and on the servers (typically the EDL department in charge of the meter reading in the area and the municipality) creating a secure data transfer connection.

A3.5.2 4G Alfa Dongle

A 150 Mbps dongle to be installed on servers (typically the EDL department in charge of the meter reading in the area and the municipality); the dongles should have the following features:

- Compatible with LTE, EDGE, GPRS and GSM networks
- Compatible with Windows XP, Windows Vista, Windows 7 and MAC operating systems

Annex 4.

Single Net Metering and the Village 24 Initiative

A4.1 Single Net Metering

Net metering is a billing technique based on EDL decision No. 318-32 / 2011 that allows residential, commercial, and industrial entities to produce electricity using renewable energy, and send the additional production not used on the site itself back into the grid. Over any given accounting year (starting from January 1st to December 31st), installers of renewable energy systems would be allowed to export their respective electricity production at times when these are not used locally. At the end of each billing period (commonly: 2 months), the installer of the renewable energy system will be charged only for the net amount of power consumed from the grid, i.e., the import minus the export of power. If there is excess power injected to the grid, over and on top of those imported, then this excess power is rolled over to the next billing period. At each billing period, whenever exports are greater than 75% of the import the customer's connection fees are cancelled. This goes on until the end of the year, where if electricity exported is more than imported, EDL will zero the meter. This will entail no financial transfers from EDL to the subscriber.

A4.2 Village 24 Initiative or the Community Net Metering

Community net metering uses the concept of the single net metering policy mentioned above and based on the same decree. With community net metering, households / institutions can get together and install a renewable energy farm in one area and the output of this farm can be divided into the number of subscribers that invested in installing it. Each investor / subscriber would import power from the grid and therefore will have the same import characteristics as before (single meter at the households / institutions), however the subscriber's exported renewable energy power from the renewable energy farm is measured through a dedicated meter - based on EDL recommendations and - installed at the point of connection with the utility network (refer to Annex 3). The export value will be calculated based on the percentage share of ownership for that subscriber in the solar power plant. It is a virtual net metering process.

To this end, a dedicated billing tool has been developed for the billing department at EDL, hosted at the collection department under whose jurisdiction the Village 24 implementation falls; in the case of Kabrikha, it is the collection department of Jouwaya in the South of Lebanon.

The tool aims at providing the billing team with indexes for bi-monthly individual imports (consumption from EDL) and exports (power fed back to EDL) for each subscriber.

Therefore once the system capacity and technical details are known and subscriptions (shares from the system's total investment cost) have been paid, the Energy Committee would input the subscribers' details (names, meter ID, branch ID, etc...) along with their shares of the system's output into excel which can then be uploaded into the billing software by EDL. This enables the tool to read the PV output production at the end of the 2-months cycle and calculate the individual power export per subscriber using their percent share (of the total exported renewable energy power). EDL will then have its import and export indexes per subscriber to issue their respective bills. The software will automatically estimate, save and rollover any excess power of individual subscribers per billing period to the next billing period.

Annex 5.

Benefits of Community Scale Renewable Energy Systems

To date, in Lebanon, distributed installations are the most common implementation set up available, given their cost and relatively smooth power production profile. Installing a distributed solar PV system would currently cost in the range of 1 -1 .5 $/kWp depending on complexity and on the connection (network) required. It would also require 10 m2 per kWp.

Community solar power provides several benefits, of which:

1. Lower Cost
Going the community scale route provides nearly 40 - 60% reduction on the investment cost normally attributed to the 'economies of scale' i.e. the development process in quantities and the specific (large capacity attributed to community level consumers) systems designs.

2. New market segments
The specific designs and larger scales create a new pool of end users / customers. In particular the available sizes (capacities) and its modularity renders the systems uniquely appropriate to meet a community level demand.

3. Alignment with local interest
The investment in such technology at the local level not only meets the local demand but also creates job opportunities for the local residents and allows the village to reduce health risks from polluting energy sources through the reduction of dependence on diesel generators.

4. Flexible system arrangement
As opposed to the distributed system, the community scale system provides additional flexible arrangements, namely when it comes the system's operation over its lifetime in cases where the user decides to move or is unable of continuing the payments, etc... The share ownership allows the user to simply sell his shares as opposed to having to remove a system and sell it.

5. Professional management
It is more likely that the community system will be operated and maintained by individuals nominated by the Energy Committee. Any need for maintenance, whether preventive or corrective, falls under this individual's responsibility and job description, hence reducing the performance risk.

6. Reduced roof space
Finally, distributed systems require localized space that could be used for other 'services' such as water tanks, solar water heaters, antennas and technical rooms. In some areas, the needed roof space might not be available or might be public owned which would require permits and agreements to install a solar PV system. The community scale set up potentially solves the space issue.

Annex 6.

Template Letter of Preliminary Approval

Template available on the CD provided with this booklet

الجمهورية اللبنانية
محافظة: _____
قضاء: _____
بلدية: _____

قرار رقم: _____

الموضوع: الموافقة المبدئية على تلزيم تركيب مشروع الطاقة المتجددة بقدرة _____ كيلو/واط على العقار رقم _____ من منطقة _____ العقارية.

إن مجلس بلدية _____،
بناءً على محضر جلسة المجلس البلدي تاريخ _____،
بناءً على المرسوم الإشتراعي رقم 118/1977 (قانون البلديات وتعديلاته),
بناءً على الموافقة المبدئية على تلزيم تنفيذ مشروع توليد طاقة نظيفة ومتجددة وهو كناية عن _____ (مزرعة شمسية أو مزرعة هوائية)، إلى آخره بقوة _____ كيلو/واط،
وبانتظار موافقة مؤسسة كهرباء لبنان على تركيب هذه المزرعة، وتشكيل لجنة لادارة هذه المنشأة مرفقة اسمائهم ربطا.

يقرر ما يأتي:

المادة الأولى: الموافقة المبدئية على انشاءمشروع توليد طاقة نظيفة ومتجددة على العقار _____ من منطقة _____ العقارية بقدرة انتاج وقدرها _____ كيلو/واط.
المادة الثانية: احالة هذا القرار الى مؤسسة كهرباء لبنان لاخذ الموافقة النهائية على تركيب هذه المنشأة وتوقيع اتفاقية مع المؤسسة بهذا الخصوص.
المادة الثالثة: انشاء لجنة لادارة هذه المنشأة مؤلفة من المشتركين المحتملين المرفقة اسمائهم ربطا.
المادة الرابعة: ينشر ويبلّغ هذا القرار حيث تدعو الحاجة.

في _____

الأعضاء نائب الرئيس رئيس البلدية

Annex 7.

Theoretical Financial Appraisal of a 100 kWp Solar PV System

A 100 kWp system is herewith presented as an example for ease of demonstration; it is highly recommended that this example be presented during the meetings, as to provide as concrete information as possible at the decision making steps.

Assumption for this financial appraisal are as follows:

- A 100 kWp system, together with its network, communication system (smart meters, data concentrator units, laptops, internet…) may cost up to 150,000 USD, all inclusive.

- We assume that each subscriber in the Village 24 initiative has 1% of the power output of the 100 kWp system and therefore owe a maximum of 1,500 USD for their respective share of the system.

- Annual operation and maintenance cost is assumed to be $3,000 (approximately 2% of capital costs), meaning that each subscriber has to pay $30 each year for the solar PV (or app. $2.5 per month).

- The net capacity factor is 17% (taking into account maximum curtailment of the solar PV of 15%), meaning that each subscriber will benefit from 1,500 kWh per year (this is a rough estimate and depends also on the geographic location in Lebanon).

- The average cost of electricity (combining EDL current rate with the possible diesel generator electricity prices that are varied between $c16 - $c26/kWh – depending on oil prices), is assumed to range from $c13 - $c18/kWh.

- Three discount rate scenarios are taken:
  - A discount rate of 13% with 5 years repayment period (similar to current rates of micro-finance loans – refer to Annex 9 for the available micro-finance institutions)
  - A discount rate of 5%, assuming all the money is put up by the subscriber without a loan (therefore it is foregone interest – assumed at 5% - of this money)
  - A discount rate of 2.6% (assuming the NEEREA soft loans are extended to the Village 24 Initiative).

The net present value (NPV) and the payback period of the above scenarios (combining low oil prices and high oil prices with the three discount rate assumptions) will yield the below dynamic payback periods listed in table A7.1:

Table A7.1: Dynamic payback periods for the present case scenarios

Discount	**2.6% (NEEREA)**		**5% (equity)**		**13% (micro-finance)**	
Oil Price	Low	High	Low	High	Low	High
NPV ($)	3,055	5,603	2,021	3,970	561	1,590
Simple PBP (years)	4.2	3	4.2	3	4.2	3
Dynamic PBP (years)	Positive cashflow	Positive cashflow	5.94	4.13	7.79	Positive cashflow

All scenarios are positive with the exception of obtaining a micro-financed loan to pay for the required capital costs, coupled with low oil prices. Therefore it is highly recommended for the Ministry of Energy and Water, the Lebanese Central Bank and the Lebanese Center for Energy Conservation to assist the Village 24 subscribers to tap into the NEEREA loan. The best case scenario will lead to a payback period of 6 years and a net present value of over $2,200, i.e. almost a return of 1.5 times the capital investment.

Annex 8.

Energy Committee by-laws and Internal Contract

Template available on the CD provided with this booklet

نظام ادارة مزرعة شمسية

مقدمة

بعد أن تمّ تركيب مزرعة طاقة متجددة بقدرة_____كيلو/واط وذلك وفقا للمعايير الدولية وبعد ان تم توقيع اتفاقية مع مؤسسة كهرباء لبنان (مرفقة ربطا) قرر الموقعين ادناه تشكيل لجنة فيما بينهم،الغاية منها تحديد حقوق وموجبات المستفيدين من هذه المزرعة (الشمسية أو الهوائية،...) والمنشأة في بلدة _____ الواقعة في محافظة _____ قضاء _____ ، وتنظيم ادارتها من أجل حسن استعمالها وصيانتها والمحافظة عليها. ويعتبر هذا النظام الزاميّاً لكلّ مستفيد من هذه المنشاة سواء كان مالكا او مستاجرا عقارا في البلدة ولديه ساعة كهربائية الكترونية باسمه، ولكل صاحب حق من الحقوق المتفرّعة عن حق الملكيّة.

اولاً - الهيئة العامة للمنشاة:

تتألف الهيئة العامة للجنة من اهالي وسكان بلدة _____ الذين يرغبون بالاستفادة من المنشأة والذين إطلعوا على نظامها ووافقوا على الإتفاقيات الموقعة من قبلها.

ثانياً - شروط الانضمام الى المنشاة:

- ان يتمكن المشترك من الاستفادة تقنيا وعمليا من المنشاة.
- ان يملك اشتراكا رسميا مع مؤسسة كهرباء لبنان وان يملك ساعة كهرباء الكترونية.
- ان يدفع فواتير مؤسسة كهرباء لبنان المستحقة على ما يملك بانتظام، والا يسقط حقه حكماً وفورا من الاستفادة من المنشأة.
- ان يدفع الفاتورة المتضمنة فرق المقطوعيات التي سجلها العداد حسب التعرفات المرعية الاجراء وذلك في موقع تسليم الطاقة ولدى تقديم الإيصال المعتمد من قبل كهرباء لبنان او الشركات المخولة من قبلها.
- ان يقوم بدفع ما يتوجب عليه من اعمال الصيانة.
- ان يلتزم بنظام اللجنة والتعديلات التي قد تطرأ عليه.
- ان يشارك باجتماعات الهيئة العامة التي يدعا اليها.

ثالثا - مركز اللجنة:

- يكون مركز اللجنة في مقرّ المجلس البلدي.

رابعا - الهيئة الادارية:

- تتألف الهيئة الادارية من رئيس ونائب رئيس و أمين سر وأمين صندوق.

يتولى رئيس البلدية حكما رئاسة اللجنة .

انّ الرئيس هو الذي يمثّل اللجنة أمام القضاء والهيئات الرسميّة والخاصّة وتجاه الغير.

يقوم رئيس اللجنة بتوجيه الدعوات من أجل حضور جلسات الجمعيّات ويترأسها ويديرها.

يتولى نائب رئيس البلدية حكما مهام نيابة الرئاسة.

يتولى _____ مهام امانة السر.

(عبر التعيين او الانتخاب حسب ما تقرره الهيئة العامة في اول اجتماع تعقده)

على الرئيس وامين السر ان يمسكا:

1. لائحة بأسماء اعضاء الهيئة العامة يبيّن فيها الأقسام التي يملكونها أو يملكون فيها وهويتهم ومحل اقامتهم ووضعيتهم القانونيّة والماليّة تجاه اللجنة.
2. ملفات اللجنة والسجلّات ومجمل المستندات المتعلّقة بها, وان يحتفظا بنسخ عن جميع الاتفاقات والعقود والأوراق الرسميّة والتصاميم وكلّ ما هو متعلّق بادارة المنشأة.
3. السجلّات التي تحتوي على محاضر الاجتماعات والأوراق والقيود المتعلّقة بها.
4. تحفظ جميع هذه الدفاتر والمستندات في مركز اللجنة.

يتولى _____ مهام امانة الصندوق. (عبر التعيين او الانتخاب حسب ما تقرره الهيئة العامة في اول اجتماع تعقده)

على الرئيس وامين الصندوق ان يمسكا وينظمان:

1. دفاتر وملفات محاسبة اللجنة بجميع علاقاتها مع الغير وخاصّة مع الدولة والادارات الرسميّة.
2. ينظّمان ميزانيّة المصاريف المرتقبة عن كلّ سنة قادمة.
3. ينظمان اوراق ومستندات صندوق الصيانة.
4. تحفظ جميع هذه الدفاتر والمستندات والملفات في مركز اللجنة.

- كما يمكن للهيئة الادارية أن تشكل لجان استشارية أو تقنية من أعضاء اللجنة ويمكن الاستعانة بتقنيين وإختصاصيين من خارج اعضائها.
- انّ مهمّة اعضاء الهيئة هي مجّانيّة.
- من الممكن ان تقبل الهيئة الادارية الهبات المادية والمالية على ان يتم عرضها على الهيئة العامة في اول اجتماع تعقده.
- تسجل الهبات فور قبولها في سجلات اللجنة .
- توضع الاموال التي تزيد قيمتها عن _____ في احد المصارف المعترف فيها في حساب خاص باسم اللجنة على ان يكون حق التوقيع عليه منوطا بالرئيس وامين الصندوق بالاتحاد.

خامساً - اجتماعات الهيئة الادارية:

• تعقد الهيئة الادارية إجتماعاتها الدورية كل شهر بدعوة من الرئيس كما لها ان تعقد اجتماعات استثنائية في حال طلب ذلك 10% من أعضاء الهيئة العامة.

سادساً - حقوق وواجبات اعضاء الهيئة العامة:

• يعفى جميع اعضاء اللجنة من رسوم الاشتراك الواردة على الفاتورة في حال كانت الطاقة الموردة من المنشأة على شبكات كهرباء لبنان اقله بحدود 75% من الطاقة المستهلكة منه.
• يتم احتساب الطاقة المستهلكة من كل من اعضاء اللجنة.
• إن أعمال الصيانة هي على عاتق اعضاء اللجنة لذلك يتم انشاء صندوق تجري تغذيته من بدل اشتراك شهري على الشكل التالي:

= تدفع اشتراكات الصيانة وفقا لمقدار حصص كل مشترك في المنشأة.
= ان الحد الادنى لكلفة تشغيل وصيانة المنشأة يقدر سنويا بحوالي 3,5 بالمائة من قيمة مجمل استثمار المنشأة.
= يتم لحظ في الموازنة السنوية للمنشاة باب خاص للاعطال الطارئة التي قد تتعرض لها المنشأة.

• كل عضو في اللجنة محددة حصته في هذه المنشأة وفقا لما هو مبين في الجدول (رقم _____) ويعتبر مشتركا بمنظومة التعداد الصافي.
• يعتبر حكما مستقيلا من عضوية اللجنة كل عضو يفقد شرطا من شروط الانتساب المذكورة في البند الرابع أو باع منزله أو لم يعد يرغب بتجديد إشتراكه في اللجنة.
• على أنه لا يحق للمشترك ان يترك اللجنة الا بعد انتهاء السنة التعاقدية التي تمتد من / / الى / / شرط اعلام الهيئة الادارية للجنة خطيا نيته هذه قبل شهرين من انتهاء السنة التعاقدية.
• لا يمكن ادخال اي عضو جديد الى اللجنة خلال السنة التعاقدية والتي تمتد من / / الى / / شرط اعلام الهيئة الادارية للجنة خطيا نيته بان يصبح عضوا فيها قبل شهرين من بدء السنة التعاقدية.
• اذا كان للقسم او للمنزل الواحد عدّة مالكين (حالة الشيوع في ملكيّة القسم أو توزيع الملكيّة بين مالك الرقبة وصاحب حق الانتفاع), يعتبر جميع هؤلاء المالكين مسؤولين بالتكافل والتضامن فيما بينهم عن نصيب القسم او المنزل في مصاريف اعمال الصيانة ويعتبر تبليغ أحدهم بمثابة تبليغ الآخرين.
• تشمل نفقات الصيانة من دون حصر جميع مصاريف التصليحات المتوجبة على المنشاة.

سابعاً - اجتماعات الهيئة العامة:

• تعقد الهيئة العامة إجتماعاتها كل ستة أشهر ولها ان تعقد اجتماعات استثنائية اذا طلبت ذلك الهيئة الإدارية.
• تبلغ الدعوات قبل اسبوع من موعد الجمعية اما مباشرة بواسطة موظف من المجلس البلدي او لصقا على باب القسم.
• لا يعتبر الاجتماع قانوني الاّ بحضور الأكثريّة المطلقة من ألاعضاء على الأقل في الجلسة الأولى, ويكون قانونياً بمن حضر في الجلسة اللاحقة,وتتخذ الهيئة قراراتها بالأكثريّة الحاضرة.
• لا يجوز أن تناقش في الجلسة الاّ المواضيع المحدّدة لها, ما لم يوافق الرئيس على بحث المواضيع التي تطرح مباشرة.
• انّ القرارات القانونية التي تتخذها الجمعيات تلزم الغائبين والمخالفين والممتنعين عن التصويت.

ثامناً - اعمال صيانة المنشأة:

- تتعاقد الهيئة الادارية مع شركة مختصة لاجراء عملية الصيانة الضرورية للمنشأة.
- يبقى للشركة التي تولت تركيب المنشأة الافضلية من اجل القيام بمهام اعمال الصيانة.

تاسعاً - تعديل النظام:

يجوز للهيئة العامة تعديل هذا النظام بأكثرية ثلثي أعضائها بناء على إقتراح الهيئة الإدارية شرط أن لا يتعارض هذا التعديل مع الإتفاقية الموقعة مع مؤسسة كهرباء لبنان.

عاشراً - حل اللجنة:

- تعتبر اللجنة محلولة حكماً في حال فسخت مؤسسة كهرباء لبنان العقد الموقع معها، او اصبحت المنشأة من دون منفعة تقنية على ان تعود أموالها وممتلكاتها في حال وجدت للبلدية، دون أن يعود لأي من أعضائها بأي حق أو مطلب أو تعويض ناتج عن هذا الحلّ.

حادي عشر - حل الخلافات:

كلّ خلاف يتعلّق بتفسير هذا النظام أو تنفيذه بين أعضاء اللجنة أو بينهم وبين الهيئة الادارية يحل حبيا وفي حال تعذر الامر يتم حل اللجنة شرط اعلام مؤسسة كهرباء لبنان فورا بهذا الاجراء.

Annex 9.

Existing Micro-Finance Institutions in Lebanon

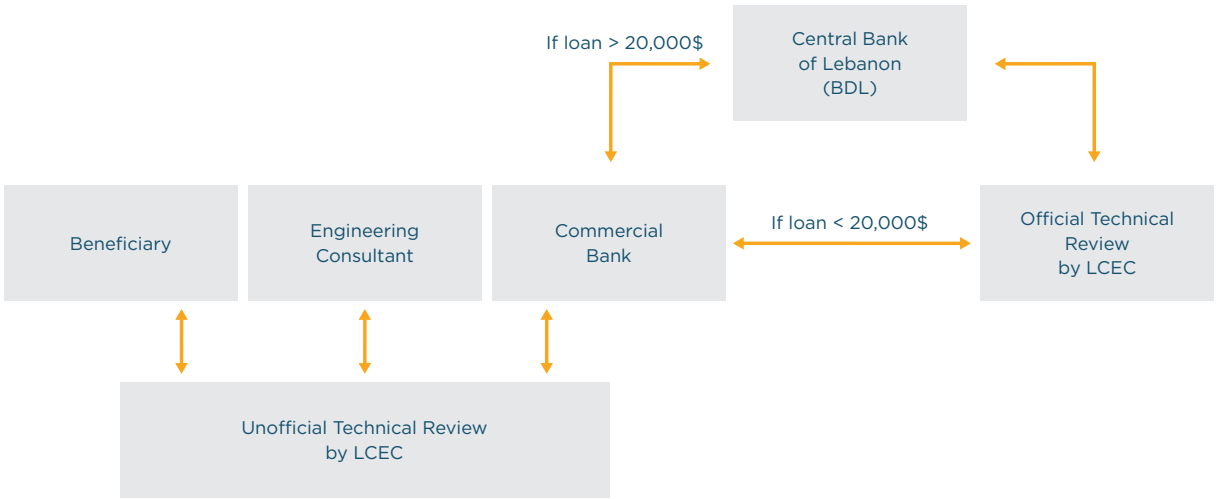
After setting up the Energy Committee and during the detailed study phase, individuals are highly encouraged to consider available options for acquiring the money for their respective shares. Hereafter are available institutions that offer financing options for a committee or for individuals.

A9.1 Energy Committee Financing Options:

A9.1.1 NEEREA

The National Energy Efficiency and Renewable Energy Action (NEEREA), launched in 2010 by the Central Bank of Lebanon, provides commercial banks with incentives to grant loans to finance an Energy Saving or Renewable Energy Project. The loan size can go up to $10M with a repayment period of 14 years. The loan has an effective interest rate of 2.6% with a grace period of up to 4 years. Figure A9.1 here below shows the comprehensive application process.

Figure A9.1 NEEREA application process



Technical Review of NEEREA Loan – LCEC

1. Proposal Contents
2. Contact Details of Involved Parties
- 2.1 Project Owner Details
- 2.2 Consultant Details
- 2.3 Bank Details
- 2.4 Product Suppliers Details

3. General Description of the State of the New Facility
4. Narrative Description of the Proposed Project
- 4.1 Rationale and Objective
- 4.2 Presentation of the Proposed Project

5. Loan Request Summary Sheet (EE measures)
6. Financial Analysis Summary (Cost savings and Payback)
7. Upcoming Situation of Energy Consumption
8. Detailed Feasibility Study of the Project (Economic, Financial and Environmental Sustainability Analysis)
9. Catalogs and Data Sheets
10. Invoices and Quotations

A 9.1.2 Kafalat Energy

The Kafalat Energy Program extends loan guarantees of 75% to small and medium enterprises to finance renewable energy and energy efficiency projects. The loan is provided by the Lebanese Commercial Banks, the loans can go up to $333k with a repayment period of 15 years. Interest is at a rate of 2.75% on USD currencies and 3.84% on LBP currencies with a 1.5% guarantee fee and a grace period of up to 2 years. Table A9.1 hereafter provides additional information on the available programs.

Table A9.1: Kafalat Energy Program

Name of Programs	**Program A - Energy Efficiency**	**Program B - Renewable Energy generation for internal use**	**Program C - Renewable Energy generation for sale to third parties**
Investment type	To finance the adoption of or conversion to sustainable energy consumption, i.e. to optimize an energy system to consume less	To install a renewable power generation system, and consume the produced electricity for internal use, to replace fossil fuel based electricity	To install a renewable power generation system, with the aim of selling all or part of the produced electricity to others, including the public grid
Maximum loan amount	LBP 500 Million or equivalent in USD	LBP 500 Million or equivalent in USD	LBP 1,320 Million or equivalent in USD
Loan Duration	or equivalent to in USD	Up to 15 years	Up to 15 years
Guarantee	75%	75%	75%
Interest Rate (%)	3%	3%	3%
Grace Period	Between 6 months and 1 year	Between 6 months and 2 years	Between 6 months and 3 years

Eligible applicants are SMEs (Individual, Sole Proprietorship, Simple Partnership, limited liability company (SARL), joint stock company (SAL), Cooperative, NGO) with less than 40 registered employees operating in one of the five subsidized sectors: Industry, Tourism, Agriculture, High Technology and Crafts.

Non Eligible Types of SMEs
In addition to the activities not supported by any of Kafalat's guarantees, SMEs which are not eligible for Kafalat Energy in particular, are:

- Energy Consultants
- Energy Service Companies (ESCO)
- Energy Contractors

These companies are engineering companies specialized in energy, and prepare packages of energy efficiency measures or renewable energy installations for their clients.
They are not eligible for Kafalat Energy themselves, but their clients might be, should they meet the eligibility criteria. Thus the application should be made in the name of the final beneficiary of the loan i.e. their client.

Technical Eligibility
In order to ensure the fund will be used by the most energy beneficial projects, energy savings (Programme A) or renewable energy generation (Programmes B & C) relative to the initial investment will be compared to a benchmark in each technology.

Programmes B & C - Renewable Energy
When submitting to the above programs, the requesting file should include the following information:

1. Current Energy Situation: The report should detail the current sources of energy generation, costs and problems. Supportive documents such as EDL bills and generator/diesel bills must be provided. In addition, the resources of the proposed renewable energy solution must be presented along with all the site constraints.

2. System Design Considerations: The design must be coherent such that equipment sizing, selection and specifications are optimal. All losses must be accounted for, and all electrical connections compliant to applicable standards. This is to ensure a fault free operation, and reduce operation costs.

3. Energy Yield Calculation: The energy yield calculations must be accurately performed with a computer-based calculation tool, and take into consideration all the previously mentioned parameters. If available, commercial or proprietary software should be used. If not available, the calculation steps will be explained and justified in detail. In any case the calculation must include a comparison to a business as usual scenario.

Indicators for files evaluation

1. Key Energy Indicators: The results should emphasize the energy benefits of the project. They could be presented as follows:

- Total energy yield in kWh/year
- Specific energy yield in kWh/kWinstalled
- Performance Ratio (PR) in %
- Overall System Conversion Efficiency in %
- Nominal output current in A
- Nominal output power in kW
- Avoided CO_2 emissions in tons of CO_2. This information is mandatory.

2. Key Financial Indicators: They should be justified by pro-forma invoices, previous energy bills of the facility, and take into account the time value of money.

- Capital cost of all components
- Engineering and Installation costs
- Operation and Maintenance costs
- Savings-to-Investment ratio (SIR)
- Levelised Cost of Energy
- Net Present Value of project

A9.1.3 Kafalat Basic

Kafalat Basic is a loan guarantee program of 75% provided to Lebanese SMEs to finance fixed assets and working capital needs. It is provided by the Lebanese Commercial Banks with a loan size of up to $200k and a repayment period of 7 years. The interest rates that apply to this loan are 3.75% on USD currencies and 3.85% on LPB currencies and a guarantee fee of 2.125%. This loan includes a grace period of 6 month to 1 year.

A 9.1.4 LEEREFF –Lebanon Energy Efficiency & Renewable Energy Finance Facility

The LEEREEF is a EUR 80Million loan provided by the European Investment Bank (Eur 50Million) and Agence Française de Développement (EUR 30Million) supporting small-scale investment in energy efficiency (EE) and renewable energy (RE). LEEREFF aims to finance projects ranging from a minimum of $54,000 of investment to a maximum of $60Million of investment. The total interest rate on a LEEREFF loan will be computed on the basis of the weighted average of the interest rates charged by EIB and AFD plus a margin of 3.75% for the local commercial banks, plus a commission of 0.5 percent for BDL. Then a percentage equivalent to 1.5 times the interest rate on one-year treasury bills in liras will be subtracted from the total interest rate and as a result the final interest paid by the borrower will be close to zero. The local banks will pay the interest to EIB and AFD, while BDL will provide liquidity in liras to the banks equivalent to one and a half times the amount of the loan.

A9.2 Individual Financing Options (micro-finance)

A9.2.1 Emkan

Emkan is a Lebanese financial institution licensed by the Central bank of Lebanon and established by Bank Med in June 2011. Emkan provides micro enterprises, small enterprises and employees with loans starting from LBP 500,000 to LBP 15,000,000. The interest rate ranges from 10% to 13% depending on the value and purpose of the requested loan. Emkan only provides individual loans. For employees the value of the loan cannot exceed 35% of his/her monthly income. Loan terms range from 4 to 48 months based on Emkan's conditions for borrowers and the ability of the borrower to repay the amount approved.

A9.2.2 Vitas

Vitas is a Lebanese microfinance institution licensed and supervised by BDL since 2007. Vitas provides financial products to both business and individuals ranging between $300 and $30,000. The interest rates range from 13-16% depending on the value and the purpose of the requested loan. The repayment period varies from 4 months to 24 months for personal loans and up to 5 years for home improvement loans.

Annex 10.

Template Questionnaire for collection of detailed individual load profile

The sample questionnaire presented herewith allows the energy consultant (s) to collect detailed information in regards to the potential subscribers' load profile for the detailed study (step 5 of the process).

It is recommended that the consultant (s) and / or champion resident (s) complete the survey themselves in the form of the households / institutions visits to facilitate the data collection process, make sure all information are provided and get as accurate information as required (refer to Annex 1 for importance of data collection accuracy).

PERSONAL

1. Which seasons do you use your home?

☐ Fall ☐ Winter ☐ Spring ☐ Summer ☐ All year round

2. How many people are active in the house during?

Fall – Weekdays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Holidays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Winter – Weekdays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Holidays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Spring – Weekdays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Holidays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Summer – Weekdays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

Holidays

_____ Early Day (6am – 10am)
_____ Midday (10am – 2pm)
_____ Afternoon (2pm – 6pm)
_____ Early Night (6pm – 12am)
_____ Late Night (12am – 6am)

3. What is the status of your home?

☐ Owned ☐ Rented

4. What do you do in case of blackouts?

☐ Owned Generator ☐ Subscribed to Generator ☐ UPS ☐ APS ☐ Nothing
Other (please specify) _____

5. Do you have any renewable energy equipment installed in your home?
If yes please mention its size.

☐ PV solar panels _____ ☐ Solar water heating _____
☐ Wind Turbine _____ Other (please specify) _____

6. On average, how much is your electricity bill per month? _____

7. On average, how much is your generator bill per month? _____

8. On average, how many hours of electricity black outs do you experience per day ? _____

9. On average, how many hours is the generator operated per day? _____

10. What is the total salary income salary for all employed members in the house per year?

☐ < 6,000$ ☐ 6,000 - 12,000$ ☐ 12,000 – 18,000$
☐ 18,000 - 24,000$ ☐ 24,000 – 30,000$ ☐ 30,000 – 36,000$
☐ 36,000 – 42,000$ ☐ 42,000 – 48,000$ ☐ 48,000 – 54,000$
☐ 54,000 – 60,000$ ☐ Prefer not to say

BUILDING

11. What year was your house built?

12. What type of construction is your home?

☐ Wood ☐ Rock/Brick ☐ Stucco Other (please specify) _____

13. Is your home insulated?

☐ Yes ☐ No ☐ I don't know

If Yes: ☐ Walls ☐ Floors ☐ Ceilings

14. What is the total living area of your home (including basement)? _____ m^2

15. How many floors? _____

16. How many windows or glass doors do you have on each side of your home?

_____ North _____ South _____ East _____ West

17. How many windows are single pane, double pane or tinted?

_____ Single _____ Double _____ Tinted

18. How would you describe you home in terms of air leakage?

☐ Very Leaky ☐ Average ☐ Very Tight

LIGHTING

19. How many lamps do you use for each type and wattage (indoor and outdoor)?

_____ Incandescent (40-75W) _____ Incandescent (75-90W)
_____ Incandescent (>100W) _____ Fluorescent
_____ LED (9-14W) _____ LED (>14W)
_____ Energy Saving Compact Fluorescent Lamp (CFL) (11-18W)
_____ CFL (19-26W) _____ Incandescent
_____ Fluorescent _____ LED
_____ Energy Saving Compact Fluorescent Lamp (CFL)

SPACE HEATING

20. What type of heating system is installed? Mention how many rooms it heats.

☐ Electric Furnace _____ ☐ Wood Stove _____
☐ Electric Heat Pump _____ ☐ Chimney _____
☐ Electric Baseboard _____ ☐ Oil Furnace _____
☐ Gas Furnace (forced air) _____ ☐ Geothermal Heat Pump _____
☐ Gas Space Heater _____ ☐ Other _____ ☐ None

21. When was the heating system installed? _____

22. How many days or months do you use your heating system per year? _____

23. At what temperature do you normally set your thermostat for heating? _____

WATER HEATING

24. What is the type of your water heaters? Mention how many units there are next to each type.

☐ Electric Furnace _____ ☐ Gas _____ ☐ Propane _____
☐ Fuel Oil _____ ☐ Heat Recovery _____ ☐ Solar _____
☐ Other _____ ☐ None

25. What is the tank size of the water heater?

☐ Small (<30 gallons or <114 Liters) ☐ Medium (30 - 49 gallons or 115 – 186 Liters)
☐ Large (50 - 69 gallons or 187 – 261 Liters) ☐ X-Large (>70 gallons or >262Liters)

26. When was it installed? _____

27. What is the thermostat setting of the water heater?

☐ Warm (<55 C˚) ☐ Hot (55 – 65 C˚) ☐ Very Hot (>65 C˚)

28. Approximately, how many showers are taken per week in your home? _____

29. On average, what is the length (minutes) of each shower? _____

COOLING

30. What type of cooling system is installed? Mention how many rooms it cools.

☐ Packaged Central Electric AC _____ ☐ Geothermal Heat Pump _____
☐ Split System Electric AC _____ ☐ Other _____
☐ Packaged Window Unit _____ ☐ None _____ ☐ Fan _____

31. When the cooling system was installed? _____

32. How many days/months do you use your cooling system per year? _____

33. At what temperature do you normally set your thermostat for cooling? _____

APPLIANCES

34. How many refrigerators and freezers do you have at home? Please mention the power consumption (in Watts) for each unit. _____

35. Please fill in the table below for non-constant use appliances

Appliances	Usage Frequency	Power	For each time, how many minutes used during					Operated on EDL or Generator or both
	Weekly	Watt	Early day	Midday	Afternoon	Early Night	Late Night	
Dishwasher								
Elect. Oven								
Washing Machine								
Dryer								
Microwave								
Pump								
Hair Dryer								
Ceiling Fan								
Coffee maker								
Iron								
TV								
Computer								
Radio								
Video game								
Humidifier								
Blender								
Vacuum cleaner								
Other:								

AWARENESS

36. Have you considered decreasing your electricity and generator bills?

☐ Yes ☐ No

37. Have you ever taken any actions to reduce your energy consumption or utility bills?

☐ Yes. What _____ ☐ No

38. Are you aware that using PV would decrease CO2 emissions (pollution) and electricity and/or generator bills?

☐ Yes ☐ No

39. Are you willing to pay an upfront costs (#$) to benefit from a PV power plant implemented in your village?

☐ Yes ☐ No

Any other comments the respondents would like to add?

Annex 11.

General Legal and Administrative Bidding Recommendation and Evaluation Criteria

Data	Specific Instructions / Requirements
Title of Goods/Services/Work Required:	Supply and Installation of a _____ Power Plant consisting of _____ (ex: PV generator and different mounting structures, inverters, hybrid PV controller (fuel reduction device)), data logger, and auxiliary equipment and the provision of training and documentation on the operation and maintenance of the installed systems, in _____ in Lebanon as follows: **Site:** Village, Kaza
Language of the Bid	English
Site Visits	Interested bidders for site visit should confirm their attendance including the name of one representative only by email **on or before** _____ (two weeks after invitation to bid publishing) to the following email address: E-mail: _____ *(consultant's email and committee's president's email)*
Period of Bid Validity commencing on the submission date	Minimum 6 months
Advanced Payment upon signing of contract	Not allowed
Performance Security	Required Amount: **10% of Contract Value** (actual quoted value) Form: **See Enclosed Section 1- Form for Performance Security**
Preferred Currency of Bid	United States Dollars (US$)
Deadline for submitting requests for clarifications/ questions	**Five (5) working days** before the submission date.
Contact Details for submitting clarifications/questions	Focal Person: **Consultant** Address: Committee's headquarters Fax No.: +961 _____ E-mail address dedicated for this purpose: _____ *(consultant's email and committee's president's email)*
Bid submission address	**Municipality** [Address] _____
Bid submission method	hard and soft copies
Deadline of Bid Submission	Date and Time: _____ (one month after ITB's publishing) **Beirut Local Time**

Evaluation method to be used in selecting the most responsive Bid	• Non-Discretionary "Pass/Fail" Criteria on the Technical Requirements, and • Lowest price offer of technically qualified/responsive Bid
Required Documents that must be Submitted to Establish Qualification of Bidders (In "Certified True Copy" form only)	• Company Profile, which should not exceed fifteen (15) pages, including printed brochures and product catalogues relevant to the goods/services being procured • Members of the Governing Board and their Designations duly certified by the Corporate Secretary, or its equivalent document if Bidder is not a corporation • Tax Registration/Payment Certificate issued by the Internal Revenue Authority evidencing that the Bidder is updated with its tax payment obligations, or Certificate of Tax exemption, if any such privilege is enjoyed by the Bidder • Certificate of Registration of the business, including Articles of Incorporation, or equivalent document if Bidder is not a corporation • Trade name registration papers, if applicable • Local Government permit to locate and operate in the current location of office or factory • Official Letter of Appointment as local representative, if Bidder is submitting a Bid in behalf of an entity located outside the country • Quality Certificate (e.g., ISO, etc.) and/or other similar certificates, accreditations, awards and citations received by the Bidder, if any • Environmental Compliance Certificates, Accreditations, Markings/Labels, and other evidences of the Bidder's practices which contributes to the ecological sustainability and reduction of adverse environmental impact (e.g., use of non-toxic substances, recycled raw materials, energy-efficient equipment, reduced carbon emission, etc.), either in its business practices or in the goods it manufactures, if any • Plan and details of manufacturing capacity, if Bidder is a manufacturer of the goods to be supplied • Certification or authorization to act as Agent in behalf of the Manufacturer, or Power of Attorney, if bidder is not a manufacturer • Latest Audited Financial Statement (Income Statement and Balance Sheet) including Auditor's Report for the past Two (2) years • Statement of Satisfactory Performance from the Top Five (5) Clients in terms of Contract Value the past Three (3) years. • All information regarding any past and current litigation during the last three (3) years, in which the bidder is involved, indicating the parties concerned, the subject of the litigation, the amounts involved, and the final resolution if already concluded.
Other documents that must be Submitted to Establish Eligibility	• VAT Registration Certificate (if applicable) • Statement of warranty • Power of Attorney for Joint Venture/ Consortium (See enclosed section 2 – Joint Venture Partner information form) • Detailed method statement for implementation with the requested timeframe and a detailed work plan that reflects a clear strategy for works implementation • Preliminary schedule based on the duration set in the work plan indicating clearly the main activities duration, resources, with clear allocations of labor, material and equipment resources versus the quantities of works to be executed in accordance with the programme of works • Organogram reflecting the structure of the team (including number of staff) who will be implementing and monitoring the required works and services as well as CVs of the team leader, key personnel, engineers, field staff, technicians, etc... • Proven track record with details, specifications and pictures of completed renewable energy projects in Lebanon of a minimum of one 100 kWp Hybrid PV systems for PV installations implemented in the past 2 years • Minimum of 3 years of experience in similar contracts within the renewable energy field (mainly solar photovoltaic systems, other than solar-powered street lighting, wind systems, waste treatment systems, etc...), for the implementing local entity.
Latest Expected date for commencement of Contract	Upon Contract Signature

Maximum Expected duration of contract	The overall term of execution is spread over Five (5) to Eight (8) months, effective from contract signature date.
The contract will be awarded to	One (1) Bidder, depending on the following factors: • Lowest price offer of technically qualified/responsive Bid, and • A result of Pass on all the Non-Discretionary "Pass/Fail" Criteria on the Technical Requirements
Criteria for the Award and Evaluation of Bid	**Award Criteria** • Non-discretionary "Pass" or "Fail" rating on the detailed contents of the Schedule of Requirements and Technical Specifications • Compliance on the following qualification requirements: **Bid Evaluation Criteria** • Demonstrated ability to honour important responsibilities and liabilities allocated to Supplier in this bid (e.g. financial, performance guarantees, warranties, or insurance coverage, etc...) • The time schedule for design, supply, transportation, installation, commissioning, documents and training complies with the deadlines set in the bid. • Similar Projects reference list showing experience of the Offeror; Minimum of 3 years of experience in similar contracts within the renewable energy field (mainly solar photovoltaic systems, other than solar-powered street lighting) for the implementing local entity. • Proof of the successful operation in similar environmental and climatic conditions for at least 3 years for the main system's components (at least 1 year for the fuel reduction device for the PV systems). • Proof of successful implementation of a minimum of one Hybrid Solar PV/ Diesel project undertaken over the past 2 years of a minimum capacity of 100 kWp (in one project at least), completed in Lebanon, for the implementing local entity. • Proof of after-sales service capacity and appropriateness, experience and capability of local service and technical support available. • The Organization and Methodology approach proposed for this Contract has the necessary general management skills and team composition of the organizational units for a project of this kind. • The CVs of the Key Staff (specialized engineers -renewable energy engineers- are required, technicians and/or skilled workers proposed for the main tasks have the qualifications and experience in the installation of hybrid photovoltaic power plants; the Offeror's local implementing team should comprise at least 1 senior engineer with minimum 3 years of experience in the design and implementation of solar PV systems (other than solar-powered street lighting) with at least 1 year in Hybrid PV design, and at least 1 junior engineer with minimum 1 years of experience in PV systems, as well as technicians with proven record in PV systems' implementation. • The technical description of equipment and preliminary design comply with the requirements of design, performance and size of the bid. • Datasheets, Catalogues and Certificates of conformity of the main components (PV modules, wind turbines, mounting structures, inverters, fuel reduction device, and other components) meet or exceed the requirements of this bid and relevant international performance standards. • Authorization by the main goods' manufacturers of all components to Bidder offering to supply the goods in the country of final destination. Not required for the goods which the Bidder manufactures. • The statement of warranty of defects in materials and workmanship and operation and performance guarantee backed by the manufacturers' guarantee on all the main components and the entire system, meets or exceeds the required periods.

Section 1: FORM FOR PERFORMANCE SECURITY

Template available on the CD provided with this booklet

(This must be finalized using the official letterhead of the Issuing Bank. Except for indicated fields, no changes may be made in this template.)

To: *Municipality* _____
[Insert contact information of Committee president]

WHEREAS *[name and address of Contractor]* _____ (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No._____ dated _____ , to deliver the goods and execute related services _____ (hereinafter called "the Contract"):

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract:

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of *[amount of guarantee] [in words and numbers]* _____, such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of *[amount of guarantee as aforesaid]* _____ without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

This guarantee shall be valid until a date 30 days from the expiry of the system's performance guarantee provided by the Contractor (2 years after commissioning).

SIGNATURE AND SEAL OF THE GUARANTOR BANK

Date _____

Name of Bank _____

Address _____

Joint Venture Partner Information Form *(if Registered)*

Template available on CD provided with this booklet

Date: _____ *(as day, month and year) of Bid Submission*

1. Bidder's Legal Name: _____

2. JV's Party legal name: _____

3. JV's Party Country of Registration: _____

4. Year of Registration: _____

5. Countries of Operation _____

6. No. of staff in each Country _____

7. Years of Operation in each Country _____

8. Legal Address/es in Country/ies of Registration/Operation:

9. Value and Description of Top three (3) Biggest Contract for the past five (5) years

10. Latest Credit Rating (if any): _____

11. Brief description of litigation history (disputes, arbitration, claims, etc.), indicating current status and outcomes, if already resolved.

_____

_____

_____

12. JV's Party Authorized Representative Information

Name: _____
[insert name of JV's Party authorized representative]

Address: _____
[insert address of JV's Party authorized representative]

Telephone/Fax numbers: _____
[insert telephone/fax numbers of JV's Party authorized representative]

Email Address: _____
[insert email address of JV's Party authorized representative]

Attached are copies of original documents of:
[check the box(es) of the attached original documents]

☐ All eligibility document requirements listed in the Data Sheet
☐ Articles of Incorporation or Registration of firm named in 2.
☐ In case of government owned entity, documents establishing legal and financial autonomy and compliance with commercial law.

Annex 12.

Agreement Contract between EDL and the Energy Committee

Template available on the CD provided with this booklet

اتفاقية خاصة بمشتركي ومنتجي الطاقة المتجددة عبر اشتراك التعداد الصافي الجماعي

الفريق الأول: مؤسسة كهرباء لبنان – ممثلة بشخص رئيس مجلس الادارة – المدير العام المهندس كمال الحايك.

الفريق الثاني: مجموع المشتركين لدى مؤسسة كهرباء لبنان والوارد اسماؤهم وارقام اشتراكاتهم وشعبهم وعناوينهم في الجداول المرفقة بهذه الاتفاقية الممثلين باللجنة المصادق عليها لدى كاتب العدل _____ والتي يرأسها _____ السيد _____.

لما كان الفريق الاول - مؤسسة كهرباء لبنان – لها الحق الحصري بإنتاج ونقل وتوزيع التيار الكهربائي وفقاً للقوانين والأنظمة السارية المفعول،

وباعتبار ان القوانين والأنظمة النافذة تجيز للمواطنين إنتاج الطاقة الكهربائية لاستهلاكهم الخاص،

واستناداً الى قرار مجلس الادارة رقم 318-32/2011 تاريخ 4/7/2011 المصادق عليه من وزارة الطاقة والمياه بكتابها رقم 1706/7ص تاريخ 16/8/2011 وموافقة وزارة المالية على القرار بكتابها رقم 854/ ص16 تاريخ 9/11/2011 لمدة سنة واحدة قابلة للتجديد بعد الحصول على المصادقات المطلوبة،

وبما ان وزارة المالية بكتابها رقم 116/ص16 تاريخ 26/2/2016 قد وافقت على تجديد العمل بمنظومة التعداد الصافي لمدة سنة واحدة على أن يتم اعداد دراسة بنتائج المشروع والجدوى التي تحققت منه لناحية الطاقة الكهربائي التي ستوضع على الشبكة،

وسنداً لقرار مجلس ادارة مؤسسة كهرباء لبنان رقم 345-25/2016 تاريخ 26/5/2016 القاضي في البندين «أولاً» و«ثانياً» منه ما يلي:

أولاً: الموافقة على معاملة المشتركين الذين يرغبون بالاستفادة من المنشأة (مزرعة الطاقة المتجددة) اسوةً بمشتركي التعداد الصافي ووفق ذات الآلية المتبعة والمنصوص عنها في قرار مجلس الادارة رقم 318-32/2011 تاريخ 4/7/2011.

ثانياً: عرض البند – أولاً- على مصادقة وزارة الطاقة والمياه وموافقة وزارة المالية.

وبعدما صادقت وزارة الطاقة والمياه على البند «أولاً» من قرار مجلس الادارة رقم 345-25/2016 تاريخ 26/5/2016 بموجب كتابها رقم 1772/7ص تاريخ 23/6/2016،

وبما أن المهلة القانونية للمصادقة على البند «اولاً» من قرار مجلس الادارة المنوه عنه اعلاه من قبل وزارة المالية والمنصوص عنها في المادة 29 من المرسوم رقم 4517 تاريخ 13/12/1972 المحددة بشهر من تاريخ التبليغ الحاصل _____ بـ 11/6/2016 قد انقضت عند نهاية الدوام الرسمي بتاريخ 12/7/2016 دون ورود أي جواب من هذه الوزارة،

وحيث انه سنداً لأحكام المادة 29 من المرسوم رقم 4517 تاريخ 13/12/1972، يعتبر البند اولاً من قرار مجلس الادارة رقم 345-25/2016 تاريخ 26/5/2016 مصدقاً حكماً من قبل وزارة المالية،

بناء على ما تقدم،
وبما ان الفريق الثاني يستفيد من مزرعة الطاقة المتجددة المتجددة (الطاقة الشمسية وطاقة الرياح والنفايات ...) المنوي انشاؤها في بلدة _____ الواقعة في محافظة _____ قضاء _____، بحيث ان كل مشترك محددة حصته في هذه المنشأة (المزرعة) وفقاً لما هو مبين في الجدول رقم _____، ويرغب في الاشتراك بمنظومة التعداد الصافي (NET METERING)،

وبما ان انتاج المزرعة من الطاقة الكهربائية سوف يقسم على مجموع المشتركين وفق الحصة المحددة لكل واحد منهم وعلى ان تعتبر هذه الحصة بمثابة الطاقة الموردة منهم على شبكة المؤسسة،

وبما أن الفريق الثاني سيقوم بشراء وتركيب العدادات الالكترونية المناسبة على نفقته الخاصة لكل مشترك بحيث يتم ربطها بآلة الكترونية تقوم بقراءة تأشيرات الطاقة المستهلكة لكل مشترك على حدة والطاقة المصدرة الى الشبكة من العداد الدقيق، وسيتم توزيع الطاقة المصدرة لكل مشترك على حدة بواسطة برنامج ووفق النسب المخصصة لكل مشترك،

وباعتبار ان الفريق الأول قد اجاز للفريق الثاني ربط تجهزياته المتعلقة بانتاج التيار الكهربائي عبر الطاقات المتجددة من مصادر الهواء أو الشمس او النفايات... بشبكاته،

لذلك، تم الاتفاق بالرضى الكامل بين الفريقين على ما يلي:

أولاً: يتكفل الفريق الثاني بتركيب عدادات تسجل كامل الكميات المستهلكة من قبله وتلك التي يجري ضخها على شبكات المؤسسة، وتصدر الفواتير بفرق المقطوعية كل شهرين وفقاً للألية المنصوص عليها في قرار مجلس الادارة 318-32/2011 تاريخ 4/7/2011.

- ان الانشاءات والتجهيزات اللازمة للاشتراكات العائدة لمشتركي منظومة التعداد الصافي (NET METER-ING) (الفريق الثاني) بما فيها العدادات الالكترونية التي سيتكفل بتركيبها تصبح ملكاً للفريق الاول نهائياً اعتباراً من تاريخ تركيبها باستثناء مزرعة الطاقة المتجددة (المنشأة) المنوي انشاؤها.

- يقتضي على الفريق الثاني تزويد الفريق الاول بعيّنة من العدادات الالكترونية التي سيجري تركيبها وذلك لإجراء الفحوصات اللازمة عليها والتأكد من مدى مطابقتها للمواصفات الفنية المعتمدة لدى الفريق الاول.

ثانياً: يعفى الفريق الثاني من رسوم الاشتراك الواردة على الفاتورة في حال كانت الطاقة الموردة منه على شبكات الفريق الاول اقله بحدود 75% من الطاقة المستهلكة منه.

ثالثاً: يتم احتساب كل من الطاقة المستهلكة من الفريق الثاني والطاقة الموردة منه وفق تعرفات مبيع الطاقة المعمول بها لدى الفريق الاول أي:
-1 تعرفات الشطور لمشتركي التوتر المنخفض.
-2 تعرفات وفق اوقات الاستهلاك لمشتركي المحطات الخاصة.

رابعاً: في حال زادت كميات الطاقة المنتجة من قبل الفريق الثاني عن تلك المستهلكة منه يتم تدوير الرصيد الى الفاتورة التالية على أن يُصفى الفائض في نهاية كل سنة ميلادية ويسجل هذا الفائض في السجلات الحسابية كهبة، وبالتالي لا يمكن للفريق الثاني الاستفادة من هذا الفائض في السنة التالية.

خامساً: يبقى للفريق الاول الحق بتحديد وتعديل الشروط والمواصفات الفنية والتقنية للتجهيزات المطلوبة من الفريق الثاني تأمينها وذلك فيما يتعلق بطريقة الربط والتعداد والتعرفة. على ان يتولى الفريق الاول اخطار الفريق الثاني بذلك قبل شهر واحد.

سادساً: يخضع الفريق الثاني للأنظمة السارية في المؤسسة والتي لها منفردة الحق بتعديلها.

سابعاً: عند تشغيل المنشأة وربطها بالشبكة العامة لا يمكن بأية حال من الاحوال حذف أو إضافة أي مشترك ضمن هذه المنظومة خلال السنة المالية التي تبدأ في أول كانون الثاني وتنتهي في 31 كانون الاول. على أنه يتوجب على اللجنة التي تمثل مجموع المشتركين بمنظومة التعداد الصافي ايداع الفريق الاول جدولاً جديداً في كل عام وذلك قبل شهرين من انتهاء السنة المالية المحددة اعلاه يتضمن اسماء المشتركين الذين يرغبون بالاستفادة من هذه المنظومة المذكورة، وعلى أن يتم الاشارة فيه الى اسماء المشتركين الذين يمت اضافتهم او حذفهم.

ثامناً: يجوز للفريق الاول وبإرادته المنفردة ان يفسح العقد الموقع مع الفريق الثاني في حال عدم القيام بتشغيل المنشأة (مزرعة الطاقة المتجددة) المنوي انشاؤها، دون أن يعود للفريق الثاني المطالبة بأي حق أو مطلب أو تعويض بهذا الخصوص على أن يسبق هذا الاجراء انذار يوجه من الفريق الاول للفريق الثاني تحدد مدته بثلاثين يوماً تمكيناً له من معالجة الموضوع.

تاسعاً: تقع اعمال الصيانة على عاتق الفريق الثاني، وبالتالي لا يتحمل الفريق الاول أية مسؤولية تجاه الاعطال التي قد تطرأ على المنشأة أو أية اضرار قد تحدث والتي من شأنها التأثير على السلامة العامة، ويبقى للفريق الاول الحق في إجراء الكشوفات الدورية للتأكد من أن أعمال الصيانة تتم وفقاً للأصول لاسيما في ما يتعلق منها بصيانة اجهزة التعداد.

عاشراً: يتوجب على الفريق الثاني تركيب اجهزة حماية كافية وملائمة لتجهيزاته وأماكن اشتراكه لدرء الاخطار التي يمكن ان تحدث من جراء هذا الربط، وان المؤسسة في حل من اي مسؤولية او مطالبة بأي عطل أو ضرر.

حادي عشرة: يعود للفريق الاول حصرياً الاستفادة من عائدات بيع الكاربون الناتج عن تخفيض انبعاثات غازات الدفيئة المتولدة عن تنفيذ مشاريع الطاقة المتجددة.

ثاني عشرة: يجيز الفريق الثاني للفريق الاول مراقبة الاجهزة المركبة في أي وقت يشاء ويقتضي عليه الحفاظ عليها من أي ضرر او تلف.

ثالث عشرة: يتعهد الفريق الثاني بأن يدفع الفاتورة المتضمنة فرق المقطوعيات التي سجلها العداد حسب التعرفات المرعية الإجراء وذلك في موقع تسليم الطاقة ولدى تقديم الإيصال المعتمد من قبل مستخدمي الفريق الاول.

رابع عشرة: اذا تمنع احد المشتركين بمنظومة التعداد الصافي عن تسديد الفاتورة التي تقدم اليه، يحق للفريق الاول اللجوء الى كافة الوسائل القانونية والنظامية لاستيفاء المبالغ المرتبة له دون ان يؤثر ذلك على عمل ونشاط المنشأة، كما يحق للفريق الاول شطب هذا المشترك المتخلف عن الدفع من الجداول المرفقة وبالتالي عدم تمكينه من الاستفادة من منظومة التعداد الصافي.

خامس عشرة: يحق للفريق الثاني التقدم بطلب لتعديل هذه الاتفاقية، على أنه يعود بالمقابل للفريق الاول النظر بهذا الطلب وتقرير المناسب بشأنه بما لا يتعارض مع أنظمته والقرارات الصادرة المتعلقة بهذه الاتفاقية ذات الصلة.

سادس عشرة: حررت هذه الاتفاقية على نسختين اصليتين بيد كل طرف نسخة منها للعمل بموجبها ووقع من قبل الفريقين.

الفريق الاول: _____ الفريق الثاني: _____

مؤسسة كهرباء لبنان
رئيس مجلس الادارة –
المدير العام
المهندس كمال الحايك