Sustainable Impacts of Energy Projects on Livelihoods, Education and Health

Prepared by: UNDP - CEDRO Team

Kingdom of the Netherlands

CEDRO

Overview

Date of Project Status
October, 2018

Recent progress

A. 12 Solar PV sites
B. 43 Transformers & related infrastructure
C. 50 Solar Powered Street Lighting Poles
D. 300 Solar Homes Systems
E. 2 Biomass briquetting plant upgrades
F. 15 public school solar systems refurbishment

Social Impact

The implemented projects focused on the elevating energy poverty in the most vulnerable areas impacted by the Syrian refugee crisis in Lebanon.

A. Solar PV-Hybrid

Impact on Education & Health Sector: Energy as a sustainable solution for LCRP

Challenges in Education & Health Sector

- **Large amount of funds are required every year to provide/cover essential services such as school enrolment and healthcare**

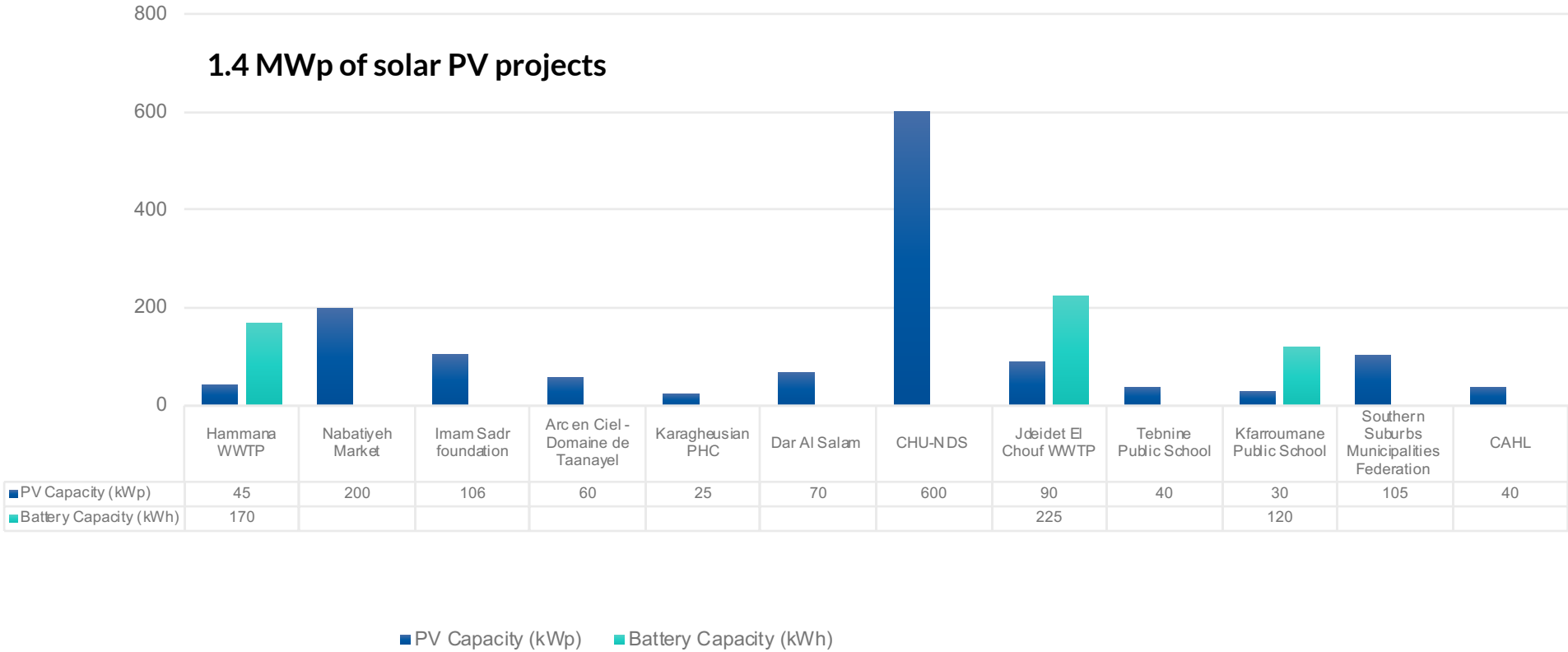
  - c.a. US$ 150m yearly budget for enrolment in formal education.

- **Educational & health institutions are spending heavily on electricity bills, which are borne by the government's budget.**

Value Proposition of Energy Intervention

- ✓ **Installation of renewable energy is proven to be an effective way to reduce the electricity cost burdens and provide reliable electricity.**
- ✓ **Sustainable energy savings can be shifted toward education and health-related service**
- ✓ **Savings can potentially & partially finance enrolment fees & other services that are currently supported by international donors (over a constant 20 year period).**

Site Implementation – Solar – Hybrid



	Hammana WWTP	Nabatiyeh Market	Imam Sadr foundation	Arc en Ciel - Domaine de Taanayel	Karagheusian PHC	Dar Al Salam	CHU-NDS	Jdeidet El Chouf WWTP	Tebnine Public School	Kfarroumane Public School	Southern Suburbs Municipalities Federation	CAHL
PV Capacity (kWp)	45	200	106	60	25	70	600	90	40	30	105	40
Battery Capacity (kWh)	170							225		120		

Solar - Hybrid Projects
Social & Environmental Impacts

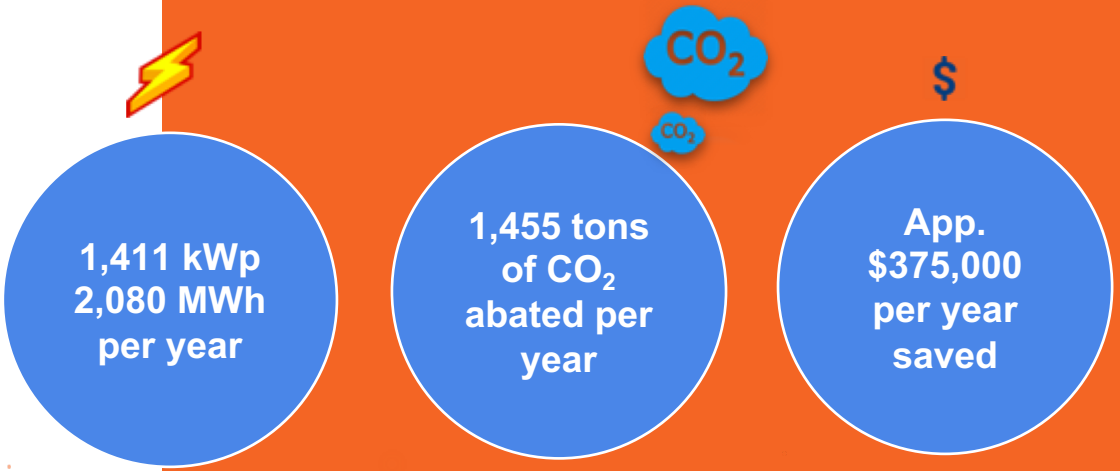
Beneficiaries:

Education sector:	2
Public sector:	4
NGO (Health):	2
NGO (Elderly):	2
NGO (Social):	2
Total	12

Social Impact

> 1,000,000 person
from various nationalities

Economic & Environmental Impacts:



Site Implementation – Solar – Hybrid: Educational Institute (1)

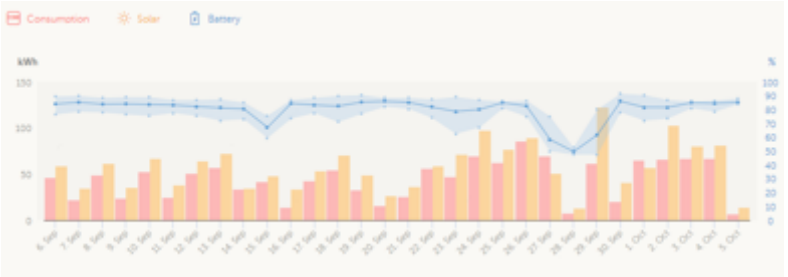
Tebnine Public School:

- System Capacity: 40 kWp
- Capital expenditure: $ 71,200.00 (systems includes carport structure, one 45 kVA diesel generator and a synchronization board for the gensets along with the cabling and electrical protection components)
- Specific cost (PV system only): **1.2 $/Wp**
- Project yearly conventional energy saved: 61,200 kWh
- Projected yearly monetary savings: $ 10,700.00
- PBP of PV system alone: **4.5 years**
- Energy yield in September (no net-metering yet): 2,261.59 kWh

Site Implementation – Solar – Hybrid: Educational Institute (2)

Kfarroumane Public School:

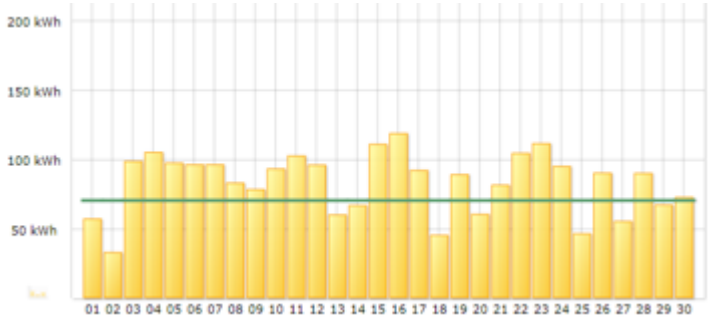
- System Capacity: 30 kWp
- Battery energy storage system capacity: 120 kWh
- Capital expenditure: $ 75,811.00 (systems includes a battery energy storage system and related electrical components)
- Specific cost (PV system only): **0.9 $/Wp**
- Project yearly conventional energy saved: 45,000 kWh
- Projected yearly monetary savings: $ 9,000.00 (drastically decreased the use of the diesel gensets due to the availability of the battery bank)
- PBP of PV system alone: **8.4 years**
- Energy yield in September (no net-metering yet): 1,674.78 kWh



Site Implementation – Solar – Hybrid: Health Institute (1)

Karagheusian Association for Child Welfare in Lebanon (PHC):

- System Capacity: 25 kWp
- Capital expenditure: $ 29,370.00 (systems includes pergola structure)
- Specific cost (PV system only): **1.17 $/Wp**
- Project yearly conventional energy saved: 36,250 kWh
- Projected yearly monetary savings: $ 6,344.00
- PBP of PV system alone: **4.6 years**
- Energy yield in September (no net-metering yet): 2,480 kWh



Site Implementation – Solar – Hybrid: Health Institute (2)

CHU-NDS Hospital:

- System Capacity: 600 kWp
- Capital expenditure: $ 470,000.00 (not including client specific VOs amounting to $ 71,588.05)
- Specific cost (without VOs - with VOs): **0.78 $/Wp – 0.9 $/Wp**
- Project yearly conventional energy saved: 888,000 kWh
- Projected yearly monetary savings: $ 155,400.00
- PBP (without VOs – with VOs): **3 years – 3.5 years**
- System in testing and hand- over phase

– Solar System Refurbishment

In the pipeline

North, South and Bekaa

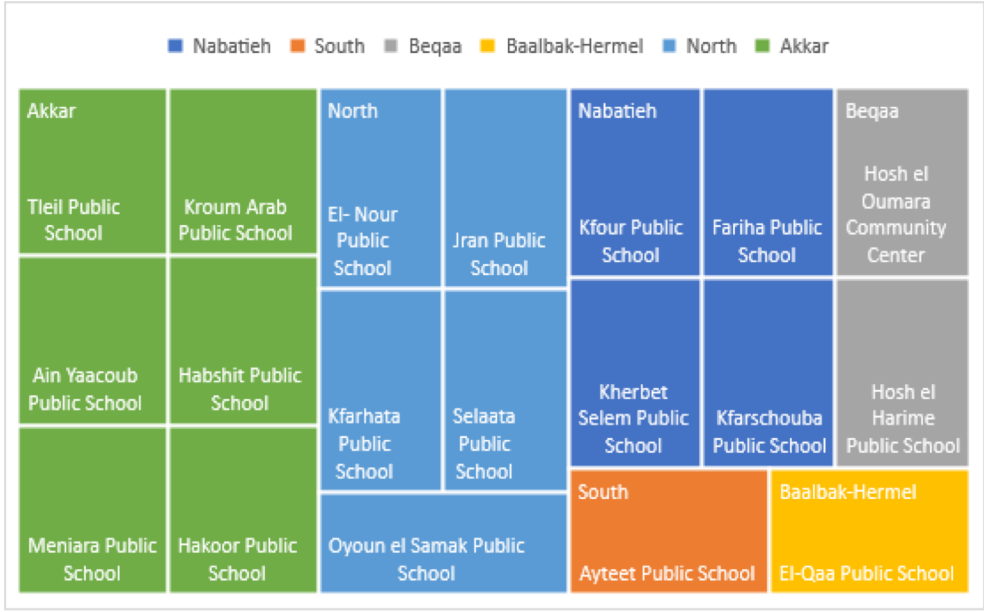
7 x10,080 Wh (site capacities)

12 x13,440 Wh (site capacities)

17 public schools

1,881 Lebanese

1,741 Syrians



Transformers

Site Implementation - Transformers

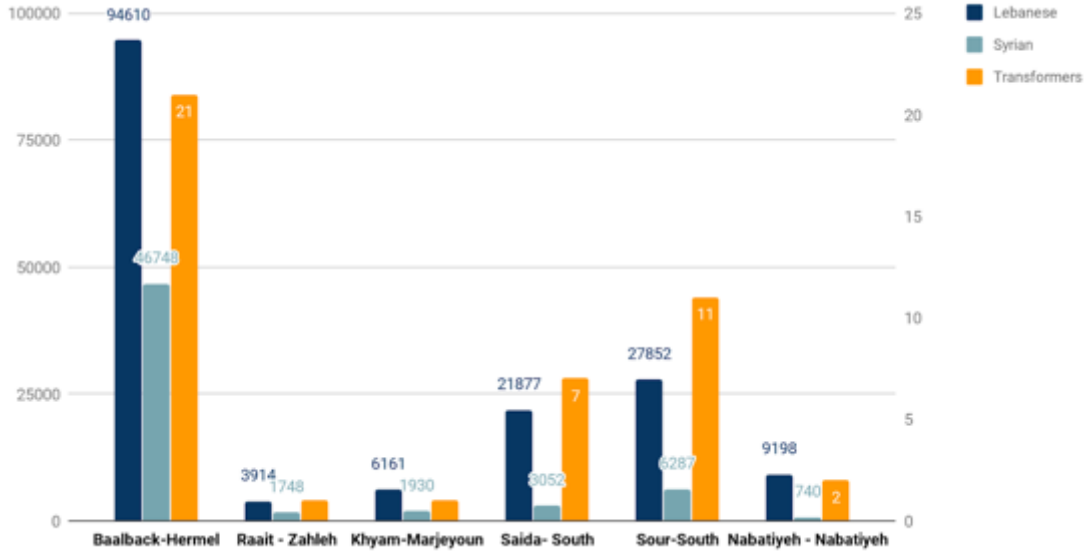
South and Bekaa

43 MV/LV Transformers

172,828 Lebanese

68,293 Syrians

Overall, improving medium to low voltage transformers will improve the power system's efficiency by 1-2%



Solar Powered Street Lighting Poles

Site Implementation - SSL

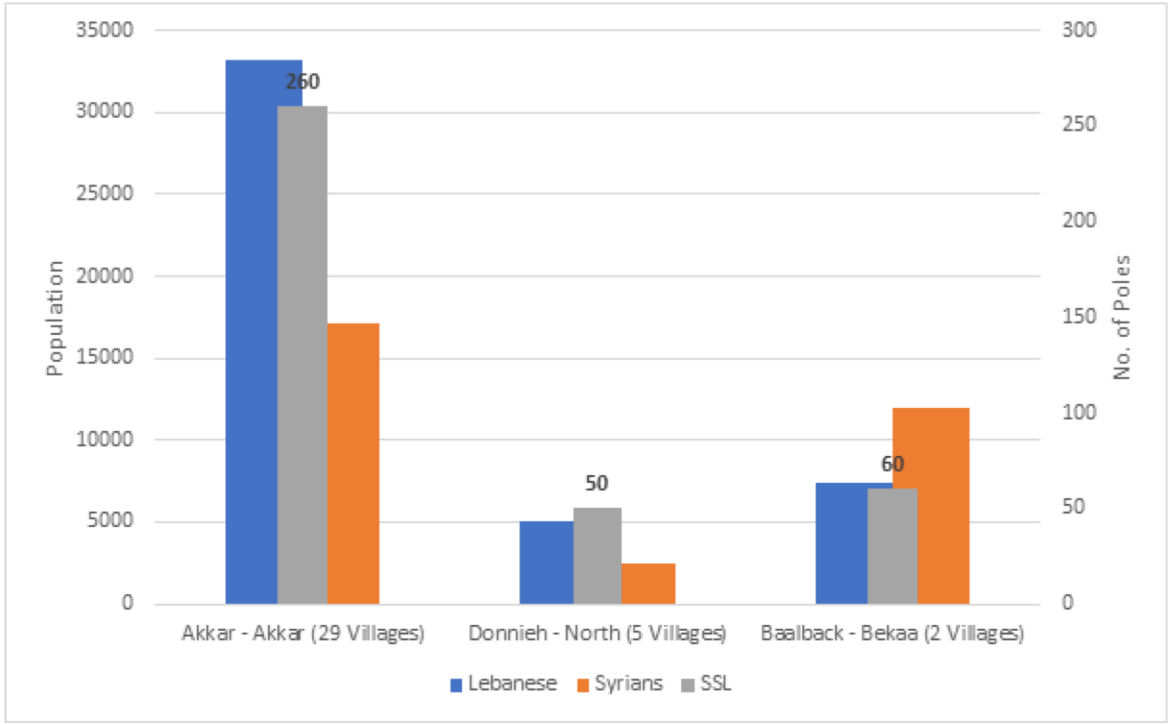
North and Bekaa

370 Solar Street Lighting poles

36 villages

45,625 Lebanese

31,536 Syrians



Solar Home Systems

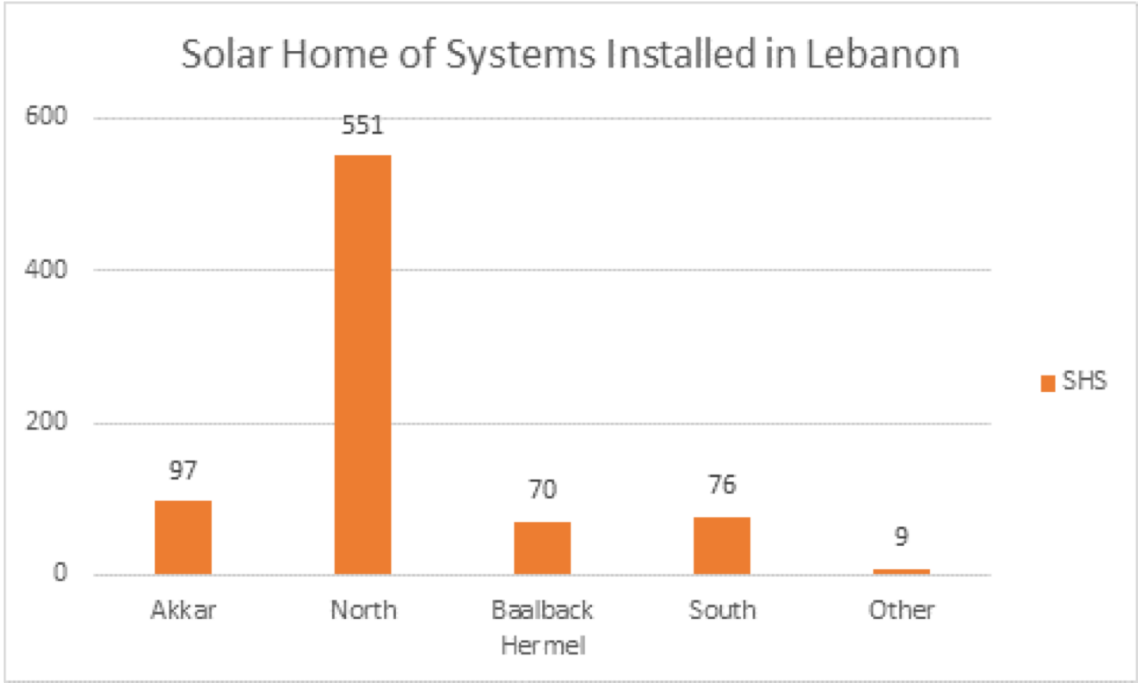
– Solar Home Systems - SHS

North, South and Bekaa

803 SHS

69 villages

4,015 Lebanese

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Impact on Livelihood

Job Creation: UNDP's Work _-Vitalizing the Solar PV Industry

A major price drop was witnessed for Solar PV technologies:

2.7 $/W pre CEDRO 4

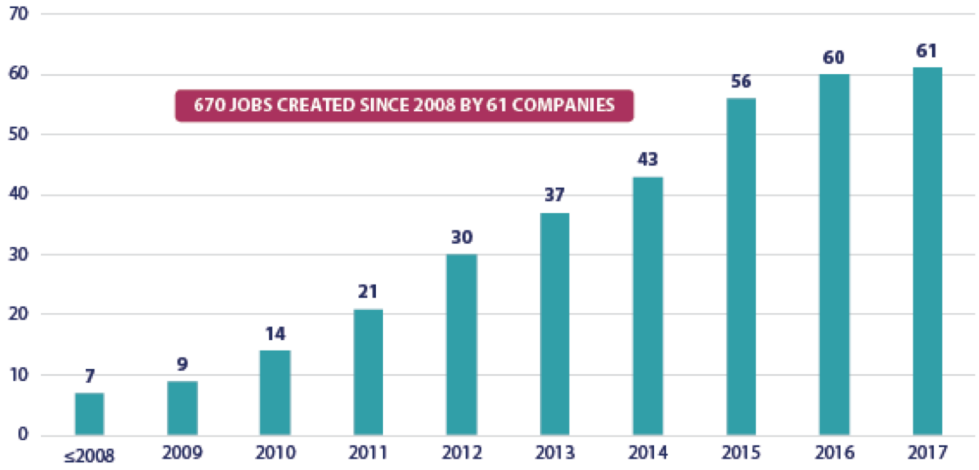
1.1 $/W for CEDRO 4 PV commercial scale project

Main implications:

•Capacity building among contractors and suppliers through knowledge and technology diffusion

•Awareness raising among beneficiaries and Lebanese people through first hand experiences and pilot projects

•Expanding market potential through reduced costs and enhanced financials



7 Lebanese solar PV companies were working in the sector up until 2008. This number started growing steadily from 14 companies in 2010 to 61 companies by the end of 2017. At least 670 jobs were created throughout.

Job Creation: Impact of Solar PV Investment

The studies show that Investment in Renewable Energy creates **various local jobs**, indicating that **RE investment and its acceleration will increase the job-demand** in Lebanon.

Job Creation Impact of Solar PV in Lebanon

Input (investment)

$1.0 m Invested

1 MW Solar PV

Output (job creation)

11 - 20 Direct Jobs*
- **Construction**
- Electrical Eng.
- Business & Finance

20-25 Indirect Jobs**
- Finance & Admin.
- Production of cable , metal, plastic, dye

30-45 Jobs

$1m Invested

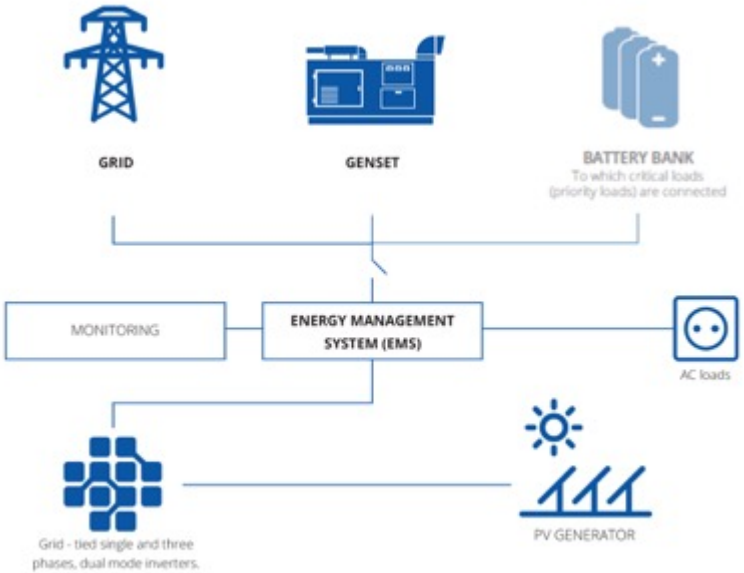
References: IRENA (2017), UNDP (2018)

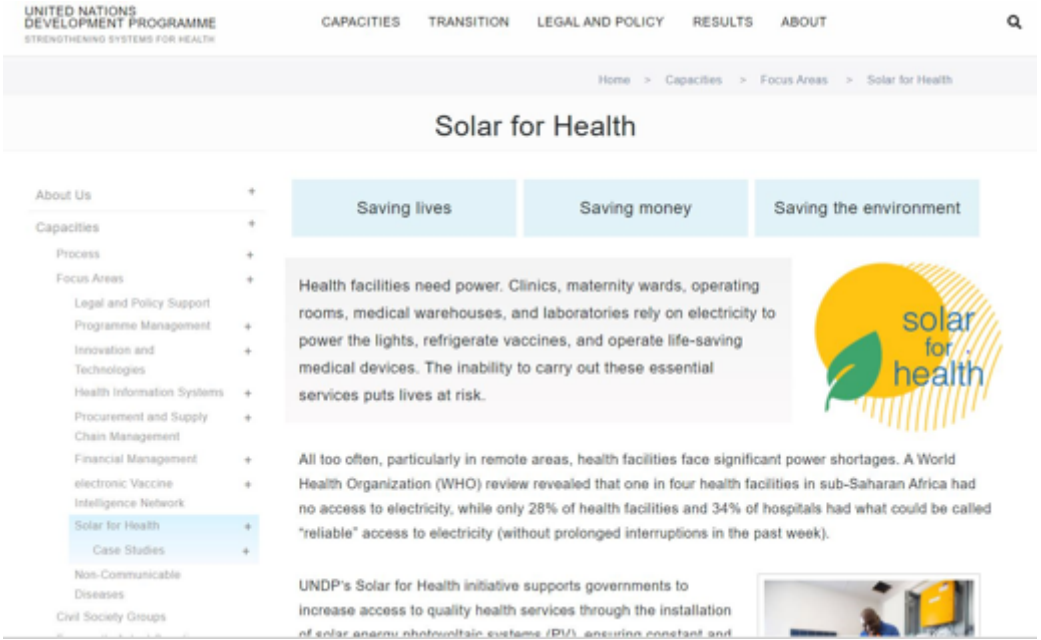
* Full-Time Employment Equivalent (FTE)
** Indirect productive activities along the value chain.

- Other RE investments such as wind power, bioenergy & energy efficiency have different job creation impacts.

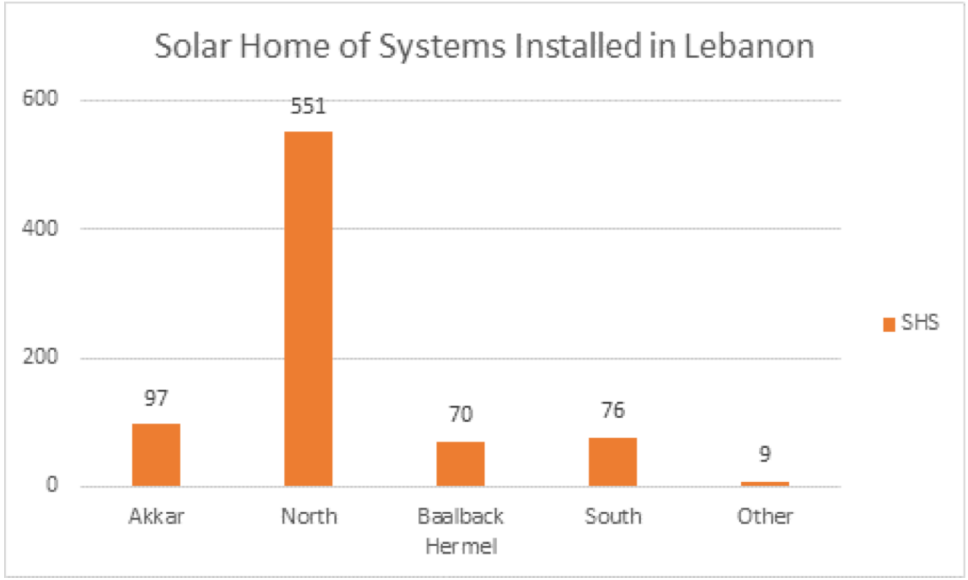
Looking Ahead 2019 ….

– Solar for Health & Education





Solar Home Systems



Energy poverty in Lebanon affects 16% of the households – paying more than 10% of their income on electricity bills.

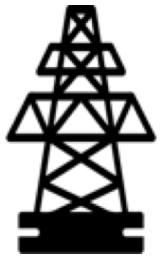
Upgrading the SHS to include fridges

MV/LV Transformers

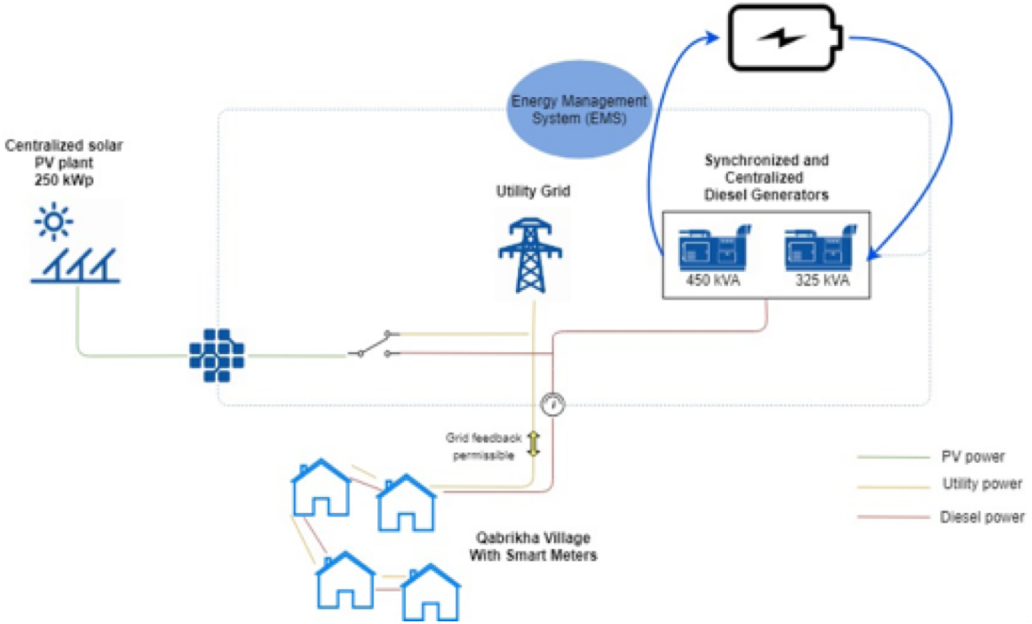
App. 700 MV/LV transformers are required as per the LCRP

122 implemented with funding from DFID & Kingdom of Netherlands

578 remaining…



Community Scale Renewable Energy Sytems

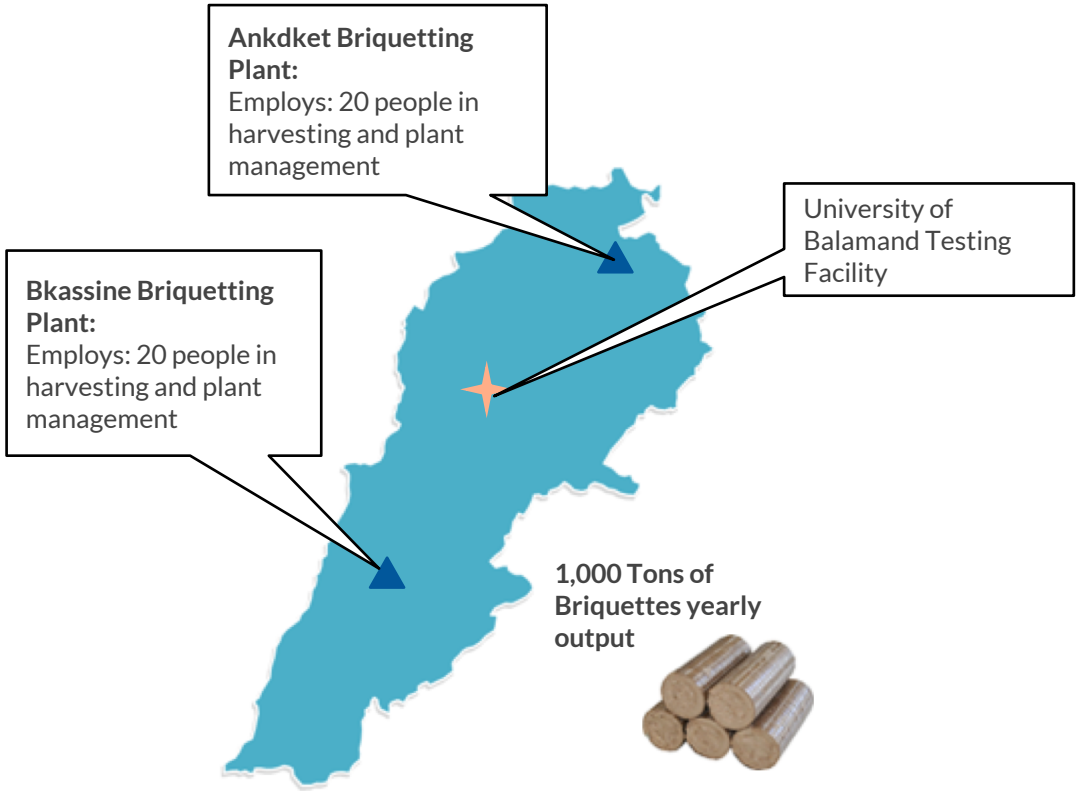


Introducing an upgrade to the Qabrikha model

Based on the success story encountered in the village of Qabrikha with the community-led centralized solar PV system with the virtual net metering scheme, a new system architecture can be developed where the centralized diesel generators are replaced by a grid connected battery energy storage system.

- Decreased costs and enhanced characteristics of battery storage systems.
- Removing the reliance on diesel generators.
- The capability to use blockchain based solutions for energy accounting during off-grid (islanded) operations.

Biomass & Biogas



Comprehensive Forestry Management Plans

There is still potential in implementing new briquetting plants in Mount Lebanon and in the Bekaa. The market is still developing and the possibility of export is feasible with the certification process underway.

Thank you