

RENEWABLE ENERGY FOR ADVANCING WATER- ENERGY INTERLINKAGES FOR SUSTAINABLE DEVELOPMENT *Lebanon Case Studies*

By Rani Al Achkar,
Director - Engineering & Planning



**Expert Group Meeting on “Enhancing
capacity building addressing Water and
Energy interlinkages for Sustainable
Development in the Arab Region”**

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FOUR AREAS OF WATER-ENERGY INTERLINKAGES in LEBANON

- I. Existing hydropower plants in Lebanon
- II. Hydropower potential (hydropower share within national targets)
- III. Solar pumping for domestic water supply
- V. Solar pumping for irrigation

Existing Hydropower plants in Lebanon

River Stream	Establishment	Plant Name	Year of Installation	No. of Units	MW Installed Capacity
Litani / Awali Rivers	Litani Water Authority	Markabi, Awali, Joun	1961, 1964, 1967	7	199
Nahr Ibrahim River	Societe Phoenicienne des Forces de Nahr Ibrahim des Eaux et Electrecite	Chouane, Yahchouch, Fitri	1961, 1955, 1951	8	32
Kadisha Valley	La Kadisha - Societe Anonyme d'Electrecite du Liban Nord	Bechare, Mar Licha, Blaouza II, Abu-Ali	1924, 1957, 1961, 1932	11	21
Nahr Al Bared	Al Bared Concession	Al Bared 1, Al Bared 2	1936	5	17
Safa Spring	Electricite du Liban	Richmaya-Safa	1931	3	13
Total Installed Capacity in MW					282

Source: "Hydropower in Lebanon; History and Prospects", CEDRO Exchange Issue Number 4, UNDP/CEDRO, February 2013

Existing Hydropower plants in Lebanon*

- 836.5 GWh in 2010 – 6.1 % of the total nationally produced electric power for 2010
- Compared to more than 75% of the electricity demand in the 1970's!
- Negatively affected by:
 - Lack of upgrades to infrastructure
 - Changing snowfall and rainfall patterns (due to climate change?!)
 - Extensive irrigation projects in the pipeline that will divert water from hydropower
 - Ever-increasing need for domestic water usage

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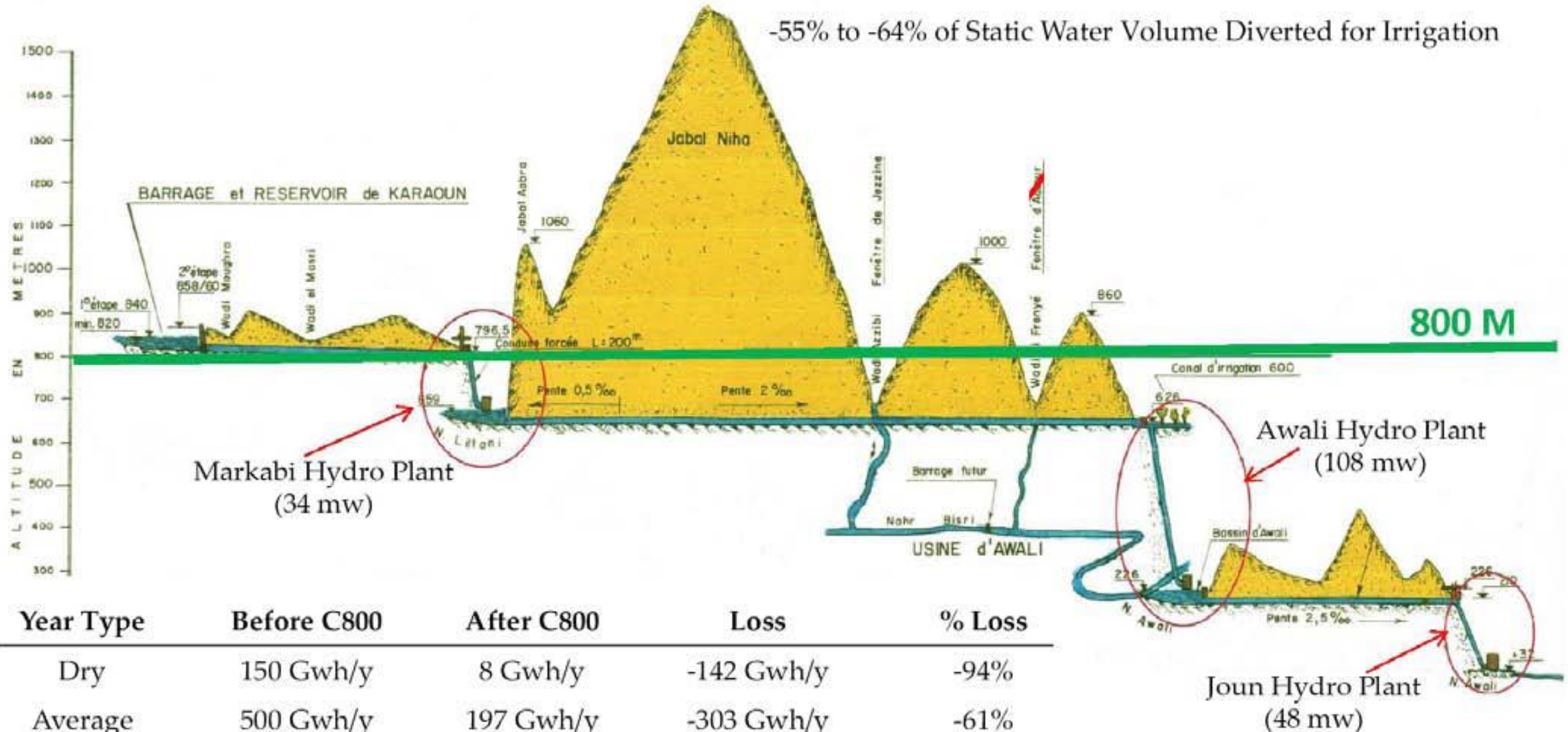
Existing Hydropower plants in Lebanon*

Conveyor 800 project of the Litani Water Authority

- Expected to draw 50% from the static water volume of the Qaraoun reservoir in the Southern Bekaa
 - for irrigation of 14,700 hectares of farmland , 20 main reservoirs distributed among 12 irrigation perimeters, and
 - for domestic water for 100 villages.

Litani Water Authority: Conveyors 800 m & 900 m

-55% to -64% of Static Water Volume Diverted for Irrigation



Hydropower potential (hydropower share within national targets)*

- Rehabilitation and upgrade of existing units (25.1% increase in production capabilities)
- New hydro units on the main rivers and streams (263 MW run-of river or 368 MW peak)
- Investigate potential for pumped storage
- Target of more than 600 MW by 2030 as per the IRENA energy outlook for Lebanon that is under development (to be published at the international Beirut Energy Forum 2019).

Hydropower potential (hydropower share within national targets)*

- Micro-hydro on small streams (pilot sites)
 - Micro-hydro on non-river sources such as irrigation storage reservoirs and channels (4 sites 1.27 MW),
 - Municipal water distribution networks (4 sites 0.144 MW),
 - Electric plants intakes and outfalls (5 sites 3.421 MW), and
 - Large wastewater treatment plants (1 site 0.123 MW)

Site Name	Flow [m3/s]	Gross Head [m]	Electrical power (estimated) [kW]	Remarks
Naher el Bared lake	3.0	5	88	Reservoir and intake already existing
Ain Leghwaibe (b)	0.9	30	168	No existing irrigation channels
Qasimia Irrigation System	5.0	15	566	Power plant could only be operated outside of the 6 month irrigation period
Falouss Irrigation System	1.5	90	448	During the 5 month irrigation period, power plants could be operated during daytime only (14 hours per day)
Zahrani Power Plant	8.89	10	671	Existing intake. Available data and documents
Zouk Power Plant	30	4	876	Existing intake. The available layout is very old and not precise
Jieh Power Plant	20	5	738	Documents are not available
Deir Ammar (Beddawi) Power plant	8.89	13	872	Existing intake. Available data and documents
Hrayche Power Plant	3.50	10	264	Existing intake. Available data and documents
Saida water station (a)	0.23	20	22	Existing reservoir and pipelines. Residual flow and pressure at consumers have to be considered
Saida water station (b)	0.11	20	10	Existing reservoir and pipelines. Residual flow and pressure at consumers have to be considered
Kaa el Rim	0.09	140	51	Existing pipeline
Ain Leghwaibe (a)	0.38	200	61	Very high friction losses in the pipeline due to small diameter

Hydropower potential (hydropower share within national targets)*



Discharge channels in Zouk and Hreicheh thermal power plants - Source: "Hydropower from Non-River Sources; The potential in LEBANON", UNDP/CEDRO, May 2013

Solar pumping for domestic water supply

- Project by the World Bank and the Council for Development and Reconstruction in the Union of Municipalities of Baalbeck
- 11 solar pumping stations in the Bekaa for domestic water supply.





Solar pumping for irrigation

- Institute for University Cooperation (ICU) - an Italian Non-Governmental Organization – provided PV-Integrated Drip Irrigation system in the Bekaa region for 6 “pilot” farmers
- The six PV systems were installed in Lebanon in April-June 2017. They were installed in Labwe (10 kWp capacity), Baalbek (10 kWp capacity), Ferzol (5 kWp capacity), Kherbet Khanafar (20 kWp capacity), Hermel (10 kWp capacity), Younin (10 kWp PV capacity)
- 6 farmers provided a financial contribution to investment higher than 50% of the total system cost.

Solar pumping for irrigation

- 34 solar pumping projects by the private sector applied for financing under the NEEREA financing mechanism by the Central Bank of Lebanon
- Total installed capacity 3.4 MWp



Solar pumping for irrigation

Ref.	Owner	Site Location	Size of Pump	Size of Solar PV (KWp)
1	Private	Al Qaa	10 HP and 12 HP	30 KWp
2	Private	Younin	30 HP	30 KWp
3	Private	El Nasriyi	125 HP	135 KWp
4	Private	Hermel	60 HP, 35 HP and 20 HP	135 KWp
5	Private	Al Qaa	70 HP	72 KWp
6	Private	Maqneh	100 HP	110 KWp
7	Private	Niha	15 HP	19.2 KWp
8	Private	Amique	100 HP	126.9 KWp
9	Private	Zahleh	50 HP	60 KWp
10	Private	Al Qaa	60 HP	70 KWp
11	Private	Deyr El Ahmar	3x110 KWp and 90 KWp	960 KWp
12	Private	Hadath Baalback	10 HP	15 KWp
13	Private	Babliye	90 KW	135 KWp
14	Private	Ras Baalback	15 HP	20 KWp
15	Private	Al Qaa	30 HP	36.4 KWp
16	Private	Al Qaa	150 HP	144 KWp
17	Private	Joun	70 HP	85 KWp

Solar pumping for irrigation

Ref.	Owner	Site Location	Size of Pump	Size of Solar PV (KWp)
18	Private	Zahleh	20 HP	13.395 KWp
19	Private	Labwe	40 HP	47.5 KWp
20	Private	Maqneh	50 HP	60 KWp
21	Private	Quinnarit	2x50 HP	112.2 KWp
22	Private	Faour	80 HP	93.6 KWp
23	Private	Ain Bourdai-Baalback	75 HP and 45 HP	140 KWp
24	Private	Ansar	50 HP	60 KWp
25	Private	Doueir	30 HP	36 KWp
26	Private	Teffeha	100 HP	125 KWp
27	Private	Harouf	37.5 KW	62.4 KWp
28	Private	Ras Baalback	7.5 HP	11.44 KWp
29	Private	Zefta	8 pumps with total of 181HP	242 KWp
30	Private	Mazraet ElYahoudiyye	2x25 HP	2x28.8 KWp
31	Private	Ferzol	2x5.59 KW	13 KWp
32	Private	Saida	30 HP	41 KWp
33	Private	Harouf	50 HP	62.4 KWp
34	Private	Insar	50 HP	62.4 KWp



Thank You!

Rani Al Achkar,
LCEC Director of Engineering & Planning
Rani.alachkar@lcec.org.lb

@LCECTweets
@alachkarani



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<https://lb.linkedin.com/in/alachkarani>

