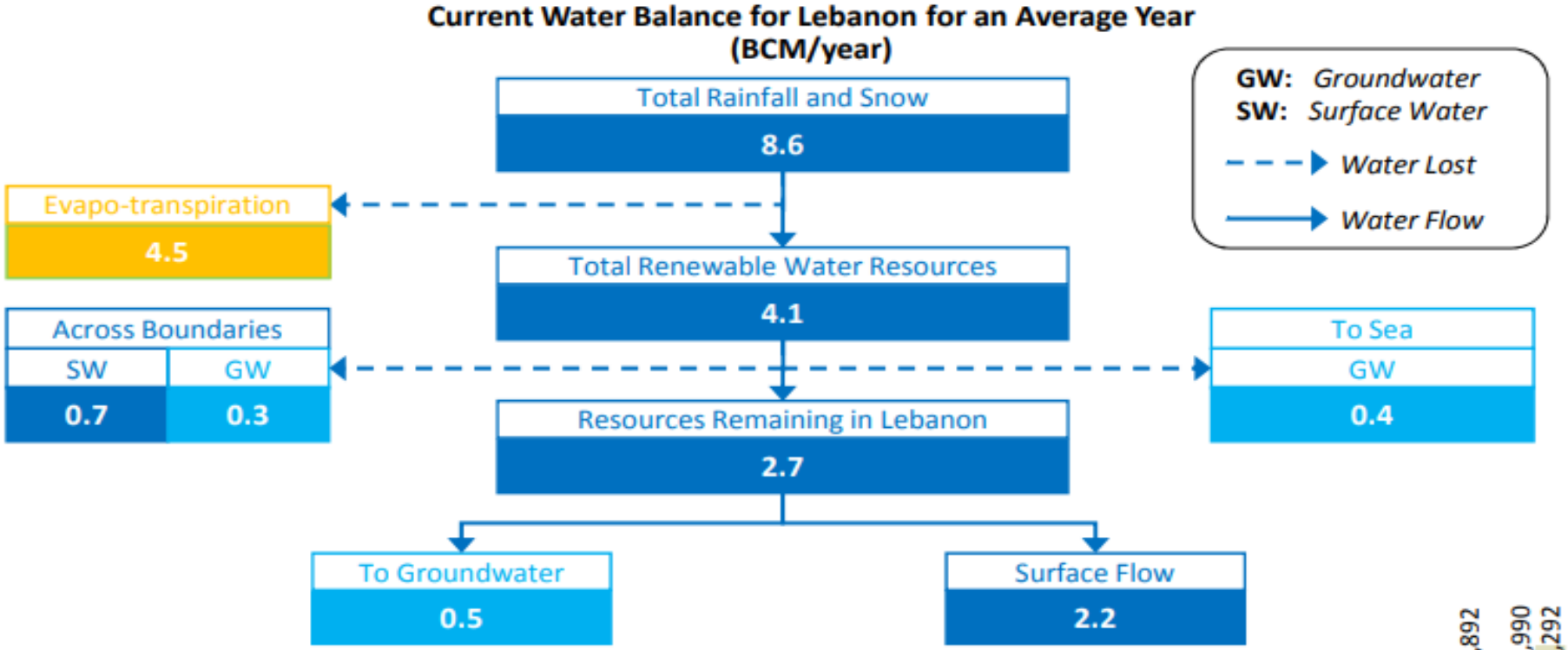
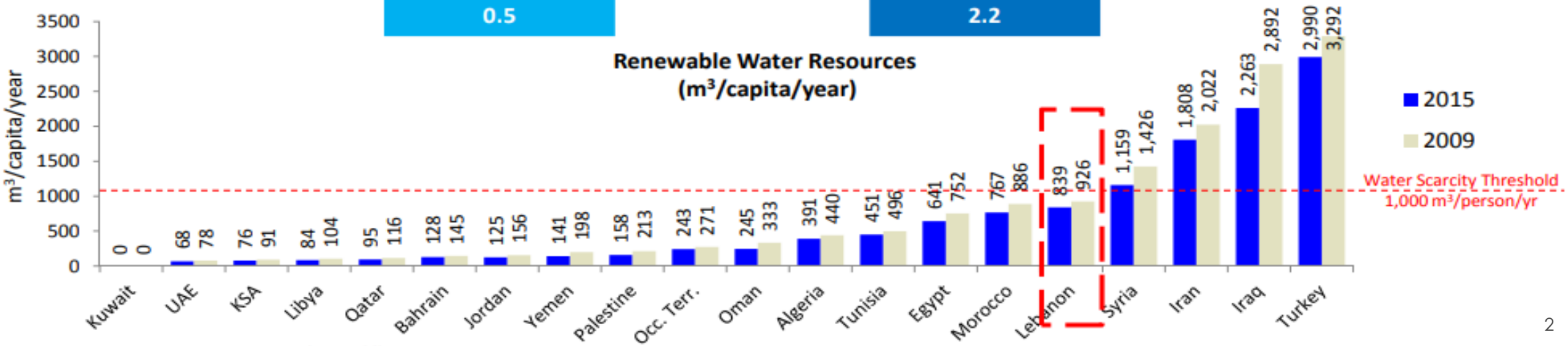
NORTH LEBANON WATER MANAGEMENT

Presented by: Maryam Abdel-karim

1 Renewable water resources per capita are already slightly below scarcity threshold, with expected decrease in the coming years

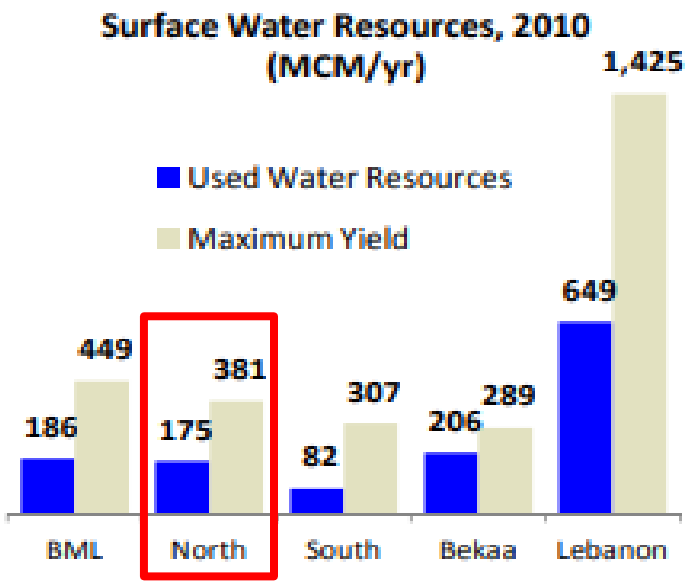


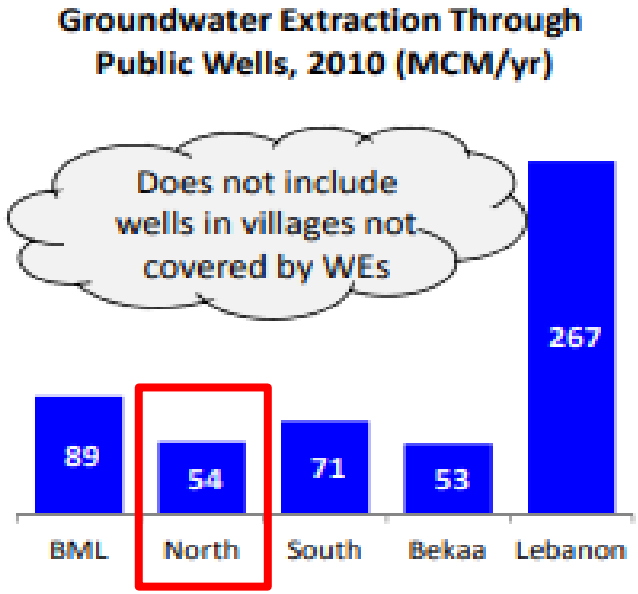


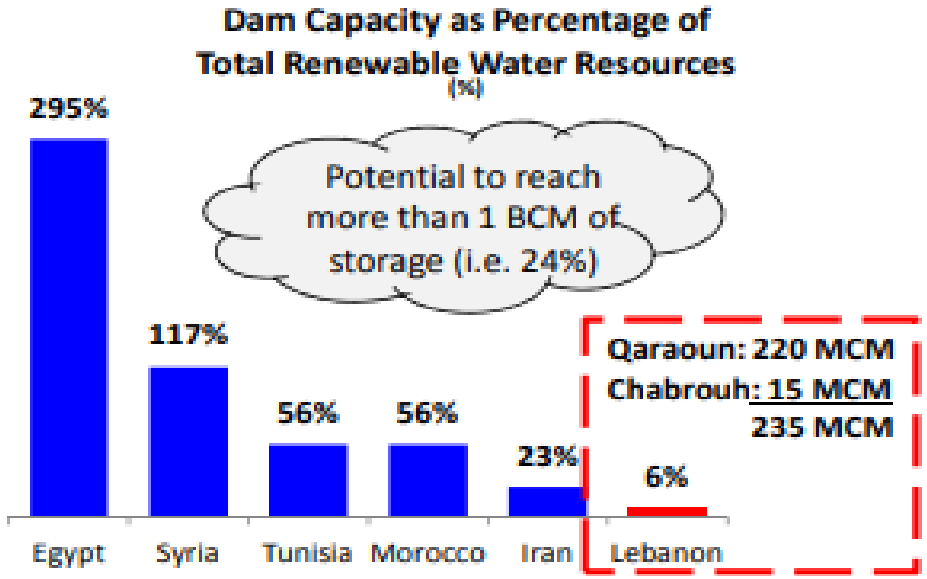
Source: MEW, FAO Aquastat, Water Market Middle East

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

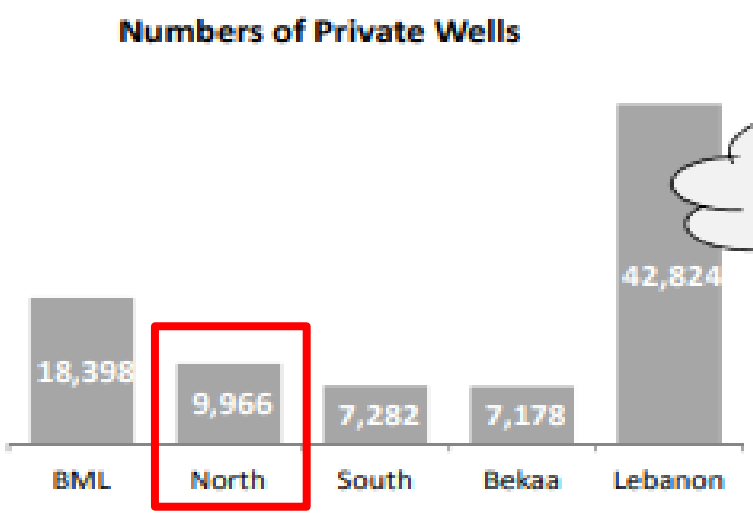
1 Surface water resources are largely exploited but with limited storage, while significant stress is put on groundwater mainly through private wells

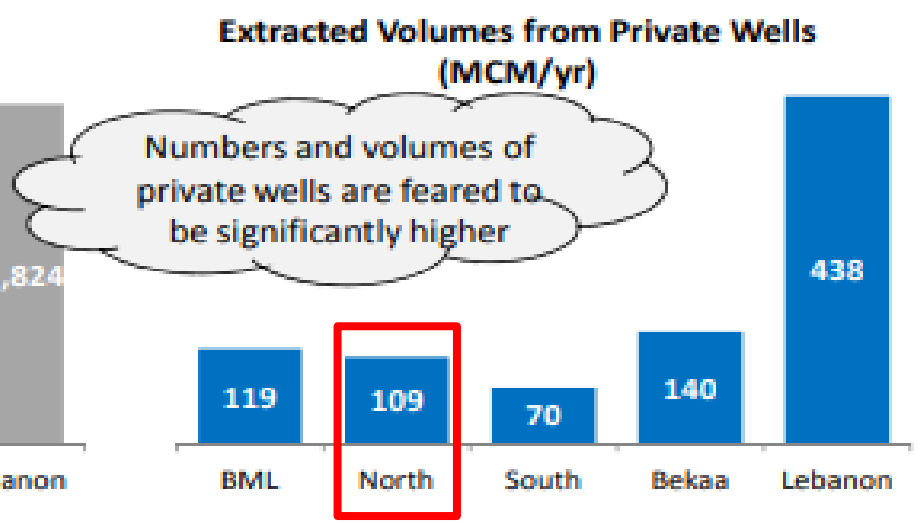


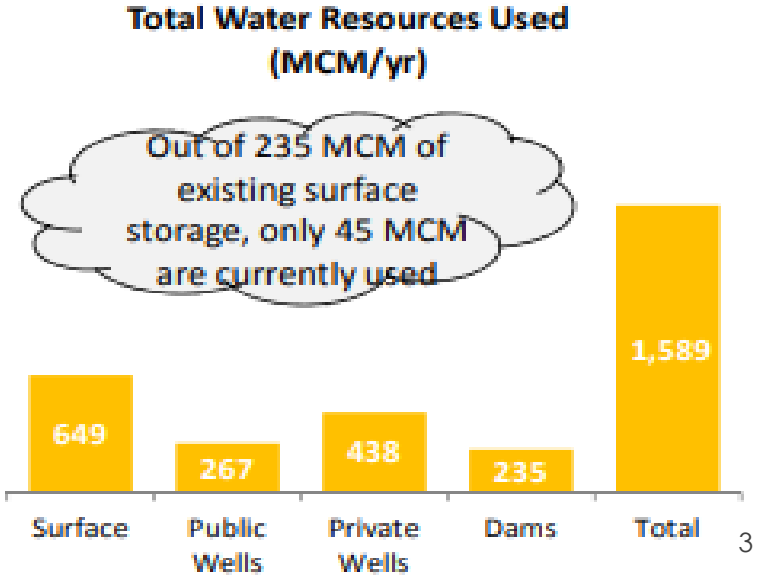




Groundwater Extraction Through Private Wells, 2010







Source: MEW, WEs, FAO Aquastat

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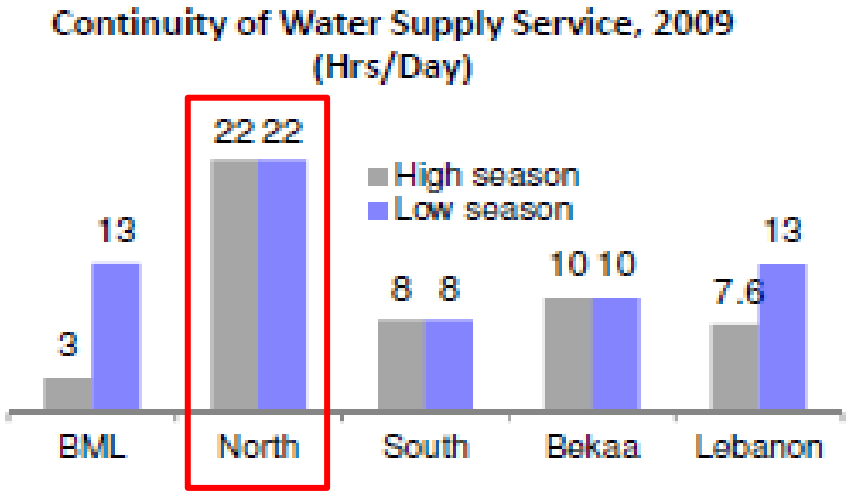
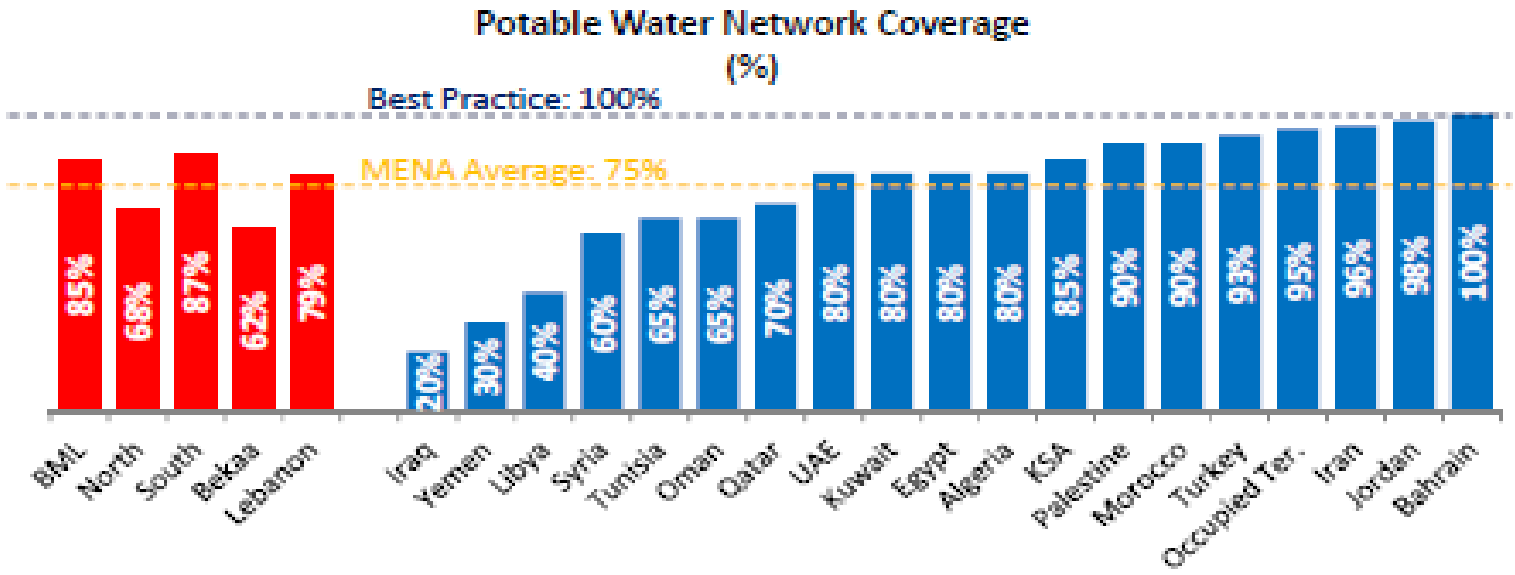
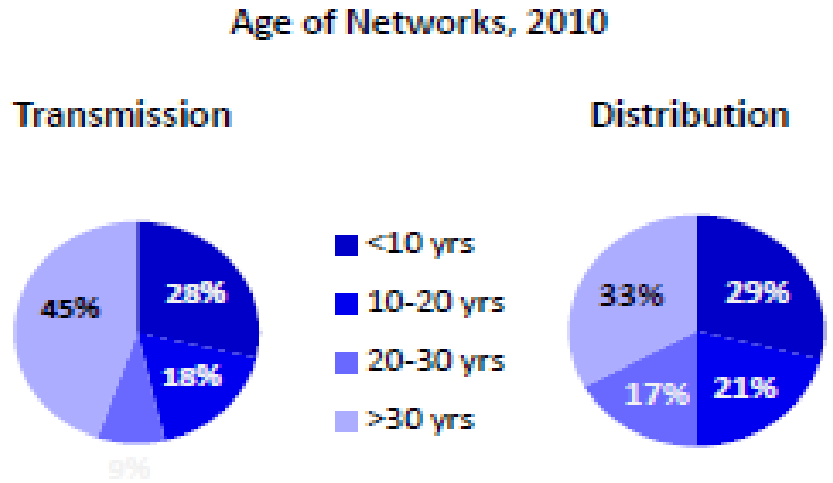
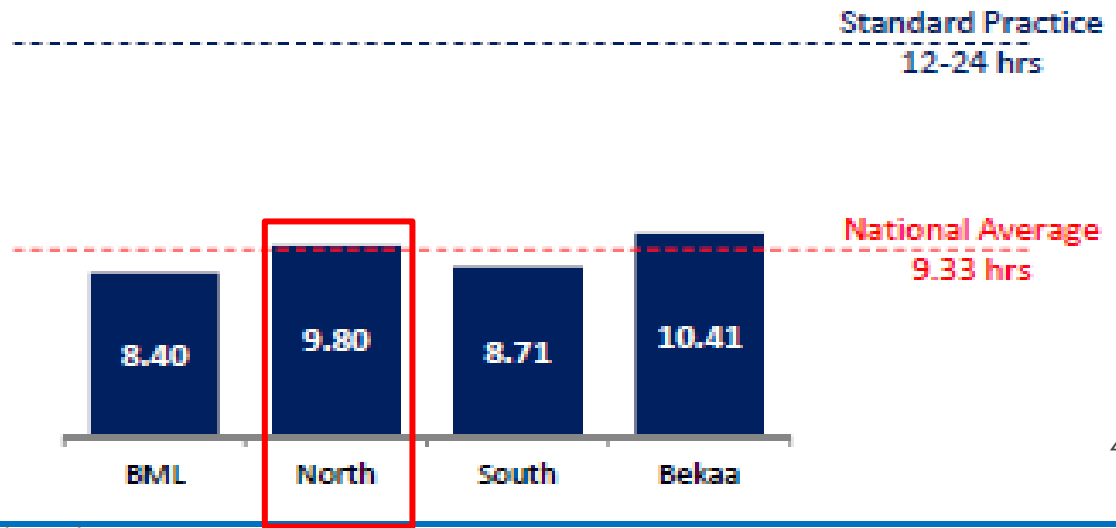
2 Although coverage is better than the regional average, more than 50% of transmission and distribution networks are past their useful life …



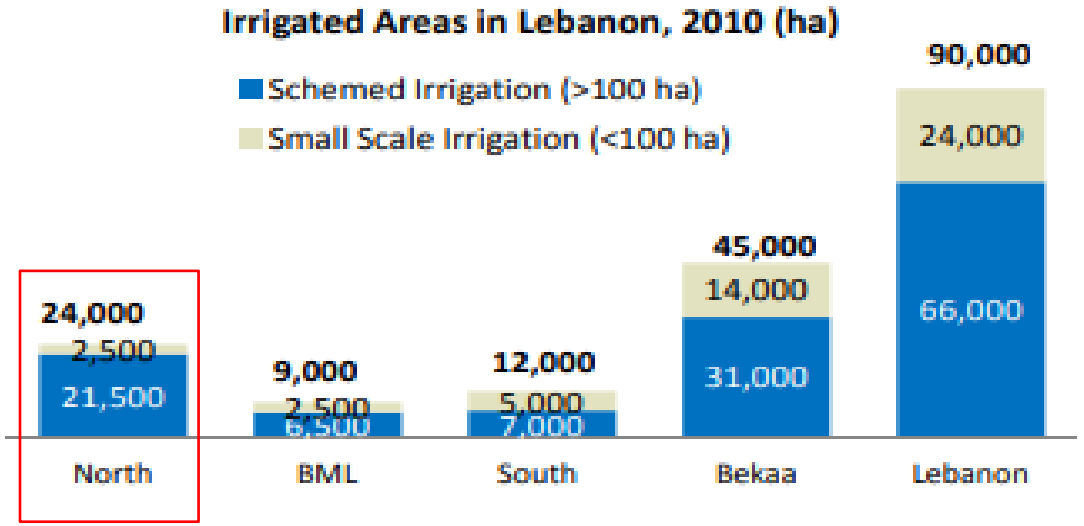


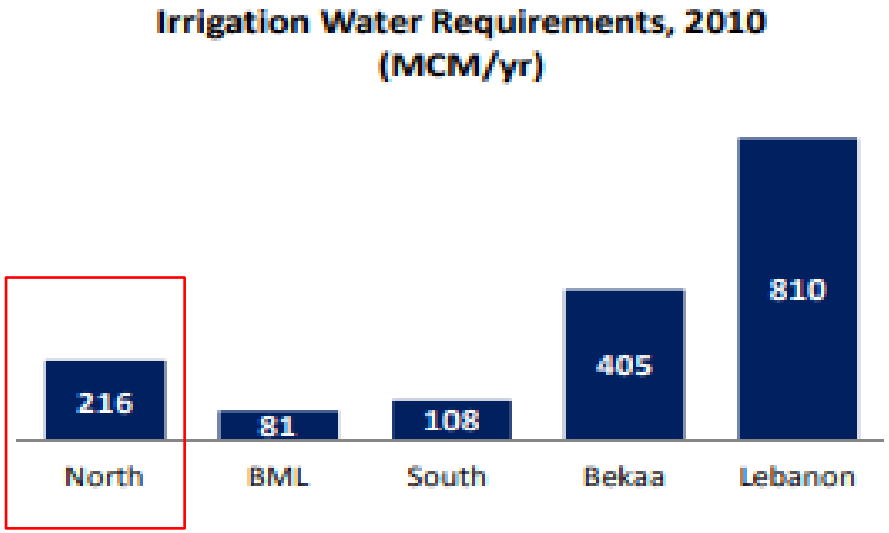


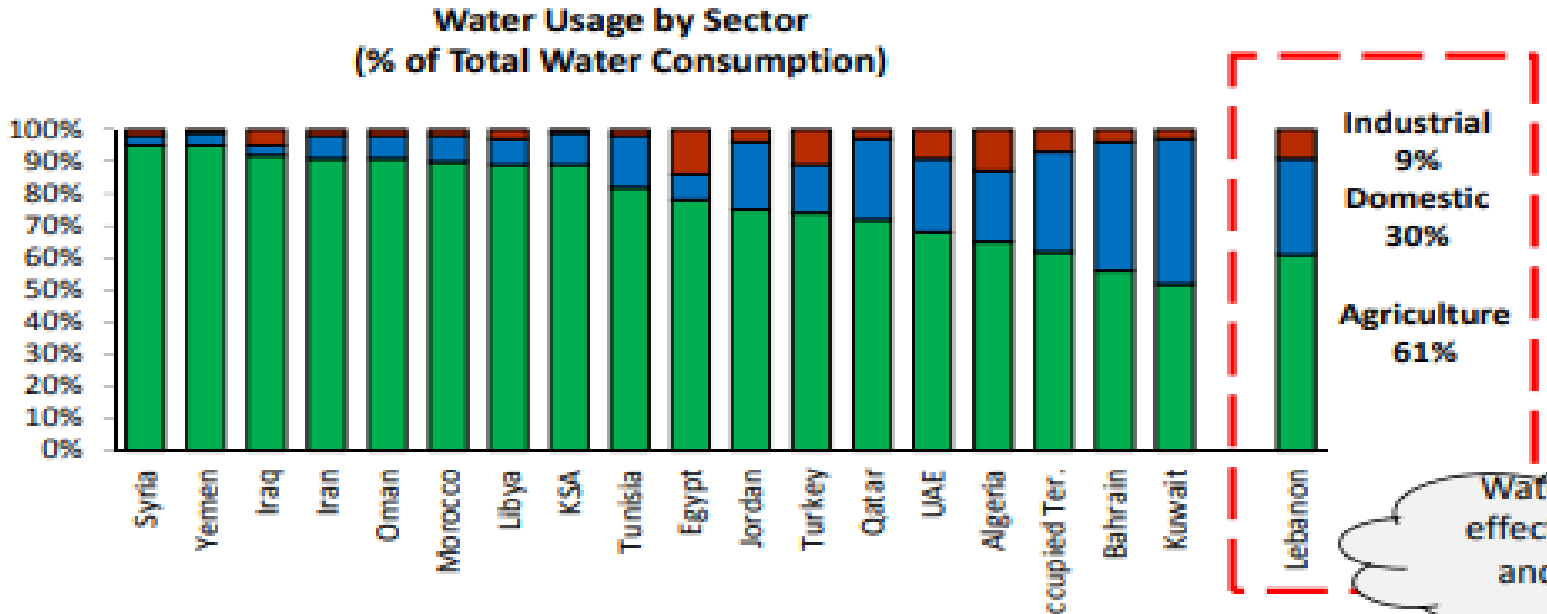


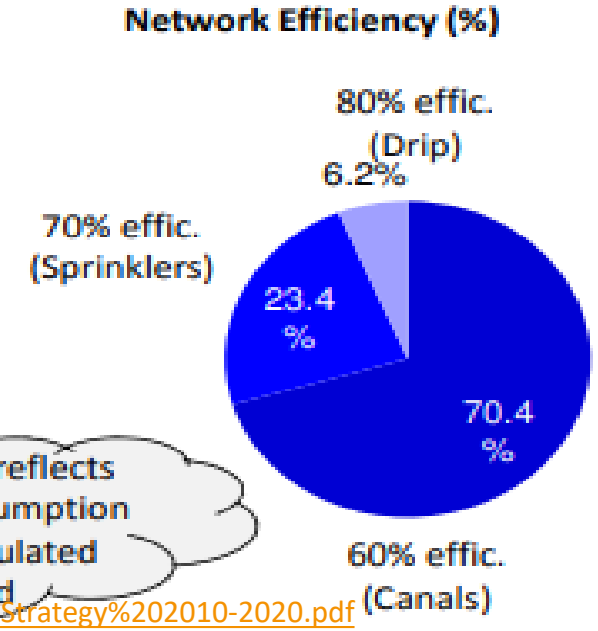
Source: MEW, WEs, WB, CAS, Water Market Middle East

2 Irrigation is the largest water consumer with low efficiencies, as open channels still constitute the majority of the networks









Water usage reflects effective consumption and not calculated demand

Source: MEW, WEs, World Bank

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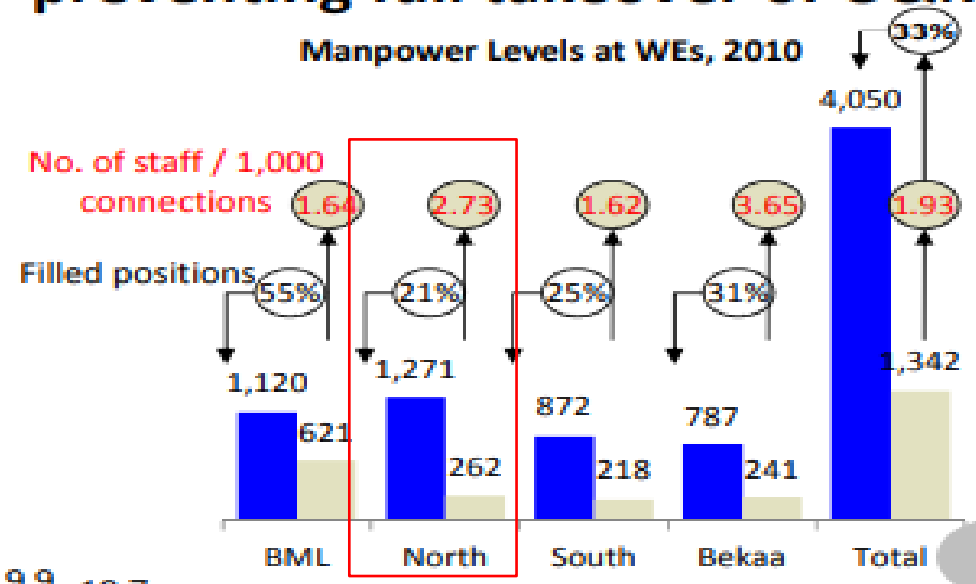
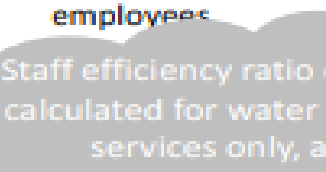
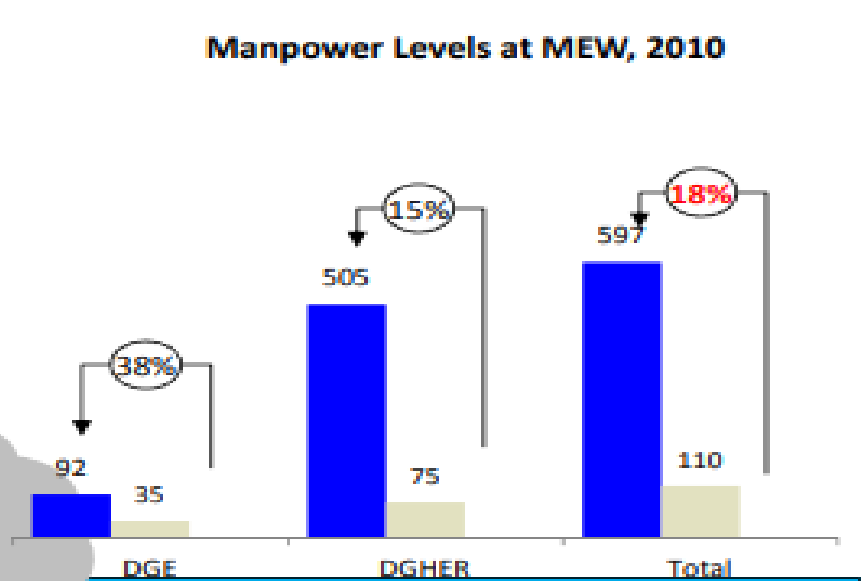
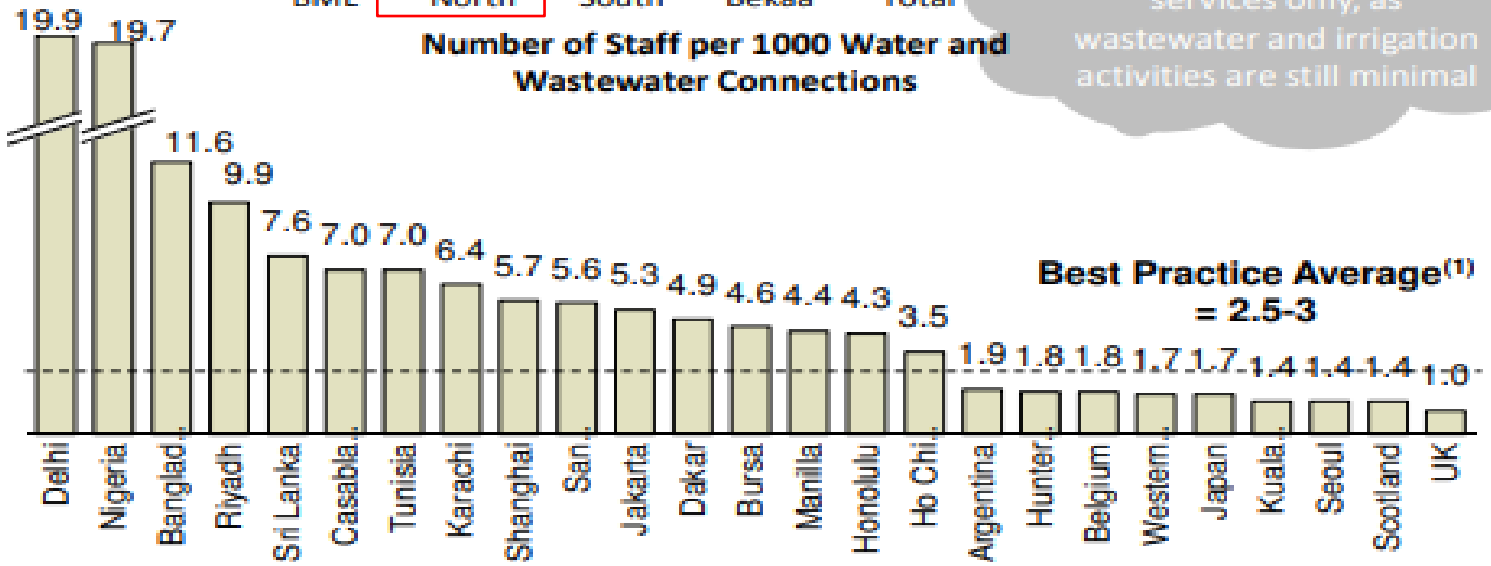
I The lack of technical capacity, financial autonomy and accountability are preventing full takeover of O&M responsibilities









Staff efficiency ratio of WEs calculated for water supply services only, as wastewater and irrigation activities are still minimal

Comments

- MEW and WEs are largely understaffed
- WEs rely on contractor-provided staff, mainly workers performing O&M, to partially fill the gaps. Almost 50% of total staff working in WEs are provided by contractors
- Gaps are mainly in managerial positions (Heads of Department or Unit)
- The high efficiency ratio in Bekaa reflects a low number of connections rather than a high number of employees

Note: (1) Best practice is indicative and is an average of top 15 operators. Average depends on scale, level of outsourcing as well as productivity

Source: IBNET Report and Water and wastewater utilities of the World

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

State of Water Resources

Rivers, springs and groundwater adversely impacted by raw sewage and other wastes, both domestic and industrial, discharged without pre-treatment.

Rivers and springs

- High BOD load and faecal contamination in several river systems (see table)

River	*BOD_5 (mg/L)*	*NO_3 (mg/L)*	*TDS (mg/L)*	*SO_3 (mg/L)*	*Total Coliform (c/100mL)*	*E. Coli (c/100mL)*
Kabir	14.4	3	270	20	900	20
Bared	28.2	2.8	225	28	610	17
Abou Ali	39.3	3.4	280	22	26,500	3,000
Ibrahim	62.8	1	150	8	3,500	200
Antelias	53.2	3	300	30	28,000	6,000
Damour	21.3	3	200	38	490	15
Awali	33.4	7	210	22	710	1
Qasmieh	22.5	5.5	250	21	80	0
Limit Value	**Nil***	**50***	**600***	**250***	**500****	**100****

Notes: Reported values are averages for period Jul-Aug-Sep 2004
** WHO (2006) standards for drinking water quality*
***MOE Decision 52/1-1996: requirement for bathing water quality including sea, rivers and lakes*

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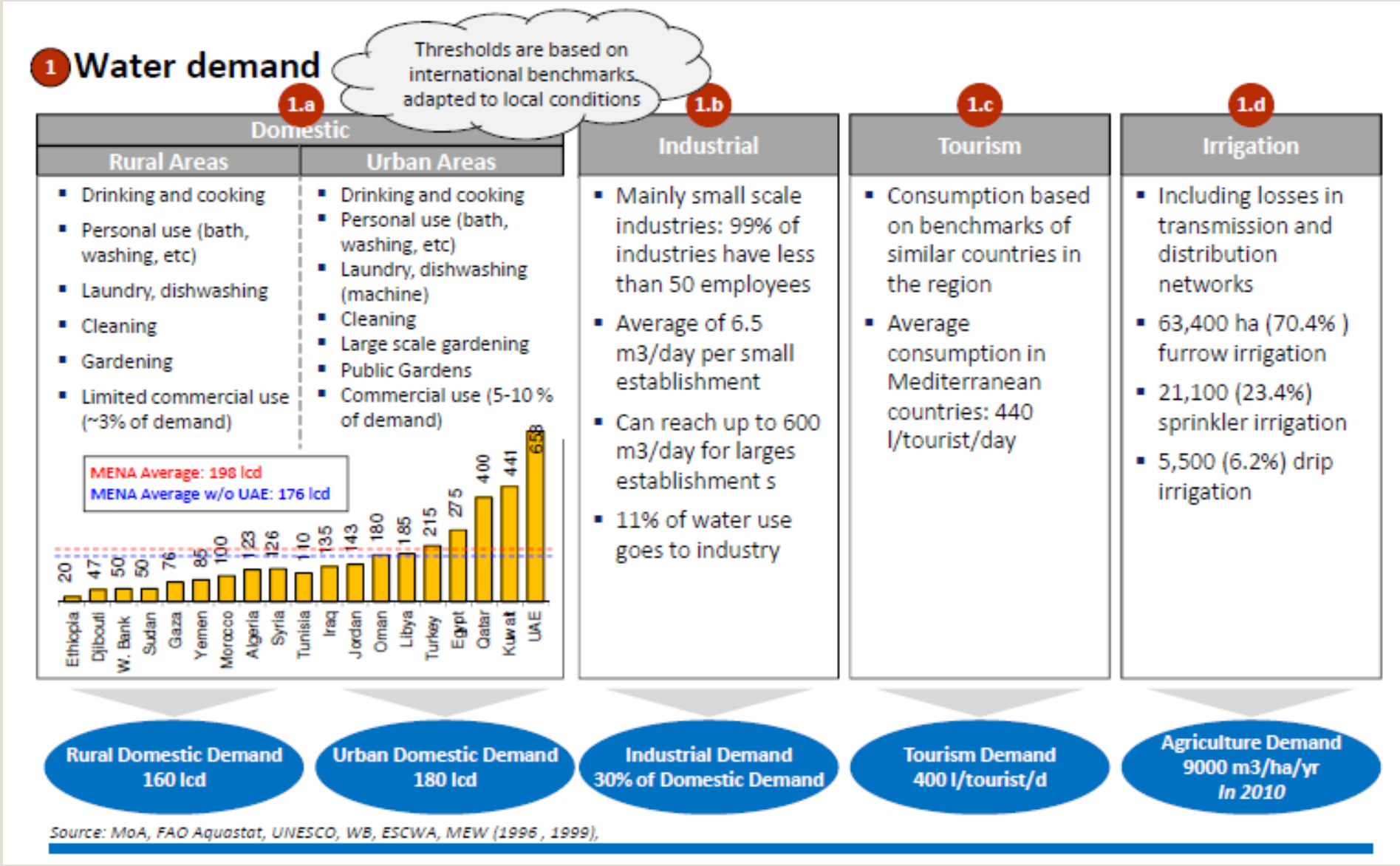
Demand



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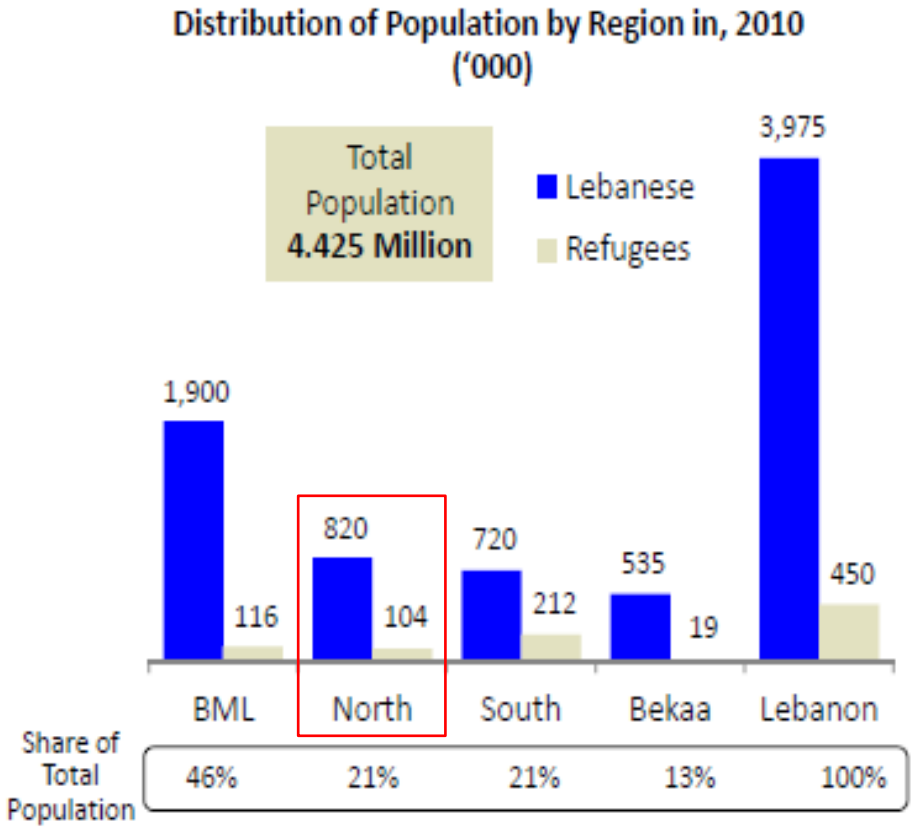
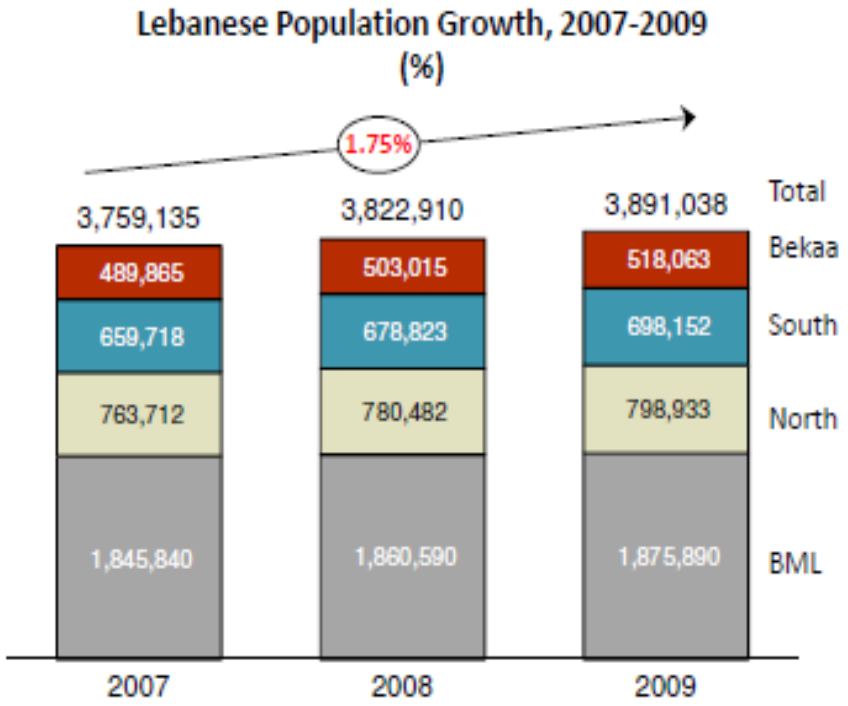
2 Population and growth





Source: CAS, UNRWA

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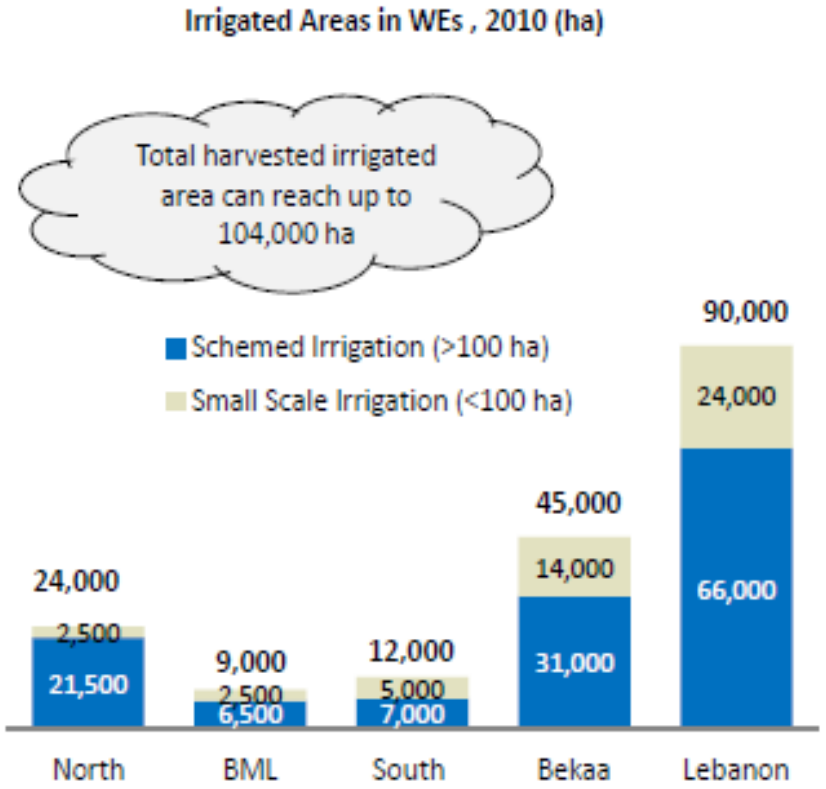
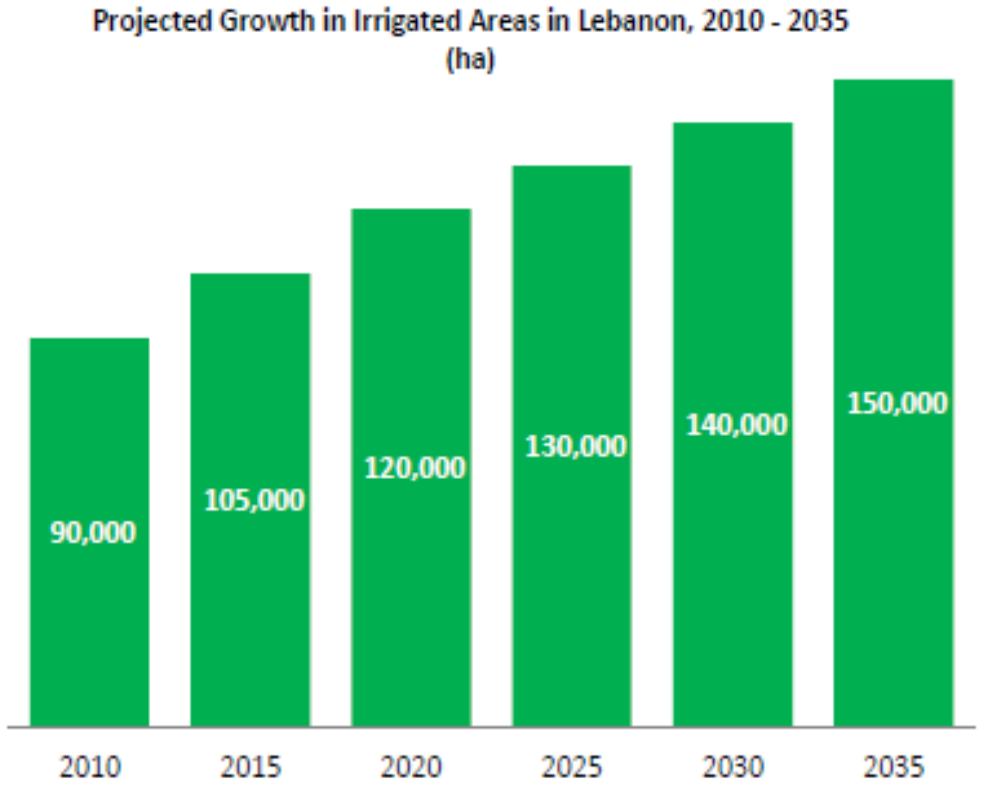
3 Irrigated areas and growth

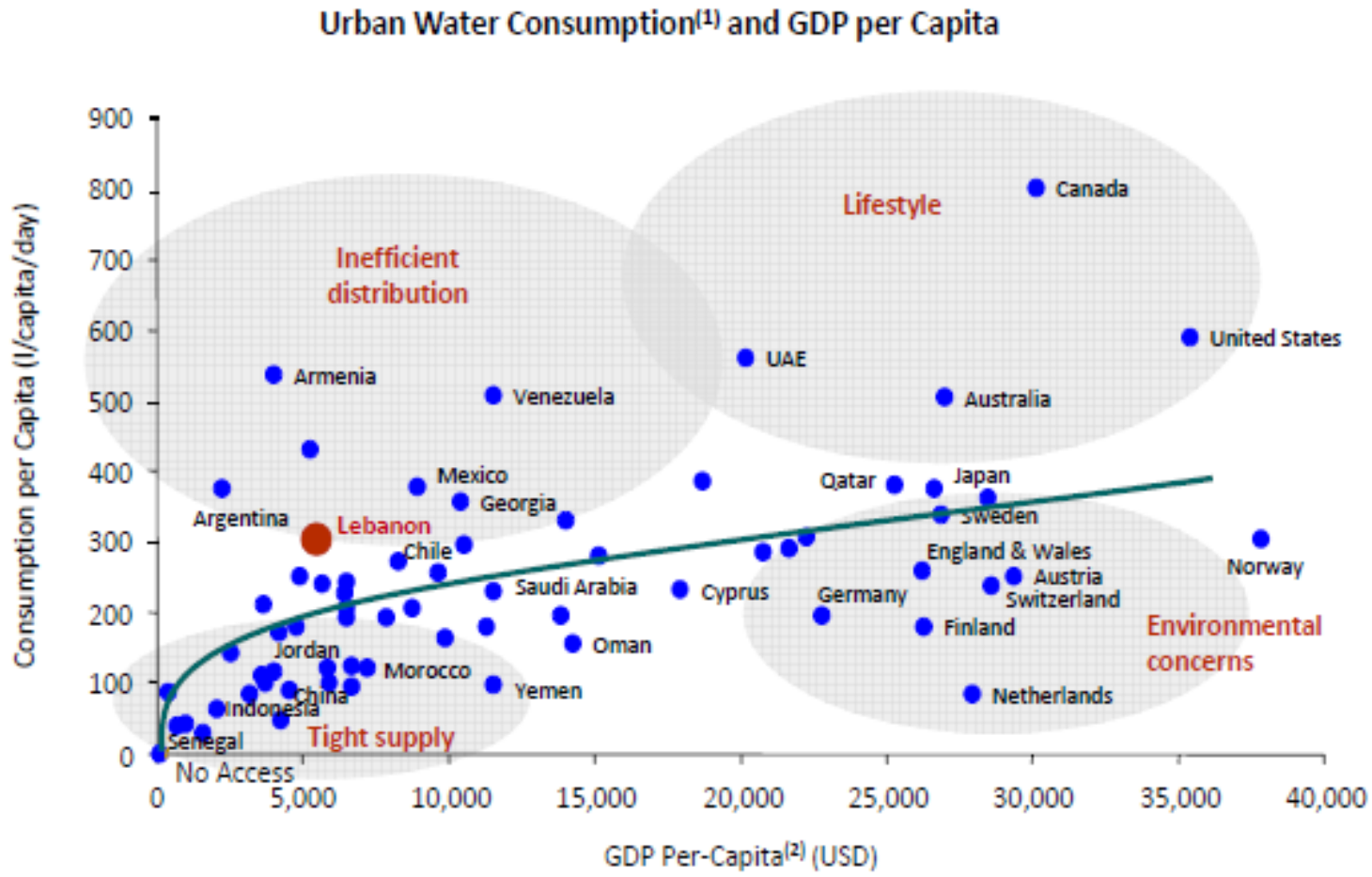




Source: MoA , FAO, WB, MEW

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

4 Urban water consumption and relation with economic development



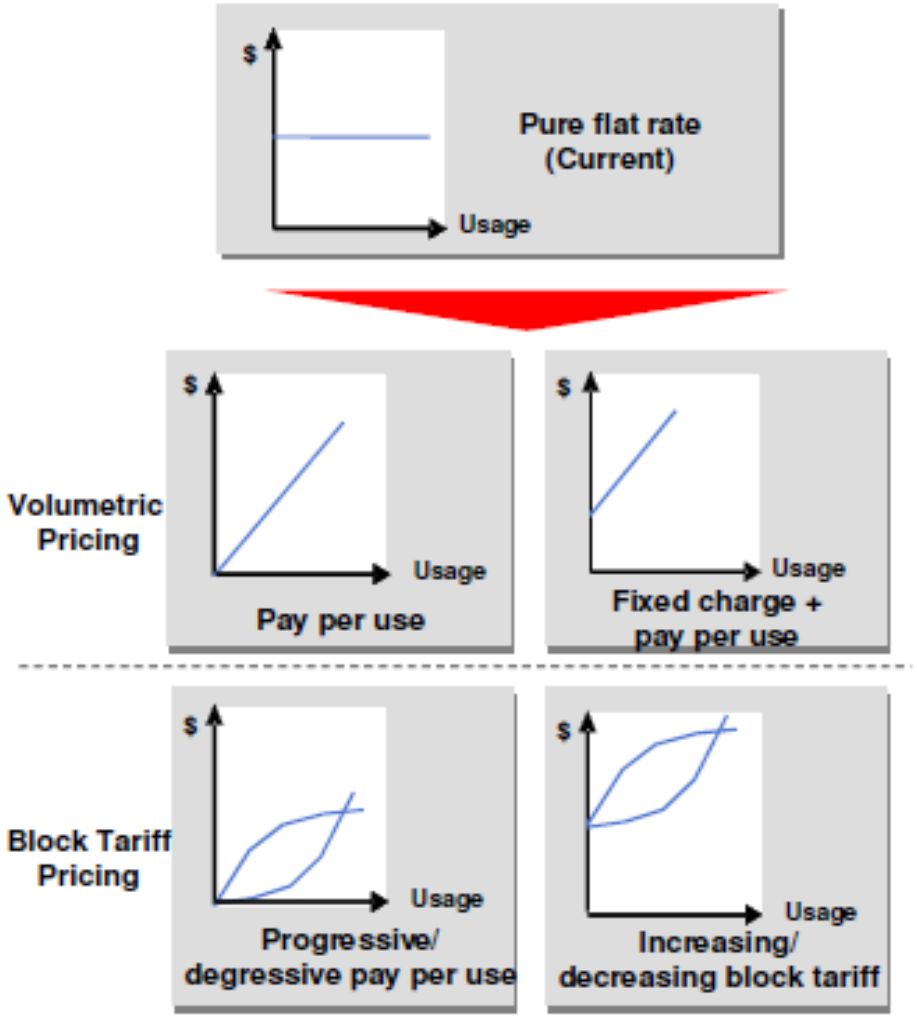
Note: (1) Includes UfW (2) Adjusted by purchasing power parity

Source: IMF, UN, MEW Analysis

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

5 Impact of tariff change (1/2)

Current and Proposed Tariff Systems



Source: IB-Net

Benchmarks on Applied Tariffs in MENA region

Country	City	Structure	Block Tariff	Level of Water Tariff	Level of WW Tariff
		V, F, M	I, D, C	USD/m3	USD/m3
Turkey	Adana	V	C	1.38	0.34
	Ankara	V	C	1.31	n/a
	Izmir	V	I	1.45	1.02
	Istambul	V	I	1.96	1.29
	Konya	V	C	0.98	n/a
Syria	Damascus	V	I	0.05	0.02
Lebanon	BMLWE	F	n/a	0.43	0
Morocco	Casablanca	V	I	0.72	0.05
Oman	Muscat	n/a	n/a	0	n/a
Occupied Territories		V	I	1.23	0.32
Palestine	Ramallah	V	I	1.23	0.32
Bahrain	Manama	V	I	0.07	n/a
Qatar	Doha	V	C	1.21	n/a
KSA	Jeddah	V	C	0.05	0
	Riyad	V	I	0.03	0
UAE	Dubai	V	I	2.16	n/a

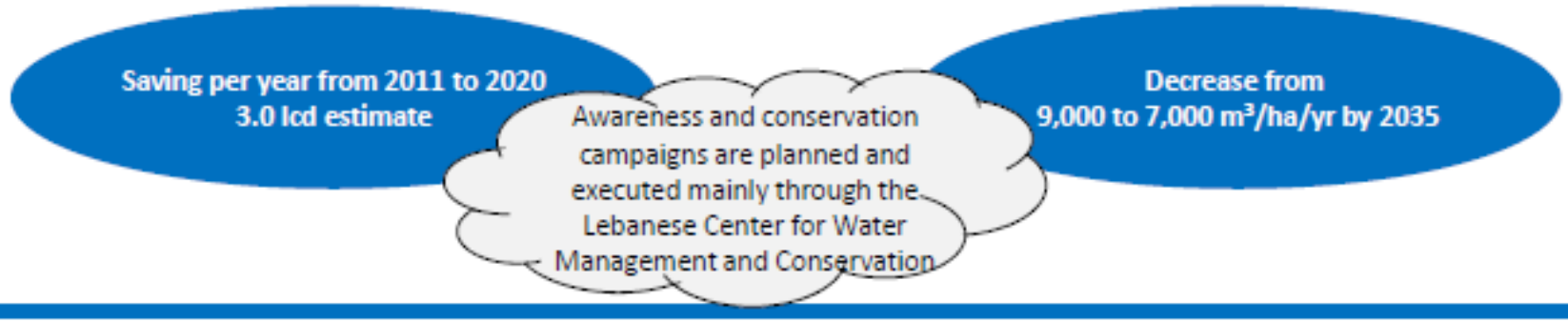
	V = volumetric	I = increasing
	F = fixed fee	D = decreasing
	M = Mix	C = constant

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

6 Water conservation

Water Conservation Initiatives

Planned Conservation Initiatives on Domestic and Industrial Demand	Planned Conservation Initiatives on Irrigation Water
▪ Installation of conservation kits (plumbing retrofits and high-efficiency toilets and showerheads, dual flush toilets, faucet aerators, kitchen aerators) ▪ High-efficiency cloth washers ▪ Complete retrofit of large water consumers, e.g., industrial, commercial ▪ Public outreach, awareness and education programs ▪ Household and establishment audits	▪ Adoption of high efficiency on-farm irrigation techniques, e.g., drip irrigation, sprinkler irrigation, overhead irrigation where applicable ▪ Coordination with Ministry of Agriculture for the adoption towards lower consumption crops ▪ Public outreach, awareness and farmer education programs ▪ Farm audits and optimization according to local conditions



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To allow for more flexibility, three scenarios have been considered on the demand side: High Demand, Moderate Demand, Conservative Demand (1/2)

Drivers/Policy Levers	Scenario 1 Conservative Demand	Scenario 2 Moderate Demand	Scenario 3 High Demand
1.a Domestic Consumption per Capita	160 lcd - *Urban* 140 lcd - *Rural*	180 lcd - *Urban* 160 lcd - *Rural*	200 lcd - *Urban* 180 lcd - *Rural*
1.b Industrial Consumption	Share of domestic 25%	Share of domestic 30%	Share of domestic 35%
1.c Tourism Consumption	350 l/tourist/d	400 l/tourist/d	450 l/tourist/d
1.d Irrigation Consumption	Decrease from 9,000 to 7,000 m3/ha/yr by 2035	Decrease from 9,000 to 7,000 m3/ha/yr by 2035	Decrease from 9,000 to 8,000 m3/ha/yr by 2035
2 Population Growth	CAGR 2010-2035 1.5%	CAGR 2010-2035 1.75%	CAGR 2010-2035 2.0%

CAGR: Compound Annual Growth Rate

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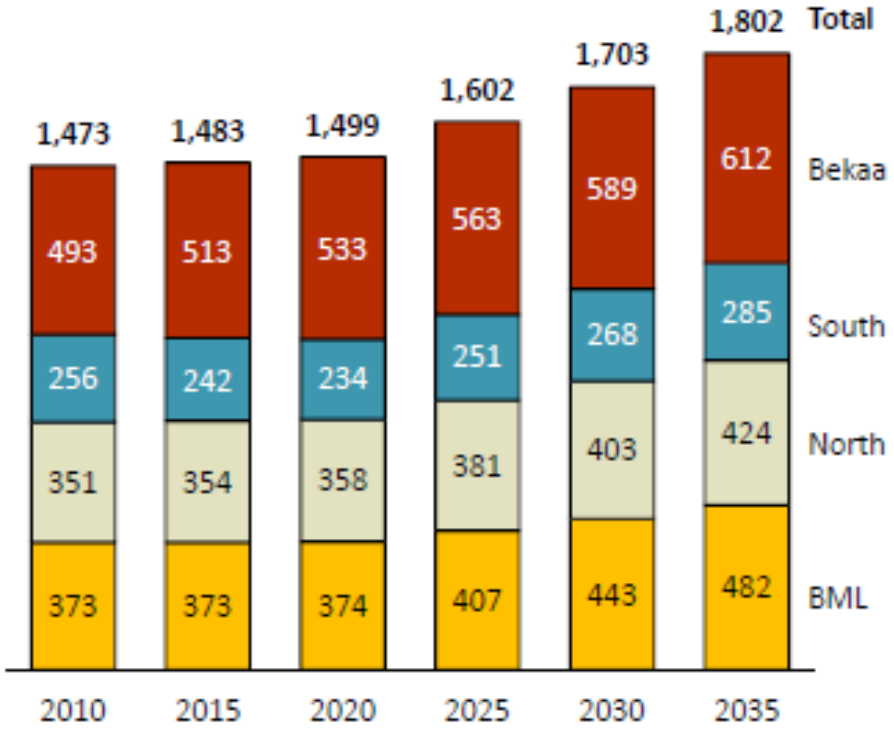
To allow for more flexibility, three scenarios have been considered on the demand side: High Demand, Moderate Demand, Conservative Demand (2/2)

Drivers/Policy Levers	Scenario 1 Conservative Demand	Scenario 2 Moderate Demand	Scenario 3 High Demand
3 Irrigation Growth	**110,000 ha** in 2020 **130,000 ha** in 2035	**120,000 ha** in 2020 **150,000 ha** in 2035	**140,000 ha** in 2020 **180,000 ha** in 2035
4 Impact of Economic Development	Consumption Growth **0.8% per annum**	Consumption Growth **1% per annum**	Consumption Growth **1.2% per annum**
5 Tariff Change	Volumetric tariff introduction in **2012**	Volumetric tariff introduction in **2013**	Volumetric tariff introduction in **2014**
6 Water Conservation	Saving per year from 2011 to 2020 **3.5 lcd**	Saving per year from 2011 to 2020 **3.0 lcd**	Saving per year from 2011 to 2020 **2.5 lcd**
7 Reduction in UfW	Decrease from **48% to 25% by 2020 then to 15% by 2035**	Decrease from **48% to 30% by 2020 then to 20% by 2035**	Decrease from **48% to 35% by 2020 then to 25% by 2035**

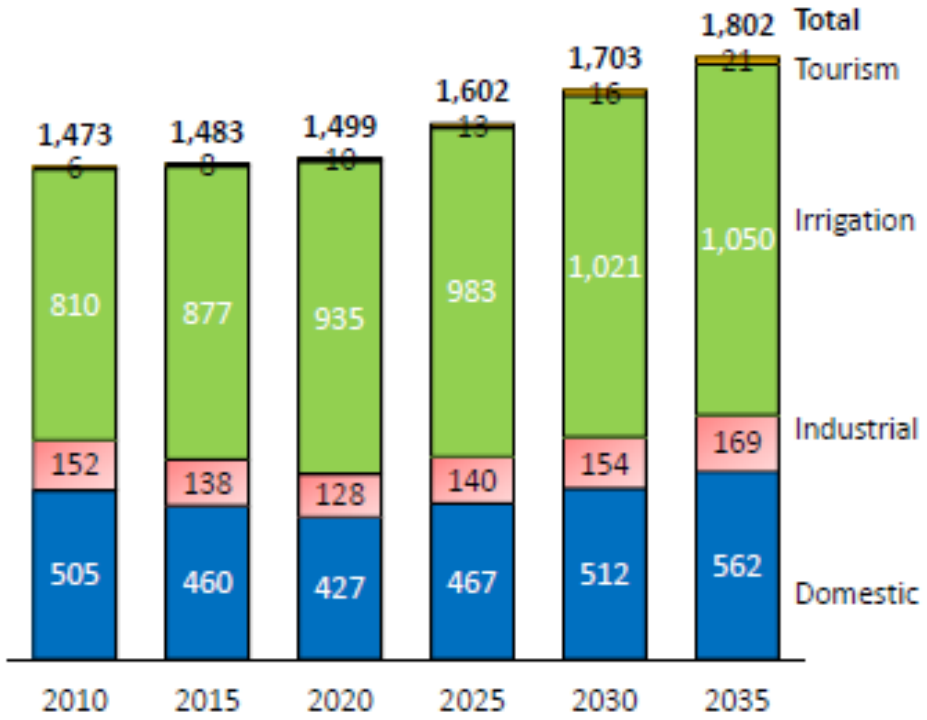
http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

Total demand under the moderate demand scenario is expected to reach 1,802 MCM/yr by 2035

Moderate Scenario for Water Demand per Region
(in MCM/yr, 2010 - 2035)



Moderate Scenario for Water Demand per Usage
(in MCM/yr, 2010 - 2035)



Currently the actual amount of water consumed is different form the demand due to availability and supply constraints

Icd (Urban)	180	174	167	176	185	194
Pop (M)	4.43	4.83	5.26	5.74	6.37	6.82
Irr ('000 ha)	90	105	120	130	140	150

Source: MEW, WEs,

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf

Supply

Main sources of water in Lebanon include surface water and groundwater while surface storage and non conventional sources are limited

Surface Water

- More than 2,000 springs exist all over Lebanon with varying flows around the year
- Total yield exceeds 1200 MCM in an average year, with less than 200 MCM available during the dry summer months
- Existing surface water resources (springs) are being currently exploited to a large extent by WEs. Limited optimization could be achieved by around 1% per year for the coming 10 years

Groundwater

- Around 650 governmental wells supply WEs throughout the country with potable water. Total volume used in 2009: more than 270 MCM
- More than 43,000 private wells are used for potable water and agriculture. Total volume used in 2009 is feared to be higher than 440 MCM. **Unlike other sources, private wells serve only a portion of the population**
- Although strict policies for groundwater extractions have been initiated, no major reductions in extractions are planned before 2015, planned date for the coming on board of sustainable alternatives. Between 2015 and 2024, private groundwater extractions are to be reduced gradually at a rate of 6%per year with increasing reliance on public wells.
- Ultimately, withdrawals from aquifers should not exceed natural replenishment rate, i.e. 500 MCM/yr

Surface Storage

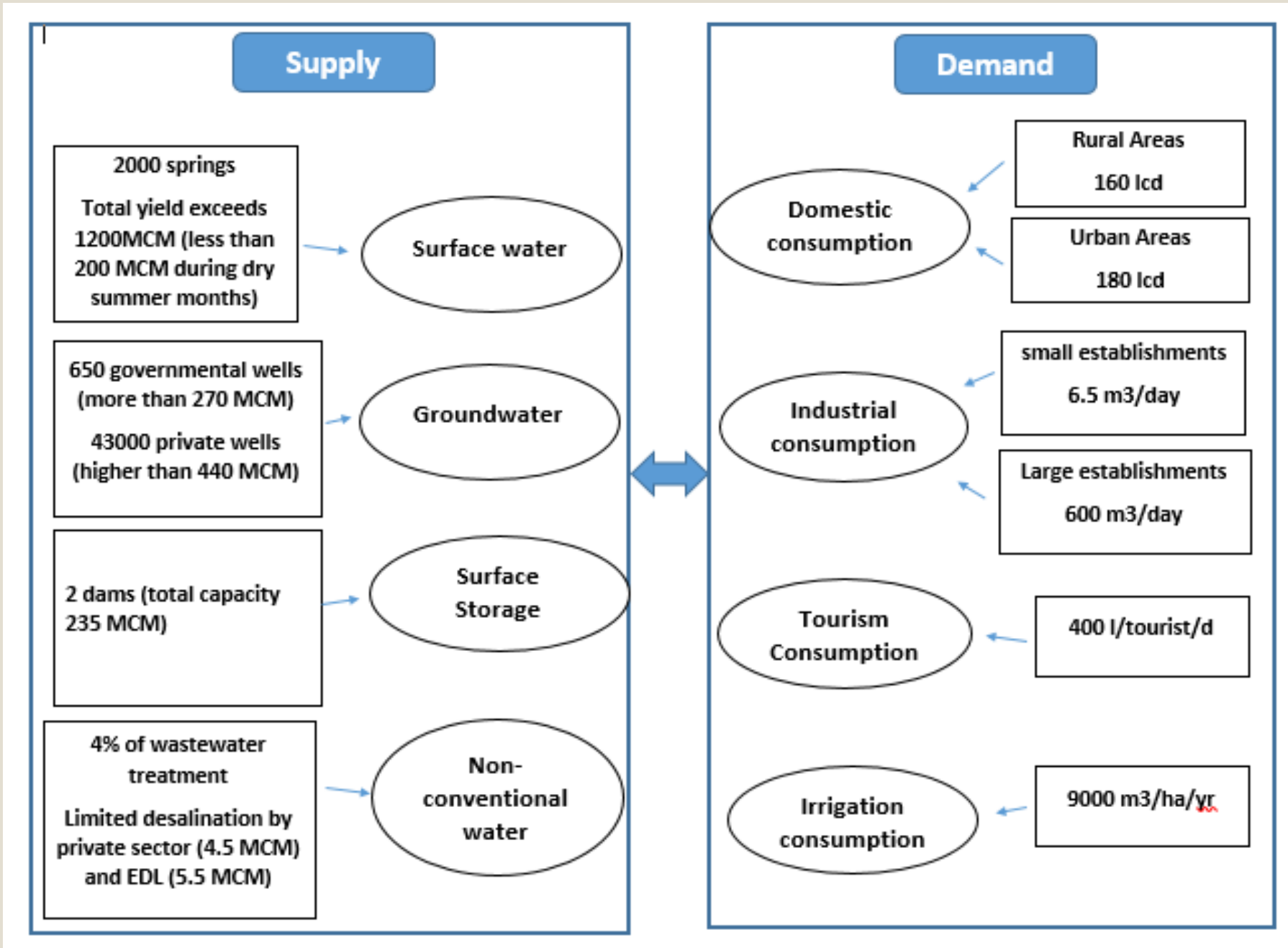
- Surface storage is mainly concentrated in 2 dams with a total capacity of 235 MCM:
  - Qaraoun Dam: 220 MCM static and 160 MCM (up to 180 MCM) dynamic
  - Chabrouh Dam: 8 MCM static and up to 15 MCM dynamic
- Currently, only 45 MCM are used for WS and irrigation, the rest for hydropower

Non Conventional Water

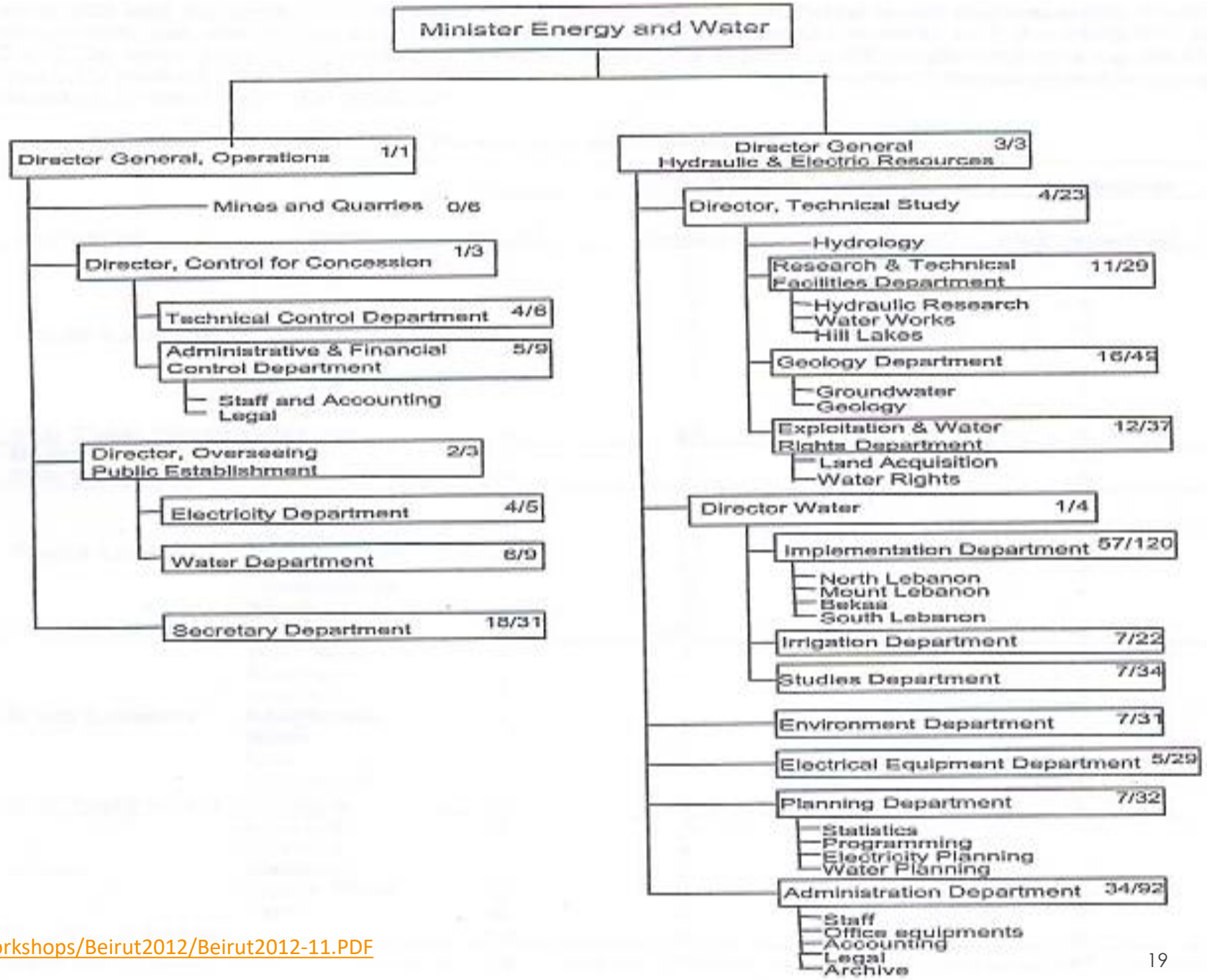
- The average rate of wastewater treatment reached 4% in 2009 – Virtually no reuse is being currently practiced
- Limited desalination is done by private sector (4.5MCM) and EDL (5.5 MCM)
- Additional flows are expected from non conventional sources, but have not been modeled for lack of clarity on available data

Source: MEW, WEs, Ministry of Agriculture

http://www.databank.com.lb/docs/National%20Water%20Sector%20Strategy%202010-2020.pdf


Supply
2000 springs
Total yield exceeds 1200MCM (less than 200 MCM during dry summer months)
Surface water
650 governmental wells (more than 270 MCM)
43000 private wells (higher than 440 MCM)
Groundwater
2 dams (total capacity 235 MCM)
Surface Storage
4% of wastewater treatment
Limited desalination by private sector (4.5 MCM) and EDL (5.5 MCM)
Non-conventional water
Demand
Domestic consumption
Rural Areas
160 lcd
Urban Areas
180 lcd
Industrial consumption
small establishments
6.5 m3/day
Large establishments
600 m3/day
Tourism Consumption
400 l/tourist/d
Irrigation consumption
9000 m3/ha/yr

Organization of ministry of energy and water



https://unstats.un.org/unsd/envaccounting/workshops/Beirut2012/Beirut2012-11.PDF

Local Committee

			Local Committees		
New Water Authority	No	Old Water Authority	Potable	Irrigation	Total*
1- North Lebanon	1	Tripoli Water Board	8	51	64
	2	Nabaa AI-Ghar Water Committee			
	3	Kubayat Water Board			
	4	Nabaa Al-Kadi Water Committee			
	5	Bcharri Water Committee			
	6	Batroun Water Committee			
	7	Akkar			
	8	Danniyeh			

https://unstats.un.org/unsd/envaccounting/workshops/Beirut2012/Beirut2012-11.PDF

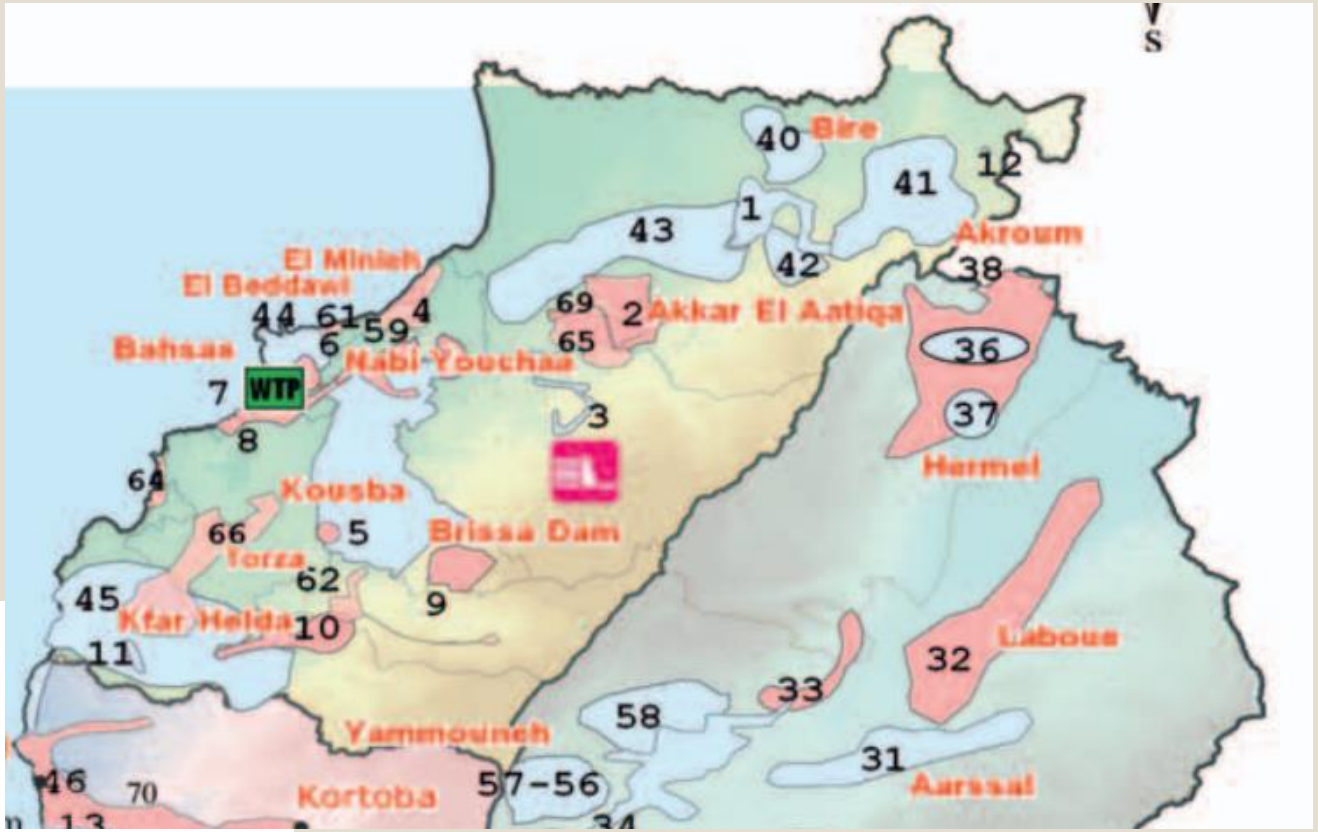
	No.	Dam/Lake	Storage capacity (MCM)	Purpose
BML	1	Boqata	6	Drinking
	2	Chabrouh	8	Drinking+Irrigation
	3	Bisri	120	Drinking
	4	Damour	42	
	5	Janneh	30	Drinking+Irrigation+Hydropower
Bekaa	6	Qaraoun	220	Irrigation+Hydropower
	7	Younine	5.7	Drinking
	8	Assi Phase II	37	Hydropower+Flow Regulation
	9	Massa Lake	8	Drinking
North	10	Mseilha	6	Drinking+Irrigation
	11	Bared	37	Drinking
	12	Qarqaf	20	Irrigation
	13	Noura el tahta	35	Drinking+Irrigation
	14	Iaal	12	Drinking
	15	Dar Boochtar	55	Drinking+Irrigation
South	16	Ibl al Saqi	50	Drinking+Irrigation
	17	Khardali	120	Drinking+Irrigation
	18	Kfarsir Lake	15	Drinking

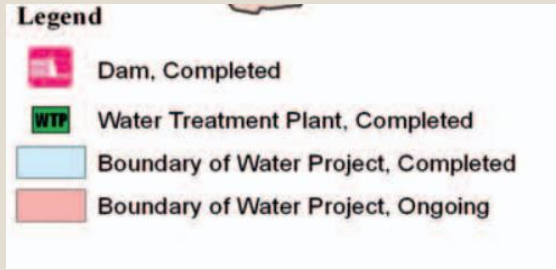
6 Completed dam
1 Dam under construction
3 Planned dam
9 Planned lakes
Town
River and Wadi
National border
UFW Unaccounted For Water

Figure 5. Planned major dams and lakes (>5 MCM) and status of water supply by establishment. Source: Fanack after MEW, 2010, updated based on personal communication with MEW, 2015.

http://www.cdr.gov.lb/eng/progress_reports/pr102014/Ewater.pdf

Completed and ongoing projects





40 Qoubaiyat
41 Akroum - kfartoun
42 Ain Yaacoub
43 Beit Mellat
44 Tripoli Network & water treatment plant
45 Batroune
59 Nabi youshaa & Deir Amar well Equipments
61 secondary and Tertiary networks in Beddawi
62 water supply project in Becharre
64 Rehabilitation of water systems in Chekka and Anfeh in the coastal area of Batroun and koura
65 complete supply of water for the area of Barghash, Hrar, kaf el tine and Quabiit
66 execution of water supply networks and boreholes and pumping stations in the cazas of koura and Batroun
69 complete supply of the villages from Hrar and Quabiit water Reservoirs in South Akkar
1 water supply project in Akkar El aatiqa villages
2 water supply project in el bergosh - Hrar & kaf el tine and kabiit
3 Brisa dam construction
4 Completion of water supply project in the villages of el Minnieh - Dinnieh caza
5 implementation of various water works in Zgharta
6 Secondary and tertiary networks in Tripoli + Add nb 1
7 Extension of Bahsas water treatment plant + Add nb 1
8 Implementation of water works in koura & Tripoli
9 Construction of a new drinking water distribution network & sewerage system for Ehden
10 Completion of water supply project works in Batroun
11 Equipping of Jaran & Aabdly water plants with electric generators
12 Rehabilitation of mounseh well pumping station (caza of Akkar)

http://www.cdr.gov.lb/eng/progress_reports/pr102014/Ewater.pdf

جزاكم الله خيرا