Annexes

Annex I - List of stakeholders

Name	Affiliation	Consultation Approach
Alaa Moussa	Schneider	Workshops
Amal Deghaili	Greenplan	Workshops
Amid Sahyoun	BUTEC	Workshops
Angela Akl	GIZ/EFL	Workshops
Boghos Ghougassian	MECTAT	Workshops and interviews
Chafic Abi Said	Energy Expert	Meeting
Chafic Estephan	LARI	Workshops
Charbel Rizk	MoA	Workshops and interview
Charbel Zeidan	EFL-CDR	Workshops
Dietmar Ueberbacher	Italian Cooperation	Workshops
Dr. Carla Khater	CNRS	Workshops
Dr. Charbel Afif	USJ-FS	Workshops
Dr. Elia Choueiri	LARI	Workshops and interviews
Dr. Hassan Harajli	CEDRO	Workshops and interviews
Dr. Hassan Jaber	ALMEE	Workshops and meeting
Dr. Hassan Machlab	ICARDA	Workshops
Dr. Ihab Jomaa	LARI	Workshops and interviews
Dr. Imad Suleiman	ESCWA	Workshops
Dr. Issam bashour	AUB	Workshops and meeting
Dr. Leila Dagher	AUB	Interview
Dr. Michel Afram	LARI	Workshops and interviews
Dr. Nadim Farjallah	AUB	Workshops
Dr. Raymond Ghajjar	LAU/MoEW	Workshops and interviews
Dr. Riad Chedid	AUB/MoEW	Workshops and interviews
Dr. Salah Kandil	ESCWA/SDPD	Workshops and interviews
Dr. Talal Darwich	CNRS	Workshops

Annexes

Name	Affiliation	Consultation Approach
Dr. Tamam Nakkash	Team international	Workshops and interviews
Dr. Bothayna Rashed	ESCWA	Workshops
Farah Charafeddine	Energy Expert	Interview
Farah Choucair	MoF	Workshops
Faten Adada	CDR	Workshops and interviews
George Abboud	Green Party	Workshops
Georges Akl	MoE	Workshops
Habib Maalouf	Al-Safir newspaper /Leb. Environment Party	Workshops and interview
Hassan Jaafar	MoEW	Workshops
Hicham Kotob	EDL	Workshops
Hisham Malaeb	MoPWT	Workshops and interviews
Hussam Hawwa	IRG	Workshops and interviews
Jad Abou Arrage	ARC-EN-CIEL	Workshops and interviews
Jawdat abou jaoude	CDR	Workshops
Jean Paul Sfeir	Solarnet	Workshops
Jeanine Kounjian	IFP	Workshops
Kassem Jouni	GIZ	Workshops and interviews
Katia Fakhry	UNDP	Workshops
Krekor Baboyan	MoF	Workshops
Lea hakim	MoF	Workshops and interviews
Lutfallah El Hage	GETI/Order of Engineers	Workshops and interview
Mabelle Chedid	ARC-EN-CIEL	Workshops
Manar Dagher	MoA	Workshops and interviews
Marie-Therese Kfoury	LARI	Workshops and interviews
Maya Abboud	UNDP	Workshops
Maya Mhanna	MoA	Workshops and interviews
Mona Fakih	MoEW	Workshops
Mufid Duhayni	MoEW	Workshops

Annexes

Name	Affiliation	Consultation Approach
Nabil Amacha	LRA	Workshops and interviews
Nader Hajj Chehade	LCEC	Workshops and interviews
Naji Tannous	Energy expert	Workshops
Nancy Awad	CDR	Workshops
Nour Oueidat	ESIB	Workshops
Philip Al Hajj	Fransabank	Interview
Pierre Khoury	MoEW/LCEC	Workshops and interviews
Rana el Hajj	AUB IFI	Workshops
Randa Massad	LARI	Workshops and interviews
Rani Al Achkar	LCEC	Workshops
Raymond Khoury	Green Plan	Workshops and interviews
Ricardo Khoury	ELARD	Workshops
Roger Francis	CNRS-RS	Workshops
Ronald Diab	NEC/EEG	Workshops
Samir Sarkis	Green Party	Workshops
Siham Daher	MoET	Workshops and interviews
Tarek Yehia	NEEDS	Workshops
Wajdi Khater	ARC-EN-CIEL	Workshops and interviews
Wassef Kodeih	CEDRO project	Workshops
Ziad Al Zein	MoEW/LCEC	Workshops and interviews
Ziad Khayat	MoEW	Workshops and interviews

Annex II - Multi- Criteria Analysis Calculations for the Power Sector

Selection criteria	Absolute weight	Relative Weight	CCGT			RE		
			Value	Standard score	Weighed score	Value	Standard score	Weighed score
GHG reduction (Tons)	0.30	0.30	1,711,106.00	1.00	0.30	270,588.00	0.16	0.05
Fuel cost (USD/MWh)	0.30	0.30	70.00	0.03	-0.01	209.00	0.10	-0.03
Capital cost (10^3USD/MW)	0.15	0.15	0.40	0.00	0.00	1.05	0.14	-0.02
O$M cost (USD/MW)	0.10	0.10	556,764.00	1.00	-0.10	358,328.00	0.63	-0.06
Option Sustainability	0.10	0.10	1.90	0.00	0.00	2.00	0.08	0.01
Societal benefits	0.05	0.05	2.00	0.10	0.00	1.81	0.00	0.00
Total					0.19			-0.06
Rank					1st			6th

Selection criteria	Wind			PV		
	Value	Standard score	Weighed score	Value	Standard score	Weighed score
GHG reduction (Tons)	14,212.00	0.01	0.00	1,258.00	0.00	0.00
Fuel cost (USD/MWh)	0.10	0.00	0.00	0.10	0.00	0.00
Capital cost (10^3USD/MW)	1.90	0.33	-0.05	4.00	0.78	-0.12
O$M cost (USD/MW)	19,000.00	0.00	0.00	40,000.00	0.04	0.00
Option Sustainability	2.90	0.77	0.08	2.90	0.77	0.08
Societal benefits	2.09	0.14	0.01	3.90	1.05	0.05
Total			0.04			0.01
Rank			2nd			3rd

Selection criteria	Hydro			Biomass		
	Value	Standard score	Weighed score	Value	Standard score	Weighed score
GHG reduction (Tons)	181,507.00	0.11	0.03	102,492.00	0.06	0.02
Fuel cost (USD/MWh)	0.10	0.00	0.00	50.00	0.02	-0.01
Capital cost (10^3USD/MW)	3.50	0.67	-0.10	5.00	1.00	-0.15
O$M cost (USD/MW)	35,000.00	0.03	0.00	284,700.00	0.49	-0.05
Option Sustainability	2.00	0.08	0.01	3.20	1.00	0.10
Societal benefits	3.81	1.00	0.05	3.40	0.80	0.04
Total			-0.01			-0.05
Rank			4th			5th

Annex III -Marginal Abatement Cost Calculations for Power Sector

		CCGT	Wind	Hydro	PV
Capital cost	USD	270,000,000	190,000,000	245,000,000	4,000,000
Annual benefit/cost	USD	377,485,920	1,900,000	2,450,000	40,000
Annual average CO2 savings	(tonnes/year)	1,711,104	142,613	181,507	1,257
Project life	(years)	25	25	25	25
NPV	USD	(3,437,885,499)	171,337,099	220,934,680	3,607,097
Cumulative savings for all projects	(thousand tonnes/year)	1,711.10	1,853.72	2,035.22	2,036.48
MAC (carbon not discounted)	(USD/tonnes)	(80.37)	48.06	48.69	114.78
Discounted life savings of carbon	(tonnes)	16,807,455	1,400,828	1,782,867	12,347
MAC (carbon discounted)	(USD/tonnes)	(204.55)	122.31	123.92	292.14

Annexes

Annex IV. Market maps and problem trees for the transport sector

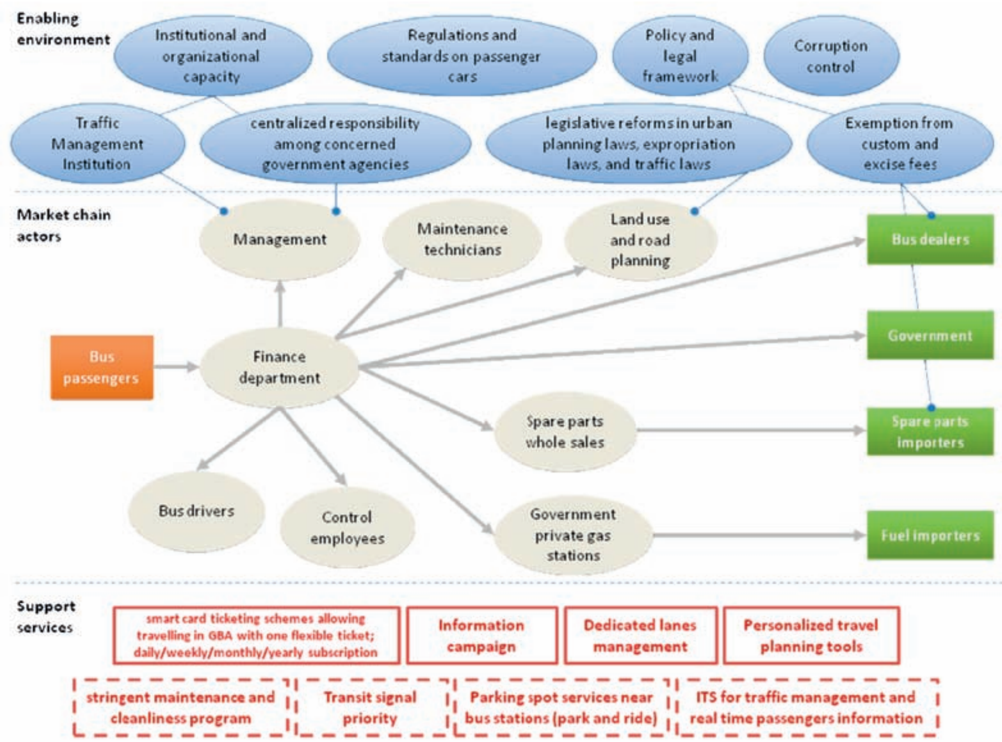

Figure 1. Market map for mass transit buses in GBA.

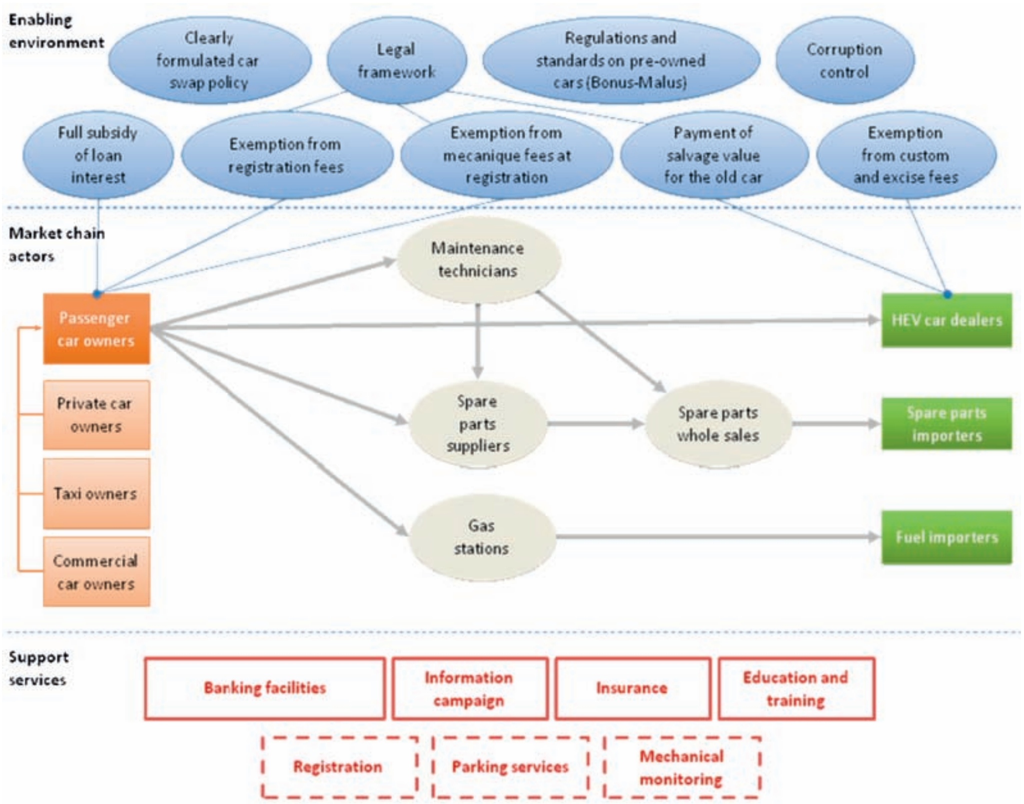

Figure 2. Market map for hybrid and fuel efficient vehicles.

Annexes

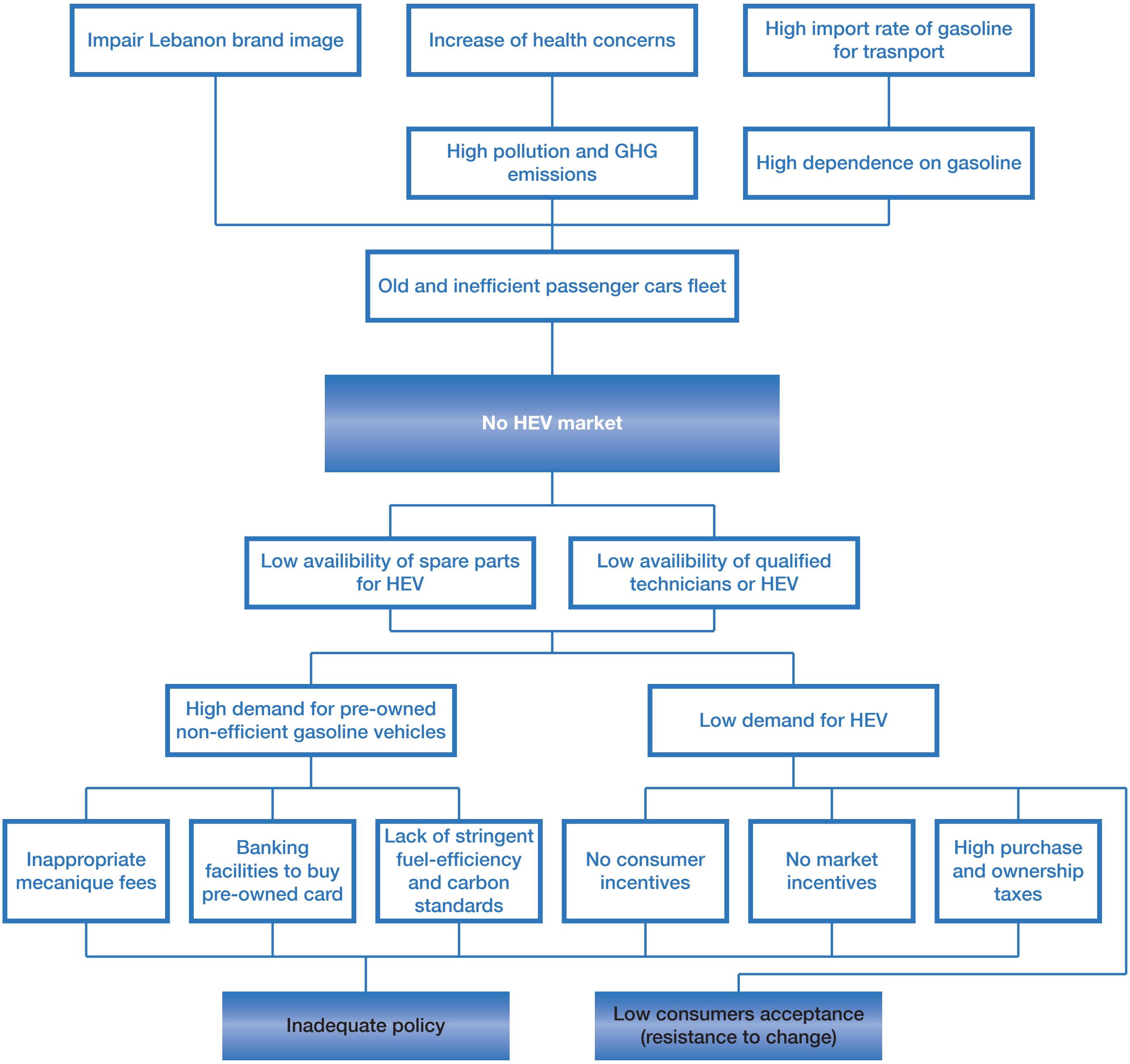

Figure 3. Logic problem tree: hybrid electric vehicles.

Annexes

Figure 4. Logic problem tree: mass transit bus system operated by the government on dedicated lanes in GBA.

Annex V. Assumptions in the transport sector

Table 1. Average consumption under GBA driving conditions (l/100km).

	Average passenger car	Non fuel-efficient car	Fuel efficient gasoline car	Full hybrid HEV	Diesel bus (diesel l/100km)
Urban peak	15.83	23.55	8.23	5.3	33.4
Urban off-peak	11.16	16.6	5.8	5.3	33.4
Rural	9.08	13.51	4.72	5.3	27.19

Table 2. Average speed under GBA driving conditions (Mansour, 2012).

	urban peak	urban off-peak	rural
Passenger cars (km/h)	17.6	39.1	51.3
Bus not operating on reserved lanes (km/h)	14.7	32.6	42.8
Bus operating on reserved lanes (km/h)	20	35	52

Annex VI Cost Benefit Analysis for the Technologies of the Agriculture Sector

Cost Benefit Analysis for CA

Table 1: Increase in area (A) adopting CA according to assumptions and respective subsidies

year	olive (ha), 25% annual increment	fruits (ha), 20% annual increment	cereals/legumes (ha), 30% annual increment	Subsidies rate (USD/ ha) for cereals/legumes	total subsidies (USD)
	A_1	A_2	A_3		A_4
1	500	100	1,500	50	75,000
2	625	120	1,950		97,500
3	781	144	2,535		126,750
4	977	173	3,296		164,775
5	1,221	207	4,284		214,208
6	1,526	249	5,569		278,470
7	1,907	299	7,240		362,011
8	2,384	358	9,412		470,614
9	2,980	430	12,236		611,798
10	3,725	516	15,907		795,337
				Cumulated	3,196,462

Table 2: Costs for CA transfer and diffusion

CA measures	Public (USD)
R&D	240,000
Institutional arrangements	10,000
Training of trainers	5,000
Training for farmers	15,000
Total	270,000

Table 3: Additional revenues (benefits) related to CA

	OLIVE			FRUITS			CEREALS/LEGUMES			TOTAL CROPS
CA	Net revenue without CA (USD/ha)	Net revenue with CA (USD/ha)	Additional revenue from CA (USD)	Net revenue without CA	Net revenue with CA	Additional revenue from CA per surface	Net revenue without CA	Net revenue with CA	Additional revenue from CA per surface	Total additional revenue from CA (USD)
year	B_1	C_1	$D_1=(C_1-B_1)x(A_1)$	B_2	C_2	$D_2=(C_2-B_2)x(A_2)$	B_3	C_3	$D_3=(C_3-B_3)x(A_3)$	$D=D_1+D_2+D_3$
1	380	1,000	310,000	19,700	20,000	30,000	840	1,600	1,065,000	1,405,000
2	340	800	287,500	19,700	20,000	36,000	832	1,600	1,400,880	1,724,380
3	380	1,000	484,375	19,700	20,000	43,200	823	1,600	1,842,225	2,369,800
4	340	1,000	644,531	19,700	20,000	51,840	815	1,600	2,422,024	3,118,395
5	380	1,000	756,836	19,700	20,000	62,208	807	1,600	3,183,549	4,002,593
6	340	1,000	1,007,080	19,700	20,000	74,650	799	1,600	4,183,553	5,265,283
7	380	1,000	1,182,556	19,700	20,000	89,580	791	1,600	5,496,456	6,768,592
8	340	1,000	1,573,563	19,700	20,000	107,495	783	1,600	7,219,830	8,900,888
9	380	1,000	1,847,744	19,700	20,000	128,995	775	1,600	9,481,578	11,458,317
10	340	1,000	2,458,692	19,700	20,000	154,793	767	1,600	12,449,346	15,062,831
Total			10,552,877			778,760	8,032	16,000	48,744,441	60,076,079

Table 5: Cost benefit analysis for all crops under CA

Year	Added revenue from all crops under CA(USD)	Total costs of CA (USD)	Discounted benefit for CA (USD)
n	D	$E= A_4$	$F= (D-E)/ (1+0.06)^n$
1	1,405,000	345,000	1,000,000
2	1,724,380	97,500	1,447,917
3	2,369,800	126,750	1,883,308
4	3,118,395	164,775	2,339,544
5	4,002,593	214,208	2,830,902
6	5,265,283	278,470	3,515,507
7	6,768,592	362,011	4,260,743
8	8,900,888	470,614	5,289,258
9	11,458,317	611,798	6,420,038
10	15,062,831	795,337	7,966,894
NPV			36,954,110

(*) Additional 270,000 USD are added the first year as cost for measures.

Annexes

Cost Benefit Analysis for SAVR

Table 1: Increase in annual demand (A) on seeds and seedlings for SAVR according to assumptions

	Fruit trees					
yr	Produced seedlings	Cost (USD/ seedling)	Subsidy (USD/ seedling)	Imported seedlings	Cost (USD/ seedling)	Subsidy (USD/ seedling)
	A_1	B_1	C_1	A_2	B_2	C_2
1	250,000	3	2	250,000	9	6
2	300,000	3	2	225,000	9	6
3	350,000	3	2	200,000	9	6
4	400,000	3	2	175,000	9	6
5	450,000	3	2	150,000	9	6
6	500,000	3	2	150,000	9	6
7	500,000	3	2	150,000	9	6
8	500,000	3	2	150,000	9	6
9	500,000	3	2	150,000	9	6
10	500,000	3	2	150,000	9	6

	Tomato						Potato		
yr	Produced seedlings	Cost (USD/ seedling)	Subsidy (USD/ seedling)	Seed bags in field	Cost (USD/ bag)	Subsidy (USD/ bag)	Imported seeds (int)	Cost (USD/t)	Subsidy (USD/t)
	A_3	B_3	C_3	A_4	B_4	C_4	A_5	B_5	C_5
1	600,000	1	0	10,000	25	5	100	2,000	50
2	720,000	1	0	20,000	25	5	200	2,000	50
3	900,000	1	0	30,000	25	5	300	2,000	50
4	1,125,000	1	0	40,000	25	5	400	2,000	50
5	1,406,250	1	0	50,000	25	5	500	2,000	50
6	1,687,500	1	0	60,000	25	5	600	2,000	50
7	1,856,250	1	0	70,000	25	5	600	2,000	50
8	1,856,250	1	0	80,000	25	5	600	2,000	50
9	1,856,250	1	0	90,000	25	5	600	2,000	50
10	1,856,250	1	0	90,000	25	5	600	2,000	50

Annexes

Table 2: Total cost for SAVR including subsidies according to the increase in annual demand on seeds and seedlings for SAVR

Year	Tomato field	Tomato greenhouse	Potato	Fruit trees	All crops	
	Surface (in ha)*				Total cost (USD)	Subsidies (USD)
n	S_1	S_2	S_3	S_4	D = ∑(A x B)	E = ∑(A x C)
1	400	480	250	700	3,750,000	2,080,000
2	800	576	500	1,435	4,185,000	2,090,000
3	1,200	720	750	2,205	4,650,000	2,115,000
4	1,600	900	1,000	3,010	5,137,500	2,151,250
5	2,000	1,125	1,250	3,850	5,653,125	2,201,563
6	2,400	1,350	1,500	4,760	6,393,750	2,401,875
7	2,800	1,485	1,500	5,670	6,728,125	2,494,063
8	3,200	1,485	1,500	6,580	6,978,125	2,544,063
9	3,600	1,485	1,500	7,490	7,228,125	2,594,063
10	3,600	1,485	1,500	8,400	7,228,125	2,594,063
Total					57,931,875	23,265,938

(*) Based on the number of seeds and seedlings annual demand; annual plantations of trees (local and imported) are cumulated

Table 3: Costs for the deployment of SAVR without subsidies (public expenditure)

SAVR measures	Public (USD)
Infrastructure for multiplication, conservation, demonstration	2,000,000
R&D (including sanitization and certification)	2,000,000
Training of trainers	100,000
Marketing studies, campaigns to promote SAVR, tasting…	100,000
Awareness campaign about intellectual property right	20,000
Product traceability establishment	50,000
Process for adherence to UPOV or respect IPR	20,000
Institutional and financial arrangements to subsidize SAVR/financial mechanism to sustain R&D	25,000
Total	4,315,000

Annexes

Table 4: Additional revenues (benefits) from SAVR

	TOMATO OPEN FIELD			TOMATO GREENHOUSE		
Year	Net revenue without SAVR (USD/ha)	Net revenue with SAVR (USD/ha)	Additional revenue from SAVR per planted surface (USD)	Net revenue without SAVR	Additional revenue from SAVR	Additional revenue from SAVR per planted surface
	F_1	G_1	$H_1=(G_1-F_1)\times S_1$	F_2	$H=H_1+H_2+H_3+H_4$	$H_2=(G_2-F_2)\times S_2$
1	15,000	20,000	2,000,000	60,000	22,690,000	19,440,000
2	14,850	20,000	4,120,000	59,400	30,650,600	23,673,600
3	14,702	20,000	6,358,200	58,806	43,715,905	30,019,680
4	14,554	20,000	8,712,824	58,218	59,258,099	38,053,854
5	14,409	20,000	11,182,120	57,636	78,441,044	48,222,269
6	14,265	20,000	13,764,358	57,059	99,367,378	58,644,806
7	14,122	20,000	16,457,834	56,489	116,576,928	65,356,619
8	13,981	20,000	19,260,863	55,924	129,527,882	66,195,478
9	13,841	20,000	22,171,787	55,365	150,789,876	67,025,948
10	13,703	20,000	22,670,069	54,811	161,154,489	67,848,113
	143,427	200,000		573,708	892,172,200	

Table 4: Additional revenues (benefits) from SAVR (Continued)

	POTATO			FRUIT TREES			Total crops
Year	Net revenue without SAVR	Net revenue with SAVR	Additional revenue from SAVR per planted surface	Net revenue without SAVR	Net revenue with SAVR	Additional revenue from SAVR per cumulated planted surface	Additional revenue from SAVR
	F_3	G_3	$H_1=(G_3-F_3) \times S_3$	F_4	G_4	$H_4=\sum_n \{(G_4-F_4) \times S_4\}_n + \{(G_4-F_4) \times S_4\}_{n-1}$	$H=H_1+H_2+H_3+H_4$
1	21,000	26,000	1,250,000	-	-	-	22,690,000
2	20,790	26,000	2,605,000	140	500	252,000	30,650,600
3	20,582	26,000	4,063,425	700	5,000	3,274,600	43,715,905
4	20,376	26,000	5,623,721	2,100	7,000	6,867,700	59,258,099
5	20,173	26,000	7,284,355	3,500	10,000	11,752,300	78,441,044
6	19,971	26,000	9,043,813	7,000	15,000	17,914,400	99,367,378
7	19,771	26,000	9,343,375	10,500	20,000	25,419,100	116,576,928
8	19,573	26,000	9,639,942	14,000	25,000	34,431,600	129,527,882
9	19,378	26,000	9,933,542	14,000	30,000	51,658,600	150,789,876
10	19,184	26,000	10,224,207	14,000	30,000	60,412,100	161,154,489
	200,798	260,000		65,940	142,500		892,172,200

Table 5: Cost benefit analysis for all crops under SAVR

Year	Added revenue from all crops under SAVR (USD)	Total costs (USD)	Discounted benefit for SAVR (USD)
n	$H= H_1+H_2+H_3+H_4$	E	$I= (H-E)/ (1+0.06)^n$
1	22,690,000	6,395,000*	15,372,642
2	30,650,600	2,090,000	25,418,832
3	43,715,905	2,115,000	34,928,922
4	59,258,099	2,151,250	45,233,973
5	78,441,044	2,201,563	56,970,575
6	99,367,378	2,401,875	68,356,853
7	116,576,928	2,494,063	75,871,621
8	129,527,882	2,544,063	79,671,220
9	150,789,876	2,594,063	87,716,875
10	161,154,489	2,594,063	88,539,314
NPV			578,080,827

(*) Additional USD 4,450,000 are added to the first year as cost for measures.

Annexes

Cost Benefit Analysis for GAP

Table 1: Cumulated expansion of areas of grapevine production under GAP

Year	Farmer GAP cost (USD/ha) over 10 years	Grapevine area under GAP (ha) over 10 years	GAP cost per total area under GAP over 10 years
n	B	A	$C_n = A_n*B_n + \sum_n\{(A_n - A_{(n-1)})*B_{(n-1)} + A_{(n-1)}*B_n\}$
1	2,650	200	530,000
2	-350	400	460,000
3	600	600	460,000
4	4,550	800	1,300,000
5	-450	1,000	1,210,000
6	-450	1,200	1,120,000
7	-450	1,400	1,030,000
8	-450	1,600	940,000
9	-450	1,800	850,000
10	-450	2,000	760,000
NPV			8,660,000

Table 2: Public expenditures for the transfer and diffusion of GAP

GAP cost	Public expenditure (USD)
Research and development	250,000
Training of trainers	20,000
Information dissemination strategy	5,000
Awareness campaign	50,000
Total	325,000

Annexes

Table 3: Additional revenues from GAP deployment on table grape production over a period of 10 years

Year	Revenue without GAP (USD/ha)	Revenue with GAP per farmer (USD/ha)	Additional revenue from GAP (USD/ha)	Additional revenue from GAP for total area under GAP (USD)	Additional net benefit per total area under GAP over 10 years (USD)
n	D	E	F =(E-D)	G=F*A	H=G-C
1	9,000	22,500	10,850	4,500,000	3,970,000
2	8,910	22,500	13,940	9,000,000	8,540,000
3	8,821	22,500	14,029	13,500,000	13,040,000
4	8,733	22,500	9,217	18,000,000	16,700,000
5	8,645	22,500	14,305	22,500,000	21,290,000
6	8,559	22,500	14,391	27,000,000	25,880,000
7	8,473	22,500	14,477	31,500,000	30,470,000
8	8,389	22,500	14,561	36,000,000	35,060,000
9	8,305	22,500	14,645	40,500,000	39,650,000
10	8,222	22,500	14,728	45,000,000	44,240,000
Total	86,056	225,000	135,144	247,500,000	238,840,000

Table 4: Cost benefit analysis for table grape production under GAP

Year	Additional revenue from GAP for total area under GAP (USD)	GAP cost per total area under GAP over 10 years (USD)	Discounted benefit for GAP (USD)
n	G	C	$I= (G-C)/ (1+0.06)^n$
1	4,500,000	855,000*	3,245,283
2	9,000,000	460,000	7,600,570
3	13,500,000	460,000	10,948,635
4	18,000,000	1,300,000	13,227,964
5	22,500,000	1,210,000	15,909,127
6	27,000,000	1,120,000	18,244,379
7	31,500,000	1,030,000	20,264,290
8	36,000,000	940,000	21,997,078
9	40,500,000	850,000	23,468,774
10	45,000,000	760,000	24,703,385
NPV			159,802,881

(*) The cost of public expenditure (USD 325,000) is added to the costs of the first year.

Annexes

Annex VII: Cost Benefit Analysis for the Technologies of the Water Sector

Cost Benefit Analysis for RWHR

Table 1: Calculation for water harvesting quantities per 1km of road with a minimal slope of 5%

Road length (m):	A	1,000
Width of road (m):	B	6
Precipitation (m):	C	0.80
Active rainfall (m):	D= C x 0.8	0.64
Total amount of water/1000m road (m^3)	E= D x A x B	3,840
Additional runoff (50%) from upper catchment to the road (m^3)	F= E x 1.5	5,760
Lost in evaporation in hill lake		15%
Total available water/1000m road (m^3)	G= F x 0.85	4,896

Table 2: Costs of the measures for the deployment of RWHR

Measure	USD/ Unit		Private/Public costs (USD)	Public costs (USD)
			K_1	K_2
Redesign roads and integrate drainage system for water collection (USD/m)	25	H= 10 x A	25,000	
Construction of earth/hill lakes (USD/m^3)	8	I= 8 x F	46,080	
Construction of decantation unit, sieves and filters installation (USD/unit)	2,500	J= 1,500	2,500	
Establishment of water distribution system (vehicle with a cistern)	40,000		40,000	
Regulations for road design, water quality				10,000
Institutional arrangements				5,000
Awareness raising and information transfer				5,000
Installation of a financial mechanism				5,000
Total			112,480	25,000

Table 3: Benefit from RWHR in terms of revenues from increased crop production according to the available water

Year	Annual crop produced (t)	crop price (USD/t)	Revenue (USD)
n	L = (G x 24.5)/6000*	M	O= L x M
1	20	800	16,000
2	20	800	16,000
3	20	800	16,000
4	20	800	16,000
5	20	800	16,000
6	20	800	16,000
7	20	800	16,000
8	20	800	16,000
9	20	800	16,000
10	20	800	16,000
Total			160,000

(*) We assume that 6000m3 /ha produce 24.5/ha of crops.

Annexes

Table 4: Cost benefit analysis for RWHR

Year	Revenues (USD)	Costs	Discounted benefits
n	O	$K = K_1+K_2$	$P= (O-K)/(1+0.06)^n$
1	16,000	137,480	-114,604
2	16,000	400	13,884
3	16,000	400	13,098
4	16,000	400	12,357
5	16,000	400	11,657
6	16,000	400	10,997
7	16,000	400	10,375
8	16,000	400	9,788
9	16,000	400	9,234
10	16,000	400	8,711
11	16,000	400	8,218
12	16,000	400	7,753
13	16,000	400	7,314
14	16,000	400	6,900
NPV			15,681

Annexes

Cost Benefit Analysis for RWHG

Table 1: Calculation for water harvesting quantities per greenhouse, water demand per crop/altitude combination

		High demanding crop at sea level	Low demanding crop at 500m altitude
Greenhouse area (m^2)	A	400.00	400.00
Precipitation (m)	B	0.65	1.10
Active harvested rainfall (m)	C	0.6	1.0
Harvested rain/ greenhouse top	D= C x A	234.00	400.00
Crop water demand (GH/year/m^3)	E= (crop-climate demand/10000) x A x 2*	440.00	360.00
Irrigation requirement	F	550.00	400.00
Water to import (m^3)	G= F-D	316.00	0.00
% of water demand covered	D/F	43%	100%

(*) Crop-climate demand is estimated to 5500m^3/ha at sea level for a high demanding crop and 4500m^3/ha at 500m altitude for a low demanding crop. Since 2 cropping seasons are achieved, these figures are multiplied by 2.

Table 2: Costs for the deployment of RWHR

Measures	USD/Unit	
Cost of 1m^3 stored water in earth reservoir (USD)	16	H
Establishment of water drainage system and linkage to storage unit (USD)	1,200	I
Cost of pumping (USD/ 1000 m^3)	1,833	J
Surface water annual cost	100	K
Annual rental of the land occupied by earth reservoir (USD/m^2)	1	L

Table 3: Cost variation among different water source scenarios for one greenhouse

year	RWHG (100%) (USD)	RWHG (43%) + surface (USD)	RWHG (43%) + pumping (USD)	Groundwater (100%) (USD)
n	$M_1 = (D_1/2) \times H + I + L_1$	$M_2 = (D_2/2) \times H + I + L_2 + K$	$M_3 = (D_3/2) \times H + I + L_3 + (G \times J/1000)$	$M_4 = F \times J/1000$
1	4,460	3,260	3,639	1,008
2	60	140	619	1,008
3	60	140	619	1,008
4	60	140	619	1,008
5	60	140	619	1,008
6	60	140	619	1,008
7	60	140	619	1,008
8	60	140	619	1,008
9	60	140	619	1,008
10	60	140	619	1,008
Total	5,000	4,580	9,273	10,083

Table 4: Cost benefit analysis among different water source scenarios for one greenhouse

		RWHG (100%)		RWHG (43%) + surface		RWHG (43%) + pumping		100% pumping	
year	Benefits (USD)	Cost (USD)	Discounted benefits (USD)	Cost	Discounted benefits	Cost	Discounted benefits	Cost	Discounted benefits
n	O	M_1	$P_1 = (O-M_1)/(1+0.06)^n$	M_2	$P_2 = (O-M_2)/(1+0.06)^n$	M_3	$P_3 = (O-M_3)/(1+0.06)^n$	M_4	$P_4 = (O-M_4)/(1+0.06)^n$
1	3,200	4,460	-1,189	3,260	-57	3,639	-471	1,008	2,068
2	3,200	60	2,795	140	2,723	619	2,297	1,008	1,951
3	3,200	60	2,636	140	2,569	619	2,167	1,008	1,840
4	3,200	60	2,487	140	2,424	619	2,044	1,008	1,736
5	3,200	60	2,346	140	2,287	619	1,928	1,008	1,638
6	3,200	60	2,214	140	2,157	619	1,819	1,008	1,545
7	3,200	60	2,088	140	2,035	619	1,716	1,008	1,458
8	3,200	60	1,970	140	1,920	619	1,619	1,008	1,375
9	3,200	60	1,859	140	1,811	619	1,527	1,008	1,297
10	3,200	60	1,753	140	1,709	619	1,441	1,008	1,224
NPV			18,960		19,578		16,088		16,131

Annexes

Cost Benefit Analysis for WUA

Table 1: Costs for the measures for deployment of WUA

Measures	Cost (USD)
Awareness campaign at social level	50,000
Lobbying, capacity building, awareness at decision maker's level	20,000
Law revision, law amendments, creation of a water act	50,000
Introducing WUA in university curricula	10,000
Studies for alternative funding mechanism	10,000
Cost of infrastructure for 5000ha of irrigated areas (schemes)	900,000
Total	1,040,180

Table 2: Estimated additional annual revenue from the deployment of WUA

Yield improvement	Actual yield (t/ha)	Yield increase due to WUA (t/ha)	Crop value (USD/t)	Increased revenue due to WUA (USD/ha)	Increase revenue for 5000ha under WUA (USD)
A	B	C = A x B	D	E = C x D	F = 5000 x E
15%	30	4.5	800	3,600	4,000,000