

Enabling PV Afghanistan & Suitable Business Models

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German Solar Association: who we are



TASK To represent the solar industry in Germany in the thermal, photovoltaic and storage sector

VISION A sustainable global energy supply provided by solar (renewable) energy

ACTIVITIES Lobbying, political advice, public relations, market observation, standardization

EXPERIENCE Active in the solar energy sector for over 30 years

REPRESENTS More than 800 solar producers, suppliers, wholesalers, installers and other companies active in the solar business from all over the world

HEADQUARTERS Berlin

Enabling PV



- “Enabling PV” gives first guidance to project developers who want to deploy the technologies with all the quality and efficiency standards that are available. It describes the processes for investments and project development
- By these means, the project establishes a long-term cooperation with solar energy companies and the respective industry association
- Enabling-PV-projects developed by BSW so far:



Enabling PV in the MENA Region
The Emerging PV Market in Jordan



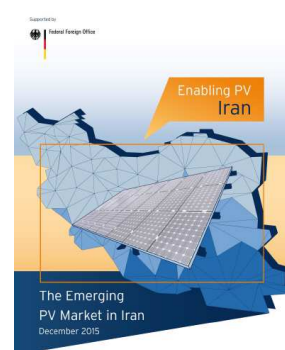
Jordan



Enabling PV dans la région MENA
Analyse du marché solaire photovoltaïque en Tunisie



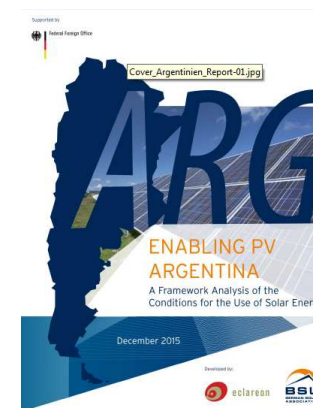
Tunisia



The Emerging
PV Market in Iran
December 2015



Iran



ENABLING PV
ARGENTINA
A Framework Analysis of the
Conditions for the Use of Solar Energy

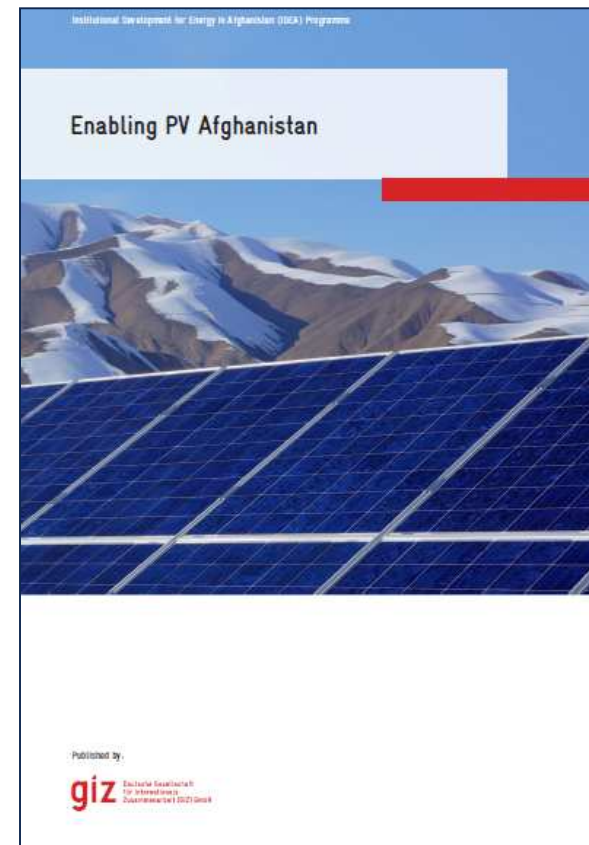


Argentina

Enabling PV Afghanistan



- Duration: December 2016 – December 2017
- On behalf of the GIZ
- Partner: Afghanistan Renewable Energy Union (AREU)
- Publication of the study: June 2017



Online available: [link](#)

Agenda

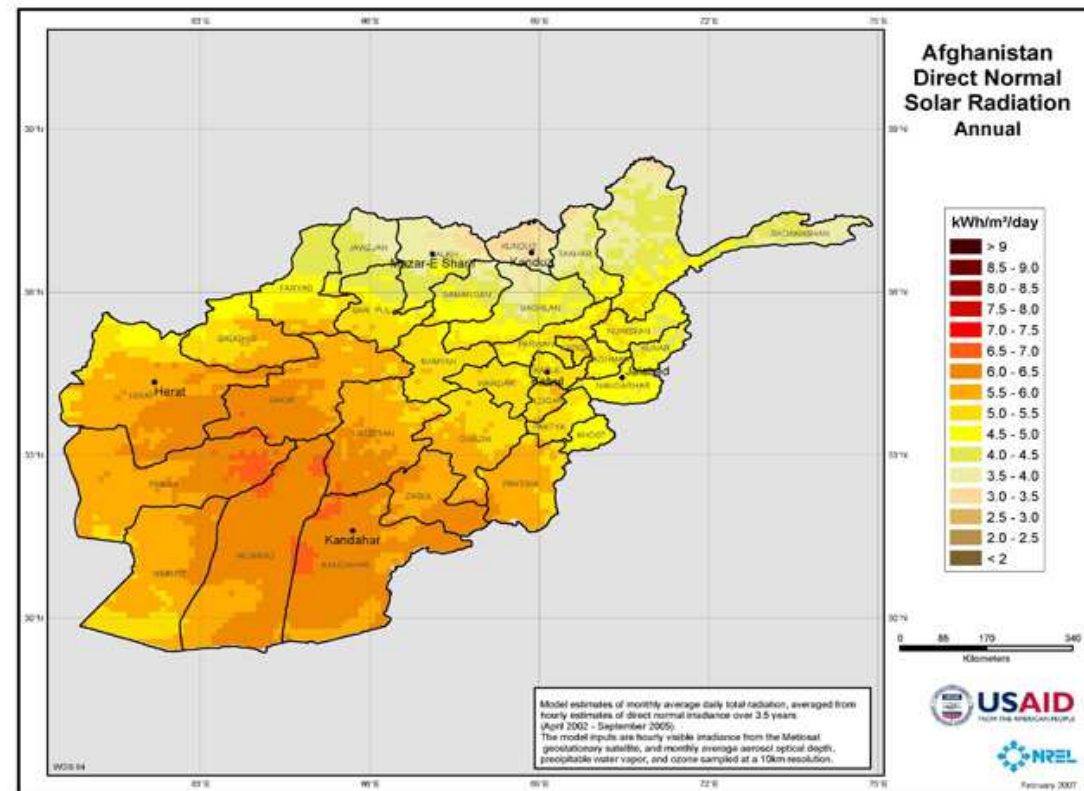


- Reasons why to invest in Afghan PV market
- Business models for PV in Afghanistan
 - 1. Off-grid project:**
 - 400 kW PV-Diesel hybrid plant with battery support
 - 2. Rooftop Net-Metering project:**
 - 100 kW commercial plant in an urban area
 - 3. PPA project:**
 - 5 MW ground-mounted PV plant connected to the grid
- Conclusions

High potential and suitable conditions for PV development



- Average Solar Insolation of 6.5 kWh/m²/day
- 300 Sunny days per year
- According to the MEW, the estimated renewable energy potential is 300 GW, including **222 GW of solar energy**



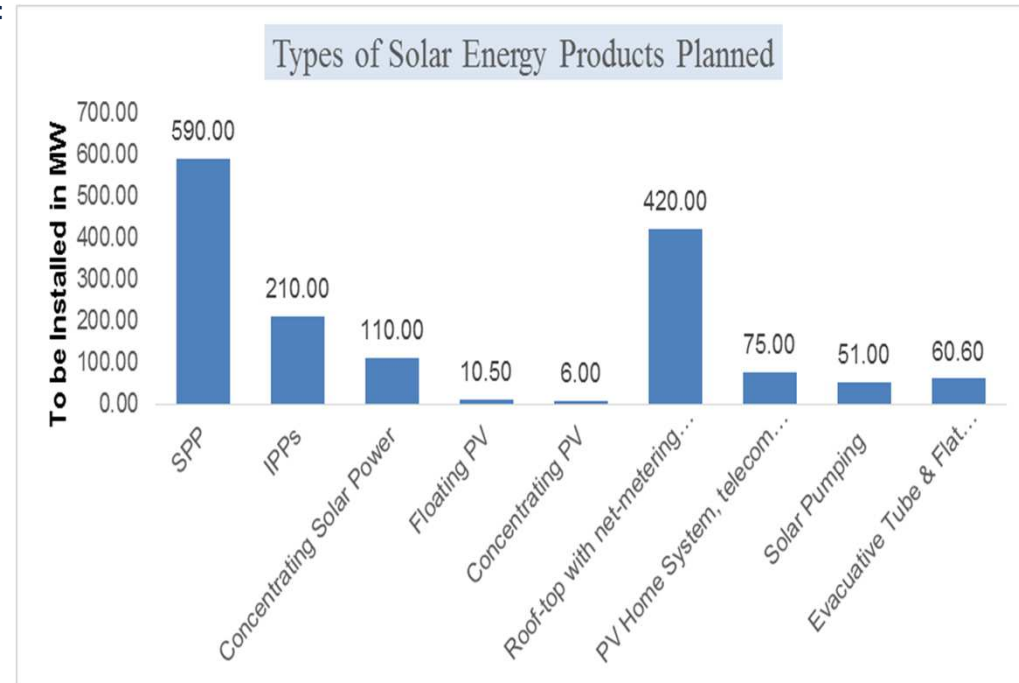
Supporting regulatory framework: The Government plans to install 1.5GW by 2032



- Total 1.5 GW as per road map of MEW till 2032
 - 900 MW PV on-grid
 - 600 MW PV off-grid

Additionally:

- ASERD projects for rural electrification total 7.850MW
- Kabul Rooftop 15MW



Projected solar energy share in Afghanistan by 2032

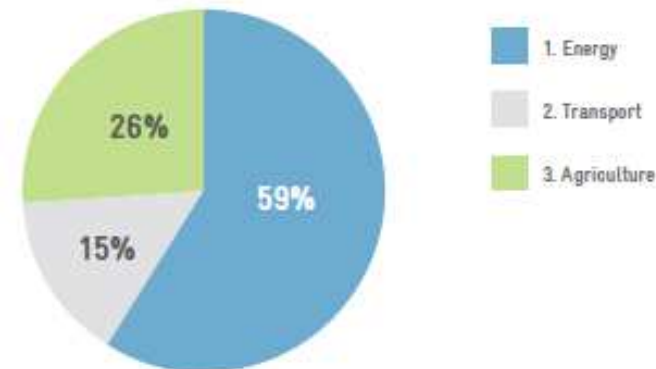
Nevertheless, AREU estimates a higher PV share to cover the electricity demand in 2032 with 3.3 GW

International funding available



- Asian Development Bank (ADB)
- Afghan Credit Guarantee Foundation (ACGF)
- International Finance Corporation (Incl. Microcredits) and the World Bank

Asian Development Fund allocation
2016 - 2018 = \$ 507 million





Business models for PV in Afghanistan: Off-grid projects

Project Overview: PV-Diesel hybrid project with battery in an off-grid location with a PPA tariff and investment subsidy



PV Project			
PV System Size	kWp		400
Specific System Cost	AFN/kWp		267.000
Additional CapEx (e.g. Batterie)	AFN		-
Investment Subsidy	60%	AFN	64.080.000
Total System Cost	AFN		42.720.000
Fixed Operation Costs	AFN p.a.		450.700
Variable Operation Costs	AFN/kWh		-

PV Generation			
Specific Yield	kWh/qm/a		2.000
Performance Factor	%		80%
Specific System Performance	kWh/kWp/a		1.600
Degradation	% p.a.		0,70%

Investment			
Project Duration	Years		20
Equity	AFN		34.176.000
Debt (Gearing)	-	AFN	-
Loan Tenor	Years		-
Interest Rate	%		-
Inflation Rate	%		4,5%

PV Business Model			
Category	Share	Unit	Price
Feed-in Tariff	-	AFN/kWh	-
Self-consumption	-	AFN/kWh	-
Fees		AFN/kWh	-
Net-metering	-	AFN/kWh	-
Fees		AFN/kWh	-
Excess Electricity		AFN/kWh	-
PPA Tariff	95%	AFN/kWh	10,00
Fees		AFN/kWh	-
Overysupply Price		AFN/kWh	-
Undersupply Penalty		AFN/kWh	-

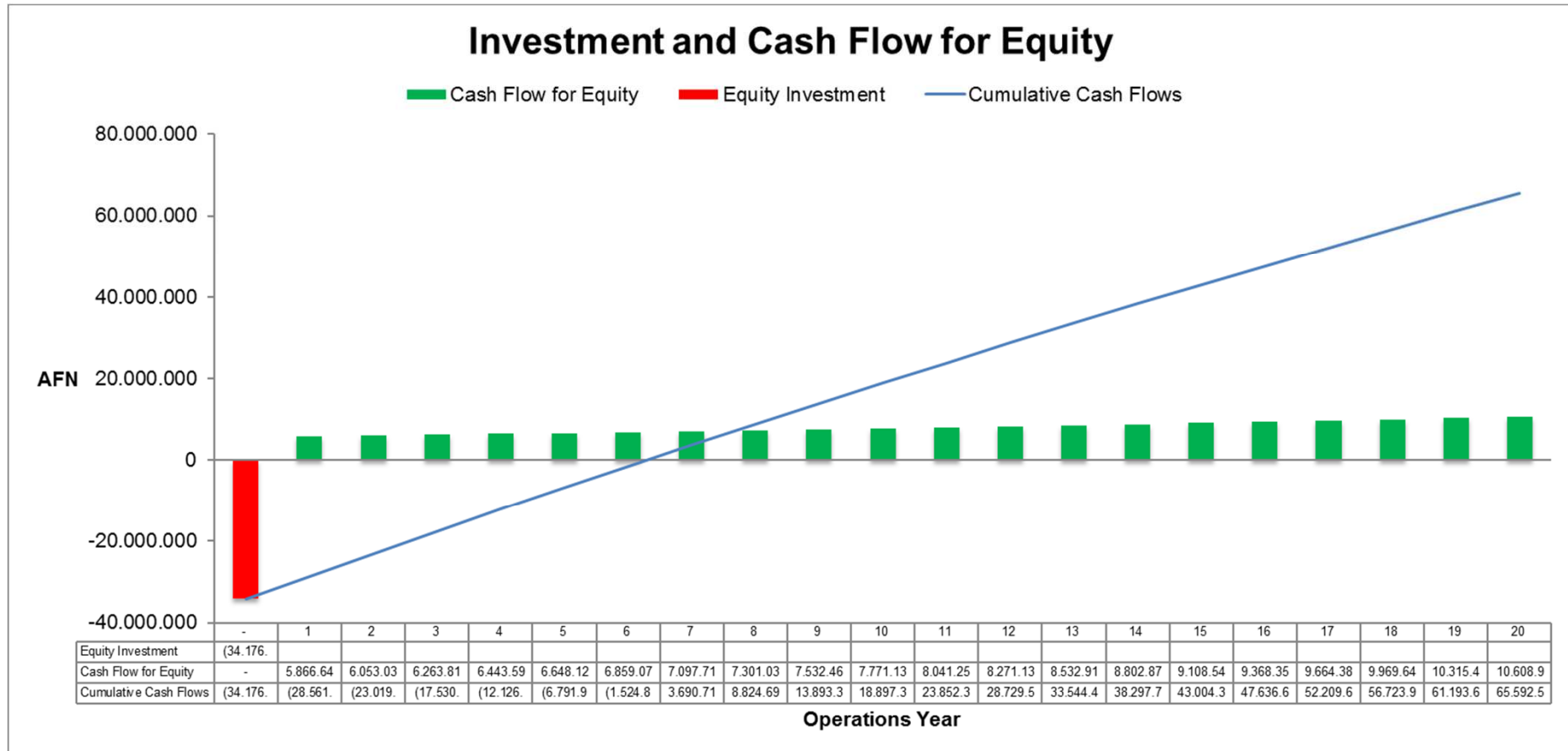
Results			
Net-Present Value	AFN		64.964.014
Project IRR	%		19,13%
Equity IRR	%		19,13%
Payback Period	Years		6,29
LCOE* (w/o subsidy)	AFN/kWh		13,71
LCOE (w subsidy)	AFN/kWh		5,52
Min DSCR**	x		-
Min LLCR***	x		-

* LCOE: Levelized Cost of Electricity

** DSCR: Debt Service Coverage Ratio

*** LLCR: Loan Life Coverage Ratio

Due to the high investment subsidy payback of equity investment is achieved after 6 years only





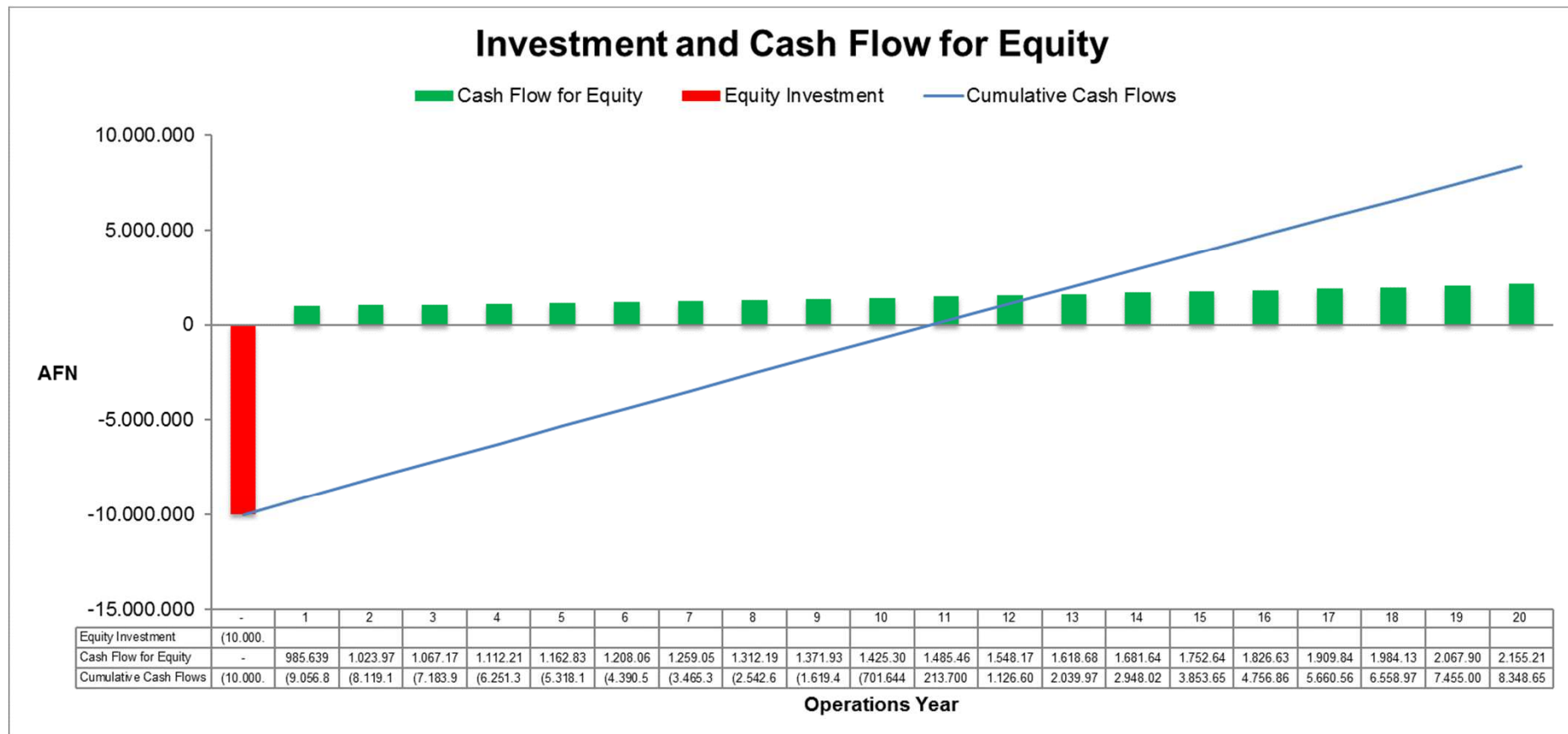
Business models for PV in Afghanistan: Rooftop projects

Project Overview: Commercial net-metering project on a roof-top in an urban area with less solar irradiation compared to the PPA example



PV Project			PV Business Model			
PV System Size	kWp	100	Category	Share	Unit	Price
Specific System Cost	AFN/kWp	100.000	Feed-in Tariff	-	AFN/kWh	-
Additional CapEx (e.g. Batterie)	AFN	-	Self-consumption	-	AFN/kWh	-
Investment Subsidy	AFN	-	Fees		AFN/kWh	-
Total System Cost	AFN	10.000.000	Net-metering	60%	AFN/kWh	12,50
Fixed Operation Costs	AFN p.a.	150.000	Fees		AFN/kWh	-
Variable Operation Costs	AFN/kWh	-	Excess EI.	40%	AFN/kWh	-
PV Generation			Results			
Specific Yield	kWh/qm/a	1.800	Net-Present Value		AFN	8.192.594
Performance Factor	%	80%	Project IRR		%	11,31%
Specific System Performance	kWh/kWp/a	1.440	Equity IRR		%	11,31%
Degradation	% p.a.	0,70%	Payback Period		Years	10,77
Investment			LCOE* (w/o subsidy)		AFN/kWh	7,38
Project Duration	Years	20	LCOE (w subsidy)		AFN/kWh	7,38
Equity	AFN	10.000.000	Min DSCR**		x	-
Debt (Gearing)	-	AFN	Min LLCR***		x	-
Loan Tenor	Years	-	* LCOE: Levelized Cost of Electricity			
Interest Rate	%	-	** DSCR: Debt Service Coverage Ratio			
Inflation Rate	%	4,5%	*** LLCR: Loan Life Coverage Ratio			

Equity Cash Flow: Payback is achieved in year 10 dependent on commercial electricity prices and the remuneration for excess electricity.





Business models for PV in Afghanistan: Large scale PPA

Project Overview: Grid connected small to medium-sized ground-mounted system in a location with high solar irradiation.



PV Project		
PV System Size	kWp	5.000
Specific System Cost	AFN/kWp	84.000
Additional CapEx (e.g. Batterie)	AFN	-
Investment Subsidy	AFN	-
Total System Cost	AFN	420.000.000
Fixed Operation Costs	AFN p.a.	6.323.500
Variable Operation Costs	AFN/kWh	-

PV Generation		
Specific Yield	kWh/qm/a	2.000
Performance Factor	%	80%
Specific System Performance	kWh/kWp/a	1.600
Degradation	% p.a.	0,70%

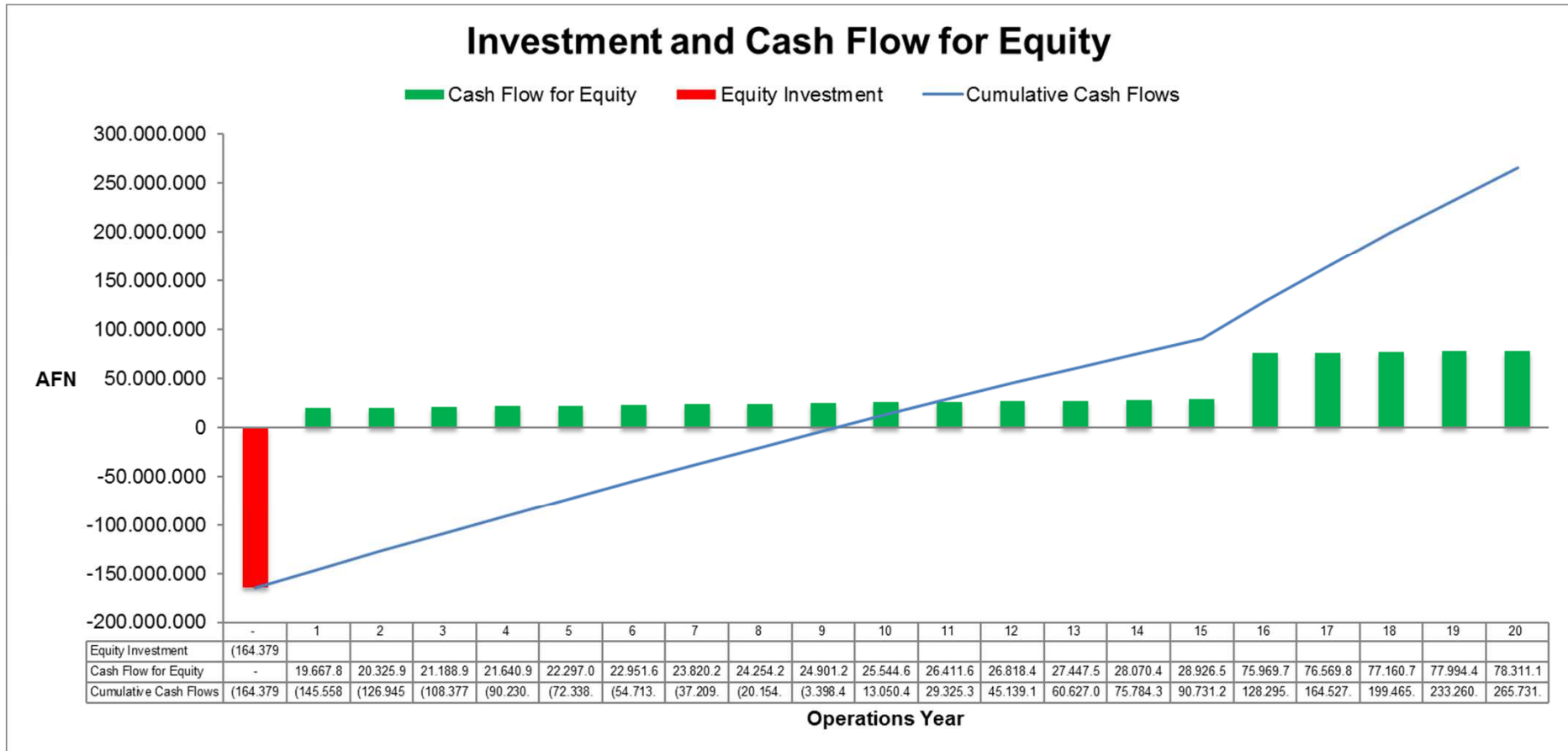
Investment		
Project Duration	Years	20
Equity	AFN	164.379.490
Debt (Gearing)	70%	AFN 294.000.000
Loan Tenor	Years	15
Interest Rate	%	13,5%
Inflation Rate	%	4,5%

PV Business Model			
Category	Share	Unit	Price
Feed-in Tariff	-	AFN/kWh	-
Self-consumption	-	AFN/kWh	-
Fees		AFN/kWh	-
Net-metering	-	AFN/kWh	-
Fees		AFN/kWh	-
Excess Electricity		AFN/kWh	-
PPA Tariff	100%	USD/kWh	0,085
USD Inflation Rate		%	2%
Viability Gap		USD/kWh	0,047

Results		
Net-Present Value	AFN	248.522.325
Project IRR	%	12,55%
Equity IRR	%	13,61%
Payback Period	Years	9,21
LCOE* (w/o subsidy)	AFN/kWh	8,40
LCOE (w subsidy)	AFN/kWh	8,40
Min DSCR**	x	1,42 x
Min LLCR***	x	1,49 x

* LCOE: Levelized Cost of Electricity
 ** DSCR: Debt Service Coverage Ratio
 *** LLCR: Loan Life Coverage Ratio

Payback of equity investment is achieved in year 9 only due to ongoing debt service in the first 15 years.



Conclusions



- The Afghan PV market shows a massive potential, do not miss it out
- At the current stage of the Afghan PV market donor-based projects seem most attractive
- There is a potential of a more mature – and considerably larger – PV market if
 - systems prices and particularly custom duties for PV systems are reduced;
 - guarantees are provided for reducing the interest rates on project loans;
 - (in case of net metering projects) electricity prices are adjusted.



Thank you for your attention

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