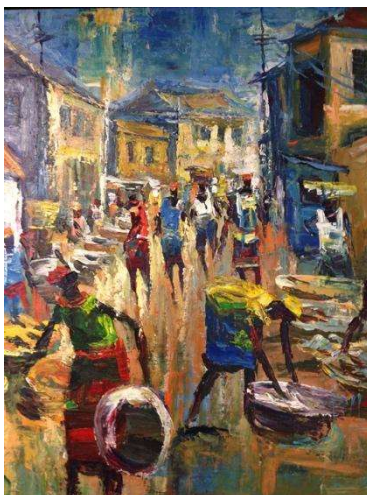


Currency Risk and Mitigation Strategies For the Off-Grid Energy Sector



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November 2015

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Background

The fastest growing businesses in the off-grid (or beyond the grid) energy sector are companies that offer their customers solar home systems either on a rent-to-own or pure rental basis. We refer to these businesses as Distributed Energy Services Companies, or DESCOs.¹

DESCOs have grown rapidly over the last 5 years as the proliferation of mobile phone networks has enabled companies to control and manage thousands of distributed energy systems remotely and collect payments from as many customers effectively and efficiently.

The leading companies have provided close to 500,000 households with modern energy access at an affordable price; attracted millions of dollars in capital and created an estimated 5,000 full time equivalent jobs. The sector is on track to meet even the most optimistic projections and could conceivably reach millions more households by 2020.

For details on the business model and the key characteristics of a DESCO we refer to following articles by Persistent Energy:

- DESCO - A commercial approach to energy access, *June 2014*
- Financing DESCOs - A framework, *March 2015*
- Financing the DESCO S-Curve, *October 2015*

While the business model is increasingly well understood, a range of challenges related to executing such a model in difficult frontier markets remain. One large risk DESCOs face is currency risk.

This paper is a practical guide to typical currency risks and general mitigation strategies in the energy access sector. It is intended for Distributed Energy Services Companies (DESCOs), their equity investors and lenders. The paper is based on a seminar given on 29 October 2015 at the 2015 Lighting Global/GOGLA Conference in Dubai. The seminar was sponsored by responsAbility Investments AG ("responsAbility").

Accompanying this paper on our website is an excel spreadsheet with tools to analyze a company's currency risk and to calculate relative costs of borrowing in different currencies and using instruments to mitigate currency risk. These tools are for illustrative purposes only and neither responsAbility nor Persistent Energy Capital shall have any liability for any results they generate. Managing currency exposure is a highly sophisticated area. Accordingly, **we advise you to seek professional advice before engaging in currency risk mitigation transactions.**

¹ They are also referred to as pay-as-you-go or PAYG companies.

DESCOs are typically long emerging market currencies

DESCOs sell solar energy assets to their customers by providing such customers with a payment plan. These payment plans can be as short as a year (lease finance model) or they can be perpetual (pure lease model). The result for purposes of this discussion is the same in that a DESCO's main asset is the present value of its expected customer payments. Because these payments are made in local currency (LCY), they represent a local currency asset on the DESCO's balance sheet until they are either repaid or have been sold in a securitization or similar transaction².

At the same time, DESCOs have only one natural local currency liability, the present value of their operating costs.

The asset and liability balance of a DESCO that has sold 25,000 solar home systems at an average price of \$500 to its customers could look very similar to the summary below:

Table 1: Simplified Balance of Assets and Liabilities in a DESCO

t = 0; August 15, 2015

Assets [Present value cash in-flow]	USD denom.	LCY denom.	Note
Cash	200		
Inventory incl. good in transit	1,563		1
<i>Present value of contractual revenue</i>		7,915	2
Liabilities [Present value of cash out-flow]			
Working capital facility	2,344		3
Consumer finance loan	5,541		4
<i>Present value of operating costs</i>		1,500	5
Equity	293		
Net position (short) / long LCY		6,415	

Notes:

All in USD '000s

While the numbers above are examples only, they are realistic for a DESCO of such scale.

- 1 *[inventory value = 50% * 25k * 6mth/12mth * \$250 per system] Assuming a 50% growth rate per year, a 6-mth inventory turn over, \$250 landed cost*
- 2 *[PV = 25k systems * monthly payment discounted to today] Assuming a 15% local interest rate, a 36-mth pay plan, and a total price of \$500*
- 3 *150% of inventory*
- 4 *~70% of PV of contractual revenue*
- 5 *Estimate for operational cost*

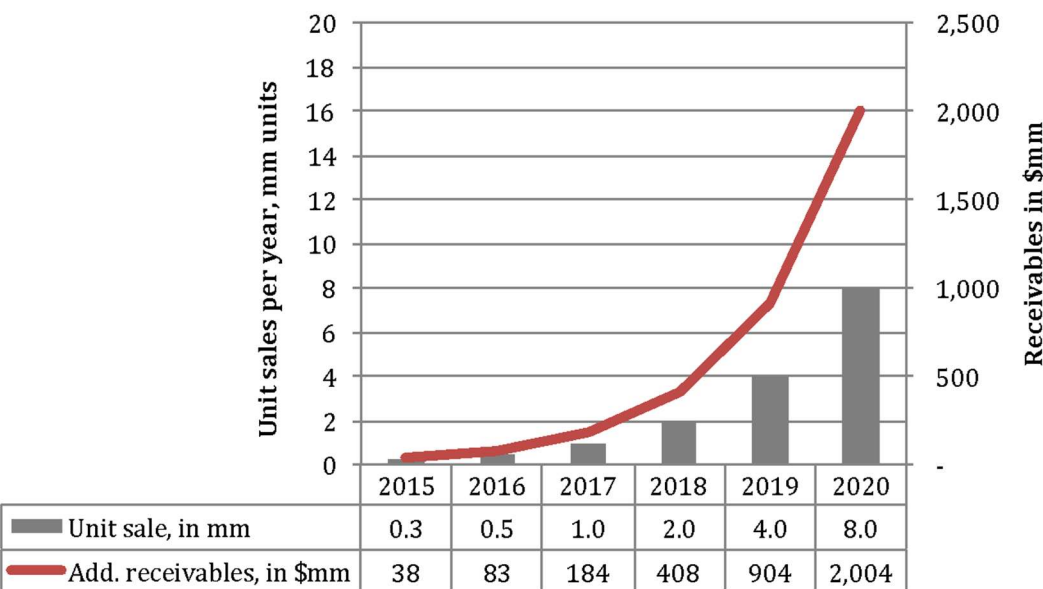
² Securitization is a scalable way to finance receivables and deal with a large part of a DESCO's currency exposure. Many DESCOs and their advisors are currently working on securitization programs.

The FX exposure can grow quickly

We estimate that cumulatively by the end of 2015 DESCOs will have sold or leased about 500,000 solar home systems. Of these, 250,000 will have been sold in 2015. Assuming the average remaining receivable value of pay-plans related to these systems is \$150, the sector collectively will have created a local currency asset worth \$37.5m in 2015.

Consider a scenario of 100% year-over-year growth in the sector over the next 5 years. This would mean that 8m new systems would be sold in 2020 alone. If the average system price to the customer would grow to \$250 from \$150 over this period, the sector would add receivables worth about \$2bn USD in 2020.

Figure 1: Growth of LCY denominated receivables created per year given a 100% YoY sector growth



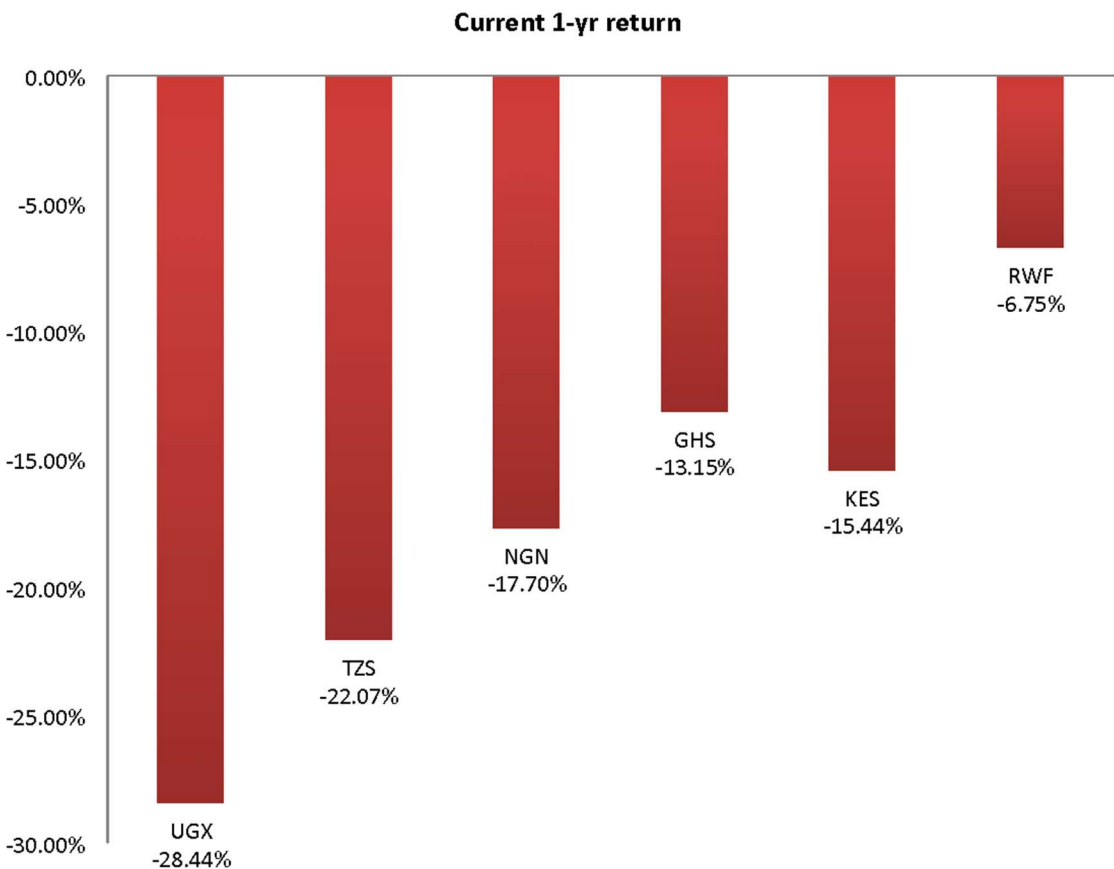
Net FX positions pose a significant risk

We have seen above that DESCOS are typically long local currencies; i.e. DESCOS have a net positive balance of assets which are denominated in local currency. These assets would lose value in USD terms if the local currency loses value against the dollar.

Local currencies can lose value quickly

All local currencies in sub-Saharan Africa have lost value relative to the USD over the past year.

Figure 2: 1-year currency devaluation (FX return) as of September 30th of 6 LCY currencies against the USD



Source: Bloomberg.

Notes: FX Return = $\text{USDLCY}(t_0 = 9/30/14) / \text{USDLCY}(t_1 = 9/30/15) - 1$;
[for example: GHS: $-13.15\% = 3.2761 / 3.7722 - 1$]

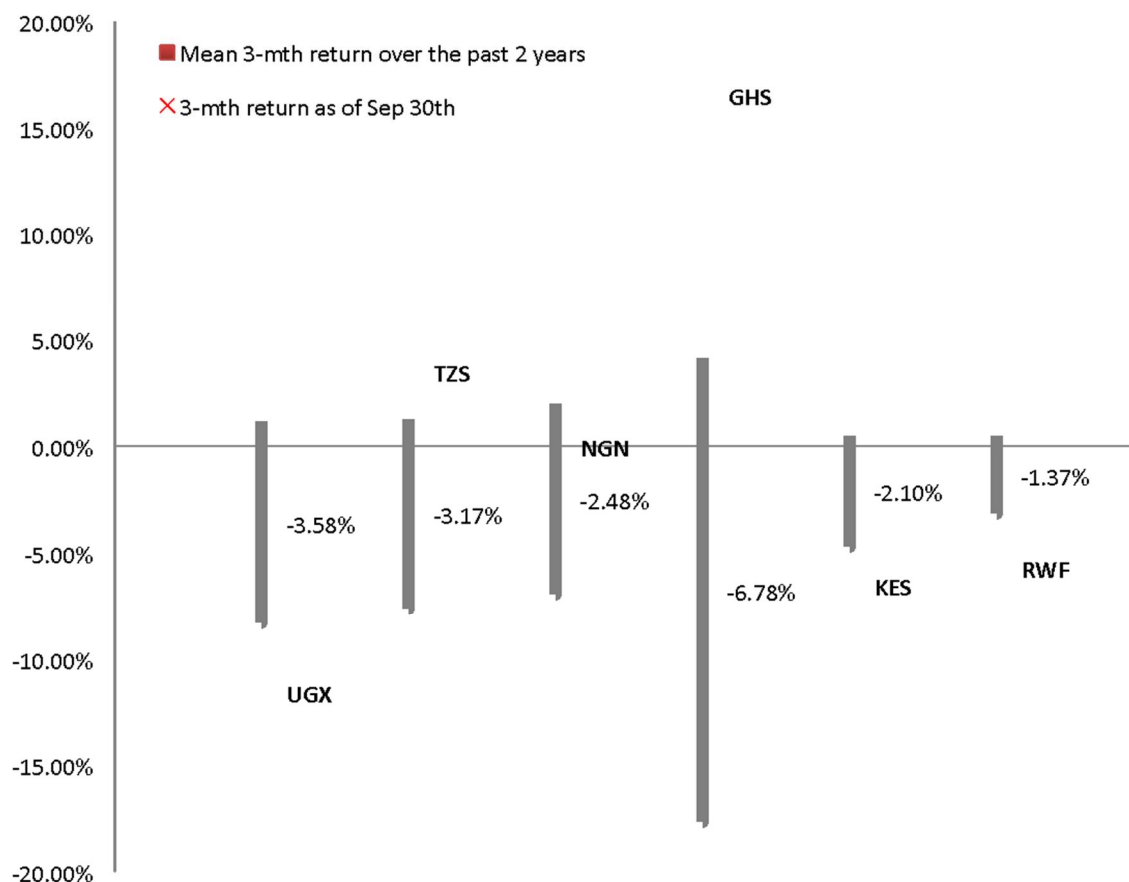
But this directional trend provides an incomplete picture.

Local currencies are volatile

The chart below plots the average 3-mth return³ (red dot) and the standard deviation of these returns (grey error bars). It also provides most recent 3-mth return, i.e. the return between 30-June and 30-September 2015 (red cross).

The Ghanaian Cedi in particular has exhibited significant amounts of volatility. While the average return may have appeared relatively benign, and the most recent return has even be positive - the volatility of the returns in the Cedi has been twice as large as all other currencies.

Figure 3: 3-month returns as of September 30th versus average 3-month returns over the past two years - and the standard deviation over 3-months returns



Notes:

1. The grey bars reflect the standard deviation of 3-month returns.
2. Analyzing and interpreting rates is tricky business. There are many different ways to create a perspective on a currency's return and the volatility of such returns. We believe the chart above gives a very good summary of currencies' relative performance. (Included with this article is an excel tool to replicate the chart.)
3. The grey standard deviation bar shows where one would expect that 68% of future returns would be. (There are alternative ways to estimate a currency's expected 'uncertainty' range, see also:

³ "FX Return" is the percent loss/gain of a USD converted into local currency at t=0 and converted from local currency back to USD at t=1. It is equal to the devaluation / valuation gain of the local currency against the dollar.

http://www.investopedia.com/articles/basics/09/simplified-measuring-interpreting-volatility.asp?adtest=article_page_v12_v1

4. The results will vary depending on the period over which the return is measured (here we use the daily measurement of the 90-day return) and the period over which we calculate the average realized 90-day return (here we use 200 days of 90-day returns).

The impact of currency movements on a DESCO with local currency exposure

If the business carries a net exposure to the local currency, then any change in the exchange rate would affect its USD enterprise value.

The change in the USD denominated enterprise value is equivalent to the product of the net currency position and the currency return. This also means that the balancing position in the simplified analysis below is the USD denominated equity value.

$$\Delta \text{enterprise value} = \text{net currency position} \times \text{exchange rate return}$$

In our example:

$$\Delta \text{enterprise value} = \$6.4 \times (-3.88\%) = \$0.25m$$

Table 2: Impact of a 1-mth currency devaluation on a DESCO

t = 0; August 15, 2015

Assets [Present value cash in-flow]	USD denom.	LCY denom.	Note
Cash	200		
Inventory incl. good in transit	1,563		1
<i>Present value of contractual revenue</i>		7,915	2
Liabilities [Present value of cash out-flow]			
Working capital facility	2,344		3
Consumer finance loan	5,541		4
<i>Present value of operating costs</i>		1,500	5
Equity	293		
Net position (short) / long LCY		6,415	

KESUSD exchange rate 9/15/15	t=0	100.95
KESUSD exchange rate 8/15/15	t=1	105.02
Return in %		-3.88%

t = 1, September 15, 2015

Assets [Present value cash in-flow]	USD	LCY	Note
Cash	200		
Inventory incl. good in transit	1,563		
<i>Present value of contractual revenue</i>		7,609	
Liabilities [Present value of cash out-flow]			
Working capital facility	2,344		
Consumer finance loan	5,541		
<i>Present value of operating costs</i>		1,442	
Equity	45		
Net position (short) / long LCY		6,167	
Resulting loss		- 249	

Key assumptions

# Customers	25,000
Payplan term	36
Price of system	500
Cost of system	250
Growth rate	50%
Interest rate	15%
Operating cost per month	62,500

Notes:

All values are expressed in USD '000s; including the value of assets which are denominated in local currency [Column: "LCY denom."]

- 1 *[inventory value = 50% * 25k * 6mth/12mth * \$250 per system] Assuming a 50% growth rate per year, a 6-mth inventory turn over, \$250 landed cost*
- 2 *[PV = 25k systems * monthly payment discounted to today] Assuming a 15% local interest rate, a 36-mth payplan, and a total price of \$500*
- 3 *150% of inventory*
- 4 *~70% of PV of contractual revenue*
- 5 *Estimate for operational cost*

Don't risk it

Emerging market currencies can of course gain or lose value. A positive net currency position could also lead to a gain in enterprise value. But forecasting currency moves - not only the direction, but also the timing and the size of a move - is akin to betting on a number at a roulette table in a casino and is *not core to the business of the DESCO*. It seems therefore obvious that the main goal of FX risk management in a DESCO should be to minimize currency exposure.

In the following chapters we outline some basic options to manage a net currency position and provide a simple framework to understand the costs of such options.

Managing currency risk: It's simple - borrow locally

The simplest, and in effect the only, way to fully successfully manage currency risk is to match local currency denominated assets (customer pay-plans) with local currency liabilities (bank loan); in other words, borrow in local currency.

Table 3: The impact of borrowing locally on the asset and liability balance of a DESCO

Scenario A:

t = 0; August 15, 2015

Assets [Present value cash in-flow]	USD denom.	LCY denom.
Cash	200	
Inventory incl. good in transit	1,563	
<i>Present value of contractual revenue</i>		7,915
Liabilities [Present value of cash out-flow]		
Working capital facility	2,344	
Consumer finance loan	5,541	
<i>Present value of operating costs</i>		1,500
Equity	293	
Net position (short) / long LCY		6,415

Scenario B:

t = 0; August 15, 2015

Assets [Present value cash in-flow]	USD denom.	LCY denom.
Cash	200	
Inventory incl. good in transit	1,563	
<i>Present value of contractual revenue</i>		7,915
Liabilities [Present value of cash out-flow]		
Working capital facility	2,344	
Consumer finance loan in LCY	- - - - -	5,541
<i>Present value of operating costs</i>		1,500
Equity	293	
Net position (short) / long LCY		875

The cost of borrowing locally versus borrowing in USD

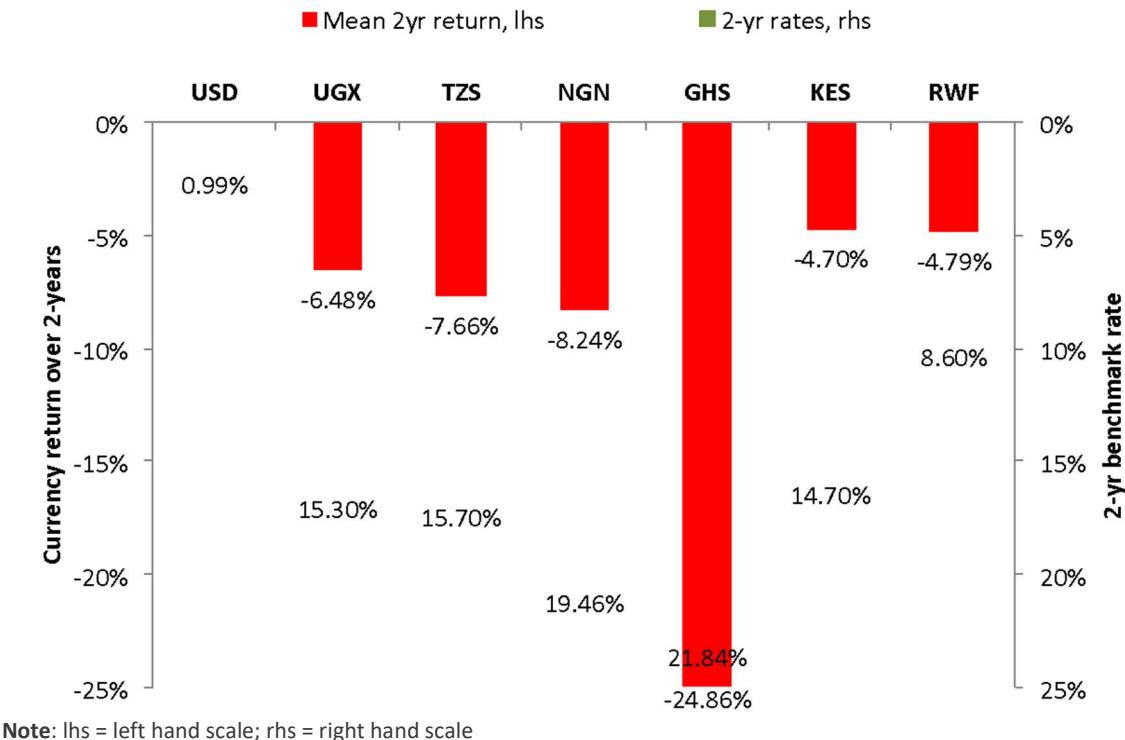
DESCOs will by definition of their business models create a large local currency asset on their balance sheets. The only way to mitigate this currency exposure is to create a local currency liability, either by borrowing in local currency or by borrowing from a lender who can combine a USD loan with a local currency loan as we outline further below.

The net effect is always the same: in order to hedge its local currency asset, the DESCO should make payments in local currency towards a loan / loan-hedge structure denominated in local currency.

We know that many DESCO's - their management and shareholders - will struggle with this decision because borrowing in local currency comes at a much higher interest rate than borrowing in USD. At first sight it seems prohibitively expensive to borrow at 35% in GHS compared to a loan available in 10% in USD.

It is important to understand that interest rates in local currencies are often so much higher because they reflect the market's expectation of future currency devaluation. Accordingly, the more value currencies have recently lost against the USD, the higher the interest rates should be.

Figure 4: 2-year benchmark interest rates compared to historical 2-year currency return against the USD



The question whether it is on average more expensive to borrow in USD than in LCY (or, from the lenders perspective, is it more profitable to lend in LCY versus USD) could be debated for a very long time; but for most investors and lenders it is only important to consider that it is not necessarily more expensive to borrow in LCY despite much higher interest rates. In fact, one might argue that the best starting assumption is that the borrowing cost is expected to be the same. And, therefore, from a borrowing cost perspective (or investment return perspective), a DESCO (or a debt investor) should be indifferent to borrowing (or lending) in local currency or USD.

Table 4: Quantitative comparison of borrowing costs in USD to a direct loan in LCY

FX Spot [a]	102.15	USDLCY		
USD 3y benchmark yield [b]	1.25%	USD_yield		
LCY 3y benchmark yield [c]	17.00%	LCY_yield		
Implied 3yr-FX forward [d]	157.62			
DESCO borrowing need	2,000,000	USD_LoanNtl		
	Option 1 USD Loan		Option 2 LCY loan	
Notionals	Notional loan 2,000,000	-2,000,000	Notional loan 204,300,000	-204,300,000
Loan / hedge quotes	Interest USD 9.00%	Interest USD 9.00%	Interest LCY 27.00%	Interest LCY 27.00%
	DESCO pays USD	Investor recs. USD	DESCO pays LCY	Investor recs. LCY
	to Investor	from DESCO	to Investor	from DESCO
Yr 1	-180,000	180,000	-55,161,000	55,161,000
Yr 2	-180,000	180,000	-55,161,000	55,161,000
Yr 3	-2,180,000	2,180,000	-259,461,000	259,461,000
Discount Rate	1.25%	1.25%	17%	17%
PV of interest cost	-453,613	453,613	-45,141,821	45,141,821
FX Spot	1.000	1.000	102.150	102.150
PV of interest cost in USD	-453,613	453,613	-441,917	441,917
USDLCY exposure	0	0	-2,441,917	2,441,917
	DESCO	Investor	DESCO	Investor
Savings / Cost vs USD loan [1]	0	0	11,696	-11,696
Short LCY / Long LCY [2]	0	0	-2,441,917	2,441,917

Note: The key to comparing a series of cash flows in different currencies is to compare the present value (PV) of each cash flow stream using the spot FX rate in order to express both present values in USD. The present value of each cash flow stream is calculated using the relevant discount rate (benchmark yield).

All numbers are examples only, albeit the set of numbers below is close to actual values in Kenya as of this writing.

"Investor" refers to the lender to the DESCO.

- a Current exchange rate
- b i.e. 3y swap rate
- c i.e. 3y government bond yield
- d $USDLCY_{fwd} = USDLCY * (1 + LCY_{yield})^3 / (1 + USD_{yield})^3$

The table above shows that the present value of the interest rate cost of a 9%, 3-yr loan in USD is equal to \$453,613. This is the base case cost against which we have to compare the alternative of a local currency loan. Using the same financial analysis, we find that a 27%, 3-yr loan in local currency (LCY) with the same notional in LCY is about \$11,696 (or 0.6%) cheaper despite the much higher absolute interest rate number. The hedge cost (from the DESCO's perspective) is therefore equal to a relative gain of US\$11,696.

The 27% LCY loan creates a net short position of \$2.44m. This is higher than the notional of the hedge as the loan carries significant interest. This is exactly the position the DESCO is seeking in order to balance its long local currency asset.

It's tricky - how to borrow locally

We have previously discussed:

- DESCOs build a local currency asset;
- DESCOs should try to minimize the currency risk;
- Borrowing in local currency (straight loan or structured loan) will mitigate the currency risk;
- Borrowing in local currency is just as expensive as borrowing in USD despite often significantly higher interest rates on the local currency loan.

The reality however is that the simple option of a local currency loan currently is either not available or has unattractive terms (collateral requirements, off-market rates). If this simple route is not available, or if it is too expensive to follow it, there are three practical alternatives.

Investors can lend to DESCOs in local currency by combining a USD loan with a currency derivative and thereby structure a local currency loan without assuming the currency risk themselves⁴. The two most commonly used derivatives are:

- A **cross currency swap** - which, from the DESCO perspective, swaps a “hard” (i.e., USD, Euro or GBP) currency liability into a local currency liability.
- A **FX forward** - which fixes a future hard currency liability in local currency; the DESCO has a fixed local currency liability.

Or DESCOs can, together with their investors, arrange a non-derivative structure that would achieve the same result:

- A **back-to-back loan or guarantee agreement** - the DESCO receives a local currency loan from a local lender (i.e. bank) by arranging hard currency collateral or a guarantee for the local lender; the DESCO has a local liability (to the bank) plus a much smaller hard currency liability in the fees and interest rates it has to pay to hard currency lender/guarantor.⁵

The net result of any of the above options is that the DESCO borrows in local currency (builds a net short position) and the lender ends up with a USD loan by passing on the currency risk to a financial intermediary.

In all our examples below we will show the lender acting as the counterparty to the intermediary providing the currency derivative. In theory the DESCO could instead borrow in USD and hedge its currency risk by trading such a derivative with the intermediary. In practice however, to become counterparty to an institutions that can provide currency hedges is costly and will only be worthwhile for the largest and most advanced DESCOs in the sector. Only the most ambitious and sophisticated micro-finance institutions decided to build this internal capacity. The reward is of course the ability to access a much wider market, which in turn should lead to lower borrowing costs and lower re-financing risk.

Below we provide a quantitative comparison and discussion of each of these different options. Applying realistic (if not actual quoted) interest and exchange rates, we calculate the cost of borrowing, compare the cost of local currency options versus the cost of a straight hard currency (USD) loan and estimate the remaining net position.

⁴ The currency risk is passed on to the intermediary providing the FX derivative. The costs of the derivative transaction are passed on to the borrower.

⁵ See also: “Understanding non-derivative Alternatives for mitigating FX risk”, MFX

Table 5: Structuring a local currency loan with a cross currency swap

FX Spot [a]	102.15	>>>>>	Quote between DESCO and Investor		
USD 3y benchmark yield [b]	1.25%	>>>>>	Quote from hedge provider		
LCY 3y benchmark yield [c]	17.00%				
Implied 3yr-FX forward [d]	157.62				
DESCO borrowing need	2,000,000				

	Option 1 USD Loan	Option 3 USD Loan + USDLCY xCCY swap			
	Notional loan	Notional loan	Ntl. LCY leg	Ntl. USD leg	
Notionals	2,000,000	204,300,000	-204,300,000	204,300,000	-2,000,000
	Interest USD	Interest LCY	Interest LCY	Interest LCY	Interest USD
Loan / hedge quotes	9.00%	29.00%	29%	18.75%	1.25%
	DESCO pays USD to Investor	DESCO pays LCY to Investor	Investor recs. LCY from DESCO	Investor pays LCY to Intermed.	Investor recs. USD from Intermed.
Yr 1	-180,000	-59,247,000	59,247,000	-38,306,250	25,000
Yr 2	-180,000	-59,247,000	59,247,000	-38,306,250	25,000
Yr 3	-2,180,000	-263,547,000	263,547,000	-242,606,250	2,025,000
Discount Rate	1.25%	17.00%	17.00%	17.00%	1.25%
PV of interest cost	-453,613	-54,170,185	54,170,185	-7,899,819	0
FX Spot	1.000	102.150	102.150	102.150	1.000
PV of interest cost in USD	-453,613	-530,300	530,300	-77,335	0
USDLCY exposure	0	-2,530,300	2,530,300	-2,077,335	0
	DESCO	DESCO	Investor		
Savings / Cost vs USD loan [1]	0	-76,688	-648		
Short LCY / Long LCY [2]	0	-2,530,300	452,965		

In this example the DESCO pays the debt investor a 29% LCY coupon on a \$2m equivalent notional, 3yr loan. And the investor receives local currency payments from the DESCO and has arranged a swap with an intermediary. Under the swap the investor has agreed to pay a fixed 18.75% coupon on the LCY notional of the swap to the intermediary and receive a fixed 1.25% coupon on the USD notional of the swap in return⁶.

Discounting all cash flows to their present value and translating all present values into USD using the spot FX rate we find that:

1. The DESCO pays \$76,668 more for the LCY loan at 29% than the 9% USD loan but in return acquires a \$2.53m net short LCY position.
2. The debt investor has passed on all costs of the hedge to the DESCO and in the end makes only \$648 less than in the case of lending in USD at 9%. The investor however is left with a net currency exposure of a net long LCY position of \$452,965 (i.e. the investor gains if the local currency strengthens against the USD).
3. The hedge cost is \$77,336 [= \$76,688 + \$648]; this is the "margin" for the intermediary who assumed the difference in the currency risk between the position of the DESCO and the position of the investor.

⁶ Given 3-yr benchmark yields of 1.25% in USD and 17.00% in LCY the 18.25% vs 1.25% fixed/fixed swap is close to market. Investors could ask for a matching coupon - i.e. Y% in LCY vs 9% USD to match the USD loan to the DESCO exactly and reduce the net currency risk position. If they were to pass the rate of Y% to the DESCO the cost of the structure would be 0 relative to the straight 9% USD loan.

Table 6: Structuring a local currency loan with a single FX forward

FX Spot [a]	102.15	>>>>>	Quote between DESCO and Investor		
USD 3y benchmark yield [b]	1.25%	>>>>>	Quote from hedge provider		
LCY 3y benchmark yield [c]	17.00%				
Implied 3yr-FX forward [d]	157.62				
DESCO borrowing need	2,000,000				

	Option 1 USD Loan	Option 4 USD Loan + FX forward			
	Notional loan	Notional loan	Notional FX fwd		
Notionals	2,000,000	204,300,000	-204,300,000	400,000,000	-3,915,810
	Interest USD	Interest LCY	Interest LCY	Fwd FX rate	
Loan / hedge quotes	9.00%	29.00%	29.00%	162.5000	
	DESCO pays USD to Investor	DESCO pays LCY to Investor	Investor recs. LCY from DESCO	Investor pays LCY to Interm.	Investor recs USD from Interm.
Yr 1	-180,000	-59,247,000	59,247,000	0	0
Yr 2	-180,000	-59,247,000	59,247,000	0	0
Yr 3	-2,180,000	-263,547,000	263,547,000	-400,000,000	2,461,538
Discount Rate	1.25%	17.00%	17.00%	17.00%	1.25%
PV of interest cost	-453,613	-54,170,185	54,170,185	-249,748,223	2,371,491
FX Spot	1.000	102.150	102.150	102.150	1.000
PV of interest cost in USD	-453,613	-530,300	530,300	-2,444,917	2,371,491
USDLCY exposure	0	-2,530,300	2,530,300	-2,444,917	0
	DESCO	DESCO	Investor		
Savings / Cost vs USD loan [1]	0	-76,688	3,262		
Short LCY / Long LCY [2]	0	-2,530,300	85,384		

In this example the DESCO pays the debt investor a 29% LCY coupon on a \$2m equivalent notional, 3yr loan. The investor receives local currency payments from the DESCO and has arranged a single large FX forward trade with an intermediary. Under the FX forward the investor has agreed to pay LCY400m to the intermediary and receive \$3.915m in return 3 years from today⁷.

Discounting all cash flows to their present value and translating all present values into USD using the spot FX rate we find that:

1. The DESCO pays \$76,688 more for the LCY loan at 29% than the 9% USD loan, but in return acquires a \$2.53m net short LCY position.
2. The debt investor has passed on all costs of the hedge (plus some \$3,262) to the DESCO and in the end makes \$3,262 more than in the case of lending in USD at 9%. The investor is left with a small net currency exposure of a net long LCY position of \$85,384 (i.e. the investor gains if the local currency strengthens against the USD).
3. The hedge cost is \$79,950 [= \$76,688 + \$3,262]; the "margin" for the intermediary is however only \$73,425 = [\$76,688 - \$3,262].

⁷ The FX forward is often quoted as a forward FX rate. The forward FX rate in turn is directly dependent on the interest rate differential between the equivalent USD and LCY benchmark rate. The mid forward rate must be equal to $USDLCY^{fwd} = USDLCY^{current} * (1 + LCY_yld)^3 / (1 + USD_yld)^3$. Given the numbers in this scenario the mid forward exchange rate would be 157.62. The Investor would exchange the notional of the FX forward at a higher rate and receives therefore less USD in return compared to a trade at this mid rate.

Table 7: Hedging a USD loan in a non-derivative structure

FX Spot [a]	102.15	>>>>>	Quote between DESCO and Investor
USD 3y benchmark yield [b]	1.25%	>>>>>	Quote from hedge provider
LCY 3y benchmark yield [c]	17.00%		
Implied 3yr-FX forward [d]	157.62		
DESCO borrowing need	2,000,000		

	Option 1 USD Loan	Option 5 USD Loan + Deposit + LCY Loan		
Notionals	Notional loan 2,000,000	Notional 2,000,000	USD deposit -2,000,000	Notional 204,300,000
Loan / hedge quotes	Interest USD 9.00%	Interest USD 9.00%	Interest USD 0.75%	Interest LCY 19.00%
	DESCO pays USD to Investor	DESCO pays USD to Investor	DESCO receives USD from Deposit Inst.	DESCO pays LCY to Deposit Inst.
Yr 1	-180,000	-180,000	15,000	-38,817,000
Yr 2	-180,000	-180,000	15,000	-38,817,000
Yr 3	-2,180,000	-2,180,000	2,015,000	-243,117,000
Discount Rate	1.25%	1.25%	1.25%	17%
PV of interest cost	-453,613	-453,613	-29,265	-9,028,364
FX Spot	1.000	1.000	1.000	102.150
PV of interest cost in USD	-453,613	-453,613	-29,265	-88,383
USDLCY exposure	0	0	0	-2,088,383
Savings / Cost vs USD loan [1]	DESCO 0	DESCO -117,649		
Short LCY / Long LCY [2]	0	-2,088,383		

In this example the DESCO pays the debt investor a 9% USD coupon on a \$2m notional, 3yr loan. The DESCO then deposits the proceeds with a local bank (or an international bank with a local affiliate) as collateral against a local currency loan. The key to understanding why this structure can be economical despite the fact that the DESCO is paying USD interest and LCY interest is that, because the LCY loan is secured by cash proceeds of the USD loan, the LCY interest rate can be expected to be close to the benchmark rate and the net cost of this payment leg in USD terms is close to 0.

Discounting all cash flows to their present value and translating all present values into USD using the spot FX rate we find that:

1. The DESCO pays \$117,649 more in this structure compared to the 9% USD loan but thereby acquires a \$2.1m net short LCY position.
2. The debt investor receives 9% fixed and is therefore in the base case position.
3. The hedge cost is \$117,649 [= \$29,265 + \$88,383].

This structure has been frequently used in the microfinance sector. It carries a number of situation specific risks and it has often been found to be impractical and too expensive in the end. See also: "Understanding non-derivative Alternatives for mitigating FX risk", MFX and "Guaranteed Loans to MFIs", CGAP 2007.

Implementing trades in practice

Almost all calculations in this document are approximate only. The level of accuracy is sufficient for smaller trades (<\$5m say) but larger trades would require a more sophisticated approach towards interest rate curves, discount factors, benchmark yields, etc.

Few local banks stand ready to provide economical local currency loans to all but the largest DESCOS in the sector. DESCOS can therefore either borrow in US Dollars, implementing a currency derivative themselves or they can work with an investor who has access to one of the two main FX hedge providers available to the DESCO sector - TCX and MFX.

DFIs and other investors created TCX and MFX almost 10 years ago to mitigate currency exposure of microfinance institutions. Both have identified the currency risk in the off-grid energy sector as a logical expansion of their mission and expressed interest to work with debt investors and DESCOS alike (See also: *Microfinance foreign exchange facilities*, CGAP 2010).

The reality however remains that the restrictions and limitations of both institutions, in particular with respect to counterparty credit risk, will make it nearly impossible for all but the largest DESCOS to trade directly with MFX or even TCX.

Figure 5: TCX and MFX are the only practical hedge counterparties

Institution	TCX	MFX
Products	FX forwards and cross currency swaps, 2-7yrs, illiquid currencies	FX forwards and cross currency swaps, 6m to 7 years, illiquid currencies
Risks	FX and rates risk, credit risk[*] only with vetted institutions	MFX assumes credit risk, FX and rate risk is passed on to TCX or other counterparties [i.e. MFX guarantees to pay under an existing derivative contract even if the MFX's counterparty had defaulted].
Transaction size	\$20-30m notional (cumulative position)	\$2m+
Requirements	ISDA, credit support agreement (DEG, FMO) or cash collateral (w daily "Margin Calls")	ISDA, independent credit rating [1]; cash collateral [10% + MtM]; HUG insurance (only larger trades)
Size of Institution	Exposure: \$1.5bn; Equity: 500m+	Exposure: <\$0.5bn; Equity: \$50m+
Typical Counterparty	MFX (see below), Investors and DFIs (who are typically investors in TCX)	Investors, DFIs who can't trade with TCX directly; MFIs [2]
Other	Shareholds w TCX: AfD, AfDB, ASN-Novib Fund, BIO, BlueOrchard, Cofides, DBSA, EBRD, EFSE, FMO, Grameen Credit Agricole, IFC, IDB, JBIC, KfW, MFX, OFID, Oiko Credit, Oxfam, PROPARCO	
Contact	Harald Hirschofer	Anmol Chantan

Notes:

- 1 Microfinanza, MicroRate, M-Cril and Planet Rating; cost of rating \$12-15k; to get rating companies should be a) profitable, b) show some track record and c) be big enough (ideally a balance sheet of USD 10m or larger)
- 2 An MFI is an institution with an average loan size below \$1,000; most DESCOS would meet this requirement
- 3 Commercial banks - such as Stanbic/Standard Chartered, Citi Bank, CS - are typically only considering counterparties with substantial balance sheets and after putting an ISDA in place.

[*] Derivative positions such as a cross currency swap and represent significant credit risk, as the MtM of any trade is effectively a liability (or asset) for a counterparty

Building blocks of a currency risk mitigation strategy for DESCOS

The fundamental ingredient of risk management is of course the build-up of a minimum amount of expertise within any DESCO or investment institution. We hope that this document, together with the excel spreadsheet tools on our web site will aid in that process.

With the basic understanding in place, DESCOS and investors should:

1. Measure and monitor the DESCO's FX position: calculate the net exposure by estimating the present value of key assets and liabilities in hard and local currency on an ongoing basis.
 - As the net exposure is likely to change on a daily basis, frequent monitoring is necessary.
 - The reasons for the change can be (i) a change in interest rates (impacting the present value of fixed income assets [receivable pool] and liabilities [loans]) or (ii) a change in the expected customer default rates or (iii) the increase in amount of receivables in connection with sales growth.
2. Estimate the risk by considering the product of net currency position and a volatility measure.
 - Consider defining risk thresholds, which would require a re-balancing of the net position.
3. Balance the likely long local currency position⁸ as much as possible by borrowing locally directly, or from an investor who can access MFX and TCX or by using a USD deposit - LCY loan structure.
 - Price alternative options against market variables and optimize hedge costs and net remaining currency exposure against situation specific needs

Summary

- DESCO create a LCY denominated asset on their balance sheet by definition and are 'naturally' long LCYs.
- The sector will produce several billion in LCY denominated assets (net LCY positions) per year by 2020.
- LCYs can lose value quickly and are very volatile.
- Don't risk it
- DESCOS should borrow in LCY to balance the LCY asset and mitigate their FX exposure
- The cost of borrowing in LCY is lower than high interest rates suggest.
- Borrowing in LCY may require working with international investors and an FX hedge provider who can 'translate' a USD loan into a LCY loan.
- There are only few possible structures and intermediaries who provide such structures.
- DESCOS (and their equity investors) need to build the capacity to measure and mitigate their currency risk.
- Lenders to DESCOS should develop capacity to lend in local currencies.

Additional Resources

- [1] Understanding FX forwards, MFX; <http://mfxsolutions.com/educationcenter/>
- [2] Understanding Cross Currency Swaps, MFX; <http://mfxsolutions.com/educationcenter/>
- [3] Understanding non-derivative Alternatives for mitigating FX risk, MFX; <http://mfxsolutions.com/educationcenter/>

⁸ Start-up companies will likely be short local currencies until their expected receivables exceed the expected operational expenses in local currencies. The fix is easy - carry a cash balance in local currency.

- [4] MFX Summary of Risk in Microfinance, MFX; <http://mfxsolutions.com/educationcenter/>
- [5] Microfinance foreign exchange facilities, CGAP 2010; <http://www.cgap.org>
- [6] Guaranteed Loans to MFIs, CGAP 2007; <http://www.cgap.org>
- [7] DESCO - A commercial approach to energy access, Persistent Energy & Pepukaye Bardouille, June 2014
- [8] Financing DESCOs - A framework, Persistent Energy, March 2015
- [9] Financing the DESCO S-Curve, Persistent Energy & Pepukaye Bardouille, June 2014 October 2015

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responsAbility is one of the world's leading asset managers in the field of development investments, is headquartered in Zurich and has local offices in Hong Kong, Lima, Luxembourg, Mumbai, Nairobi, Oslo, Paris and Bangkok. The company's investment vehicles supply debt and equity financing to non-listed firms in emerging economies and developing countries. responsAbility currently has USD 2.9 billion of assets under management that is invested in around 530 companies in more than 90 countries.

Persistent Energy Capital is a boutique investment and advisory firm that invests in, incubates and builds businesses that provide services to off-grid customers. PEC also provides financial advisory services to companies and investors, fund management through its private equity funds and consulting services to governments and development organizations