



Forest Carbon Partnership Facility

Portfolio Management and Decisions on ER-PDs

Fifteenth meeting of the Carbon Fund (CF15)

Washington, DC

December 12-15, 2016

Task at CF15

- **Decide whether to select Chile, Mexico and Vietnam's ER Programs into the Carbon Fund portfolio**
- Portfolio selection is on a first come first served basis, while taking into account:
 - quality
 - selection criteria as per ER-PIN criteria, and
 - consistency with the Methodological Framework
- CF15 decision to select ER program would authorize Trustee to start negotiating an Emission Reductions Payment Agreement, subject to World Bank due diligence and approval

Options for Decisions by Carbon Fund Participants (1)

- i. Decide to **select** an ER Program into its portfolio and proceed to negotiating an ERPA subject to completion of World Bank due diligence and final World Bank approval of the program
- ii. Decide to **provisionally select** an ER Program into its portfolio and proceed to negotiating an ERPA subject to: completion of World Bank due diligence and final World Bank approval of the program and other requirements, such as a **list of key issues** to be addressed, have been fulfilled to the satisfaction of the World Bank
- iii. Request the REDD Country to **resubmit a revised ER-PD** with specific revisions or attention to certain areas
- iv. Decide **not to select** an ER Program into its portfolio and, therefore, not to proceed to negotiating an ERPA and do not request the country to resubmit (i.e. rejection)

Options for Decisions by Carbon Fund Participants (2)

- Option iv (**not to select program**) should only be valid if proposed ER Program is substantially different from the selected ER-PIN or the selection has portfolio management implications e.g., in relation to net emission reductions across the portfolio
- Other issues, such as non-compliance with the Methodological Framework, could be addressed through options ii (**provisional selection**) or iii (**request revised ER-PD**)

Carbon Fund Contributions to Date

FCPF Carbon Fund

Donor Contributions as of December 9, 2016 (in \$ thousands)

Participant Name	Total	Outstanding*	FY17	FY16	FY15	FY14	FY13	FY12	FY11	FY10	FY09
Australia	18,393							5,658	12,735		
BP Technology Ventures	5,000								5,000		
Canada	5,015							5,015			
European Commission	6,709									362	6,347
France	5,114				114				5,000		
Germany	179,062	1,908	53,485	13,329	32,108	27,280	6,556	15,443	21,125	3,819	4,009
Norway	300,462	70,800		58,352			161,310				10,000
Switzerland	10,796							10,796			
The Nature Conservancy	5,000										5,000
United Kingdom	181,740	163,800							17,940		
United States of America	18,500		4,500				4,000		10,000		
Committed Funding	735,791	236,508	57,985	71,681	32,222	27,280	171,866	36,912	71,800	4,181	25,356

*Amounts may vary due to exchange rate fluctuations.

Carbon Fund Financial Situation: Sources and Uses Summary

Carbon Fund Sources and Uses Summary (\$m)	
	Current Situation
Sources (\$m)	735.7
Number of Lols (#)	19
Number of ER Programs (#)	13
Uses	
Costs over Fund Lifetime	\$m
Fixed Costs (FY10 to FY26)	22.7
ER Program Costs	32.1
Total Costs	54.8
Available for Purchase of ERs	680.9
Average ER Program	52.4

Carbon Fund Dashboard

FOREST CARBON PARTNERSHIP FACILITY	FCPF Carbon Fund Dashboard								
	Updated: December 9, 2016								
	Invited into CF Pipeline	LOI Letter Date	HFLD ¹	Max Lol Volume	Advanced Draft ER-PD Submitted to FMT	ER-PD Presented to CF	ER-PD Selected into the Portfolio	Begin ERPA Negotiations (Lol + 18 months)	Exclusivity Period End
Cameroon	06/22/16		x	23.6					
Chile	06/19/14	08/22/14		5.2	07/17/16	12/12/16		n/a	06/22/17
Costa Rica	03/16/13	09/10/13		12.0	12/05/15	06/20/16		n/a	03/04/17
Cote D'Ivoire	10/15/15	11/18/15		16.5				05/18/17	11/18/17
DR Congo	04/11/14	06/13/14	x	10.0	01/15/16	06/20/16	12/07/16	n/a	10/31/17
Dominican Republic	10/15/15	06/02/16		7.5				12/02/17	06/02/18
Fiji	10/15/15			3.6					
Ghana	04/11/14	09/29/14		18.5	10/12/16			07/29/17	12/29/17
Guatemala	10/08/14			21.0					
Indonesia	06/22/16			22.0					
Lao PDR	10/15/15	07/20/16		8.4				01/20/18	07/20/18
Madagascar	10/15/15	11/26/15		16.4				05/26/17	11/26/17
Mexico	04/11/14	09/24/14		8.7	07/23/16	12/12/16		n/a	06/24/17
Mozambique	10/15/15	11/30/15		8.7				06/30/17	11/30/17
Nepal	04/11/14	06/03/15		14.0				12/03/16	06/03/17
Nicaragua	10/15/15	01/21/16		11.0				07/21/17	01/21/18
Peru	10/08/14	03/31/16	x	6.4				09/31/17	03/31/18
Republic of Congo	06/19/14	09/25/14	x	11.7	10/27/16				
Vietnam	06/19/14	12/10/14		10.3	07/31/16	12/12/16		n/a	12/10/16
Totals:	19	15	1	235.5	7	5	1		

■ : Countries working towards signing a Letter of Intent
 ■ : Countries that have signed a Letter of Intent.
 ■ : ER-PD Selected into Portfolio.
 ■ : Countries that have signed an ERPA.
 ¹ High Forest Cover, Low Deforestation (HFLD): Classification is self selection according to criteria in the Methodological Framework.

Today's Pipeline:

Estimated Reference Levels and Program Effectiveness

	<i>Unit: [million tCO₂e/year]</i>	HFLD Adjustment (% of total emissions)	Emissions ³	Removals ³	Effectiveness ⁴ (% estimate, indicative)
Final ER-PD ¹	Costa Rica		7.7	-4.4	47%
	DRC	4.8 (7%)	68.2	-5.9	10-30 %
	Chile		12.6	-12.4	15-20 %
	Mexico		24.0		80%
	Vietnam		8.5	-10.0	20%
Draft ER-PD ¹	Rep. Congo	8.7 (80%)	10.9		20-30%
	Ghana		45.1		15%
ER-PIN ²	Nepal		4.4		64%
	Guatemala		11.5		37%
	Peru	3.1 (18%)	17.6		24%
	Cote d'Ivoire		18.4		16%
	Dom. Republic		2.8	-5.5	49 (32)%
	Fiji		0.3	-0.1	91 (450)%
	Lao PDR		6.9	-7.2	10 (10)%
	Madagascar		12.1		27%
	Mozambique		3.9		30%
	Nicaragua		21.5		8%
Indonesia		49.9		10-20%	
Cameroon	10.0 (227%)	4.4		-	
	Total	26.6 (8%)	330.7	-45.5	

¹ December 2016

² As submitted CF9-13

³ For respective reference period

⁴ Removals in parenthesis

Key variables that affect the eventual ER Volume in the Carbon Fund portfolio

1. Updates to Reference Level (RL) estimates

- RL is more carefully estimated for the ER-PD (e.g., using updated emission factors or different satellite data)
- Updates to RL may be warranted during implementation (prior to first monitoring) due improved methods or data

<i>Unit: [million tCO₂e/year]</i>	Estimated Reference Level (removals in parenthesis where applicable)		
	ER-PIN	Draft ER-PD	Final ER-PD
DRC	23.9	103.2 (-22.0)	68.2 (- 5.9)
Costa Rica	10.6 (-15.3)	7.2 (-4.4)	7.7 (-4.4)
Vietnam	16.0 (-15.3)	8.6 (-9.8)	8.5 (-10.0)
Chile	9.4	9.3 (-10.8)	12.6 (-12.4)
Mexico	6.2	24.0	24.0

Key variables that affect the eventual ER Volume in the Carbon Fund portfolio (cont.)

2. Program Effectiveness (*percentage change in rate of emissions or removals during program implementation*)¹

- Difficult to estimate reliably at this stage
- Most ER-PINs estimate effectiveness to be 10-40%
- ER-PDs have more details on implementation design and hence effectiveness



3. Quality of Measurement (*statistical uncertainty associated with measured emission reductions*)

- Improved measurement (e.g., better data) lowers uncertainty
- Uncertainty (confidence in estimates) used for conservativeness factors (ER discount)
- Accordingly, a certain portion of ERs is managed through an Uncertainty Buffer account (and only paid for under certain conditions)



4. Share of Total ERs offered to the Carbon Fund

- Countries may choose to retain a certain portion of ERs for sale to other buyers or may not be able to transfer title

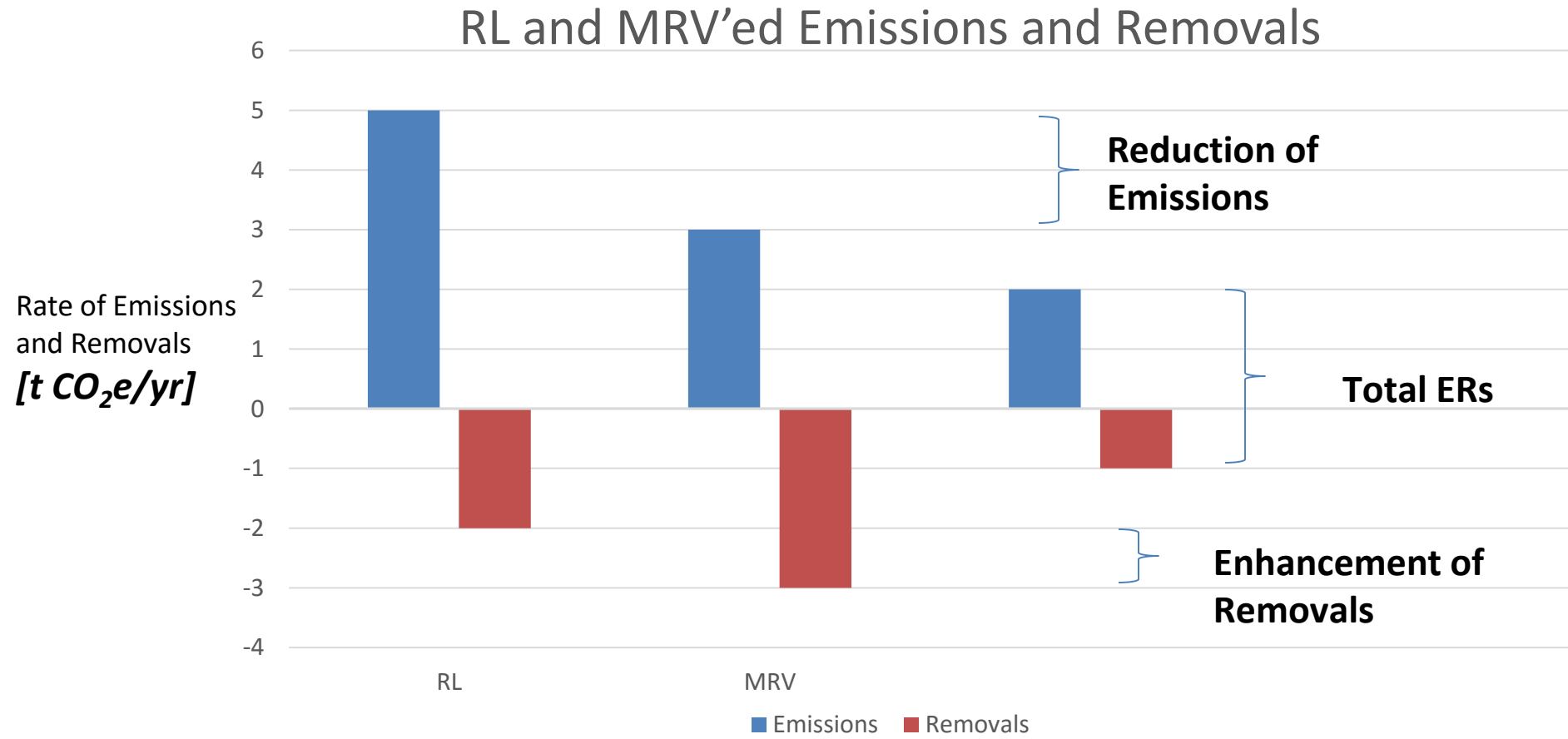


Key variables that affect the eventual ER Volume in the Carbon Fund portfolio (cont.)

4. Risk of Reversals (*disturbance events lead to emissions that impact ERs paid for by the Carbon Fund*)
 - Risk is assessed during verification
 - Risk of reversal can be mitigated (through program design) and managed (a reversal buffer)
 - A portion of ERs (10-40%) is set-aside in a Reversal Buffer account (and only released if reversal is risk reduced)
5. Length of the ERPA Term
 - With the Carbon Fund extension to 2025, up to 7-year ERPAs may be possible for some programs (subject to ERPA signature date)
6. Pipeline attrition
 - A portion of selected ER-PINs may not get fully developed and result in an ERPA



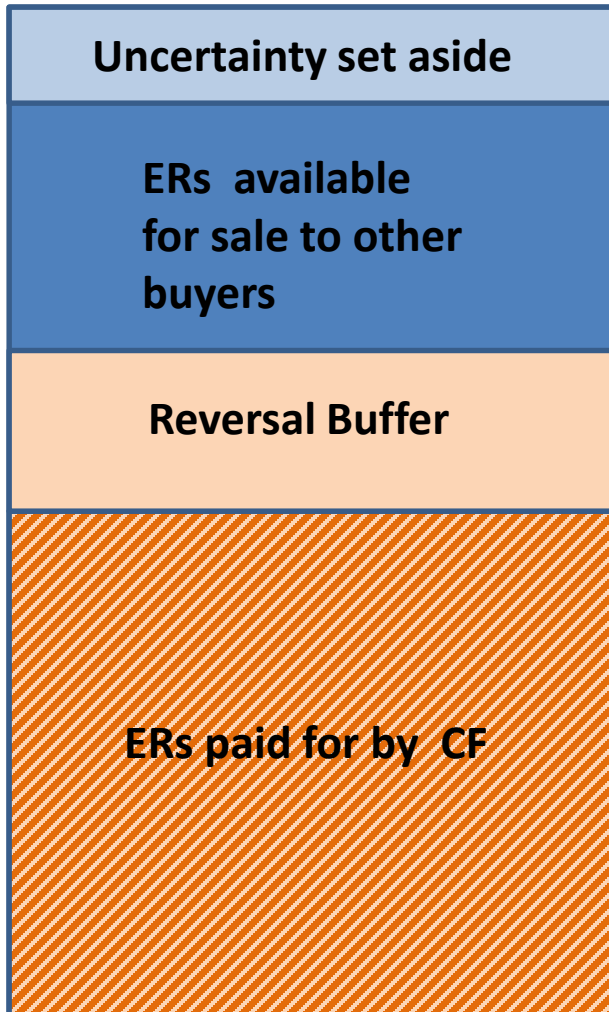
The starting point for the analysis: Total Volume of ERs generated by a country's REDD+ program



Carbon Accounting

Calculation of Emission Reductions (ERs)

Total ER Volume



- Subtract the reported and verified emissions and removals from RL
- Set aside a number of ERs to reflect the level of uncertainty associated with the estimation of ERs (percentage of ER Volume)
- CF will buy percentage of the ER Volume
- If CF Buffer is used → set-aside of ERs in CF Buffer to deal with risk of Reversals of ERs purchased by the CF (percentage of ERs purchased by CF)
- Remaining ERs can be sold to other buyers

Portfolio Simulation using Monte Carlo Analysis



- A sophisticated approach to explore potential portfolio outcomes
 - Produces a distribution of thousands of portfolios using different randomized combinations of key portfolio variables
- Requires assumptions about the range of variability in key portfolio variables
 - Reasonable input values can be defined on the basis of experience, expert judgment or expectations
 - Assumptions and expectations can be updated later as more information becomes available about the ER Programs (e.g., in Draft and Final ER-PDs)
- Some caveats and considerations
 - Pricing is not considered
 - Supports exploration, not optimization
 - Makes assumptions about effectiveness (informed by implementation design described in ER-PD where available)
 - Does not consider what country offers (and rather explores potential supply)
 - Large programs and high RL weigh more heavily

First, set variables ...

Portfolio Variable	Costa Rica	DRC	Mexico	Chile	Vietnam	Draft ER-PDs	ER-PINs
Change relative to RL in ER-PIN	+/-5%	+/-5%	+/-5%	+/-5%	+/-5%	+/-20%	+/-40%
Program effectiveness	40-50%	20-30%	60-80%	10-20%	10-20%	10-40%	10-30%
Uncertainty Buffer set-aside	10%	10%	0%	4%	4%	5-15%	5-15%
Reversal Buffer set-aside	20%	20%	20%	11%	18%	10-30%	10-30%
Share offered to Carbon Fund	32%	44%	100%	96%	96%	90%	90%
ERPA Term	6 years						
LOI drop rate	25%						

... then generate a thousand portfolios ...

... and examine the outcome!

	<i>[million tCO₂e]</i>	Net emissions reductions	ER Volume in CF portfolio			Buffer	
		< historical*	Average*	Max	Min	Uncertainty*	Reversal*
Values from Final ER-PD	Costa Rica	32.6	7.6	8.7	6.4	3.4	1.9
	DRC	111.5	44.5	53.4	36.3	14.3	11.5
	Chile	22.5	17.2	23.9	11.7	0.8	2.1
	Mexico	100.9	67.1	80.7	54.7	0	17.1
	Vietnam	16.6	11.0	15.2	7.3	0.7	3.1
Values from Draft ER-PD	Rep. Congo	16.5	41.2	61.0	27.6	8.1	7.6
	Ghana	68.3	41.6	95.4	12.0	9.5	10.9
Simulated Values (Monte Carlo)	Nepal	5.2	3.1	8.0	0.9	1.2	0.2
	Guatemala	13.7	8.4	21.0	2.4	1.9	1.3
	Peru	21.2	24.0	44.0	12.2	5.0	5.3
	Cote d'Ivoire	19.0	11.5	29.3	3.3	1.7	1.8
	Dom. Republic	10.0	5.9	13.2	1.9	0.9	1.5
	Fiji	0.4	0.3	0.6	0.1	0.1	0.1
	Lao PDR	16.3	10.2	22.6	4.3	1.5	3.8
	Madagascar	14.3	8.7	22.4	2.3	1.8	1.6
	Mozambique	4.7	2.8	6.8	0.8	0.9	1.4
	Nicaragua	26.1	15.9	38.9	4.0	3.5	4.4
	Indonesia	60.3	36.5	89.4	8.8	8.0	6.6
	Cameroon	5.2	39.2	53.7	29.4	9.4	10.5

Aggregate Simulated Portfolio at CF15

(using variable settings above)

	Net emissions reductions	ER Volume in CF portfolio			Buffer	
	< historical*	Average*	Max	Min	Uncertainty*	Reversal*
<i>[million tCO₂e]</i>	565	397	688	226	73	93

* Average of 1000 randomly generated portfolios

- **Portfolio volume (with given assumptions)**
 - Potential supply of ERs for 6-year ERPAs could be 397 million tCO₂e
 - Net emission reduction for the entire programs would be 565 million tCO₂e (measured against respective historical average)
- **Buffer ER Volumes**
 - Estimated based on average uncertainty discount and reversal risk for program lengths
 - If all ERs were paid for by CF: 73 and 93 million tCO₂e would go into the uncertainty and reversal buffer, respectively



FCPF Carbon Fund

ER delivery risk assessment model

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December 13, 2016

ER delivery risk assessment model

- Projects expected ER delivery for each program, considered in light of its ERPA purchase
- Can inform ERPA contracting, business planning and portfolio management
- Builds on the WB's Systematic Operations Risk-rating Tool (SORT) tool
- SORT risk categories are unpacked in order to consider the contributing factors in each category explicitly:
 - Makes it possible to compute probabilities
 - Allows issues that are contributing to high risk ratings to be systematically tracked and addressed

ER delivery risk assessment model – cont'd

- Development process relied on FMT/World Bank team of experts and included:
 - Identifying the major causes and sources of ER delivery, in alignment with SORT
 - Establishing interdependencies among the factors and their impact on the ER delivery through various causal chains
 - Quantifying those dependencies in terms of probability estimates elicited from team of experts
 - Testing, calibrating and validating the model
- Model can learn from data; over time, parameters could be adjusted based on evidence and lessons learned
- Model still new; going forward, projections expected to be shared with Carbon Fund Participants in advance of each fund meeting

ER delivery risk assessment model – cont'd

SORT risk categories and unpacked ER delivery risk assessment factors:

1. Political and governance
2. Macroeconomic
3. Sector strategies and policies:
 - Government ownership
 - Relevant sectoral policies, including those outside of the forest sector
 - Land tenure
4. Technical design of project or program:
 - Addresses the drivers of deforestation/degradation/land use change
 - Prioritizes proposed program activities from the available strategic options
 - Incorporates appropriate incentives tailored to different types of stakeholders
 - Proposed approaches are sufficiently diverse
 - Resources are flexible enough
 - Program costs have been appropriately identified
 - Proposed program activities have a track record of being effective
 - Program design reflects capacity of stakeholders involved in implementation

ER delivery risk assessment model – cont'd

SORT risk categories and unpacked ER delivery risk assessment factors:

5. Institutional capacity for implementation and sustainability:

- Capacity of coordinating entity and stakeholders involved in implementation
- Program complexity
- Monitoring, reporting and verification (MRV)
- Monitoring and evaluation

6. Fiduciary:

- Secured financing

7. Environment and social

8. Stakeholders

Hypothetical scenarios

1. “High risk” program (#1 in table):

- Low-income country with poor political and macroeconomic stability
- Likely that environmental/anthropogenic events could affect program implementation
- Program design generally adequate, with a few challenging elements
- Despite a few favorable conditions, generally challenging environment for implementation, with capacity and financing being significant issues

2. “Medium risk” program (#2 in table):

- Middle-income country with good political and macroeconomic stability
- Unlikely that environmental/anthropogenic events could affect program implementation
- Strong program design, well tailored to country circumstances
- Good enabling environment for implementation, high capacity and adequate financing

Program Name	Program ERs	Risk Factor (% delivery)	Risk- Adjusted Program ERs	Expected ERPA Delivery		
				ERPA Contracted ERs	Expected ERPA Delivery	% ERPA Delivery
Program #1 (high risk)	20,000	15%	3,000	6,000	3,000	50%
Program #2 (medium risk)	14,400	35%	5,040	10,000	5,040	50%
TOTAL	34,400		8,040	16,000	8,040	50%

FCPF Carbon Fund preliminary ER delivery risk assessment – cont'd

- Preliminary estimates:
 - Discount factor of **15-40%** across programs in the portfolio
 - First estimate; needs internal calibration to ensure consistency in application of the tool across all programs
 - Results in a portfolio delivery of **70-90 million** risk-adjusted ERs over ERPA period (**\$350-\$450 million @ \$5 per ton**)
 - Upper range is risk-adjusted ER volume available at portfolio level after adjusting for buffers
 - Lower range is same volume, but taking into account maximum Lol volumes (i.e., some programs expected to over-deliver relative to their maximum Lol volumes)
 - Very preliminary estimates:
 - ER estimates need to be looked at in detail (some come from ERPDs, others from modelling)
 - Contracted volumes expected to evolve from what was first established in Lols
 - Many programs in early design stage, which makes it difficult to assess risk

FCPF Carbon Fund preliminary ER delivery risk assessment

- Monte Carlo analysis:
 - Global analysis based on program's assumed effectiveness (%) against its Reference Level
 - Provides a range of outcomes that can inform how far to over-program the portfolio
- ER delivery risk assessment tool:
 - Generates a risk discount factor (%) based on a program's *specific* risk assessment at a certain point in time
 - Discount factor is applied to ER volume in ERPD (or best available estimate), adjusting for the uncertainty and reversal buffer
 - Over time as ERPA's are signed and as program risk is assessed better, tool expected to provide most relevant ER delivery data

Carbon Fund: Portfolio Management: Summary

- Too early for firm predictions
- Available for purchase of ERs: \$681 million
- Assuming \$5 per ton
- Monte Carlo: Average \$1.1 billion (range from \$2 billion to \$300 million) (6 year ERPA term, LOI drop rate 25%)
- New ER delivery risk assessment model: \$350 to \$450 million (based on WB Systematic Operations Risk-rating Tool (SORT))
- LOI values: 235 million tons @ \$5 per ton = \$1.175 billion x 2/3rds = \$783 million
- At this stage in developing the portfolio these numbers should not weigh very heavily (or not at all) on the review and decisions on the new ER-PDs
- Other factors to consider



THANK YOU!

www.forestcarbonpartnership.org