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REDD+ SUPPLY AND DEMAND 2015– 2025

FOREST CARBON, MARKETS AND COMMUNITIES
(FCMC) PROGRAM

JANUARY 2015

This publication was produced for review by the United States Agency for International Development.

The U.S. Agency for International Development (USAID) launched the Forest Carbon, Markets and Communities (FCMC) Program to provide its missions, partner governments, local and international stakeholders with assistance in developing and implementing REDD+ initiatives. FCMC services include analysis, evaluation, tools and guidance for program design support; training materials; and meeting and workshop development and facilitation that support U.S. Government contributions to international REDD+ architecture.

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ACR	American Carbon Registry
ACCU	Australian Carbon Credit Units
AFOLU	Agriculture, Forestry, and Other Land Use
APD	Avoided Planned Deforestation
ARB	Air Resources Board
AUFD	Avoided Unplanned Frontier Deforestation and/or Degradation
AUMD	Avoided Unplanned Mosaic Deforestation and/or Degradation
A/R	Afforestation and Reforestation
BAU	Business as Usual
BioCF	BioCarbon Fund
BRICS	Brazil, Russia, India, China, and South Africa
BSER	best system for emissions reductions
CAA	Clean Air Act
CCAP	Climate Change Action Plan
CAR	Climate Action Reserve
CCB	Climate, Community, and Biodiversity
CCER	Chinese Certified Emission Reductions
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CFI	Carbon Farming Initiative
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (decision-making body of the Kyoto Protocol)
COP	Conference of the Parties (decision-making body of the UNFCCC)
CSR	Corporate Social Responsibility
EGU	Electric Utility Generating Units
EII	Earth Innovation Institute

EPA	Environmental Protection Agency
EPC	Energy Performance Certificate
ER	Emission Reductions
ERPA	Emission Reduction Purchase Agreement
ERU	Emission Reduction Unit
ESD	Effort-Sharing Decision
EU	European Union
EU ETS	European Union Emissions Trading Scheme
FCI	Forest Carbon Index
FCMC	Forest Carbon, Markets and Communities Program
FCPF	Forest Carbon Partnership Facility
FIP	Forest Investment Program
GCF	Governors' Forests and Climate Task Force
GCI	Global Competitiveness Index
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GtCO _{2e}	Metric Gigaton Carbon Dioxide Equivalent
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDESAM	Institute for the Conservation and Sustainable Development of Amazonas
IFM	Improved Forest Management
ISFL	Initiative for Sustainable Forest Landscapes
JCM	Joint Crediting Mechanism
JI	Joint Implementation
JNR	Jurisdictional and Nested REDD+
KCERs	Korean Certified Emissions Reductions
KfW	KfW Bankengruppe; German development bank (KfW comes from Kreditanstalt für Wiederaufbau, or Reconstruction Credit Institute)
LULUCF	Land Use, Land-Use Change, and Forestry
MOU	Memorandum of understanding

MRV	Monitoring, Reporting, and Verification
MtCO ₂ e	Million metric tons of carbon dioxide equivalent.
NAMA	Nationally Appropriate Mitigation Action
NDRC	National Development and Reform Commission
NDP	National Development Plan
NGCC	Natural gas combined cycle
NGO	Nongovernmental Organization
NICFI	Norway's International Climate and Forest Initiative
OSIRIS	Open Source Impacts of REDD Incentive Spreadsheet
PAT	Perform Achieve and Trade
PMR	Partnership for Market Readiness
REC	Renewable Energy Certificate
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks
REDD	Reducing Emissions from Deforestation and Degradation (only; i.e., excluding forest conservation, management, and enhancements)
REL	Reference Emissions Levels
REM	REDD Early Movers
RGGI	Regional Greenhouse Gas Initiative
ROW	REDD Offset Working Group
SBSTA	Subsidiary Body for Scientific and Technical Advice
SEMARNAT	Secretaría del Medio Ambiente y Recursos Naturales
SISA	System of Incentives for Environmental Services
tCO ₂ e	Metric Ton Carbon Dioxide Equivalent
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USG	United States Government
VER	Verified Emission Reduction
VCS	Verified Carbon Standard
VCU	Verified Carbon Units

EXECUTIVE SUMMARY

BACKGROUND

Forest loss in developing countries represents a significant contribution to global emissions along with significant climate change mitigation potential. How Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks (REDD+) will be incentivized in a future climate agreement is still being negotiated under the United Nations Framework Convention on Climate Change (UNFCCC).

One option to incentivize REDD+ is the use of carbon markets that provide economic benefits to those who reduce emissions. A voluntary market for forest credits started in the 1990s and has grown during the last decade. Bilateral and multilateral initiatives also are piloting market mechanisms and non-market results-based payments for emission reductions. This report develops a bottom-up analysis of supply using existing REDD+ projects and jurisdictional programs. It compares this supply to three scenarios of demand for REDD+ credits based on existing and emerging voluntary, regulatory and results-based payment programs.

METHODOLOGY

Two supply estimates are developed.

- **Potential Supply** is estimated empirically by calculating the volume of REDD+ credits that may be generated by already registered Verified Carbon Standard (VCS) REDD+ projects plus the potential volume from additional REDD+ projects and jurisdictional REDD+ programs currently under development.
- **Expanded Supply** captures significant uncertainty that is embedded in jurisdictional program supply. This is in addition to jurisdictional program supply included in the Potential Supply estimate. The uncertainty results from programs included in the Governor's Climate and Forests Task Force (GCF) and Brazil's national-level emission reductions.

Three scenarios estimate the potential demand.

- **Status Quo demand** represents the demand currently observable from the voluntary market and Japan along with fixed dollar funds from results-based programs including the Forest Carbon Partnership Facility's Carbon Fund, Initiative for Sustainable Forest Landscapes, and REDD Early Movers. The per ton price assumption used for the fixed dollar funds impacts the demand in the Status Quo scenario. Results-based payments from Norway are considered separately within the Status Quo scenario.
- The **Compliance Growth demand** scenario includes Status Quo plus the potential future demand from regulations or national credit purchases that may be seen in developed and developing countries along with potential demand from the aviation sector. The ambition of these policy measures drives variability in demand.
- **Blue Sky demand** represents the most aggressive and least likely demand scenario and is based on strong domestic action by national governments to limit the impacts of climate change. The main

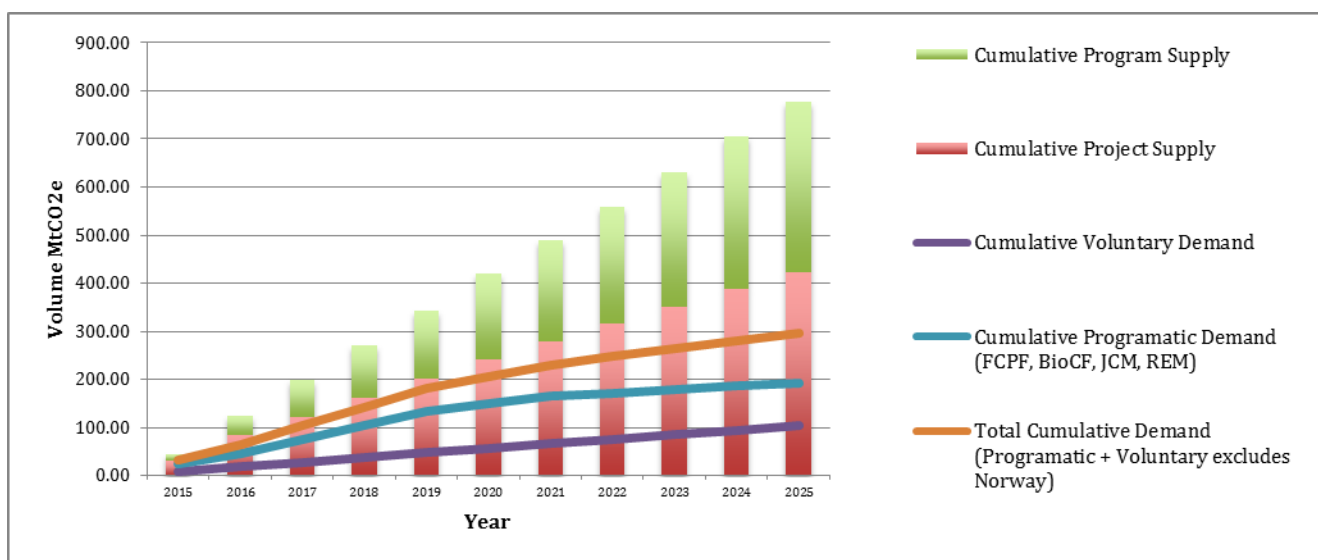
difference between the Blue Sky and Compliance Growth scenarios is the inclusion of demand from U.S. and Canadian national schemes, demand from Japan and New Zealand, and increased demand from Australia.

Demand estimates do not include the Green Climate Fund, as pledges and allocation of funding were unknown when the analysis was conducted in 2014. If the fund starts operations during 2015–2025, demand is expected to increase from this source. If US\$1 billion of the Green Climate Fund’s current US\$10.2 billion pledge was spent on REDD+ at US\$5 per ton, this action would create 200 million metric tons of carbon dioxide equivalent (200 MtCO_{2e}) in additional demand. The United States, United Kingdom, Germany, and Norway also have commitments to scale up results-based payments. Their commitments were not quantified but would be an additional source of demand not captured in the analysis.

FINDINGS

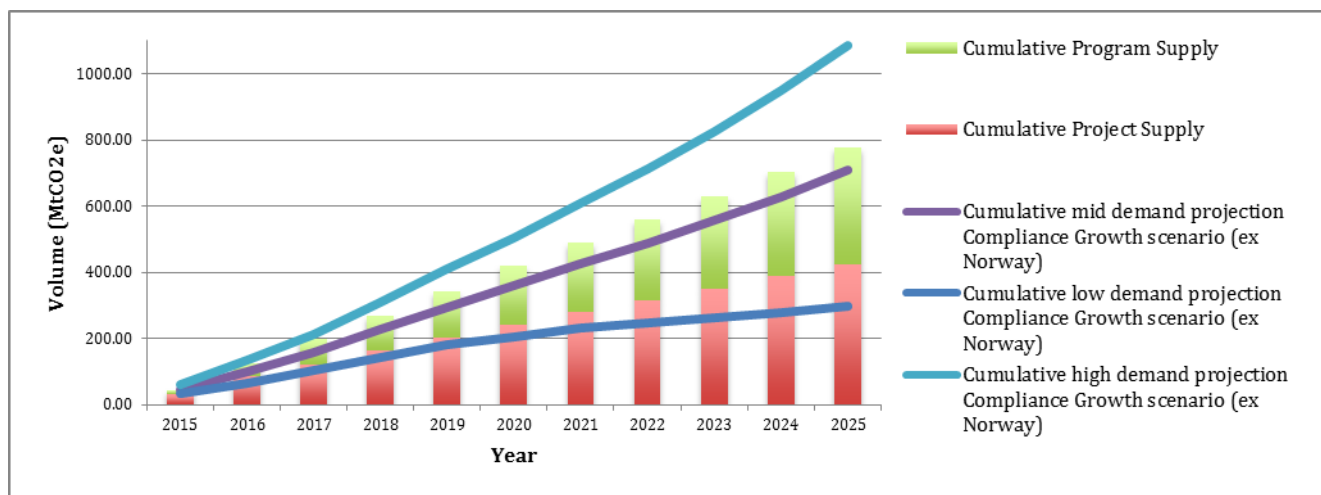
- The Potential Supply is 918 MtCO_{2e} credits during the 2015–2025 period (83 MtCO_{2e}/yr), including retroactive crediting of emissions reductions that occurred up to 5 years before registration. After the initial period of backdating, average annual supply is 71 MtCO_{2e}. Projects account for 518 MtCO_{2e} of the Potential Supply, and 400 MtCO_{2e} comes from programs.
- For the Status Quo scenario, demand estimates vary between 207 and 739 MtCO_{2e} during the 2015–2025 period depending on price assumptions paid by the fixed dollar funds.
- Supply and demand in the REDD+ credit market is unbalanced under Status Quo demand. There is short-term program level undersupply that is expected to turn quickly into chronic oversupply for projects and programs during the outlook period (2015–2025). See Figure 1.
- The oversupply in the Status Quo situation means that prices subject to market forces will remain depressed and verified credits will remain unsold unless demand can be expanded to absorb supply.

FIGURE 1: POTENTIAL SUPPLY (PROGRAM AND PROJECT) COMPARED TO THREE ESTIMATES FOR STATUS QUO DEMAND



- For the Compliance Growth scenario, demand varies between 429 and 1,188 MtCO₂e during the 2015–2025 period resulting in oversupply at low demand projections and undersupply at high demand projections (see Figure 2). Compliance demand growth could come from Australia, aviation, California, and the U.S. Clean Power Plan.
 - Australia has removed its cap-and-trade bill but remains committed to meeting its 2020 greenhouse gas (GHG) emissions target of 5 percent below the 2000 levels. This target implies a potential cumulative shortfall of 421 MtCO₂e during the 2014–2020 period, which could be made up of a mix of international and domestic actions, including REDD+.
 - International aviation is moving toward a market-based mechanism to achieve carbon neutrality from 2020. If REDD+ offsets are included, this shift could generate up 142 MtCO₂e in new demand during the outlook period.
 - California already has implemented cap-and-trade legislation that allows for the potential inclusion of REDD if additional rules are promulgated. California and Mexico recently signed a Memorandum of Understanding to enhance cooperation to reduce GHG emissions, which could spur a forest carbon market in California.
 - The United States Administration proposes to limit carbon pollution via the Clean Power Plan, which may add to demand. Potential litigation may block or create delays for this initiative.

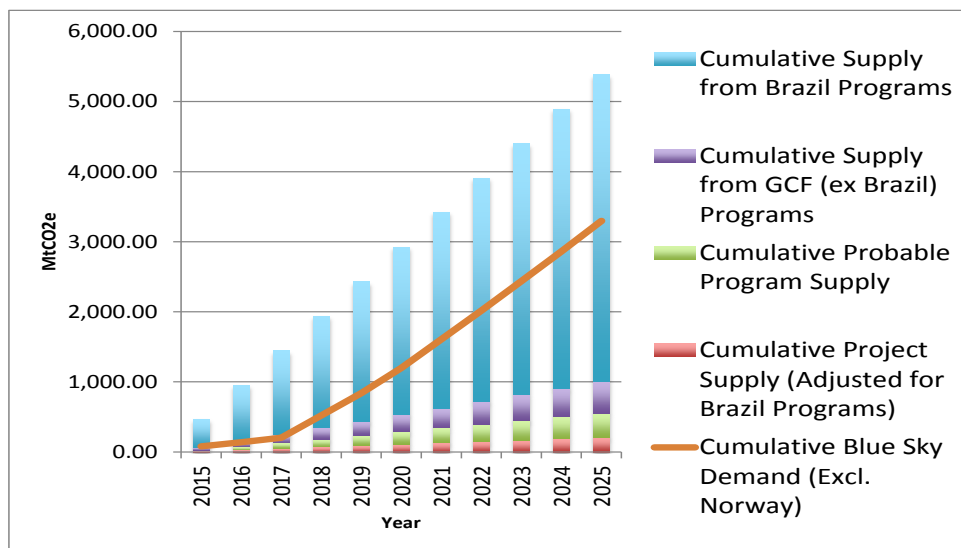
FIGURE 2: POTENTIAL SUPPLY (PROGRAM AND PROJECT) COMPARED TO THREE ESTIMATES FOR COMPLIANCE GROWTH DEMAND



- Blue Sky demand is estimated at 3.5 GtCO₂e during the 2015–2025 period. The Expanding Supply scenario captures the impact of significant new programmatic supply potential from the GCF (442.1 MtCO₂e – (excluding Brazil) and Brazil (4,380.30 MtCO₂e total, including 2,978.30 MtCO₂e claimed from states participating in the GCF). Together, the potential Expanded Supply adds 4.8 GtCO₂e in total during the 2015–2025 period). This amount is added to Potential Supply to achieve a total supply of 5.4 GtCO₂e (490.9 MtCO₂e/yr). See Figure 3 on the following page.
- However, the Brazilian federal government is not claiming that its national reductions are offsets or credits and currently does not seek to bring them to market. It is also unclear if the Brazilian states participating in the GCF will be able to bring some or all of the emission reductions generated at the

national level to market through state-level REDD+ initiatives. Acre is the most likely and is included in the Potential Supply scenario. Others may follow.

FIGURE 3: BLUE SKY DEMAND COMPARED TO ALL COMPONENTS OF EXPANDED SUPPLY



All of the results in this report can be found in an interactive graphic available online at the REDD Desk – <http://theredddesk.org>. The graphic allows users to select amongst each of the supply and demand scenarios described above. This includes options to select individual supply scenarios along with the low, mid, and high demand estimates for each country within the Status Quo and Compliance Growth scenarios and their inclusion or exclusion in the Blue Sky scenario.

IMPLICATIONS AND POLICY ACTIONS

- A substantial global commitment above and beyond our Blue Sky scenario is needed to fully harness the low-cost abatement potential of REDD+. Third party analysis estimates the feasible supply of emission reduction from deforestation to be 1.8 GtCO₂e per year at a cost of less than US\$ 20 per tCO₂e, with significantly higher estimates of theoretical supply (4.3 GtCO₂e per year).¹ This implies there is significant potential to grow supply beyond our Expanded Supply estimate of 490.9 MtCO₂e/yr. How demand could meet this feasible supply estimate is unclear as the Blue Sky demand scenario represents only 18 percent of this estimated annual feasible supply. Markets may absorb this volume over time, but other policy tools alongside ambitious market commitments and non-market payments may be needed to rapidly drive low-cost mitigation from REDD+.
- Continued weak demand will put a downward pressure on market prices, which may discourage REDD+ supply countries from engaging in markets and may create disillusionment in results-based REDD+ more broadly. With continued oversupply, many projects and programs may fail to be developed or not continue, resulting in a loss of skills and experience and potential increases in deforestation and forest degradation.

¹ Coren, M.; Streck, C.; and Myers Madeira, M. (2011). Estimated supply of RED credits 2011-2035. *Climate Policy*, 11:6, 1272-1288.

- Domestic mitigation actions drive demand, but schemes that use flexibility mechanisms for cost containment generally allow only internationally recognized offsets. If REDD+ markets are to work, REDD+ credits need to be incorporated in a future UNFCCC agreement alongside other options to incentivize REDD+.
- Growth in domestic compliance demand for REDD+ is uncertain, and large scale demand may be slow to emerge even with an international agreement. International aviation is an important growth opportunity, but this potential requires clear policy signals on approach and timing.
- Market rules can balance the objectives of encouraging broad sovereign participation, stimulating low-cost abatement, and preventing market flooding. Rules could include volume limitations from high-volume countries (caps), conservative rules to estimate tradable credit volumes, exclusion of some reductions from entering a market, and/or rules to prevent double payment for reductions from market and non-market sources.

1.0 INTRODUCTION

This report is intended to provide information on REDD+ supply and demand to carbon market participants, investors, donors, multilateral and bilateral institutions, governments, and nongovernmental organizations (NGOs) active in the REDD+ sector. As such, this document is aimed at a technical audience and assumes a certain level of prior knowledge. For the additional background on REDD+ and REDD+ markets, the Forest Carbon, Markets and Communities Program (FCMC) provides several resources.^{2,3}

In 2013, FCMC released the report “Emerging Compliance Markets for REDD+: An Assessment of Supply and Demand.” The report assessed the policies and early REDD+ actions that represented the status of market and results-based finance mechanisms for REDD+ around the world in late 2012/early 2013. A customizable interactive graphic containing all the supply and demand results from the 2013 report and from the current report can be found online at the REDD Desk – <http://theredddesk.org>.

During the past 2 years, the dynamics of the REDD+ market have changed significantly. On the demand side, the Californian market has not moved to admit REDD+, and the Australian market was wound up before it became fully operational; however, the Australian Government continued with domestic offsets laws as part of the government’s direct action policy that includes forest carbon. New Environmental Protection Agency (EPA) regulations in the United States may also create new market potential, depending on the response of U.S. states.

Additionally, hybrid market-like instruments that provided results-based payments for verified emission reductions for REDD+ have emerged. The BioCarbon Fund launched a new tranche with US\$280 million of funds to support landscape-level initiatives (the Initiative for Sustainable Forest Landscapes), the Forest Carbon Partnership Facility (FCPF) Carbon Fund received additional contributions, and Germany’s REDD Early Movers program is expanding.

There also is potential demand from the development of a single market-based mechanism for aviation, which would be used to achieve carbon neutrality in the international aviation industry. If implemented as an offset market that recognizes REDD+, it is likely to generate significant new demand for REDD+.

On the supply side, the REDD+ credits are generated at multiple scales including project and jurisdictional schemes.⁴ A large pipeline of credits at the REDD+ project scale currently dominates credit supply. Much of this supply is destined for the voluntary market, but some supply is likely to be incorporated within the growing jurisdiction-level programs.

² FCMC. (2013). Emerging Compliance Markets For REDD+: An Assessment of Supply and Demand. [Online]. Retrieved from http://www.fcmglobal.org/documents/Emerging_Compliance_Summary.pdf. Accessed 9 January 2015.

³ For further background on carbon markets: Linacre, N., et al. (2011). State and Trends of the Carbon Market 2011. World Bank, Washington, D.C. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/StateAndTrend_LowRes.pdf

⁴ Jurisdictional approaches are large-scale REDD+ initiatives that aim to reduce emissions or enhance removals at the national or jurisdictional level, such as a state, province, or ecoregion. They also can include project-level approaches “nested” within them.

A large number of jurisdictional programs are being developed, with a number submitted to the FCPF Carbon Fund (FCPF-C). The sheer number of jurisdictional initiatives that have embarked on readiness-development with the aim of moving toward results-based funding shows strong interest and support for jurisdictional programs as a precursor toward a future national REDD+ framework.

The significant changes in supply and demand during 2013 and 2014 necessitate an update of this report that now includes the large number of new jurisdictional programs under development. This report also develops a more detailed and nuanced analysis of the supply and demand dynamics between projects and large-scale jurisdictional programs, which was not included in the previous report.

Looking forward, domestic compliance markets that accept REDD+ offsets will play a key role in increasing demand. However, it is important that REDD+ be recognized in a future international agreement, as international recognition will likely be a precondition for acceptance within many domestic compliance markets. On-going commitments from voluntary buyers (corporate and consumers) will be critical along with action by the aviation industry and integration of carbon mitigation into large extractive and infrastructure projects (not included in this report).

The remainder of this document is divided up as follows: Section 2 provides background on the methodology and changes, Section 3 discusses market supply, Section 4 examines market demand, and Section 5 provides an analysis of supply and demand balance out to 2025. A series of technical appendices follow. These provide detailed information on the supply and demand modeling.

2.0 METHODOLOGY

There are methodological changes between this report and the previous report that FCMC released in 2013. The coverage of supply and demand sources is expanded to include non-market Payments for Results. The projection period now runs from 2015 to 2025, as compared to 2013–2020 for the 2013 report. The methodology used to estimate demand has been revised significantly, and where possible now uses models to project the demand estimates.

For the supply analysis an empirical model is developed, similar to the model used in the previous report. The main difference is the inclusion and separation of significant programmatic supply. The supply model is based on ex-ante carbon estimates extracted from those REDD+ mitigation activities (projects and programs) that demonstrated a measureable potential to produce high-quality credits that may be considered “compliance-grade”⁵ within the context of future compliance frameworks.

The primary supply estimate (credit pipeline) over the outlook period comprises a number of project-scale activities that already have met criteria to produce compliance-grade credits (referred to as Level I), projects preparing to satisfy criteria to produce compliance-grade credits (referred to as Level II), and jurisdictional-scale programs that have expressed an intent to pursue REDD+ credit markets and received REDD-readiness funding or at minimum established ex-ante estimates (referred to as jurisdictional programs).

Significant uncertainty in jurisdictional supply exists over and above that included in the potential supply pipeline. This uncertainty results from programs under the umbrella of the Governor’s Climate and Forests Task Force⁶ where the volume estimates for some programs is questionable and for the Brazil National program which may not supply international markets. These are modeled using a scenario approach that illustrates the impact of potential supply from these relatively unknown sources.

The demand projections rely on assumptions about prices, emissions, emissions growth and decline, caps, offset volumes, REDD and REDD+ credit volumes and percentages, timing of policy decisions, and the types of rules likely to be introduced. Some of the assumptions are based on historical data that may not be a reliable indicator of future behavior. Nevertheless, historical data is used in the development the REDD+ demand projections.

Demand uncertainty is communicated through a scenario analysis combined with an indication of the range of values that might arise within each scenario. The scenarios cover low but certain demand (Status Quo), expanding compliance demand (Compliance Growth), and high but uncertain demand

⁵ Compliance-grade REDD+ credits are considered to be those accounted for and verified under a high quality voluntary market standard that is either i) of comparable robustness to compliance market standards; and/or ii) may be recognized as eligible to meet regulated obligations under a compliance market. VCS is the dominant carbon accounting standard on the supply side and, for purposes of this study, represents the sole source of compliance-grade project level REDD+ credits. For jurisdictional or jurisdictional supply, the VCS Jurisdictional and Nested REDD+ standard was included, as were submissions to the FCPF’s Carbon Fund that would follow its Methodological Framework. Other jurisdictional proposals also were considered.

⁶ For more information, please visit <http://www.gcftaskforce.org/>.

(Blue Sky). Within Status Quo and Compliance Growth scenarios, an interval⁷ is used to indicate variability within each scenario, providing low-, mid-, and high-demand guidance.

Further details on the assumptions and methods used for the supply and demand analysis are found in the appendices of this report.

⁷ An interval represents our assessment of uncertainty in the model results due to uncertainty in prices, emissions, emissions growth and decline, caps, offset volumes, REDD and REDD+ credit volumes and percentages, timing of policy decisions, and the types of rules likely to be introduced.

3.0 SUPPLY

In response to changing demand patterns, the international REDD+ credit supply is increasingly favoring jurisdictional/programmatic approaches at the expense of project-level activities. Despite this change, there is still a large pipeline of credits from REDD+ projects in the primary supply estimate. Many of these are destined for the voluntary market but as REDD+ programs develop in granularity, numerous projects are being integrated (or nested) into the program's geographic boundaries.

Demand for jurisdiction-level credits may absorb some project supply where they can be incorporated into jurisdictional programs. Some projects that are not currently registered (Level II projects) may be abandoned. Should anticipated jurisdictional demand fail to materialize, jurisdictional credit oversupply is likely. In this situation, it is also conceivable that some programmatic activities will be sold to the voluntary market, further exacerbating the oversupply situation under the Status Quo demand scenario.

Two supply scenarios are developed. The first is a potential credit supply pipeline based on likely volumes from programs and projects. The second scenario is a speculative scenario based on potentially significant additional jurisdictional supply from Brazil National and GCF programs. The following sections discuss various aspects of the probable credit pipeline and include analysis of the credit pipeline with and without backdating, analysis of country supply, and analysis of project activities and size.

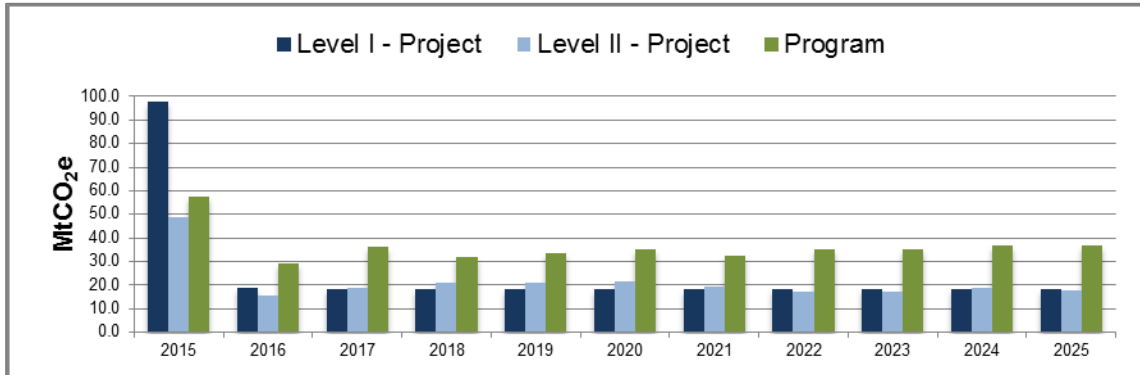
The volumes estimates for individual projects and programs, was primarily taken from self-reported data for Level II projects and programs. The quality of these data is highly variable, and while extreme outliers were corrected and estimates were discounted for a number of risk factors (See Appendix A), they are likely to be upwardly biased as developers seek to project favorable estimates in preparation of documents.

3.1 BACKDATING

Many programs and Level II REDD+ projects are at various stages of implementation but have yet to be validated or verified to enable issuance. Depending on a future program's rules, projects or programs may be eligible to receive credit for emissions reductions that occurred before the registration date, which is known as backdating. This represents the credits generated between the start of the project or program and the date of registration and first issuance. Most program rules limit this period to 5 years. Primary volumes for the credit pipeline are estimated with and without backdating.

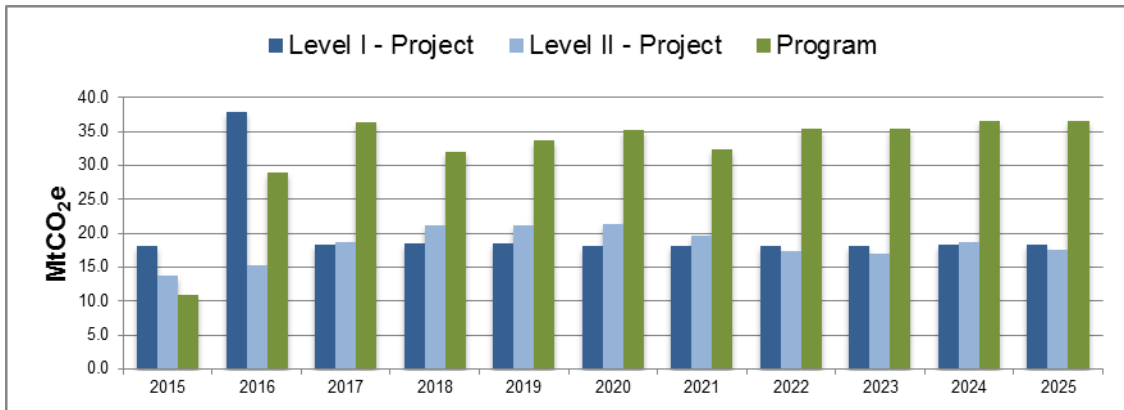
In the case of backdating, if first issuance occurs between 2015 and 2017, then up to five years of backdated credits may be included, which will deliver a higher-than-average annual volume of credits upon initial issuance. Figure 4 shows the effects of backdating on the primary credit pipeline.

FIGURE 4: ANNUAL CREDIT SUPPLY PIPELINE WITH BACKDATING TO 2010 (MTCO₂e)



The combined subtotal estimate shows credit volumes of nearly 918 MtCO₂e through 2025, with average annual supplies of more than 71 MtCO₂e per year after the initial period of backdating. When backdating is removed, the supply estimate drops by 15.4 percent to a total of more than 776 MtCO₂e through 2025 (see Figure 5).

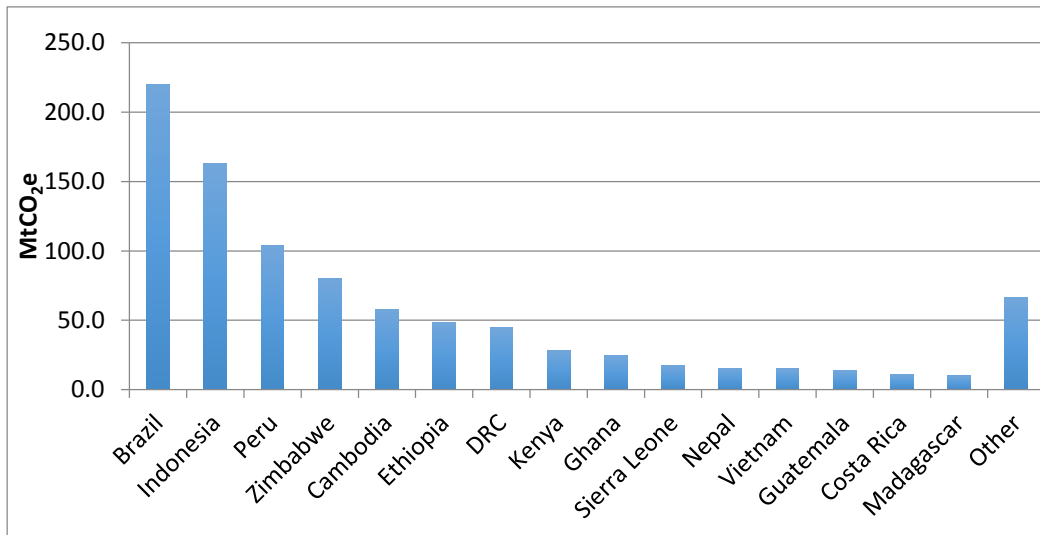
FIGURE 5: ANNUAL SUPPLY PIPELINE WITHOUT BACKDATING (MTCO₂e)



3.2 COUNTRY SUPPLY

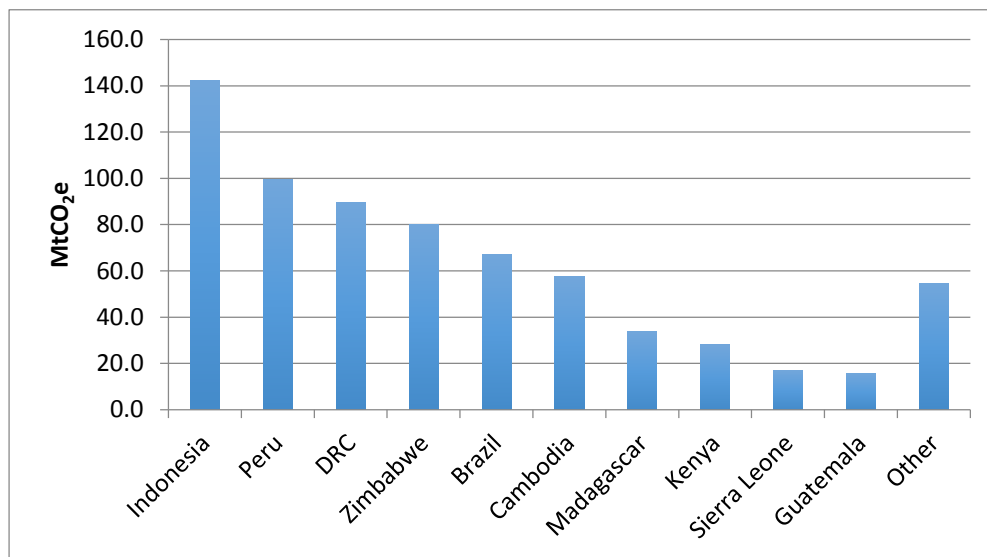
Thirty-three countries were represented across the projects and programs. The vast majority covers tropical forests, although temperate and shrub-land forests are also represented. The cumulative emission reductions per country through 2025 (with backdating to 2010 where applicable) are shown in Figure 6. The analysis excludes speculative volumes from GCF and Brazil National programs, except for the jurisdictional program in Acre, Brazil, currently seeking VCS Jurisdictional and Nested REDD+ (JNR) validation. Projects that are located within program areas pursuing jurisdiction-level REDD+ are excluded to avoid double counting.

FIGURE 6: SUPPLY PIPELINE (PROJECTS AND PROGRAMS) BY COUNTRY WITH BACKDATING (MTCO₂e)



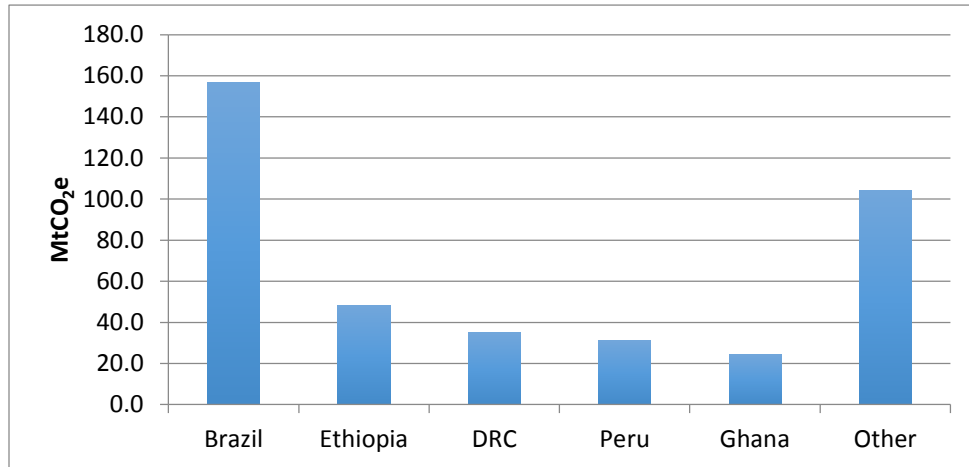
The programs contain significantly greater emission reductions than projects do. Figure 7 shows the volumes from the top 10 countries in the dataset, including projects located within jurisdictions.

FIGURE 7: CUMULATIVE PROJECT-LEVEL SUPPLY PIPELINE IN TOP 10 COUNTRIES, WITH BACKDATING (MTCO₂e)



The jurisdictional program supply for the five countries with the greatest programmatic volumes is shown in Figure 8. This excludes GCF and Brazil National programs (except for the VCS JNR estimates for Acre, Brazil, which are included).

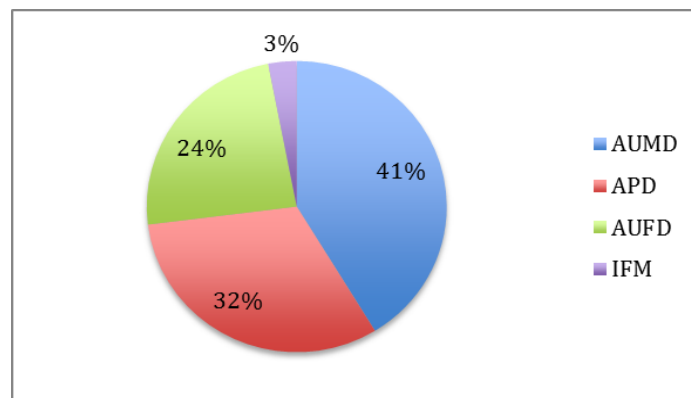
FIGURE 8: CUMULATIVE PROGRAM SUPPLY PIPELINE BY COUNTRY, WITH BACKDATING (MTCO₂e)



3.3 SUPPLY SEGMENTED BY VCS PROJECT ACTIVITY TYPE

Project supply can be segmented using the VCS typology of emission reduction projects in the forest and land-use sector. The categories are: Avoided Planned Deforestation (APD), Avoided Unplanned Frontier Deforestation and/or Degradation (AUF), Avoided Unplanned Mosaic Deforestation and/or Degradation (AUMD), and Improved Forest Management (IFM) (Figure 9). Project activities, without discounting or being omitted due to their presence within jurisdictional programs, account for 670.1 million credits through 2025.

FIGURE 9: CREDIT ISSUANCE VOLUMES SEGMENTED BY PROJECT TYPES



AUMD is the largest category (41 percent). This amount represents supply volumes from projects that address the phenomenon of mosaic deforestation or degradation, which is deforestation or degradation that occurs in patches across a forested area and is typically driven by local land use practices such as

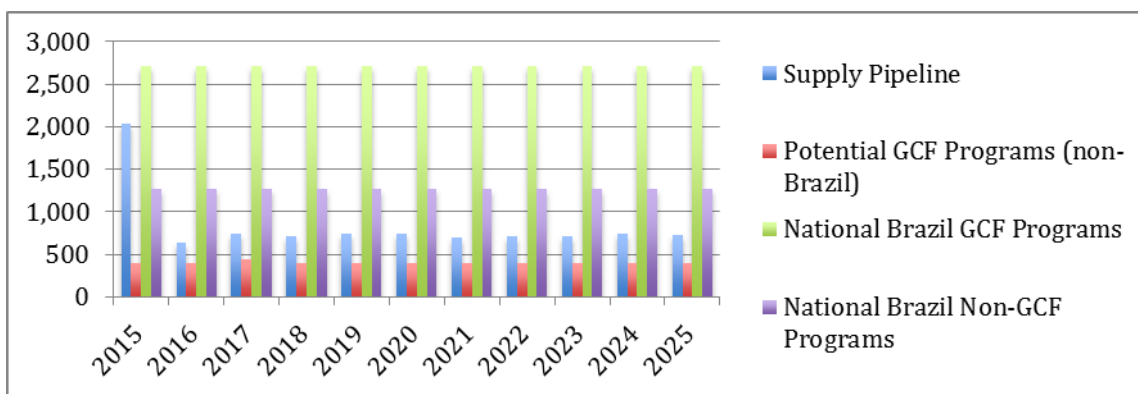
shifting cultivation agriculture. In many areas AUMD tends to occur with AUFD (24 percent)⁸, which represents supply volumes from projects that address deforestation and forest destruction that occurs along a discernible frontier, such as a new road cut into a forest. Together, projects addressing these issues account for 65 percent of credit issuances. APD accounts for nearly one-third (32 percent) of all project supply credits, with IFM projects making up the remaining 3 percent.

3.4 EFFECT OF BRAZIL NATIONAL AND GCF-SUPPLY

A number of programs were not included in the probable supply estimate, as there were insufficient underlying data on the programs (GCF) and/or questions about whether the emission reductions would be sold as credits (Brazil). However, an Expanded Supply scenario was created with this for comparison to the Blue Sky demand scenario. The Expanded Supply estimates include, i) planned GCF programs (excluding Brazil) that could be brought to market; ii) GCF programs in Brazil that fall within Brazil’s national-level reductions (Acre’s VCS/JNR values are subtracted to avoid double-counting); and iii) potential supply from the rest of Brazil as a result of Brazil’s national-level reductions. Without significantly reducing volumes to account for the early development stage of the GCF programs, volume from the GCF and Brazil would swamp the credit pipeline (Figure 10). Each of the scenarios in Figure 10 are additive, showing that including Brazil and GCF programs would have a roughly 10 fold increase in supply. This is to be expected given contribution from Brazil and GCF provinces in Indonesia.

However, it is important to emphasize that the Brazilian federal government is not claiming its national reductions as offsets or credits, and it is not currently seeking to bring them to market. Brazil’s national-level emission reduction estimates also have not been calculated to produce marketable offsets, and new estimates may be needed if these reductions were to enter a market. That said, it is also unclear whether the Brazilian states participating in the GCF will be able to bring emission reductions generated at the national level to market through any state-level REDD+ initiatives, and how such volumes would be calculated. For example, Acre’s estimates following the VCS JNR are significantly lower than those estimated using national data or from other Brazilian state programs reported under the GCF.

FIGURE 10: SUPPLY VOLUMES FROM THE POTENTIAL CREDIT PIPELINE AS COMPARED TO BRAZIL NATIONAL AND GCF



⁸ Verified Carbon Standard. (2014). VM0015 Methodology for Avoided Unplanned Deforestation. Retrieved from <http://www.v-c-s.org/news-events/news/vcs-approves-new-redd-methodology-avoid-unplanned-deforestation>. Accessed 18 November 2014.

4.0 DEMAND

Estimating REDD+ demand is complicated by political uncertainty over its acceptance and use in new or existing schemes. Rules on the types and volumes of offsets allowed into a scheme vary, and while no regulated market accepts REDD+ to date, future markets may place limits on the use of REDD+ or exclude REDD+ altogether. These factors create uncertainty in estimating future demand. In the current voluntary market and future compliance markets, demand for REDD+ will not be static and will need to compete, based on price and perceptions of quality, with other credit types. Despite this, a static analysis is used to estimate potential future REDD+ demand.

Uncertainty is communicated through a scenario analysis combined with an indication of the range of values that might arise within each scenario. The scenarios used are: Status Quo, Compliance Growth, and Blue Sky. The scenarios indicate the scope of potential actions, ranging from higher confidence and lower volumes to lower confidence and higher volumes.

4.1 STATUS QUO DEMAND

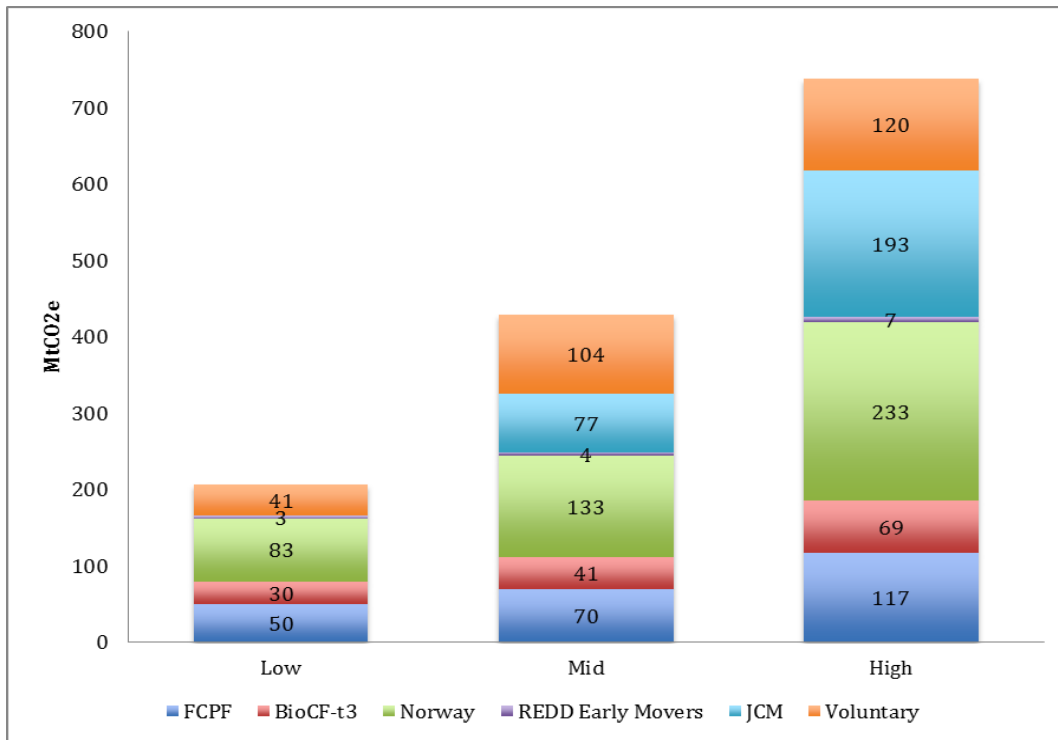
The Status Quo scenario is built on the voluntary market and on the following bilateral and multilateral results-based mechanisms: Forest Carbon Partnership Facility Carbon Fund, Initiative for Sustainable Forest Landscapes (ISFL), Japan's Joint Crediting Mechanism (JCM), and REDD Early Movers (REM). Norway's Payment for Results programs are also included to provide a complete picture of potential demand, but these results-based-payments are of a different nature than other sources of demand. Demand from these sources, while representing the least volume when compared to those in other scenarios, is known with the greatest confidence (see Figure 11). In this scenario, potential demand varies between 213 and 749 MtCO₂e for 2015–2025, reflecting price uncertainty and uncertainty around the JCM and Norway's payments to Indonesia.

Several factors affect this market. The most important is possibly general economic conditions, which can materially adversely affect the willingness of voluntary market participants to offset emissions and the willingness of donors to support efforts to slow deforestation.

Fixed dollar funds such as ISFL and FCPF-C are sensitive to the agreed purchase price of credits. High prices result in fewer credit purchases (i.e., lower volumes) and lower prices result in more credit purchases (i.e., higher volumes). Also, future volume from the voluntary market is unknown; however, past volume data may be a reasonable guide to estimate future volumes.

Uncertainty is communicated through a range of price and volume assumptions that may provide a guide to future demand. Figure 11 provides a breakdown of low-, mid-, and high-demand guidance and illustrates uncertain components of the Status Quo scenario, which is volume from Japan's JCM and the likely timing of deliveries of emission reductions from Norway's Indonesia fund.

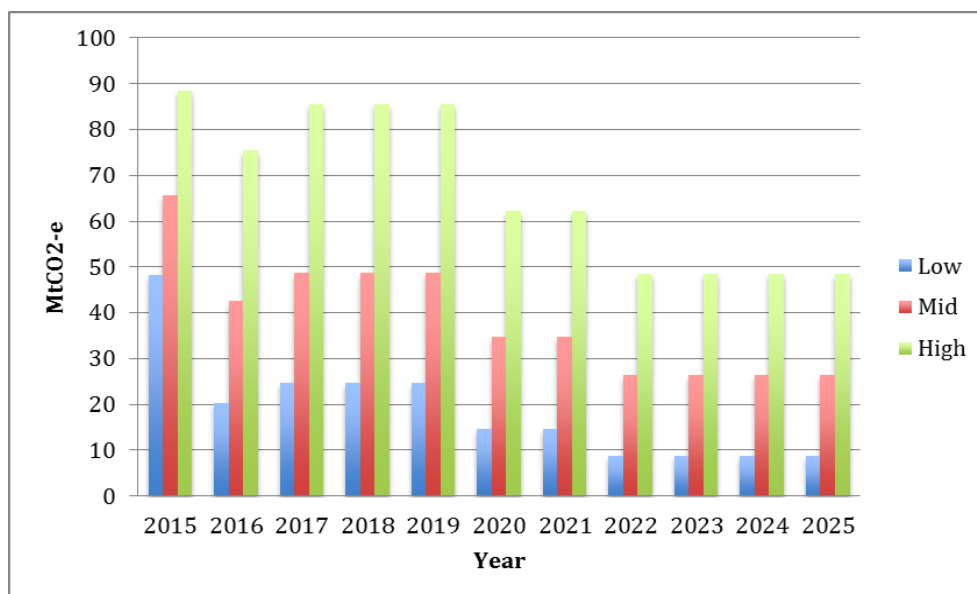
FIGURE 11: TOTAL STATUS QUO DEMAND 2015–2025 (MtCO₂e)



The annual demand provides an indication of the timing of demand. Figure 12 shows that Status Quo demand peaks between 2015 and 2019 and then falls away due to the time- and funding-bound ISFL and FCPF-C wrapping up purchases. This figure illustrates the importance of having other sources of demand ramping up past 2020 to maintain even modest amounts of current demand.

The analysis does not include potential demand from the Green Climate Fund, which was unknown when the analysis was conducted. If US\$1 billion of the Green Climate Fund’s current US\$10.2 billion pledge were spent on REDD+ at US\$5 per metric ton, 200 MtCO₂e in additional demand would be created. As the details of support for REDD+ are resolved, there may be additional demand during the outlook period that may alleviate the decline in demand associated with existing bilateral and multilateral programs.

FIGURE 12: STATUS QUO ANNUAL DEMAND PROFILE FOR LOW, MID, AND HIGH ESTIMATES



4.2 COMPLIANCE GROWTH DEMAND

The Compliance Growth scenario represents demand that might arise from existing or new GHG mitigation schemes, including commitments from the aviation industry and developing country’s domestic programs. This scenario covers a range of actions from broad coverage cap-and-trade schemes (e.g., California); carbon taxes (e.g., South Africa); offsetting (e.g., aviation); and national actions such as the impact of United States Environmental Protection Agency (EPA) actions on the Clean Power Plan under the Clean Air Act section 111 (CAA s111). It does not include demand from the European Union Emissions Trading Scheme (EU ETS). This scenario is less certain than Status Quo demand (see Appendix A for further details). If countries include the types of regulations considered here in their Intended Nationally Determined Contributions submitted to the UNFCCC, this effort could start to paint a picture of future domestic demand found in a new UNFCCC agreement.

Demand projections vary between 437 and 1,196 MtCO₂e in the 2015 to 2025 timeframe. This estimate includes the mid-point projection from the Status Quo scenario of 437 MtCO₂e (Figure 13).

Demand from Asia and Oceania is largely driven by Australia, making good any emissions shortfall with demand also coming from China and Korea. Although Australia remains committed to meeting its 2020 GHG emissions target of 5 percent below 2000 levels, with current policies Australia may not be able to meet this target.⁹ While Australia does not currently intend to purchase international offsets, there is potential for a shortfall that could be made up using a mix of international offsets including REDD+. Demand projections for Asia and Oceania vary between 0 and 279 MtCO₂e.

⁹ Australian Climate Change Authority. (2014): “Based on its current configuration and funding, the Authority considers that the Emissions Reduction Fund is unlikely to deliver sufficient emissions reductions to reach Australia’s minimum 2020 target of 5 per cent below 2000 levels. A range of complementary actions will be required, now and beyond 2020”. Retrieved from <http://www.climatechangeauthority.gov.au/news/article/climate-change-authority-releases-carbon-farming-initiative-and-renewable-energy-target>. Accessed 27 December 2014.

North America is a less significant source of projected demand (between 0 and 194 MtCO_{2e}) – but possibly less speculative, as it is based on the stated intentions of California to use REDD credits. The potential impacts of U.S. EPA CAA s111 are included and also uncertain. California is modeled by assuming that its cap-and-trade scheme is sufficiently restrictive to meet the new EPA rules and all sectors can use offsets. It is also assumed that at least one state neighboring California joins in the cap-and-trade scheme and that Quebec allows REDD offsets. Oregon and Washington were considered as choices to include in an expanded California scheme linked to Quebec. Based on interviews, it appears that Washington is a more likely candidate but still somewhat speculative. The modeled effect of CAA s111 is relatively modest, with demand projections varying between 0 and 23 MtCO_{2e}. Recent falls in oil prices, if sustained, may lead to significant changes in gas volumes from the shale gas industry, which in turn may affect the costs associated with CAA s111 and its likely success. Potential volumes from Mexico are also included in this scenario (0-110 MtCO_{2e}).

A relatively important potential source of demand in this scenario is a carbon neutrality goal of the international aviation industry, which is projected to need between 0 and 142 MtCO_{2e} of REDD+ credits to meet its demand. To achieve the carbon neutrality goal, the aviation industry is developing a roadmap for the development of a single market-based mechanism for aviation to be implemented from 2020, which is expected to be adopted at the International Civil Aviation Organization's (ICAO's) next Assembly in 2016.¹⁰ It is likely that this mechanism will be an offset mechanism and may include the potential to use REDD+ credits. Should REDD+ not be included, then no demand will arise – hence the lower bound of zero on the interval.

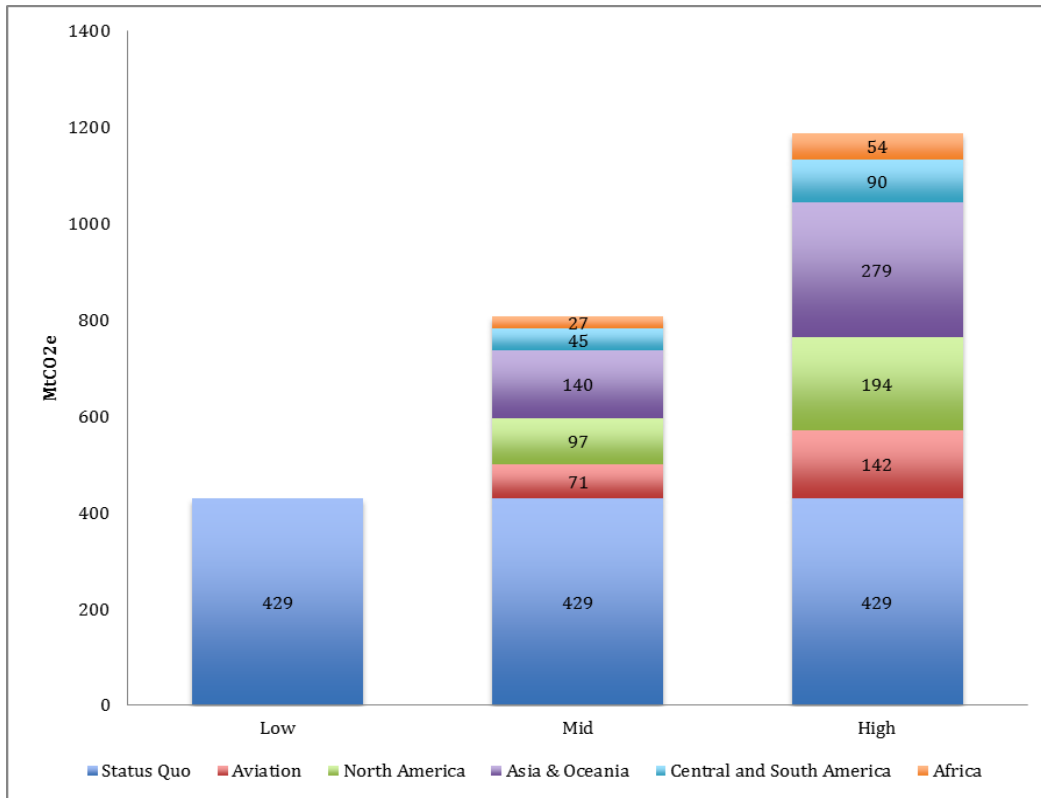
This scenario includes demand from domestic actions of (0-90 MtCO_{2e}) from countries in Central and South America where programs for reducing GHG emissions are emerging. Primarily, this region is a source of supply; however, with ambitious targets, the region may become a source of demand. Brazil¹¹, Chile, and Costa Rica are included in the analysis, with Costa Rica being the main driver of demand in the projections (0–64 MtCO_{2e}).

Finally, some demand (0–54 MtCO_{2e}) is also included from the proposed South African carbon tax and associated offset scheme. The tax is currently on hold.

¹⁰ International Civil Aviation Organization. (2013). Reducing Emissions from Aviation through Carbon-Neutral Growth. Working Paper. Retrieved from <https://www.iata.org/policy/environment/Documents/atag-paper-on-cng2020-july2013.pdf>. Accessed 28 August 2014.

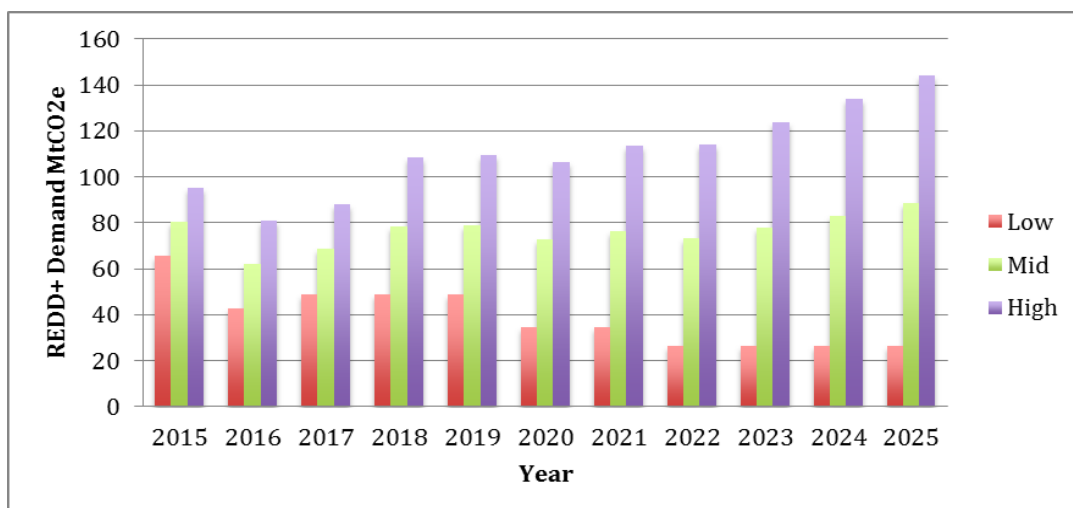
¹¹ Brazil's total demand in this scenario is 5 (mid) to 10 (high) million MtCO_{2e}, which is below the supply of estimated credits coming from Brazil from Level I and II projects and the Acre program which is 220 MtCO_{2e}, making Brazil a net supplier of credits.

FIGURE 13: TOTAL DEMAND FOR THE COMPLIANCE GROWTH SCENARIO 2015 – 2025 (MTCO_{2e})



The annual demand provides an indication of the timing of demand and shows growing volumes over the outlook period for this scenario if demand from California materializes after 2020. Under either mid or high projections, the demand ramps up after 2020 and compensates for any declines in the Status Quo scenario (Figure 14).

FIGURE 14: THREE ESTIMATES OF ANNUAL DEMAND IN THE COMPLIANCE GROWTH SCENARIO (MTCO_{2e})



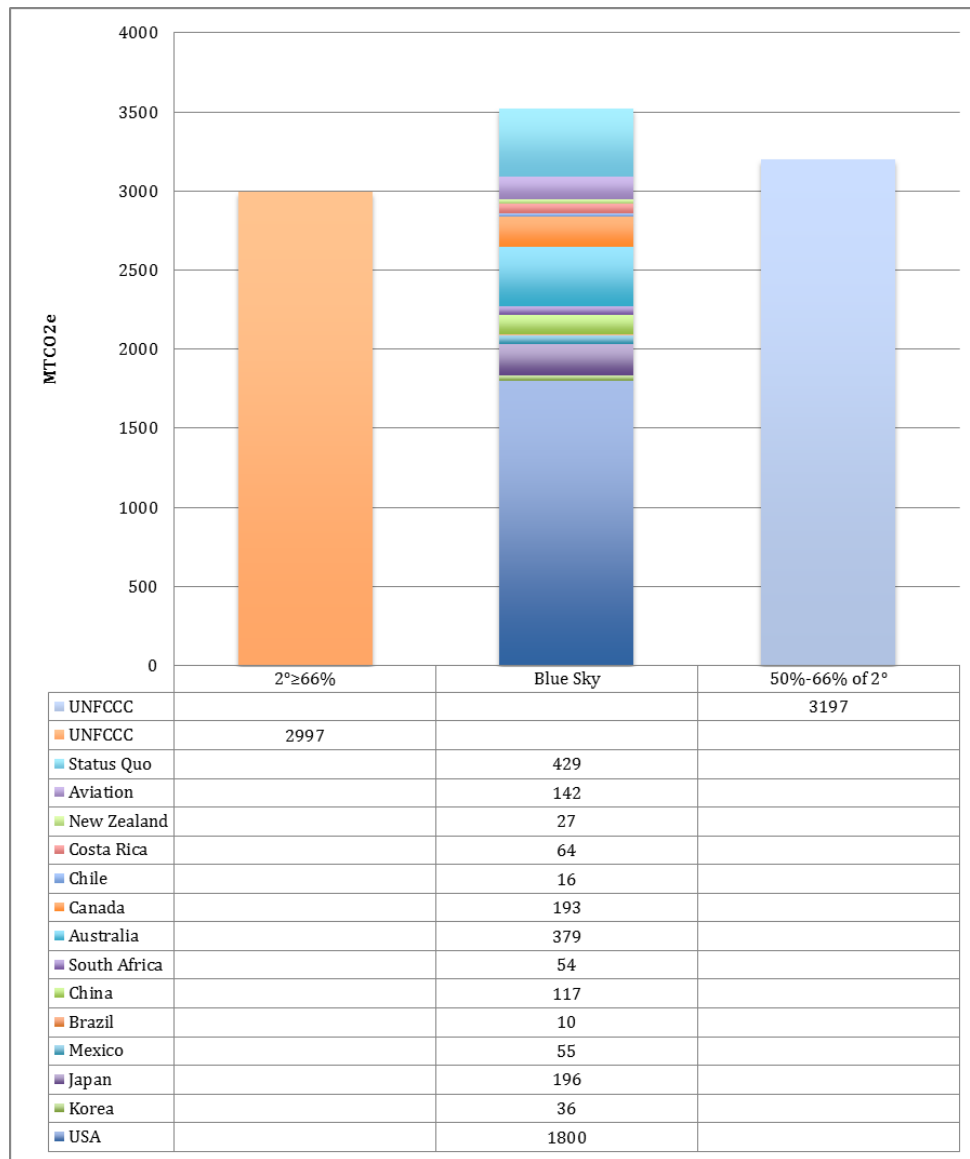
4.3 BLUE SKY DEMAND

The Blue Sky scenario represents the highest and least likely demand scenario and is predicated upon strong domestic action by developed and developing country governments to limit the impacts of climate change. In this scenario, demand is projected to be 3,518 MtCO₂e during the 2015–2025 period. A range is not provided, as this scenario is speculative. The assumptions contained in the Blue Sky scenario also could be viewed as the highest possible outcome for REDD+ in Intended Nationally Determined Contributions incorporated in a new UNFCCC agreement.

The bottom-up approach of the Blue Sky scenario is also compared against a top-down view of a global UNFCCC agreement to limit the global temperature rise to 2 °C with a high chance (≥ 66 percent) and medium chance (50 percent to 66 percent) during the 21st century. The top-down UNFCCC projections assume that a binding global cap is agreed upon in 2020, and that emissions reductions are achieved in the volumes needed to have a high chance (≥66 percent) and medium change (50 percent to 66 percent) by 2025, consistent with achieving a 2 °C target over the century. The projection assumes that 2.5 percent of the theoretical cap is allowed for offsets and that offsets come from the uncapped sector being agriculture, forestry, and other land use (AFOLU).

Figure 15 shows the impact of potential REDD+ demand from major emitters—principally the United States in the Blue Sky scenario—and compares this demand to the estimates from the UNFCCC model for high chance (≥66 percent) and medium change (50 percent to 66 percent) of 2 °C.

FIGURE 15: BLUE SKY DEMAND COMPARED TO UNFCCC DEMAND



The main difference between the Blue Sky and Compliance Growth scenarios is the inclusion of strong demand from U.S. and Canadian national schemes, demand from Japan and New Zealand, and increased demand for REDD+ from Australia. The most important new source of demand is assumed to come from the United States, which is assumed to adopt a broad coverage national cap-and-trade scheme in response to industry lobbying to simplify the plethora of state-based regulatory schemes that might arise in response to CAA s111.

The U.S. national scheme is modeled on the American Clean Energy and Security Act of 2009.¹² The Act targeted 720 million tons of emission reductions from deforestation in developing countries in 2020 and 6,000 million tons cumulatively by 2025. Financing for these reductions was provided by allocating 5 percent of allowances to this purpose, with flexibility to change this percentage to achieve targets.^{120,121}

The U.S. national scheme is assumed to start in 2018. The projection assumes the same level of ambition as the original Act but delayed to 2025. This approach requires 750 MtCO_{2e} of emission reductions per year to meet the 6,000-million target. A US\$5 per ton price implies that US\$3.75 billion annually needs to be allocated from emissions allowances.

In the top-down UNFCCC comparison, the high confidence model projects global emissions between 2005 and 2020 and then assumes that emissions fall between 2020 and 2025 from 59 GtCO_{2e} to 40 GtCO_{2e}¹³², the 2025 target needed to be confident (≥ 66 percent) of not exceeding a 2 °C temperature increase during century. The moderate confidence model projects global emissions between 2005 and 2020 and then assumes that emissions will fall between 2020 and 2025 from 59 GtCO_{2e} to 44 GtCO_{2e}¹³², with 44 GtCO_{2e} being the 2025 target needed to be moderately confident (50-60 percent) of not exceeding a 2 °C temperature rise during the century.

¹² Congress of the United States. (2009). The American Clean Energy and Security Act 2009. Retrieved from <http://www.gpo.gov/fdsys/pkg/BILLS-111hr2454eh/pdf/BILLS-111hr2454eh.pdf>. Accessed 25 August 2014.

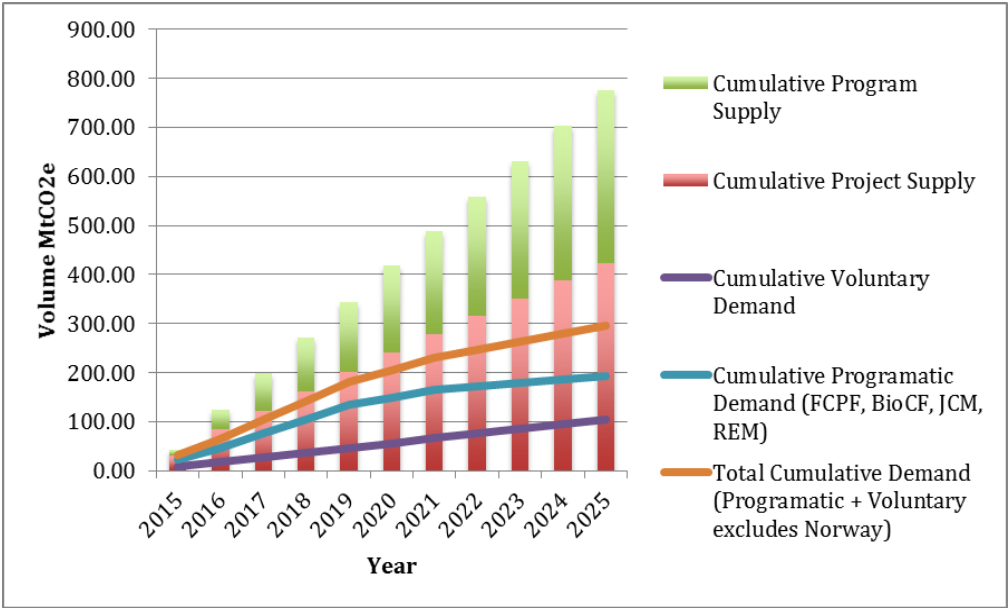
5.0 MARKET OUTLOOK: SUPPLY AND DEMAND BALANCE

The REDD+ credit market is oversupplied in the Status Quo scenarios, but could have balanced supply and demand under the Compliance Growth mid and high scenarios (see Figure 17). The Blue Sky scenario may also be oversupplied if significant programmatic supply enters the market from Brazil and numerous programs in Indonesia. This situation is likely to persist over the outlook period (2015–2025) unless REDD+ credit developers significantly scale back production or an ambitious level of new demand is created.

Analysis of Status Quo demand shows the most significant oversupply. Figure 16 shows the cumulative project and programmatic supply (excluding proposed GFC programs [excluding Brazil] and national reductions from Brazil) compared to cumulative Status Quo demand (excluding Norway).

Norway’s Payment for Results is excluded from the comparisons because it does not represent a purchase of credits that directly compares to sources of supply. There is also only one year of the Amazon fund in the projection (for 2015), and all further significant demand is expected to come from Norway’s payments to Indonesia, which so far has not met any of the benchmarks required to trigger a payment from Norway. Excluding Norway’s potential payments to Indonesia significantly reduces demand in the Status Quo scenario across the uncertainty interval used to model Status Quo volume guidance (low, mid, and high).

FIGURE 16: TOTAL SUPPLY COMPARED TO STATUS QUO DEMAND



Project supply continues to significantly exceed voluntary market demand. If most of the project supply (518 MtCO₂e) finds its way into the voluntary market, we estimate in our most optimistic demand projection that the supply (518 MtCO₂e) will exceed voluntary demand (104 MtCO₂e) by more than 500 percent. Either supply must contract, or demand must expand. In the absence of an expansion in demand, price pressure is likely to prevent several projects and programs from entering the market and to force other suppliers to exit the market.

The consequences of this excess supply are currently felt in the voluntary market. During the 2012–2013 period, many forest carbon project developers dropped their prices, with suppliers reporting an average REDD offset price of US\$4.2/tCO₂e (down from US\$7.4/tCO₂e). This price would have been even lower (US\$3.5/tCO₂e) had it not been for Acre’s sizable transaction, approximated at US\$5/tCO₂e.¹³ Additionally, REDD+ projects struggle to sell verified credits, as evidenced by the number of credits that are verified but not issued under the VCS (issuance has costs which often can only be paid upon sale).

In the near term, jurisdictional demand will expand, driven by bilateral and multilateral funds. This expansion can only help alleviate some of the chronic oversupply in the voluntary project market if projects are able to be nested into jurisdictional programs that can access the multilateral and bilateral results-based programs. However, current estimates of jurisdictional supply of 353 MtCO₂e already exceed Status Quo programmatic demand of 116 MtCO₂e (excluding voluntary market, Norway, and JCM) when assuming a US\$5/tCO₂e price. In this situation, projected programmatic supply will exceed Status Quo programmatic demand by more than 300 percent. It is also likely that many Level II projects with higher abatement costs will not be brought to market, further contracting supply.

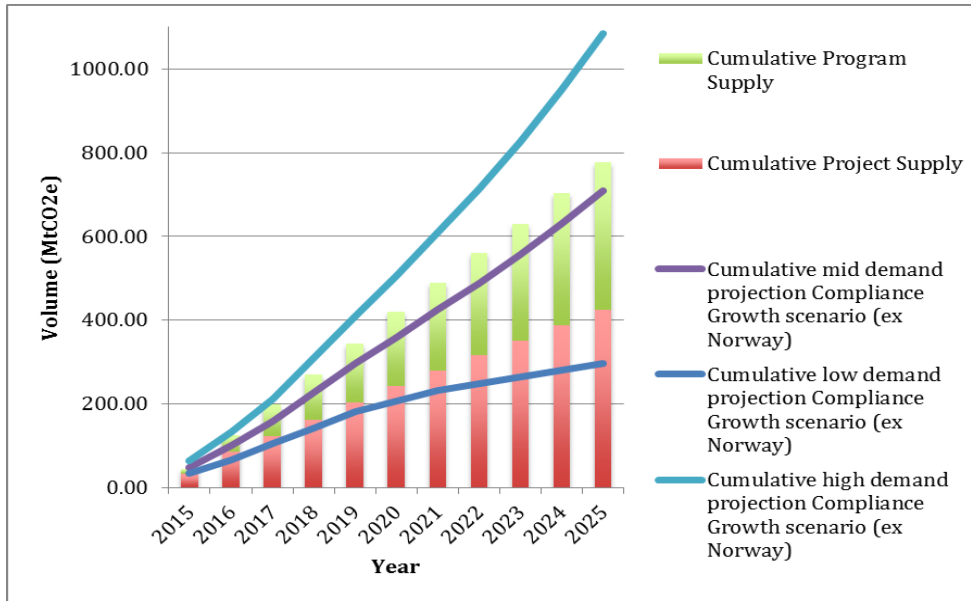
For the fixed dollar funds such as FCPF-C and ISFL, downward price pressure may mean that there will be greater flexibility to enter contracts below the current US\$5/tCO₂e price that many countries use as a contract benchmark. All other things being equal, a lower contract price will result in more volume from these funds and hence abatement.¹⁴ The pricing approach of the fixed dollar funds may not, however, be completely responsive to market forces, as these funds have broader policy objectives than sourcing low-cost REDD+ credits. Additionally, if results-based program pricing is properly developed, it will need to cover the marginal abatement costs for the program to produce emission reductions.

Despite this gloomy picture, demand from compliance activities may expand during the outlook period of 2015–2025. At the lower end of the Compliance Growth scenario (the low projection) supply still swamps demand. However, in our mid demand projection, supply and demand are balanced – and for the high demand projection in the Compliance Growth scenario, demand exceeds supply (Figure 17).

¹³ Ecosystem Market Place. (2014). State of the Voluntary Carbon Market 2014. Retrieved from http://www.forest-trends.org/documents/files/doc_4501.pdf. Accessed 3 November 2014.

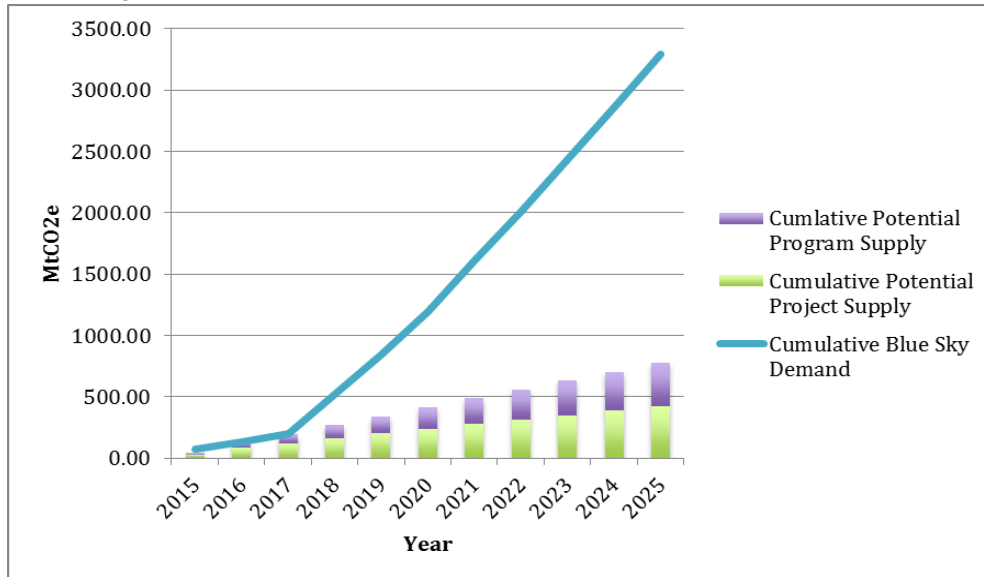
¹⁴ Because the funds available are fixed, decreasing the contract price at which the fund agrees to buy abatement leads to more abatement being purchased, and increasing the contract price at which the fund agrees to buy abatement leads to less abatement being purchased.

FIGURE 17: PROJECT AND PROGRAM SUPPLY COMPARED TO PROJECTIONS OF DEMAND FOR THE COMPLIANCE GROWTH SCENARIO



When we consider the most optimistic demand scenario, Blue Sky, the supply and demand balance is reversed with demand significantly exceeding probable supply estimates during the outlook period. Figure 18 shows the total probable supply compared to the Blue Sky demand, excluding supply from Brazil and GCF programs.

FIGURE 18: PROJECT AND PROGRAM SUPPLY COMPARED TO BLUE SKY DEMAND

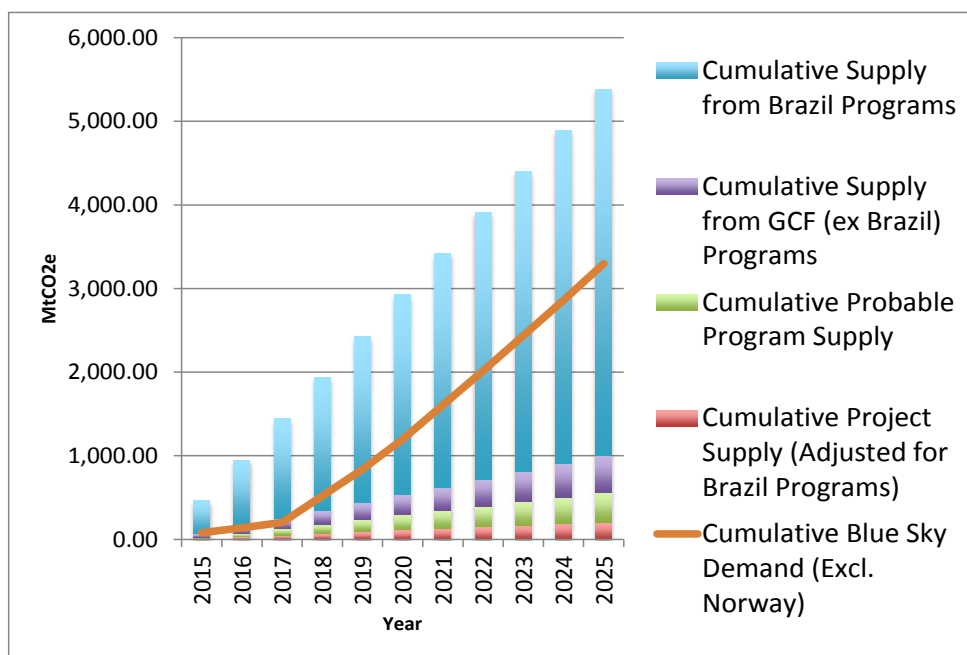


This situation is potentially reversed again if the Brazilian and GFC (excluding Brazil) programs are included in the analysis (Figure 19). The Brazil national volumes in particular are significant and on their own swamp all of our demand scenarios.

If Brazil’s reductions entered the market, this change would represent a massive oversupply, which would further depress prices for years to come. However, we emphasize that Brazil’s current national-level emission reduction estimates have not been calculated as marketable offsets, and new estimates may be needed if these reductions enter a market. The position of the Government of Brazil also would need to change from one of seeking Payment for Results to one of entering an emissions trading credit market.

At this stage, it does not appear that excess supply from Brazil will come to the REDD+ market; however, if mechanisms are adopted to create REDD+ offsets from this source, then there will be major supply ramifications. Brazilian states that are members of GCF further complicate the situation by seeking to access a carbon market if possible. State-level initiatives are a more probable route to market, but current estimates of state-level potential come with a high degree of uncertainty.

FIGURE 19: TOTAL SUPPLY, INCLUDING BRAZIL NATIONAL AND GCF, COMPARED TO BLUE SKY DEMAND



If new demand does not materialize and new supply continues to come to the market or threatens to come to the market, prices will remain depressed and may drop further. This trend should have the effect of deterring project and program developers from making additional investments. However, as the program side of the market largely depends on government sellers and donors buyers under results-based programs, it is possible that oversupply could characterize this market until serious attempts at performance/market-based commitments are made to mitigate climate change or other forms of finance are identified and secured to support REDD+. Market rules to balance the objectives of encouraging broad sovereign participation, stimulating low-cost abatement, and preventing market flooding could also be considered. Rules could include volume limitations from high-volume countries (caps), conservative rules to estimate tradable credit volumes, exclusion of some reductions from entering a market, and/or rules to prevent double payment for reductions from market and non-market sources.

Even if new demand materializes, it is unclear whether this demand will be adequate on its own to capture the low-cost mitigation potential of REDD+ in the near term. Third party estimates of the

feasible credit supply from deforestation indicate up to 1.8 GtCO₂e/yr could be generated at less than US\$20/tCO₂e, with significantly higher estimates for theoretical supply (up to 4.3 GtCO₂e/yr).¹⁵ This implies there is significant potential to grow supply beyond our Expanded Supply estimate of 490.9 MtCO₂e/yr. However, our most optimistic Blue Sky demand scenario produces approximately 300 MtCO₂e/yr of demand, which is 1.5 GtCO₂e/yr less than the feasible supply estimates. While this difference appears large, the total volume of feasible potential under \$20 / tCO₂e and/or the number of years the 1.8 GtCO₂e/yr of feasible supply will be available is unclear. As a result, it is also unclear how many years it would take for market mechanisms to absorb feasible supply under \$20 / tCO₂e. Regardless, given the gap between the Status Quo or Compliance Growth demand scenarios and the feasible supply estimates, other options in addition to market mechanisms may be needed to maximize the low-cost mitigation potential from REDD+ in the near term.

All of the results in this report can be found in an interactive graphic available online at the REDD Desk – <http://theredddesk.org>. The graphic allows users to select amongst each of the supply and demand scenarios described above. This includes options to select individual supply scenarios along with the low, mid, and high demand estimates for each country within the Status Quo and Compliance Growth scenarios and their inclusion or exclusion in the Blue Sky scenario.

¹⁵ Coren, M.; Streck, C.; and Myers Madeira, M. (2011). Estimated supply of RED credits 2011-2035. *Climate Policy*, 11:6, 1272-1288.

APPENDIX A. CREDIT SUPPLY FOR REDD+ FROM NON-ANNEX I COUNTRIES

A number of global economic models have attempted to predict the supply of future REDD emission reductions via top-down methods. These models determine the biophysical potential for emission reductions in forest areas where the economic case justifies a switch from forest use (conversion) to forest protection. These estimates are useful in providing a glimpse of the full potential of GHG emission reductions in forests, based on opportunity costs and credit price assumptions.

Such models tend to be limited by coarse data sets and often ignore many practical issues that affect actual supply of REDD credits. For example they do not take into account Reference Emission Levels (RELs), which determine the fraction of emission reduction potential that is eligible to be recognized as an offset, nor do they consider the political circumstances, implementation and monitoring challenges, or land tenure challenges project and program developers face.

The price assumptions in these models are also speculative, as a clear price signal for compliance REDD+ credits has not emerged. For these reasons, global economic models have limited utility for estimating the potential supply of compliance-grade REDD+ credits.¹⁶ We therefore adopt a bottom-up approach for estimating the supply of compliance-grade REDD+ credits. This approach provides a potential supply scenario over the short- to medium-term (2015–2025).

The bottom-up approach extrapolates available project and program supply data and captures some of the economic, political, financial, and implementation issues affecting developer decisions. Our analysis is based on data gathered from REDD+ projects and jurisdictional programs that either have been validated by a compliance-grade standard or are in the planning stages with intent to comply with such a standard. Given that the model's scope is limited to the credit pipeline of activities planned or operating, this approach risks understating supply in the scenario where greater than expected compliance demand is created.

To date, voluntary activities have been implemented at the project and jurisdictional “program” level, forming the basis for empirically estimating potential credit supply. While project-level activities have been planned and implemented since the call for early action at COP 13 in Bali in 2007¹⁷, the first “compliance-grade”¹⁸ REDD credits were only verified by VCS in 2012. Jurisdictional REDD programs,

¹⁶ Coren, M. J.; Streck C.; and Myers Madeira, E. (2011). Estimated supply of REDD credits 2011–2035. *Climate Policy*, 11:6, 1272-1288.

¹⁷ Decision 2/CP.13, *Reducing emissions from deforestation in developing countries: approaches to stimulate action*, paragraphs 3 – 5.

¹⁸ Compliance-grade REDD+ credits are considered to be those accounted and verified under a high-quality voluntary market standard that is either i) of comparable robustness to compliance market standards; and/or ii) may be recognized as eligible to meet regulated obligations under a compliance market. VCS is the dominant carbon

seen as stepping stones toward a future national REDD+ framework, have been gaining traction since the allowance of jurisdictional monitoring systems at COP 15 in Copenhagen. The first jurisdictional compliance-grade program is currently (December 2014) in the process of VCS validation, pioneering the way for a host of states, provinces, and districts across the world that seek performance-based payments for large-scale forest conservation.

This appendix outlines the methods used to estimate project and program supply and provides supply estimates.

A.1 EMPIRICAL APPROACH TO PROJECTING SUPPLY

The supply analysis is based on data from compliance-grade projects and programs, which are used to develop a projection of the global supply pipeline of marketable REDD+ credits for the period 2015–2025. The scope of the analysis includes activities implemented at the project scale and program scale (known as “sub-national” in UNFCCC and “jurisdictional” under the VCS). The analysis follows the UNFCCC clarification of REDD+ activities set forward at Cancun in 2010 with the exception of Afforestation and Reforestation (A/R) activities, which are only included in the analysis if they occurred as part of a jurisdictional program of activities.

Ex-ante carbon estimates were extracted from those REDD+ mitigation activities that demonstrated a measureable potential to produce high-quality credits that may be considered compliance-grade. A number of these project-scale activities have met criteria to produce compliance-grade credits (referred to as Level I), while the remaining projects are preparing to meet such criteria (referred to as Level II).

In addition, jurisdictional-scale “programs” were included in cases where the program was developed enough to have sought REDD-readiness finance from a fund such as the FCPF. In order to avoid double-counting, any Level I or Level II projects that are located within future jurisdictional programs were excluded in the total supply pipeline; however, these projects are included in any project-specific analyses that follow.

When aggregated the projections of supply volumes from project activities in Levels I and II as well as jurisdictional program estimates represent the REDD+ credit pipeline for 2015–2025. Although not part of the pipeline, the analysis also shows potential volumes for programs in development under the Governor’s Climate and Forests Task Force (GCF) umbrella, which currently includes 23 non-Annex I states and provinces covering more than 20 percent of the world’s tropical forests. Estimates from Brazil’s National REDD+ strategy, which includes six GCF jurisdictional programs, are also included separately, as the associated emission reductions may not come to market but rather follow a non-market payment-for-results framework. A description of methodology and assumptions can be found in Appendix B. Methodology for Empirical Supply Model.

A.1.1 Predicting Level I Credit Issuance

Level I projects are projects that were successfully validated and/or verified to VCS requirements and registered on the VCS database¹⁹ as of August 2014. The VCS database offers links to project

accounting standard on the supply side, and for purposes of this study represents the sole source of compliance-grade non-Annex I REDD+ credits.

¹⁹ Both ACR and CAR were reviewed; however, they did not contain REDD registered projects in non-Annex I countries. While CAR did include one future pipeline project in the Mexico Forest Protocol, it was not yet at the carbon readiness stage and lacked publicly available ex-ante estimates.

documents and verification reports providing ex-ante emissions reduction forecasts and ex-post monitoring reports.

Level I emission reduction projections are based on a combination of Verified Carbon Units (VCUs) and validated ex-ante estimates through 2025, excluding the minimum 10-percent VCS AFOLU non-permanence risk buffer that was deducted for each project. In some projects verification auditors updated the risk buffers, with remaining ex-ante estimates updated accordingly.

Several projects only provided ex-ante estimates through the first baseline period (generally 10 years), even if the project lifetime was 20 years or longer. In these cases, an average of the prior verified and/or validated ex-ante estimates was used through 2025. In order to maintain conservativeness, an additional 5 percent was deducted from the emission reduction estimates of each project to allow for implementation risks. The aggregation of credit issuance projections from each activity constitutes the Level I credit supply estimate.

The analysis in the prior report contained just nine Level I projects, whereas the current analysis covers 36 projects validated and/or verified by VCS. Of these projects, 28 are also pursuing Climate, Community and Biodiversity (CCB) verification. Sixteen of the current Level I projects were previously classified as Level II projects in the prior report, indicating that voluntary REDD projects continue to develop despite regulatory uncertainties. An additional 11 new VCS Level I projects were also identified.

A.1.2 Predicting Level II Credit Issuance

The minimum threshold for qualification to Level II projects or jurisdictional programs is completion of a carbon feasibility analysis, including ex-ante estimates of future emissions reductions, as well as intent to seek compliance-grade validation/verification. Twelve of the Level II projects were listed in the VCS Project Pipeline, while the rest had publicly stated their intent to seek VCS validation but had not yet registered their projects with VCS.

To be considered for the VCS Pipeline, projects must have opened an account registry, submitted a “listing representation” by the project proponent, and drafted a project description that contains both a carbon feasibility analysis and a description of project activities that in turn will be third-party audited to reduce the stated drivers of deforestation and/or degradation. From these documents, the design or intent to meet compliance-grade criteria can be evaluated.

Converting Level II ex-ante emissions reduction forecasts to realistic credit issuance estimates for projects requires adjustments to account for the real-world project risk-indicators and obstacles to meet implementation requirements. Examples of these include attaining government approval of the project, securing carbon rights, and ensuring a management capacity that is both local (within one day of travel to project site) and has at least five years of experience in each of the relevant project activities.

To capture the number of credits that Level II activities will produce in the future, a discount factor was applied to each activity’s emissions reduction forecast. The discount factor is generated from the project’s progress toward verification as well as a valuation of the above risk indicators, details of which may be found in Appendix B. Methodology for Empirical Supply Model. The discount factor was applied to the credit issuance volume for each REDD+ activity qualified under Level II. For those projects that had not indicated their percent reduction for the VCS non-permanence risk buffer, a conservative 19 percent buffer allocation was deducted.

Fifty projects were identified as containing the minimum requirements for Level II categorization. Of these, 28 projects were also listed in the previous report as Level II, indicating that they had not yet advanced to VCS validation stage. Of the 74 Level II projects in last year’s report, 20 were excluded

because they did not adequately meet this analysis's slightly more stringent requirements for the intent to seek compliance-grade credits. An additional seven projects were excluded for having been A/R rather than REDD projects. Three projects from the previous report have voluntarily withdrawn from the VCS validation process, while VCS suspended one project that was not included.

A.1.3 Jurisdictional Program Credit Issuance

Arriving at an accurate estimate for jurisdictional REDD initiatives poses a challenge due to the wide spectrum of programs that are seeking jurisdictional-scale conservation efforts, each with vastly different states of preparedness. Some programs are actively working toward validation under VCS's new methodology for Jurisdictional and Nested REDD Programs (JNR); others are aiming to follow the FCPF Carbon Fund's Methodological Framework, while others have no MRV capacity and are at the beginning stages of program development. Less stringent inclusion criteria were imposed on programs in this report, as future UNFCCC demand is expected to align itself with jurisdictional programs rather than projects.

A total of 15 programs were included in this report, including five programs that overlap with GCF jurisdictions (some containing ER estimates from multiple GCF jurisdictions). Similar to Level II projects, programs were discounted according to variables such as carbon tenure status, government approval, and overall program development, the latter seen as a proxy for likelihood of project success (see details in Appendix B. Methodology for Empirical Supply Model). Any programs that had not already accounted for buffer deductions were discounted a conservative 19 percent.

A.1.4 Impacts of GCF and Brazil National

There are currently 23 states and provinces across five non-Annex I countries developing programs under the umbrella of the GCF, a multi-jurisdictional collaboration supporting the development of technical, legal, and institutional frameworks for programs to implement REDD+ activities²⁰. Apart from the Brazilian Acre program, the majority of these are still in planning stages similar to Level II projects, while several lack even initial emissions reductions estimates. ERs from 13 of these states and provinces were extracted from the Earth Innovation Institute's (EII's)²¹ 2014 analysis. This "top-down" analysis assumes an across-the-board 80 percent linear decrease in deforestation by 2020, with Tier-I²² estimation of average carbon stocks.

Estimates for the six Brazilian GCF states were obtained from a joint publication of the GCF Task Force and the Institute for the Conservation and Sustainable Development of Amazonas (IDESAM)²³, using a unique "U-REDD+ stock-flux" national approach. As Acre is one of these states, the Acre VCS/JNR values were deducted from this estimate. The Brazil national approach allocates 20 percent of emissions reductions to the Federal Government and awards each state based on the reduction of deforestation (in relation to historic rates) relative to the reduction for the Amazonian biome as a whole (flux), as well as the relative quantity of carbon stored in the forested region of each respective state (stock). A

²⁰ Brazil, Indonesia, Peru, Mexico, and Nigeria

²¹ Swette, B.; Setiawan, J.; and Nepstad, D.C. (2014). What could the GCF Contribute to Climate Change Mitigation by 2020? A preliminary assessment. Earth Innovation Institute.

²² UNFCCC. (2009). UNFCCC Resource Guide for Preparing The National Communications of Non-Annex I Parties, Module 3: National Greenhouse Gas Inventories.

²³ Governors' Climate and Forests Task Force. (2014). Proposal for allocation of "U-REDD" emissions reductions in Brazilian GCF member states/ organized by Mariano C. Cenamo; Pedro G. Soares; Junia Karst. - Manaus: IDESAM.

proportion of these emissions reductions are accounted for under Payment-for-Results (i.e., the Amazon Fund). An additional three Brazilian states not affiliated with the GCF, together with the 20-percent allocation to the Brazilian national government were also included.

While a number of programs arising from the GCF and Brazil are less well-developed, they may have significant supply impacts and are therefore included to show the potential supply overhang in the market. The exception to this is the state of Acre, which is currently (December 2014) seeking validation under the VCS/JNR framework and is included in our primary programmatic supply volumes.

For the six Brazilian GCF states, the GCF/IDESAM estimates were used instead of EII values, as the aggregate emissions reductions were more conservative (an EII value of 475.3 MtCO₂e/year versus a GCF/IDESAM value of 424 MtCO₂e/year, both before discounting), despite vastly different accounting methodologies. A state-by-state analysis is less useful, as the Brazilian stock-flow approach represents a reallocation of emission reductions based on varying RELs across the Amazon, while the EII approach uses state-specific historical rates of deforestation and carbon stocks.

A.2 SUPPLY ESTIMATES

This analysis identified 101 different REDD+ activities: 36 Level I projects, 50 Level II projects, and 15 programs. The combined project and program adjusted credit issuance estimates that form the total estimate of compliance-grade REDD+ supply through 2025 is referred to as the credit pipeline.²⁴

A.2.1 Total Supply with Issuance Delay and Backdating to 2010

There are a large number of Level II REDD+ projects and programs that are at various stages of implementation but have yet to be validated or verified to enable issuance. To reflect expected rules of emerging compliance markets, the methodology assumes that if the first verification is to be reached in 2015, it will issue retroactive credits for any vintages between 2010 and 2015. If first issuance is scheduled for anytime between 2015 and 2017, it may include up to five years of backdating and will therefore deliver a higher-than-average annual volume of credits upon issuance, receding to consistent annual volumes through the years 2018 to 2025.

The method seeks to capture the future pipeline of compliance-grade REDD+ credits based on REDD+ activities operating or in advanced stages of development. Any projects located within program jurisdictions have been excluded so as to avoid double counting. Table I details the supply volumes for 2015–2025, with the proposed GCF programs from the EII analysis, as well as both the Brazilian GCF and non-GCF programs from the GCF/IDESAM stock-flow approach.

The combined subtotal estimate shows credit volumes of more than 918 million credits through 2025, with average annual production of more than 71.4 million credits per year after the initial period of retroactive crediting is concluded. Estimates for all categories remain relatively stable across the timeline.

The sum of Level I projects reveals flat results across the timeframe. This is in part due to 14 of the 36 projects having provided ex-ante estimates only for the first 10 years of project activities, with the remainder of data completed with averages of these first 10 years. Similarly, many Level II projects and programs provided only lifetime rather than annual estimates, while others only published annual ex-ante emissions reductions estimates through 2020. In these cases, as with Level I projects, averages of

²⁴ Not to be confused with the VCS “Project Pipeline”

the stated emissions reduction estimates were applied for the remainder of the outlook period, resulting in a slight drop beginning in 2021.

TABLE I: ANNUAL SUPPLY PIPELINE WITH BACKDATING TO 2010 (MTCO₂e)

Issuance Date	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Level I - Project	97.8	18.7	18.4	18.5	18.5	18.2	18.2	18.2	18.1	18.3	18.3	281.1
Level II - Project	48.6	15.4	18.8	21.1	21.3	21.5	19.6	17.3	17.1	18.7	17.6	237.1
Program	57.4	29.0	36.3	31.9	33.7	35.2	32.3	35.4	35.4	36.6	36.6	399.9
Total	203.9	63.1	73.5	71.6	73.4	74.8	70.1	70.9	70.6	73.7	72.5	918.1
GCF, non-Brazil	39.9	39.9	43.4	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	442.1
Brazil GCF	270.8	270.8	270.8	270.8	270.8	270.8	270.8	270.8	270.8	270.8	270.8	2,978.3
Brazil, non-GCF	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	127.5	1,402.0

Programs account for nearly half of the supply pipeline. GCF program estimates indicate that an additional 442 million credits could come online, not including the Brazil factor. Brazil's GCF counterparts will be allocated just short of 3 billion reductions over the timeline, while remaining allocations to additional states and federal government will amount to an additional 1.4 billion reductions.

A.2.2 Total Supply with Issuance Delay with No Backdating

When backdating is removed from annual credit volumes, the supply estimates decreases by 15.4 percent, to a total of more than 776 million credits through 2025. While there is a precedent for allowing retroactive credits in emerging compliance markets like California, rules for any REDD+ crediting in the UNFCCC context have not been finalized. Table 2 shows credit issuance levels for Level I, Level II, and Programs in a scenario in which emission reductions are only able to be credited after issuance. This scenario therefore only captures any emissions reductions that will be issued in 2015 and onwards.

TABLE 2: ANNUAL SUPPLY PIPELINE WITHOUT BACKDATING (MTCO₂e)

Issuance Date	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Level I - Project	18.2	37.9	18.4	18.5	18.5	18.2	18.2	18.2	18.1	18.3	18.3	220.7
Level II - Project	13.9	15.4	18.8	21.1	21.3	21.5	19.6	17.3	17.1	18.7	17.6	202.3
Program	10.9	29.0	36.3	31.9	33.7	35.2	32.3	35.4	35.4	36.6	36.6	353.4
Total	43.0	82.3	73.5	71.6	73.4	74.8	70.1	70.9	70.6	73.7	72.5	776.4

A.3 SUPPLY ANALYSIS

A dissection of the credit pipeline offers policymakers a better understanding of REDD+ progress to date. The following analysis presents credit issuance estimates according to country, REDD+ activity type, size of project or program, and stage of development.

A.3.1 Country Supply – Projects and Programs

Thirty-three different countries were represented across the projects and programs, the vast majority protecting tropical forests, although temperate and shrubland forests are also represented. Table 3 provides an annual summary of expected emission reduction per country through 2025 (with backdating to 2010 where applicable). The analysis excludes the six aforementioned Brazilian GCF programs using the stock-flow approach (though Acre’s VCS program is included), as well as the 17 additional GCF jurisdictions that lacked significant program development. Any projects that are located within programmatic jurisdictions were excluded to avoid double counting.

TABLE 3: ANNUAL SUPPLY PIPELINE OF TOP 15 COUNTRIES, WITH BACKDATING (MTCO₂e)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Brazil	72.2	14.0	14.4	14.9	15.4	15.9	14.1	14.4	14.2	16.0	14.9	220.4
Indonesia	44.8	11.3	12.9	12.0	12.2	12.4	11.4	11.4	11.5	11.5	11.6	163.0
Peru	25.5	7.9	8.0	8.2	8.0	7.8	7.6	7.7	7.6	7.7	7.6	103.6
Zimbabwe	22.3	5.9	5.9	5.9	5.9	5.8	5.8	5.7	5.7	5.6	5.5	79.9
Cambodia	4.1	3.3	6.0	7.7	7.4	6.9	5.7	4.1	4.1	4.1	4.1	57.6
Ethiopia	-	4.2	2.1	4.2	4.2	4.2	4.2	6.3	6.3	6.3	6.3	48.3
DRC	3.7	6.3	4.1	4.1	4.1	3.5	3.8	3.8	3.8	3.8	3.8	44.8
Kenya	9.0	1.7	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.0	2.0	28.0
Ghana	-	-	1.6	1.1	2.2	2.2	2.2	3.3	3.3	4.4	4.4	24.4

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Sierra Leone	2.1	1.1	1.3	1.6	1.8	2.1	2.3	1.2	1.2	1.2	1.2	17.1
Nepal	-	-	3.1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	15.6
Vietnam	-	-	3.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	15.1
Guatemala	3.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	13.6
Costa Rica	1.9	0.2	2.0	0.3	0.3	2.0	0.8	0.8	0.8	0.8	0.8	10.7
Madagascar	1.1	1.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	9.9
Other	13.2	4.7	5.5	5.1	5.2	5.2	5.5	5.3	5.4	5.4	5.5	66.1

A.3.2 Country Supply–Projects

As the programs contain significantly greater emission reductions than Level I or Level II projects, the country analysis was stratified to represent the contribution from projects and programs separately. Table 4 illustrates the project production volumes on an annual basis, including those projects that are located within jurisdictional programs.

TABLE 4: ANNUAL PROJECT-LEVEL SUPPLY PIPELINE BY TOP-10 COUNTRIES, WITH BACKDATING (MTCO_{2e})

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Indonesia	44.8	9.6	9.8	10.0	10.2	10.4	9.4	9.5	9.5	9.6	9.6	142.4
Peru	33.7	6.9	7.2	7.8	6.6	6.4	6.2	6.2	6.1	6.2	6.2	99.6
DRC	13.7	4.6	5.1	5.9	6.7	7.5	9.0	8.8	9.3	9.4	9.6	89.6
Zimbabwe	22.3	5.9	5.9	5.9	5.9	5.8	5.8	5.7	5.7	5.6	5.5	79.9
Brazil	21.4	4.0	3.9	4.0	4.0	4.2	4.6	4.9	4.6	6.5	5.3	67.2
Cambodia	4.1	3.3	6.0	7.7	7.4	6.9	5.7	4.1	4.1	4.1	4.1	57.6
Madagascar	9.7	2.7	3.0	2.0	2.0	2.2	2.3	2.3	2.4	2.4	2.7	33.7
Kenya	9.0	1.7	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.0	2.0	28.0
Sierra Leone	2.1	1.1	1.3	1.6	1.8	2.1	2.3	1.2	1.2	1.2	1.2	17.1
Guatemala	3.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	15.8
Other	15.8	3.8	4.0	4.0	4.0	3.8	3.9	3.7	3.9	3.9	3.9	54.7

The analysis shows that Indonesia, with just one Level I project and 12 Level II projects, will be the leading provider of project-based credits, with 142.4 million ERs expected. Peru, with six Level I and five Level II projects, is expected to produce nearly 100 million credits. The Democratic Republic of Congo is not far behind, with nearly 90 million expected VCUs, the majority coming from the nearly 300,000 hectare Mai Dombe APD project. Zimbabwe’s Kariba REDD+ project, first verified in 2012, is the

fourth-leading country for future issuance of compliance-grade credits, with slightly less than 80 million VCUs expected from protecting almost 800,000 ha of forest from mosaic deforestation and degradation. Brazil is expected to produce the fifth-highest amount of project-based credits, coming from nine Level I and six Level II projects.

A.3.3 Country Supply–Programs

The supply of jurisdictional programs is projected for the five countries with the leading programmatic emissions reductions, not including the proposed GCF programs or the Brazil IDESAM programs based on national allocation of ERs. Table 5 provides an annual estimate of the credit pipeline.

TABLE 5: ANNUAL PROGRAM SUPPLY PIPELINE BY COUNTRY, WITH BACKDATING (MTCO₂e)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Brazil	51.7	10.3	10.8	11.2	11.6	12.0	9.8	9.8	9.8	9.8	9.8	156.5
Ethiopia	-	4.2	2.1	4.2	4.2	4.2	4.2	6.3	6.3	6.3	6.3	48.3
DRC	-	5.6	3.5	3.5	3.5	2.9	3.2	3.2	3.2	3.2	3.2	35.0
Peru	-	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	31.3
Ghana	-	-	1.6	1.1	2.2	2.2	2.2	3.3	3.3	4.4	4.4	24.4
Other	5.8	5.7	15.1	8.8	9.0	10.8	9.9	9.7	9.8	9.8	9.9	104.2

Brazil is expected to be the largest contributor to the program pipeline, with all ERs to be sourced from the Acre program alone. The program, to be validated under the VCS/JNR methodology, will average approximately 10 million tons of avoided CO₂ per year, for a total of nearly 157 million credits. The second-largest program is expected to be Ethiopia’s Oromio District, the first jurisdictional jurisdiction to be selected by the BioCarbon Fund (ISPL), which aims to protect more than 2 million hectares of Ethiopia’s high elevation forest and woodlands mainly from unsustainable fuelwood consumption. If successful, the flagship ISPL program will produce an estimated 48.3 million carbon credits through 2025.

The DRC’s program, the third-largest in the dataset, is at 35 million credits less than half of the two combined DRC project values. Although the program includes the DRC’s massive Mai Ndombe project, and despite the fact that both the VCS PD and the FCPF ER-PIN had similar ex-ante estimates, program estimates were only given through 2020 and plateaued thereafter due to the use of program averages for the remaining five years of the analysis. The DRC flagship project, on the other hand, extended estimates for 30 years and saw a sharp climb between 2020 and 2025. This discrepancy was exaggerated by the heavy discounting placed on the program values, following the conservative approach used in this empirical study.

Peru’s combined program in the western Amazon offers to produce more than 31 million credits through 2025 via conservation efforts across the four adjacent GCF jurisdictions of San Martin, Lareto, Ucayali, and Madre de Dios.²⁵ Ghana’s Cocoa Forest REDD+ Program is poised to be the fifth leader of program-based emissions reductions, with 24.4 million credits estimated.

²⁵ Proposals from Indonesia, Peru, and Guatemala were accepted into the FCPF pipeline in October 2014.

A.3.4 Supply by Project Activity Type

The scope of this supply analysis follows the UNFCCC clarification of REDD+ activities set forward at Cancun in 2010, with the exception that A/R projects were not included in the “+” side (unless, as noted above, A/R activities were part of a jurisdictional program). Further detail follows of additional REDD-only project activity types based on the VCS typology of emission reduction projects in the forest and land-use sector: Avoided Planned Deforestation (APD), Avoided Unplanned Frontier Deforestation and/or Degradation (AUFD), Avoided Unplanned Mosaic Deforestation and/or Degradation (AUMD), and Improved Forest Management (IFM). Table 6 indicates credit issuance volumes segmented by each of these project types.

TABLE 6: PROJECT SUPPLY PIPELINE BY ACTIVITY TYPE (MTCO₂e)

Activity Type	No. Activities	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total	%
AUMD	38	64.9	18.6	21.9	22.6	22.6	22.3	21.5	20.3	20.1	20.8	21.0	276.5	41%
APD	17	54.4	12.9	13.3	14.3	15.2	16.3	16.7	16.6	17.1	18.4	17.6	212.8	32%
AUFD	22	51.5	10.7	11.4	12.2	11.1	11.3	11.4	10.1	10.2	10.3	10.2	160.3	24%
IFM	8	5.9	1.4	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	20.5	3%
Total	85												670.1	Total

Project activities alone, when not deducted for their presence inside of jurisdictional programs, will account for 670.1 million compliance-grade credits through 2025 if not otherwise nested into programs. Of these, AUMD will account for the most credits of any activity type at more than 276.5 million credits, followed by APD and then by AUFD with 212.8 and 160.3 million projected credits, respectively. IFM projects account for just 3 percent, at 20.5 million credits through 2025.

A.3.5 Project/Program Size and Supply

The number of credits per project and program was also analyzed in terms of size. Level I projects ranged from six programs under 1 million credits to two projects between 50 and 1 million credits. Level II projects were also found across the size spectrum, although most of the 50 projects were under 6 million credits. The smallest program, in Mexico, expects to produce more than 5 million credits across five districts during the 2015–2025 timeline, while the largest, Acre, anticipates 156.5 million credits.

A.4 CONCLUSIONS

As mentioned above, there are a host of studies to predict REDD emission reduction potential and credit supply using top-down approaches. The volume estimates from these studies should be treated cautiously, as they use coarse data and often employ a simplified approach to estimate emission reduction, equating biophysical potential to store carbon with potential of emission reductions. In addition, many do not incorporate the practical issues that will affect the actual supply of REDD+ credits, such as governance or political will, capacity of implementing organizations, or the presence of reference emissions levels to determine what fraction of emission reduction potential is eligible to be recognized as an offset.

The aim of the supply analysis was to account for all existing or preparatory REDD projects and programs that are or intend to be “compliance-grade” verified, based on a conservative empirical formula that deducts from estimated emissions reductions. The more uncertain components of the programmatic supply, GCF and Brazil national, are included separately from the primary supply pipeline.

The methodology applied in this report does not include A/R and likely does not capture every project or program that could produce credits during the outlook period; however, the primary results do represent a conservative estimate of known potential volume of REDD+ credits flowing to the market. This projection provides an important element in the assessment of the REDD+ market system and its ability to attract primary capital from the private sector. The bottom-up approach is generally preferred in macro quantitative analysis because it is able to incorporate political, financial, and implementation realities affecting the market.

The sum of the 101 projects and programs outlined in this report constitute the short-medium term supply pipeline of REDD credits from 2015 to 2025. The total supply is projected to reach 918.1 million credits, for an average of 83.5 million credits per year. These initiatives now span across 33 non Annex-I countries, largely in pursuit of protecting tropical forests. The methodology assumes retroactive crediting for inclusion of project activities that began up to five years prior to verification, and is considered to most accurately capture the future pipeline of compliance-grade REDD+ credits based on REDD+ activities operating or in various stages of development.

As a comparison, the previous edition of this report estimated 283 million credits to come to market between 2013 and 2020, for an annual average of about 35 million credits. Should the IDESAM/GCF stock-flow methodology be considered compliance-grade and indeed enter the market, an additional 4.4 billion credits would be added to the current pipeline (after deducting for Acre’s VCS program). Top-down estimates that were available for the 13 non-Brazilian GCF programs could bring as much as another 442 million credits to market.

Results indicate that the majority of credits will come from Brazil, even after excluding the IDESAM estimates. This development is due in large part to the success of the Acre program, the first of its kind to seek validation under the VCS/JNR methodology, as well as the eight Level I and five Level II projects in Brazil outside of Acre. Not surprisingly, Indonesia is poised to be the next-largest provider of credits given the number of projects and programs located on its carbon-rich peat forests, which allow for very high credit productivity per hectare.

Nearly half (16) of the 36 Level I projects were recorded as Level II in the previous report, indicating that projects are indeed moving through the pipeline process toward validation, despite the lack of market or regulatory signals that might otherwise drive such a progression. While many of the previous Level II projects were not included, 28 of the 50 Level II projects in the analysis maintained their Level II status, a possible indication of the funding challenges of project design and implementation in an uncertain demand landscape. Perhaps the most dramatic difference between the two reports is the momentum of jurisdictional programs coming into the REDD landscape. While this model excluded the top-down approaches for program estimates, the aggregate potential supply of additional GCF REDD programs is astounding. It remains to be seen how the UNFCCC will handle the Brazilian GCF/IDESAM program estimates, and if these will in part be received as “compliance-grade” and enter the REDD market.

While this model was largely constrained to publicly available sources and is therefore likely incomplete, it does provide a reasonable glimpse of the potential of REDD emission reductions from avoided deforestation or degradation over the short to medium term. The estimated supply volumes provide important data for policymakers and REDD strategists, in particular regarding the development of a post-2015 UNFCCC framework.

APPENDIX B. METHODOLOGY FOR EMPIRICAL SUPPLY MODEL

The methodology used to predict the REDD+ emission reduction supply pipeline categorizes the REDD+ mitigation activities into three levels based on their scale and stage of carbon development.

1. **Level I Project supply pipeline:** projects that have met the criteria to produce compliance-grade credits by way of completing VCS validation and/or verification as of August 2014
2. **Level II Project supply pipeline:** projects that are earlier in their development than Level I but meet a set of defined criteria and stated their intention to produce compliance-grade credits
3. **Program supply pipeline:** jurisdictional programs that are on par in their development with Level II projects, and which have formal affiliations with a multi-lateral REDD-readiness fund

For each level, a different approach to projecting supply is applied to produce the predicted issuance. When aggregated, the projections of supply volumes from program activities and projects in Levels I and II will represent a potential scenario of the REDD+ credit pipeline for the 2015–2025 period.

B.1 CONCEPTS AND ASSUMPTIONS

Scope of activities: Under the UNFCCC, REDD+ is split into five activities: a) Reducing emissions from deforestation; b) Reducing emissions from forest degradation; c) Conservation of forest carbon stocks; d) Sustainable management of forests; and e) Enhancement of forest carbon stocks.²⁶ As the VCS is considered the most developed and dominant voluntary standard for international REDD+, this report uses VCS categories of emissions reduction activities in the forest and land-use sector. This overlaps but does not exactly match the UNFCCC description of REDD+ activities. The VCS divides REDD+ activities into two broad categories: Reduction Emission from Deforestation and Degradation (REDD)²⁷ and IFM. The VCS further segments REDD activities to Avoiding Planned Deforestation (APD), Avoiding Unplanned Frontier Deforestation (AUFDF), and Avoiding Unplanned Mosaic Deforestation (AUMD). The analysis focuses on activities where forests remain forests, and thus it does not include afforestation/reforestation activities in the predicted supply.

Scale of implementation: REDD+ activities may pursue implementation at different scales:

1. Project scale – REDD+ initiatives and activities carried out within a specific area with defined boundaries that are smaller than a jurisdiction

²⁶ See Decision 1/CP.16 *The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, paragraph 70.

²⁷ There is another VCS type, “Wetlands Restoration and Conservation” that includes REDD activities on peat lands; for this report, these types of projects are considered REDD.

2. Program scale (known as “national” or “sub-national” in UNFCCC and “jurisdictional” under the VCS) – REDD+ initiatives, policies, strategies and activities within a larger scale encompassing the whole state/province or country, led by the government and/or in partnership with civil society or the private sector²⁸

Compliance-grade credits: Compliance-grade REDD+ credits are defined as those accounted for and verified under high quality carbon accounting standards that are either i) of comparable robustness to compliance market standards; and/or ii) may be recognized as eligible to meet compliance obligations within a regulated market. VCS is the dominant REDD+ carbon accounting standard on the supply side, and, for purposes of this study, represents the benchmark used to define the projected supply of REDD+ credits.

Short-term focus: The approach is underpinned by the assumption that activities currently operational or in planning stages will represent the dominant source of short-term supply of compliance-grade credits between 2015 and 2025. This approach was used to provide a comparison with the current demand picture and other REDD+ supply estimates derived from global economic models or “top-down” models based on ecological potential.

Data access: The authors of this study recognize the challenges and limitations of relying on publicly available data and limited interviews. Nevertheless, the analysis provides a valuable view of the future for supply of REDD+ verified emission reductions, even within the limitations of the data availability.

B.2 LEVEL I SUPPLY PIPELINE

The Level I supply pipeline is the sum of annual credit issuance forecasts that have met the criteria to produce compliance-grade credits. To model the Level I pipeline, the steps below are followed.

Step I – Qualifying Level I REDD+ Activities

Activities that qualify as “currently meeting the criteria to produce compliance-grade credits” are those that successfully have been validated and/or verified to VCS requirements and are registered on the VCS database.

Project documents for REDD+ activities validated or verified to the VCS criteria are available for public access on the VCS Project Database. The Database is the VCS central information source, in which all projects are validated to VCS criteria, comprising all information from VCS registries and including all VCUs issued under the program. The Database is the source for identifying activities qualified to Level I.

To procure credit issuance data for Level I activities, this report has engaged the sources listed in Table 7 on the following page.

²⁸ Adopted from Governors’ Forest and Climate Task Force Database of REDD+ Activities, available at <http://www.gcftaskforce.org/docs>

TABLE 7: SOURCES OF DATA

Source	Form of engagement
VCS database	Online access and direct query
American Carbon Registry ²⁹	Online access
Climate Action Reserve, Mexico Forest Protocol ³⁰	Online access

Step 2 – Develop REDD+ Emissions Reduction Forecasts

According to VCS rules, at the registration of the project the proponents are required to make public a Project Document comprising an ex-ante estimate of credit issuance.³¹ Ex-ante estimates are net emissions reduction forecasts derived using an approved VCS methodology, including applying discounts to account for leakage and secondary emissions. The validation rules call for a third-party audit of the project documentation, including its ex-ante estimates. For these reasons, ex-ante delivery volumes extracted from VCS Project Documents represent a modeled estimate of the emission reduction potential if the project is fully implemented and performs as expected over the life of the project.

Step 3 – Credit Issuance Adjustments

Although Level I projects all have been third-party validated, a potential estimate of future credit issuance must account for implementation risk. Therefore, a 5-percent discount is applied to ex-ante estimates to account for under issuance for each Level I REDD+ activity in the pipeline.

In instances where auditors adjusted the percent buffer allocation during a verification event, future ex-ante estimates were adjusted from program document values to reflect the updated buffer reductions.

Step 4 – Aggregation of Pipeline

The Level I credit supply for 2015–2025 is modeled by aggregating annual credit issuance forecasts for all REDD+ activities meeting VCS criteria and applying the under issuance discount and subtracting the most recent VCS risk buffer to the ex-ante estimates. Backdating to 2010 is also allowed. Since this study assesses supply to the market, the credit issuance forecast for 2015–2025 will include credits that are likely to be retroactively issued from vintages that are at a maximum five years prior to the beginning of the modeling forecasting period (e.g., going back no later than 2010 for an issuance in 2015).³²

B.3 LEVEL II SUPPLY PIPELINE

Level II supply is equal to the sum of annual credit issuance forecasts of activities that are currently in various stages of preparation to meet pre-compliance market criteria. The method to qualify activities

²⁹ The ACR was reviewed, yet all registered non-Annex I forest carbon projects are Afforestation or Reforestation and therefore not eligible.

³⁰ While CAR did include a potentially eligible project under the Mexico Forest Protocol, the project was not yet at the carbon readiness stage and lacked ex-ante estimates of emissions reductions.

³¹ See the VCS Procedural Document *Registration and Issuance Process: VCS Version 3*, dated October 8, 2013, v3.5, Section 4.2.3

³² VCS stipulates a maximum of five years between credit vintage and issuance.

and model credit issuance for Level II is more complex than the method used for Level I because the availability of data is often limited. Furthermore, Level II activities do not have VCS validated ex-ante carbon credit issuance estimates on which to rely. Estimates therefore need to be qualified based on the project’s progress towards validation and potentially uncertain implementation.

To qualify activities to the Level II group and to generate potential credit issuance forecasts, the following steps are implemented:

Step I – Identifying Level II REDD+ Activity Candidates

To build a database of activities to qualify, the authors engaged market participants from the private sector, NGOs, and intergovernmental agencies. They used case studies, research, and online project databases. The format was interviews, online access, and data procurement from open-access sources.

To procure credit issuance and emissions reduction forecast data for Level II activities, the authors researched project-specific websites and used the public online databases below:

TABLE 8: SOURCES OF DATA

Source	Form of engagement
CCB project database	Online access
Forest Carbon Portal project database	Online access
IGES database	Online access
Forest Carbon Asia project database	Online access
The REDD Desk	Online access
VCS Project Pipeline	Online access and direct query
Terra Global Capital	Direct query

Step 2 – Qualifying Level II REDD+ Activities

The threshold for qualification to Level II is the **a) intent to meet criteria to issue compliance-grade credits under the VCS**, and **b) advancement beyond the concept phase** (i.e., at least the carbon feasibility stage is started, including prevalence of ex-ante estimates).

1. **Intent to meet criteria to issue compliance-grade credits** is evidenced by indications that financing will be raised through sales of compliance-grade verified emission reductions, or a prevailing REDD+ compliance market-mechanism (whether bilateral or market-based). Evidence for indications of intent is gathered through the evaluation of project documents or websites.
2. **Advancement beyond the concept phase** is evidenced by dedication of resources and organizational capacity to planning and other activities to prepare for the development of verified emission reductions. While a project development plan prepared by qualified technicians is desirable, projects must at a minimum have stated an ex-ante estimate for emissions reductions.

If these conditions of capacity, resources, and intent are recorded in project documents or on the project website, the activity is considered to be Level II.

Step 3 – Develop Emission Reduction Forecasts

The forecast emission reduction data extracted from Level II activities is highly variable in quality and content. Many activities in late-stage preparations or under validation have comprehensive VCS-style project documents available that include ex-ante emissions forecasts. Activities at earlier stages of development may only offer general site-specific characteristics and planned project activities. At a minimum, all projects must issue an ex-ante emissions reductions estimate, whether in published or unpublished documents. In cases where only a project-total estimate of emissions reductions was stated, an average annual reduction was recorded. Similarly, in cases where emissions reductions forecasts were only made for the first 10 years of project implementation, the remaining years through the 2025 timeframe reverted to averages of previous years. These estimates were in turn subjected to the following deductions:

Step 4a – Credit Issuance Adjustments – Risk Buffer Withholding

To align as closely as possible with the current VCS approach to non-permanence risk, a risk buffer, as outlined in the VCS, was deducted for the emission reduction forecasts for each REDD+ activity. The VCS rules³³ require risk analysis to determine a number of credits that must be deposited to an AFOLU pooled buffer account prior to credit issuance. The set-aside value is determined by the VCS AFOLU Non-permanence risk tool.³⁴ The tool considers internal and external risks to the permanence of emission reductions and then calculates the tons of emission reductions that must be deposited in the VCS risk buffer. The scope of this study precludes assessment of the internal risks and external risks of each REDD+ activity qualified to Level II. However, the average VCS AFOLU risk buffer of 19 percent³⁵ was deducted for each REDD+ activity unless there was a VCS risk buffer document available for the activity, in which case that was used instead.

Step 4b – Credit Issuance Adjustments – Uncertainty of Future Credit Issuance

In carbon markets (generally), there has been a tradition of under-performance for projects reaching issuance versus those submitted for validation. In the CDM market, the percentage of projects that are submitted for validation versus those that actually reach issuance is approximately 25 percent, and the percentage of projects that are registered (validated) that reach issuance is slightly less than 50 percent. Given the stage of the Level II REDD+ activities, there will be a high degree of uncertainty regarding the ability of any activity to actually issue compliance-grade emission reductions. To capture the likelihood or probability that an activity will fail to produce compliance-grade emission reductions in the future, a **discount factor** was applied to each activity's emissions reduction forecast. The discount factor is generated from a set of indicators designed to reflect the risk of the REDD+ activity actually producing the verified emission reductions as forecast. Thus, the discount factor **when applied to the forecast emission reductions** is utilized to produce a risk-adjusted credit issuance forecast for each REDD+ activity qualified under Level II.

³³ See: VCS Procedural Document *Registration and Issuance Process: VCS Version 3*, dated October 8, 2013, v3.5, Sec. 6.

³⁴ See: VCS Procedural Document, *AFOLU Non-permanence Risk Tool, VCS Version 3*, dated October 4, 2012, v3.4.

³⁵ As reported in the VCS JNR Permanence Steering Committee meeting notes, December 2012.

A Risk Assessment Tool with the factors in Table 9 was used to assess the risk of each Level II REDD+ activity and to generate a discount that was applied to the emission reductions derived in Step 3 above. This is a simplified version of a Risk Assessment Tool that can be applied to a set of projects where the data availability may be limited. The tool is displayed below, and the combined risk factors are applied to each project.³⁶

TABLE 9: SIMPLIFIED VERSION OF A RISK ASSESSMENT TOOL

Risk Factor	Description	Assigning Values	Values	Discount
1. Government Approval	Captures the uncertainty to credit issuance present when proponent has not received government approval to carry out activities	If government approval is demonstrated by license, permit, or contract with a government authority, then value equals 'Approved'. If activity is Not Yet Approved (NYA), a 'Government score' is determined for each jurisdiction based on World Economic Forum indicators for legal and administrative frameworks to enable competitiveness and economic development, with credits or debits for country participation in Readiness programs, and the state of regulations and governance authorities to approve and govern REDD+ activities. (See section below for determination of Government Scores).	Approved	0%
			NYA	Government Scores (see below)
2. Carbon Tenure	Captures the uncertainty to credit issuance present when proponent has not secured rights to carbon	If ownership of the bundle of rights to secure carbon rights is demonstrated, then value equals 'Yes'. Demonstration is considered rights secured through legal contracts in conformance with statutes or legal precedence and that are aligned with and supported by recognized land tenure laws. If rights are under negotiation, or not yet secured, then value equals 'No'.	Yes	0%
			No	10%
3. Management Capacity	Measures the level of management capacity and its adequacy to carry out REDD+ activities. Capacity is determined through experience in design, implementation, carbon accounting, and reporting to GHG programs.	To determine factor, assess the operator's capacity and their project experience. Operators may qualify to both, one or none of the criteria to demonstrate adequate capacity. Adequate capacity is as follows: ³⁷ management team contains one individual with significant experience in all skills necessary to undertake activities (at least five years of experience in each area); and management team has a presence at the site, or is at maximum one day's worth of travel to site. ³⁸	AB	0%
			A or B (only)	10%
			N (neither)	20%

³⁶ This tool is applied by taking $(1 - \text{discount}_{\text{factor 1}}) * (1 - \text{discount}_{\text{factor 2}}) * (1 - \text{discount}_{\text{factor 3}}) * (1 - \text{discount}_{\text{factor 4}})$ times the emission reduction forecasts.

³⁷ Adapted from: VCS. (n.d.). Non-permanence Risk Assessment Tool, 'Project Management Risk Factors.' Retrieved from <http://v-c-s.org/sites/v-c-s.org/files/AFOLU%20Non-Permanence%20Risk%20Tool%2C%20v3.2.pdf>

³⁸ Ibid.

Risk Factor	Description	Assigning Values	Values	Discount
4. Carbon Development Stage	Indicates at what stage of development the REDD+ activities are related to developing the market standards-related work needed to generate compliance-grade emission reductions	For each REDD+ activity, a value was assigned based on the completion of documents, public commenting periods, validations, and verifications as needed to complete each stage within the carbon development process.	See list on left	Ranging from 65% to 10%
		Carbon Development Stage Discount		
		VCS or VCS/CCB PD in Development	65%	
		VCS PD in Development; CCB in Validation	60%	
		VCS PD in Development/CCB Validated	45%	
		VCS in Validation/CCB Validated	40%	
		VCS or VCS/CCB in Validation	25%	
		VCS Validated	20%	
		VCS or VCS/CCB Verification Underway	15%	
		VCS Verification Underway/CCB Validated	15%	
		VCS Verified	10%	
VCS Verified/CCB Validated	10%			
VCS Verified/CCB Verified	0%			
Credit Issuance Uncertainty Adjustment Factor =			Combined Risk Factor	

Governance Scores

To determine the appropriate discount for activities where the proponent has not yet been approved by government to carry out REDD+ activities (see Government Approval indicator), a “Governance Score” for each activity jurisdiction is calculated. The Governance Score intends to capture a level of certainty to credit issuance as a function of the strength of the REDD+ activity’s legal and administrative framework (beyond carbon tenure, which is covered in risk factor 2). The score also will capture the challenges facing REDD+ credit issuance in jurisdictions that do not promote a sound and fair institutional environment for market competition and economic growth.

To calculate Governance Scores, a base score is assigned a percentage rank of the country using the “Institutional Pillar” ranking of the World Economic Forum’s Global Competitiveness Index (GCI).³⁹ This index ranks the general legal framework, attitudes towards markets and freedoms, level of corruption, and effectiveness of regulation of the county in which the REDD+ activity is being implemented.

³⁹ GCI is a survey that gathers the views of domestic and foreign-owned firms on a range of issues related to the business environment. The report can be accessed via the World Economic Forum website, at http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

Base scores are determined by their “Institutional Pillars” rank in the GCI report. Each country’s rank is considered in relation to the other 144 countries in the study. A country’s rank is grouped into percentile ranges, equal to corresponding base scores detailed below.

TABLE 10: BASE SCORES

Percentile	Base Score
+ .79	100%
.50 - .79	90%
.25 - .49	80%
0 - .25	70%

Step 5 – Aggregation of Pipeline

The Level II credit supply for the 2015–2025 period is modeled by aggregating annual credit issuance forecasts for all REDD+ activities qualified to Level II.

B.4 PROGRAM SUPPLY PIPELINE

The projected program supply is calculated much like Level II supply, equal to the sum of annual credit issuance forecasts of activities that are currently in various stages of REDD-readiness preparation, with an aim of generating credits. While most jurisdictions intent on developing REDD+ programs are in the early stages of development, only those jurisdictions that publicly submitted requests for REDD-readiness finance, from funds such as the FCPF or BioCarbon ISFL, have been considered for inclusion in the supply pipeline. As with Level II projects, modeling future credit issuance is complex due, in most cases, to the limited availability of data; therefore, it needs to be qualified based on the program’s progress toward implementation and ultimately validation.

To qualify program activities in order to generate potential credit issuance forecasts, the following steps are implemented:

Step I – Identifying Jurisdictional REDD+ Program Candidates

To procure credit issuance and emissions reduction forecasts for programs that were sufficiently advanced, the authors primarily researched websites and/or directly queried the REDD-readiness funding agencies and relevant partner organizations.

TABLE 11: SOURCES OF DATA

Source	Form of engagement
Forest Carbon Partnership Facility	Online access
BioCarbon Fund, ISFL	Online access
UNREDD	Online access
REDD Early Movers Programme	Online access
Governors’ Climate and Forests Task Force Database	Online access and direct query
IDESAM	Online access and direct query

Step 2 – Qualifying REDD+ Jurisdictional Programs

The threshold for qualification to the program pipeline is **1) intent to meet criteria to issue compliance-grade credits**, and **2) advancement beyond the concept phase** (i.e., at least the carbon feasibility stage is started, including prevalence of ex-ante estimates).

1. **Intent to meet criteria to issue compliance-grade credits** is evidenced by indications that financing will be raised through sales of compliance-grade verified emission reductions, or a prevailing REDD+ market-mechanism (whether bilateral or market-based). Evidence for indications of intent is gathered through the evaluation of project documents or websites.
2. **Advancement beyond the concept phase** is evidenced by dedication of resources and organization capacity to planning and other activities to prepare for the development of verified emission reductions. While a project development plan prepared by qualified technicians is desirable, projects must at a minimum have stated an ex-ante estimate for emissions reductions.

If these conditions of capacity, resources, and intent are recorded in project documents or on the project website, the activity is considered to be part of the supply pipeline. Many future jurisdictional programs, such as a number in the Governor’s Climate and Forests Task Force, did not meet these minimum qualifications and as such were excluded from the Program pipeline.

Step 3 – Develop Emission Reduction Forecasts

As with Level II projects, the forecast emission reduction data extracted from program activities is highly variable in quality and content, although most are at the earlier stages of development. Where program emissions reductions were not stratified by year, or only for a number of years, an average annual reduction was recorded. All estimates are subjected to the following deductions:

Step 4a – Credit Issuance Adjustments – Risk Buffer Withholding

The majority of jurisdictional programs are still in the program design phase; thus, they have not attempted to account for non-permanence buffer withholdings. As with Level II projects, such programs were assigned a conservative risk buffer of 19 percent⁴⁰.

Step 4b – Credit Issuance Adjustments – Uncertainty of Future Credit Issuance

Given the stage of the REDD+ program activities, there will be a high degree of uncertainty on the ability of any activity to actually issue compliance-grade emission reductions. To capture the likelihood or probability that an activity will fail to produce compliance-grade emission reductions in the future, a **discount factor** was applied to each activity’s emissions reduction forecast. This approach provides for a more realistic, risk-adjusted credit issuance forecast for each qualified REDD+ program. The Risk Assessment Tool below follows the format of the Level II project tool; a deduction for management capacity was excluded due to a general lack of information on what the management capacity will look like. The tool is displayed below, and the combined risk factors are applied to each program.⁴¹

⁴⁰ As reported in the VCS JNR Permanence Steering Committee meeting notes, December 2012

⁴¹ This is applied by taking $(1 - \text{discount}_{\text{factor 1}}) * (1 - \text{discount}_{\text{factor 2}}) * (1 - \text{discount}_{\text{factor 3}})$ times the emission reduction forecasts.

TABLE 12: RISK ASSESSMENT TOOL

Risk Factor	Description	Assigning Values	Values	Discount																										
1. Government Approval	Captures the uncertainty to credit issuance present when proponent has not received Government approval to carry out activities	<p>If government approval is demonstrated by license, permit, or contract with a government authority, then value equals 'Approved'.</p> <p>If activity is Not Yet Approved (NYA), a 'Government score' is determined for each jurisdiction based on World Economic Forum indicators for legal and administrative frameworks to enable competitiveness and economic development, with credits or debits for country participation in Readiness programs, and the state of regulations and governance authorities to approve and govern REDD+ activities. (See section below for determination of Government Scores).</p>	Approved	0%																										
			NYA	Government Scores (see above)																										
2. Carbon Tenure	Captures the uncertainty to credit issuance present when proponent has not secured rights to carbon	<p>If ownership of the bundle of rights to secure carbon rights is demonstrated, then value equals 'Yes'. Demonstration is considered rights secured through legal contracts in conformance with statutes or legal precedence and that are aligned with and supported by recognized land tenure laws.</p> <p>If rights are under negotiation, or not yet secured, then value equals 'No'.</p>	Yes	0%																										
			No	10%																										
3. Carbon Development Stage	Indicates at what stage of development the REDD+ activities are related to developing the market standards related work needed to generate compliance-grade emission reductions	<p>For each REDD+ activity a value was assigned based on the completion of documents, public commenting periods, validations, and verifications as needed to complete each stage within the carbon development process.</p> <table border="1"> <thead> <tr> <th>Carbon Development Stage</th> <th>Discount</th> </tr> </thead> <tbody> <tr> <td>FCPF Early Idea Presentation</td> <td>60%</td> </tr> <tr> <td>BioCF Feasibility Complete</td> <td>55%</td> </tr> <tr> <td>FCPF ER-PIN under review</td> <td>50%</td> </tr> <tr> <td>FCPF/BioCarbon ER-PIN approved</td> <td>35%</td> </tr> <tr> <td>VCS JNR PD under development</td> <td>35%</td> </tr> <tr> <td>FCPF/BioCarbon Letter of Intent Signed</td> <td>30%</td> </tr> <tr> <td>FCPF/Biocarbon ER-PD drafted and/or VCS JPD drafted</td> <td>25%</td> </tr> <tr> <td>FCPF/Biocarbon ER-PD under review</td> <td>20%</td> </tr> <tr> <td>VCS JNR PD under validation</td> <td>15%</td> </tr> <tr> <td>FCPF/Biocarbon ER-PD Approved</td> <td>20%</td> </tr> <tr> <td>VCS JNR Validated</td> <td>10%</td> </tr> <tr> <td>VCS JNR Verified</td> <td>0%</td> </tr> </tbody> </table>	Carbon Development Stage	Discount	FCPF Early Idea Presentation	60%	BioCF Feasibility Complete	55%	FCPF ER-PIN under review	50%	FCPF/BioCarbon ER-PIN approved	35%	VCS JNR PD under development	35%	FCPF/BioCarbon Letter of Intent Signed	30%	FCPF/Biocarbon ER-PD drafted and/or VCS JPD drafted	25%	FCPF/Biocarbon ER-PD under review	20%	VCS JNR PD under validation	15%	FCPF/Biocarbon ER-PD Approved	20%	VCS JNR Validated	10%	VCS JNR Verified	0%	See list on left	Ranging from 60% to 0%
Carbon Development Stage	Discount																													
FCPF Early Idea Presentation	60%																													
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VCS JNR PD under development	35%																													
FCPF/BioCarbon Letter of Intent Signed	30%																													
FCPF/Biocarbon ER-PD drafted and/or VCS JPD drafted	25%																													
FCPF/Biocarbon ER-PD under review	20%																													
VCS JNR PD under validation	15%																													
FCPF/Biocarbon ER-PD Approved	20%																													
VCS JNR Validated	10%																													
VCS JNR Verified	0%																													
Credit Issuance Uncertainty Adjustment Factor =			Combined Risk Factor																											

B.5 CREDIT ISSUANCE ADJUSTMENTS

In practice, the timing of actual issuance of credits will lag the “vintage” or year that emission reductions are generated (i.e., project activities having taken place). This lag is a result of a verification being on ex-post emissions and reductions and is particularly relevant for the first verification, which usually includes multiple vintages. The first verification will include all vintages from the project start date, which may be several years prior to the end of the first verification period. Subsequently, there may be an annual or bi-annual verification.

Where several “vintages” of emission reductions from prior years’ activities are included in the first verification, the first verification volume may be significantly higher than the annual average volume for the activity. These multiple vintages of “verified emission reductions” from the years between the project start date (going back to 2010) and the first verification may be referred to as retroactively issued credits. Since this study is assessing market supply, the supply model will include retroactively issued credits generated from vintages prior to the first verification year which are issued within the period of model forecasting.

Determining the year of first verification for each REDD+ activity was based on an individual assessment of the activity’s start date, with considerations for delays in preparing the validation and verification requirements. The assumptions for determining delay in first issuance from an activity’s start date are detailed below. After the first verification, it was assumed that verification would be annual.

TABLE 13: ASSUMPTIONS FOR DETERMINING DELAY IN FIRST ISSUANCE FROM AN ACTIVITY’S START DATE

Start Date	Method to estimate first verification for Programs and Level II and Projects
2010–2013	A two-year delay is applied to the activity’s start date to account for the minimum verification period (one year) and delays in preparing for verification.
2014+	A one-year delay is applied to the start date to account for the minimum verification period.

These adjustments for issuance delay were applied to the Level II and Program activity forecast emission reductions to generate the issuance forecasts for each REDD+ activity for each year. For Level I activities that had not reached issuance, a first verification date was assigned based on review of available data.

APPENDIX C. CREDIT DEMAND FOR REDD+

C.1 OVERVIEW AND DEVELOPMENT OF SCENARIOS

This report heavily relies on projection models to estimate REDD+ demand. Assumptions have been made about prices, emissions, emissions growth and decline, caps, offset volumes, REDD and REDD+ credit volumes and percentages, timing of policy decisions, and the types of rules likely to be introduced. Some assumptions are based on historical data that may not be a reliable indicator of future behavior. Nevertheless, historical data has been used extensively in the development of the REDD+ demand projections.

Uncertainty is communicated through a scenario analysis combined with a within-scenario uncertainty interval that provides an indication of the range of values that might arise within each scenario. The scenarios used are: Status Quo, Compliance Growth, and Blue Sky. The scenarios indicate the scope of potential actions, ranging from higher confidence and lower volumes to lower confidence and higher volumes.

The following sections provide a breakdown of sources, assumptions, methods, and risks.

C.2 STATUS QUO

There are several potential sources of demand for the Status Quo scenario. Table 1014 provides the rationale for the sources included in the analysis. Demand comes from voluntary market participants and bilateral and multilateral support mechanisms, including payment for results. Demand from these sources, while representing the least volume, is known with the greatest confidence.

TABLE 104: RATIONAL FOR THE STATUS QUO SOURCES INCLUDED IN THE ANALYSIS

Source	Comment	REDD+ Assessment	Juris-dictional ⁴²	Detailed Analysis
Green Climate Fund (GCF)	The GCF is a fund under the UNFCCC that supports the shift toward low-emission and climate-resilient development pathways by assisting developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change.	Investment strategy and extent of deployment to REDD+ have yet to be determined.	Not known but likely	No

⁴² Jurisdiction-scale activities occur at scales larger than a project, such as a country or state, province or ecoregion within a country.

Forest Carbon Partnership Facility – Carbon Fund (FCPF-C)	The FCPF-C develops new market instruments for pricing forest carbon emission reductions and is designed as a payment-for-results model. The fund is designed to close in 2020, when it is envisaged that it will be replaced by a wider market for REDD+ credits under the auspices of an international climate agreement for this period.	Provides support to countries to scale up REDD+ implementation to deliver emission reductions at scale. It does this by providing payments on delivery of verified emission reductions	Yes	Yes
Initiative for Sustainable Forest Landscapes (ISFL)	This fund mobilizes finance to reduce carbon emissions in forest and agricultural ecosystems by 1) providing technical assistance for REDD+ implementation and measures, which improve the enabling environment for private sector investment; 2) offer finance for Verified Emission Reductions associated with avoided deforestation; and 3) secure private sector finance.	Provides support to countries to scale up REDD+ implementation to deliver emission reductions at the jurisdictional level.	Yes	Yes
Joint Crediting Mechanism (JCM)–Japan	The JCM is designed to facilitate diffusion of low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contribute to the sustainable development of developing countries.	REDD+ projects are accepted and technical presentations to the Partnership for Market Readiness (PMR) suggest that four projects are in development, but no methodology is available on the JCM website.	Not known	Yes
Norway	Norway’s International Climate and Forest Initiative (NICFI) funds several bilateral and multilateral efforts aimed at reducing deforestation and testing results-based payment. The initiative does not purchase tradable credits.	REDD payment for performance, but REDD+ is possible.	Yes	Yes
REDD Early Movers–Germany	The REDD Early Movers (REM) fund supports pioneers in the REDD+ sector – countries that are taking risks and acting independently toward mitigating climate change by preserving their forests.	REDD/REDD+ payments for performance	Yes	Yes

Forest Investment Program (FIP)	This is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the framework of the Climate Investment Funds (CIF). The FIP supports developing country efforts to reduce deforestation and forest degradation and promote sustainable forest management that leads to emissions reductions and enhancement of forest carbon stocks (REDD+)	No payment for performance	N/A	No
UN-REDD	Supports national REDD+ readiness efforts via: i) direct support to the design and implementation of UN-REDD National Programs; and ii) complementary support to national REDD+ action through common approaches, analyses, methodologies, tools, data and best practices developed through the UN-REDD Global Program. ⁴³	No payment for performance	Yes	No

The multilateral funds primarily carry a price uncertainty, while the bilateral funds—specifically Norway’s Indonesia fund and Japan’s JCM—as well as the voluntary market carry both price and volume uncertainty. The prices used for the multilateral funds in the analysis are based on UK Department of Climate Change economic analysis, which is used for our upper price guidance of US\$7 per tCO₂e.⁴⁴ Existing funds such as Norway’s Amazon pay US\$5 per tCO₂e, which is our mid-price guidance. At the low end, the majority of voluntary market transactions have been priced between US\$3 and US\$5 per tCO₂e during the 2013–2014 period.⁴⁵ Thus, we used low-end price guidance of US\$3 per tCO₂e.

C.2.1 Initiative for Sustainable Forest Landscapes (ISFL)

The BioCarbon Fund (BioCF) was established in 2004, focusing on smaller-scale projects that deliver verified emissions reductions for the Clean Development Mechanism. However, during the United Nations’ climate summit in Warsaw, known as Conference of the Parties (COP)19, Norway, the United Kingdom, and the United States together committed US\$280 million—up to US\$135 million of that from Norway, US\$120 million from the United Kingdom, and US\$25 million from the United States—as part of a new tranche of funding for the BioCF – the Initiative for Sustainable Forest Landscapes (ISFL).

⁴³ See <http://www.un-redd.org/>, accessed on 30 January 2015.

⁴⁴ Department of Energy and Climate Change. (2014). An International Climate Fund business case for DECC investment in the BioCarbon Fund and the Forest Carbon Partnership Facility–Carbon Fund. 2014. London, Great Britain. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305241/ICF_BC_for_DECC_investment_in_BioCF_and_FCPF_CF.pdf. Accessed 20 August 2014.

⁴⁵ Ecosystem Market Place, (2013). State of the Forest Carbon Market. Retrieved from <http://www.forest-trends.org/documents/files/SOFCM-full-report.pdf>. Accessed on 27 August 2014.

The ISFL provides technical assistance for REDD+ implementation and measures which actions improve the enabling environment for private sector investment, offer finance for Verified Emission Reductions (VERs) associated with avoided deforestation, and aim to secure private sector finance.

The fund operates at the jurisdiction scale, i.e., within a landscape-wide area that a single political jurisdiction governs. Activities that are likely to be supported include small-scale plantation farming, sustainable forest management, afforestation and reforestation, regeneration, National Park designation/no-deforestation zoning, agroforestry, and sustainable agricultural practices.

The verified emission reduction demand estimates for ISFL assume that the crediting period is 2017 to 2021. Demand is estimated by dividing the available funds for emission reduction payments by the expected price paid by the fund. Available funds are US\$240 million (including the U.S. contribution, which cannot be used to purchase VERs) minus initial (6.75 percent) and renewal (0.75 percent) expenses, leaving about US\$207 million available for emission reduction purchases.

Demand guidance varies between 30 MtCO_{2e} and 69 MtCO_{2e} with a mid guidance point of 41 MtCO_{2e}; purchases are assumed to start in 2017 and last until 2021. Prices are assumed to vary within the range of US\$3–US\$7 per tCO_{2e}, with a midpoint of US\$5 per tCO_{2e}.⁴⁶

C.2.2 Forest Carbon Partnership Facility-Carbon Fund (FCPF-C)

The FCPC was established 2007 with the objectives of building capacity for REDD+ and to pilot a program of payments for reduced emissions. The FCPF comprises two funds.

The Readiness Fund (FCPF-R) supports participating countries in the development of REDD+ strategies and policies, references emission levels (REL), measurement, reporting and verification (MRV) systems, and institutional capacity to manage REDD+ that includes environmental and social safeguards. The Readiness Fund became operational in 2008 and in late 2014 had a capital of about US\$258 million.⁴⁷

The Carbon Fund (FCPF-C) builds on the progress made in readiness under the FCPF-R and is designed to pilot performance-based payments for emission reductions (ER) from deforestation and/or forest degradation from REDD+ programs in a small number of FCPF countries. FCPF-C became operational in 2011 and has a capital of about US\$390 million. The fund is designed to close in 2020, when it is envisaged it will be replaced by a wider market for REDD+ credits under the auspices of an international climate agreement for this period.⁴⁷

After expenses, the FCPF-C had in late 2014 about US\$350 million⁴⁷ to purchase verified emission reductions from countries that have successfully participated in the Readiness Fund and have demonstrated advancements in MRV, a credible reference scenario, and an approach to crediting. The structure of these payments will conform to the mechanisms for compensated REDD+ currently being discussed within the UNFCCC process. Financial sponsors of the Carbon Fund will receive emission reductions in proportion to their contributions.⁴⁸

⁴⁶ Department of Energy and Climate Change, 2014.

⁴⁷ World Bank. (2013). Forest Carbon Partnership Facility 2013 Annual Report. Washington, D.C. Retrieved from https://www.forestcarbonpartnership.org/sites/fcp/files/2013/Dec2013/FCFP%20Annual%20Report_2013_0.pdf. Accessed 20 August 2014.

⁴⁸ World Bank. (2008). Forest Carbon Partnership Facility Information Memorandum, June 13, 2008. Washington, D.C. p. 1-2. Retrieved from http://www.forestcarbonpartnership.org/sites/forestcarbonpartnership.org/files/Documents/PDF/FCPF_Info_Memo_06-13-08.pdf. Accessed 20 August 2014.

To date, the FCPF-C has not purchased any emission reductions, as the pricing strategy is currently being negotiated. The verified emission reduction demand estimates for FCPF-C are assumed to run from 2015 to 2019. Demand is estimated by dividing the available funds for emission reduction payments by the expected price the fund pays. Available funds are US\$390 million minus initial (6.4 percent) and renewal (0.75 percent) expenses, leaving about US\$350 million available for emission reduction purchases.

Demand guidance varies between 50 MtCO₂e and 117 MtCO₂e, with a mid guidance of 70 MtCO₂e; purchases are assumed to commence in 2015 and last to 2019. Prices are assumed to vary within the range of US\$3 to US\$7 per tCO₂e, with a midpoint of US\$5 per tCO₂e.⁴⁹

C.2.3 Joint Crediting Mechanism (JCM)–Japan

Under the Copenhagen Accord, Japan pledged to reduce emissions 25 percent below 1990 levels by 2020, conditional on the establishment of a fair and effective international framework in which all major economies participate, and upon the agreement of those economies on ambitious targets.⁵⁰ However, the recent earthquake and tsunami as well as associated nuclear safety concerns resulted in the closure of much of Japan's nuclear energy generation capacity and increased Japan's reliance on fossil fuels, which may force reconsideration of its 2020 target.⁵¹

Japan has indicated that, as part of its emissions reduction efforts, it will develop a bilateral offset crediting mechanism known as the JCM. The JCM aims to facilitate the diffusion of low carbon technologies, products, systems, services, and infrastructure as well as the implementation of mitigation actions. It will also contribute to sustainable development of developing countries.

In the initial stages, the JCM will start its operation as a non-tradable credit mechanism similar to Payment for Results. This approach may evolve to a tradable credit mechanism. The JCM will continue until there is a new international framework under the UNFCCC.⁵² The World Bank estimates Japan will generate a demand for up to 539 million tCO₂e international offsets from developing countries between 2013 and 2020. This figure includes demand for Kyoto credits along with demand under JCM.⁵³

The Government of Japan has not presented a credit investment or purchase strategy, making it difficult to assess the likely demand for verified emission reductions from forestry. Japan and Indonesia are evaluating the inclusion of REDD+ through a number of feasibility studies, but as yet there are no published methodologies.⁵⁴

⁴⁹ Department of Energy and Climate Change, 2014.

⁵⁰ United Nations Framework Convention on Climate Change. (2011). Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention. Retrieved from <http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf>. Accessed on 26 August 2014.

⁵¹ World Bank. (2011). State and Trends of the Carbon Market 2011. Washington, D.C. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/StateAndTrend_LowRes.pdf. Accessed 21 August 2014.

⁵² Government of Japan. (2014). Recent Development of the Joint Crediting Mechanism (JCM). Retrieved from http://www.mmechanisms.org/document/20140804_JCM_goj.pdf. Accessed 21 August 2014

⁵³ World Bank. (2012). State and Trends of the Carbon Market 2012. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19_035_Cvr&Txt_LR.pdf. Accessed on 27 August 2014.

Government of Japan. (2014). Joint Crediting Mechanism (JCM) methodology webpage. Retrieved from <http://www.mmechanisms.org/e/support/adoption.html>

The verified emission reduction demand estimates for Japan's JCM assumes that the crediting period will run from 2015 to 2025. Although Japan is evaluating obtaining emission reductions from REDD with Indonesia, it is possible that no credits will be produced during the projection period; thus, we have a low volume guidance of zero.

Our mid-range guidance is equal to the World Bank demand estimate for international credits of 539 million units adjusted to 770 million credits due to the change in crediting period (from 2013–2020 to 2015–2025) multiplied by a 15-percent purchase limit on forest carbon. Our high-end guidance is equal to our estimated demand of 770 million credits multiplied by an optimistic forest carbon purchase limit of 30 percent. Depending on the details of the JCM, both price and volume may be uncertain.

Demand guidance varies between 0 MtCO_{2e} and 193 MtCO_{2e}, with a mid guidance of 77 MtCO_{2e}; purchases are assumed to commence in 2015 and last to 2025.

C.2.4 Norway

Norway's International Climate and Forest Initiative (NICFI) funds several bilateral and multilateral efforts aimed at reducing deforestation and testing results-based payment.⁵⁵ The initiative is not currently designed to involve tradable credits, and there is no indication that this path will change in the immediate future. A summary of the activities follows:

- **Brazilian Amazon Fund:** This fund channels monies to implement the Brazilian government's Plan of Action for Protection and Control of Deforestation in the Legal Amazon. As the first contributor to the fund, Norway provided approximately US\$170 million in 2011 and has pledged US\$1 billion through 2015. Should emissions in a given year exceed the reference emissions level, no payment will be made to the fund in the subsequent year. As of 2013, payments totaling about US\$760 million have been made.⁵⁶
- **Indonesia:** In May 2010, Norway pledged US\$1 billion to support Indonesia's efforts to reduce emissions from deforestation and degradation of forests and peat lands.⁵⁷ Two years later, Norway's environment minister has stated that Indonesia has not adhered to its announced moratorium on forest clearing, and the country will be unable to meet its emissions reduction target. Norway's continued financial support is predicated on performance both in policy and actual forest emission reductions.⁵⁸

⁵⁵ Government of Norway. (2014). The Government of Norway's International Climate and Forest Initiative. Retrieved from <http://www.regjeringen.no/templates/RedaksjonellArtikkel.aspx?id=547202&epslanguage=EN-GB>. Accessed 27 August 2014.

⁵⁶ Government of Brazil. (2013). Activity Report–Amazon Fund. Retrieved from http://www.amazonfund.gov.br/FundoAmazonia/fam/site_en. Accessed 27 August 2014.

⁵⁷ Government of Norway. (2014). Evaluation of Norway's International Climate and Forest Initiative. Retrieved from http://www.regjeringen.no/upload/MD/2011/vedlegg/klimate/klimate_skogprosjektet/LASH_Final_NICFI_EvaluationReport.pdf. Accessed 27 August 2014.

⁵⁸ Rondonuwu, O. (2012). Reuters, Indonesia forest moratorium won't meet climate pledge – Norway. Retrieved from <http://www.reuters.com/article/2012/05/22/us-indonesia-emissions-norway-idUSBRE84L0H920120522>. Accessed on 27 August 2014.

- Guyana: In November 2009, Norway’s Minister of the Environment and International Development and the President of Guyana signed a memorandum of understanding (MOU) pledging cooperation to protect Guyana’s forests. Norway is financially supporting the Guyana REDD+ Investment Fund, committing up to US\$250 million through 2015. Payments are tied to Guyana’s national-scale performance in reducing emissions from deforestation and degradation.⁵⁹

Both the Brazilian Amazon and Guyana funds expire in 2015; therefore, there is one year of funding left. Over the projection period, the bulk of the demand is uncertain coming from the promised US\$1 billion payment to Indonesia. To date no payments have been made to Indonesia and Guyana has earned US\$150 million in payments from Norway since the partnership started.⁶⁰

The verified emission reduction demand estimate for the Norwegian funds assumes that the crediting period is assumed to run from 2015 to 2025. Demand is estimated by dividing the available funds for emission reduction payments by the expected price paid by the fund.

Norway’s Amazon pays US\$5 per tCO₂e, which is the assumed price for Guyana and Indonesia. No price uncertainty is assumed. However, volume uncertainty exists with assumptions about the delivery of VERs by Indonesia. In the low estimate it is assumed that only 25 percent of the potential VERs from Indonesia are delivered by 2025. The midpoint assumes 50 percent, and the high estimate assumes 100 percent delivery by 2025.

Demand guidance varies between 86 MtCO₂e and 236 MtCO₂e, with a mid guidance of 136 MtCO₂e; purchases are assumed to commence in 2015 and last to 2025.

C.2.5 REDD Early Movers—Germany (REM)

Germany’s Ministry for Economic Cooperation and Development has commissioned KfW and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to implement a fund supporting REDD early movers.⁶¹ The REM fund supports pioneers in the REDD+ sector – countries that are taking risks and acting independently to mitigate climate change by preserving their forests.

To qualify as an early mover, a country must demonstrate that they have already made sufficient progress in putting in place the technical capacity and enabling policy and institutional environments needed for efficient forest conservation. Following the FCPF and UN-REDD guidelines, the REM Fund uses a phased approach to adopting REDD+ presented by the 2009 Meridian Report and endorsed by international negotiations in Cancun and Durban.^{61, 62} However, REM recognizes that it will take some time to direct financing to REDD+ countries through the international mechanism and seeks to bridge the funding gap in order to incentivize demonstration activities.

⁵⁹ Government of Norway. (2014). Norway Ministry of the Environment. Guyana-Norway partnership on climate and forests. Retrieved from <http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-guyana-norwaypartnership.html?id=592318>. Accessed 27 August 2014.

⁶⁰ Government of Guyana. (2014). Low Carbon Development Strategy Guyana. Guyana-Norway partnership on climate and forests. Retrieved from <http://www.lcds.gov.gy/index.php/media-centre/press-releases/497-norway-announces-fourth-payment-to-guyana-for-climate-services-and-continued-low-deforestation->. Accessed 21 January 2015.

⁶¹ Government of Germany. (2014). Federal Ministry for Economic Cooperation and Development (BMZ), GIZ, REDD Early Movers (REM) - Rewarding pioneers in forest conservation. Retrieved from http://www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf. Accessed 27 August 2014.

⁶² Angelsen, A., et al. (2009). Meridian Institute, ‘Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment Report’

The REM Fund is aimed exclusively at early mover national REDD+ programs and large-scale sub-national initiatives. It intends to direct funding through bilateral payments rather than through credit or emissions trading markets. Another contrast to other international REDD+ funds is that REM modalities make it possible to direct funding between the phases prescribed by the international negotiations.

The REM works with two financing modalities: incentive-based payments exchanged for ex-ante emission reductions (accompanied by measures to monitor), and performance-based payments for ex-post emission reductions based on proven methodologies and verified by an independent party.⁶³

The first phase of the REM has a funding volume of €32.5 million (US\$42.4 million).⁶¹ The fund administrators suggest that the timetable of REM funding is flexible and that it will be assessed individually according to the stage of progress and the advisory service requirements of each early mover.

The verified emissions reduction demand from German Early Movers fund assumes a credit production period to be 2015–2024. Future demand is calculated by dividing the total contributions committed to the REM Fund (US\$42.4 million) by the price for a verified emissions reduction. This approach assumes that Fund administration costs and transaction costs are managed independently, and that Phase I funding is allocated before 2020.

Demand guidance varies between 6 MtCO_{2e} and 14 MtCO_{2e}, with a mid guidance of 8 MtCO_{2e}. Purchases are assumed to commence in 2015 and last to 2025. Prices are assumed to vary within the range of US\$3 to US\$7 per tCO_{2e}, with a midpoint of US\$5 per tCO_{2e}.

C.2.6 Voluntary Market

The Verified Carbon Standard (VCS) is a well-respected GHG reduction and removal certification standard that dominates the voluntary market in general, and the forest market in particular. During 2012, VCS accounted for 57 percent of the transaction volumes in the forest carbon markets.⁶⁴ Australia's Carbon Farming Initiative accounts for some 10 percent of the volume.

The model adjusts the reported total volumes for REDD and Improved Forest Management (IFM) to obtain primary market volumes. Since this is an annual demand, the total demand is calculated as the number of years in the outlook period multiplied by the annual demand. The minimum, maximum, and average are obtained to provide the low, high, and mid-volume guidance.

Demand guidance varies between 41 MtCO_{2e} and 120 MtCO_{2e}, with a mid guidance of 104 MtCO_{2e}; purchases are assumed to commence in 2015 and last to 2025.

⁶³ GIZ; Ragna, J. (2012). Presentation, New International Programmes on REDD+ and FLEGT: REDD Early Movers and Forest Governance Programme. Retrieved from http://www.euredd.efi.int/files/attachments/euredd/16.30-17.00_giz.pdf. Accessed 27 August 2014.

⁶⁴ Ecosystem Marketplace. (2013). State of the Forest Carbon Markets 2013: Covering New Ground. Retrieved from <http://www.forest-trends.org/documents/files/SOFCM-full-report.pdf>. Accessed 11 September 2014.

C.3 COMPLIANCE GROWTH

C.3.1 Overview

The following sections provide a breakdown of assumptions, methods, and risks. There are several potential sources of demand for the Compliance Growth scenario, which represents demand that might arise from existing or new GHG abatement schemes, including commitments from the aviation industry and developing countries.

The Compliance Growth scenario is supported by demand from the Status Quo scenario and has a number of speculative elements. Volumes and prices are uncertain, particularly for some of the national and jurisdictional schemes. Figure 13 (Total Demand for the Compliance Growth Scenario (MtCO₂e)) shows the significant changes in the relative sources of demand from REDD+ from the geographical regions in the analysis. Status Quo demand predominates in our low guidance for the Compliance Growth scenario.

C.3.2 Europe and Russia

European-influenced nations actively considering emissions trading schemes appear unlikely to allow REDD+ unless Europe does (see

Table 115 for further details). The possible exception is Russia, which appears more likely to use domestic forest sinks as opposed to any international credits. Currently, the EU Emissions Trading Scheme (EU ETS) and the Effort Sharing Decision (ESD) do not permit international REDD+ credits. Therefore, no demand is anticipated for countries in this group.⁶⁵

⁶⁵ Conroy, D.; Streck, C.; and Moritz von Unger. REDD+ Finance in the European Union: Options for Scaling up Near Term Support. 2014. Retrieved from http://www.climatefocus.com/documents/redd_finance_in_the_european_union. Accessed 9 September 2014.

TABLE 115: RATIONAL FOR EXCLUDING EUROPEAN-INFLUENCED NATIONS FROM THE ANALYSIS

Source	Comment	REDD+ Assessment	Juris-dictional	Detailed Analysis
European Emissions Trading Scheme (EU ETS)	World's largest emissions trading scheme operating at a regional level. Does not allow forest based offsets, such as REDD+, in the current compliance period (phase III) and will not allow any international offsets in the next compliance period, phase IV.	No demand for REDD+	N/A	No
Kazakhstan	Kazakhstan is currently implementing its national emissions trading scheme. ⁶⁶	No demand for REDD+; assumed to follow EU ETS	N/A	No
Switzerland	Since 2008 Switzerland has imposed a CO ₂ levy on fossil fuels used for heating and lighting purposes, electricity production in thermal plants, and operation of combined heat and power plants. Motor fuels are not included. ⁶⁷	No demand for REDD+	N/A	No
Russia	Early-stage ETS is under consideration. Since 2009 Russia has been in talks about establishing a regional ETS with neighboring Belarus, Kazakhstan, and Ukraine. ⁶⁸	No demand for REDD+, likely to use internal forest sinks.	N/A	No
Turkey	Currently implementing robust, installation-level MRV system based on the MRV law and preparing a road map toward implementation of domestic ETS. ^{66, 69}	No demand for REDD+; assumed to follow EU ETS	N/A	No
Ukraine	Designing installation-level MRV for energy sector and preparing a road map toward implementation of domestic ETS. ⁶⁶	No demand for REDD+; assumed to follow EU ETS	N/A	No

⁶⁶ World Bank. (2014). Annual Report 2014—Partnership for Market Readiness. Washington, D.C. Retrieved from <https://www.thepmr.org/content/pmr-annual-report-fy14>. Accessed 01 August 2014.

⁶⁷ The World Bank. (2014). State and Trends of Carbon Pricing, March 2014. Washington, D.C. Retrieved from <http://www.worldbank.org/en/news/feature/2014/05/28/state-trends-report-tracks-global-growth-carbon-pricing>. Accessed 01 August 2014.

⁶⁸ Russian Federation. (2014). Carbon Market Scoping Study. Retrieved from <http://www.ru-cmss.org/index.php/ru-cmss-news/73-russia-s-econ-ministry-wants-co2-market-to-curb-emissions>. Accessed 22 August 2014.

⁶⁹ Personal Communication, Egbert Liese, Climate Focus.

C.3.3 Asia and Oceania

A number of Asian countries have national or jurisdictional schemes planned or operating (see Table 1216). The most noteworthy development since the previous report is Australia's repeal of the Clean Energy Bills, which started as a carbon tax but was due to transition to a floating price cap-and-trade scheme in 2015.⁷⁰

TABLE 12: RATIONAL FOR INCLUDING VARIOUS SOURCES OF DEMAND FROM ASIA

Source	Comment	REDD+ Assessment	Juris-dictional	Detailed Analysis
Australia	Repealed its Clean Energy Bills (carbon tax transitioning to cap-and-trade scheme) in 2014. Australia may have a shortfall on its unilateral 5-percent emissions reduction commitment.	International offsets and REDD+ credits might be used to make good on any shortfall.	Yes	Yes
China	Currently designing and preparing for a national ETS, including work on cap setting, allocation, MRV, mechanisms for price containment, market oversight, and a legal framework. Conducting analytical work targeted at the inclusion of state-owned enterprises and the power sector into the national ETS. Pilot schemes in Beijing, Guangdong, Hubei, Shanghai, Shenzhen, and Tianjin. ⁷¹	Allows offsets between 5 and 10 percent, mostly from Chinese CDM projects; however, REDD-type projects may be included.	Unclear	Yes
India	Currently building an integrated GHG data management system and developing an off-grid Renewable Energy Certificate (REC) program. Expanding sectoral coverage of the Perform Achieve and Trade (PAT) system.	No demand for REDD+	N/A	No
Indonesia	Currently exploring various types of market instruments; building domestic carbon market infrastructure and piloting an MRV framework in power plants and cement industry.	No demand for REDD+; likely sources with JCM and Norway agreements.	Yes	No

⁷⁰ Parliament of Australia. (2014). Repeal of the Clean Energy Legislation. Retrieved from http://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bld=r5311. Accessed on 22 August 2014.

⁷¹ World Bank. (2014). Annual Report 2014—Partnership for Market Readiness. Washington, D.C. Retrieved from <https://www.thepmr.org/content/pmr-annual-report-fy14>. Accessed 01 August 2014.

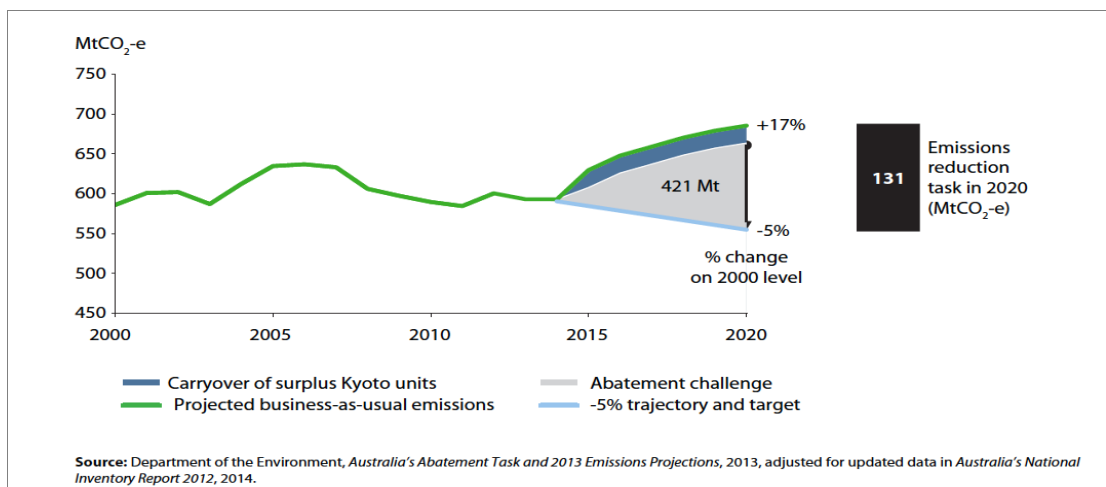
Japan	The recent earthquake and tsunami and associated nuclear safety concerns resulted in the closure of much of Japan's nuclear energy production and increased Japan's reliance on fossil fuels, which may force reconsideration of its approach to reducing GHG emissions.	Japan is developing a bilateral crediting mechanism known as the Joint Crediting Mechanism, which includes REDD.	Likely	Yes
Korea	Korea is implementing a domestic cap and trade scheme. Korean Certified Emission Reductions (KCERs) are allowed and limited to 10 percent.	In the first two phases, no international credits are allowed. Post-2020, international offsets are allowed and may include REDD.	Likely	Yes
New Zealand	New Zealand is unlikely to have a shortfall unless there is a comprehensive global agreement. Therefore, in the moderate scenario international credit demand is zero.	No demand for REDD+	Yes	Yes (under Blue Sky)
Thailand	Currently creating an Energy Performance Certificate (EPC) scheme and piloting a Low Carbon City Program.	No demand for REDD+	N/A	No
Vietnam	Currently designing and piloting market instruments in the steel and solid waste sectors as well as establishing a GHG registry and MRV system. ⁶⁶	No demand for REDD+	N/A	No

Australia

On 17 July 2014 the Clean Energy Legislation (Carbon Tax Repeal) Bill 2014 obtained Royal Assent.⁷² Despite the repeal, Australia will continue to have a renewable energy standard, currently under review, and a fund to invest in clean energy. Australia also remains committed to reducing emissions to 5 percent below 2000 levels by 2020. The latest estimates of Australia's future greenhouse gas emissions are that Australia faces a cumulative emissions reduction task of around 421 MtCO₂e in the period from now until 2020 (see Figure 20).

⁷² Parliament of Australia, 2014.

FIGURE 20: AUSTRALIA'S EMISSIONS REDUCTION CHALLENGE



The Australian government’s direct action policy was designed to help address this gap.⁷³ The direct action policy known as the Carbon Farming Amendment Bill passed the parliament in November 2014.⁷⁴ Australian demand during the 2015–2025 period depends on the Government of Australia successfully passing measures to meet Australia’s current international commitments.

Our low guidance of 0 MtCO₂e is predicated on Australia either the Carbon Farming Amendments Bill and/or other policy measures that allow it to achieve its 5 percent target without recourse to purchasing REDD+ credits. The mid estimate is obtained by assuming that Australia purchases international credits, some of which are REDD+, to make up a proportion of the shortfall. In the mid guidance case, 15 percent of the shortfall of 421 MtCO₂e is assumed to come from REDD+ credits. The high guidance assumes that 30 percent of the shortfall comes from REDD+ credits and in both cases it is assumed that Australia has no further need of international credits in the remainder of the forecast period (2021–2025).

Demand guidance varies between 0 MtCO₂e and 126 MtCO₂e with a mid guidance of 63 MtCO₂e. Purchases are assumed to commence in 2015 and last to 2020.

China

China’s 12th Five-Year Plan (2011–2015) commits China to a national GHG emissions intensity reduction of 17 percent per unit of GDP from 2011 to 2015. As a Nationally Appropriate Mitigation Action (NAMA) under the December 2009 Copenhagen Accord, China has set a target to reduce carbon intensity by 40-45 percent by 2020 from 2005 levels.⁷⁵

⁷³ Government of Australia. (2014). Emissions Reduction Fund White Paper. Canberra. Retrieved from <http://www.environment.gov.au/climate-change/publications/emissions-reduction-fund-white-paper>. Accessed on 22 August 2014.

⁷⁴ Parliament of Australia. (2014). Carbon Farming Amendment Bill. Retrieved from http://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bld=r5280. Accessed on: 30 January 2015.

⁷⁵ Point Carbon. “Focal Point: Towards a Chinese emissions trading scheme.” *Carbon Market Monitor* 6 March 2012. Retrieved from http://www.pointcarbon.com/polopoly_fs/1.1857764!Carbon_Market_Monitor_2012-5_v9.pdf

The 12th Five-Year Plan also targets development of a national carbon market by 2015. On this basis, the National Development and Reform Commission's (NDRC) Climate Change Department announced in 2011 that emissions trading programs would be piloted in seven cities and provinces, with a goal of launching by 2013. These pilots are now operating and are expected to continue until there is a national scheme in place, most likely around 2020.⁷⁶

The Pilot schemes include the provinces of Guangdong and Hubei, as well as the cities of Beijing, Chongqing, Shanghai, Tianjin, and Shenzhen. Experiences from the pilot initiatives will be incorporated into the design of a national system. There are also proposals to test carbon trading on a sectoral basis, such as for non-residential buildings or distributed heating facilities.⁷⁷

It has been previously reported that the pilot programs would use emissions intensity targets, but that the NDRC had instead directed them to impose absolute caps.⁷⁸ While this report may be accurate, in practice the pilot caps in China do not operate like the caps in California or EU ETS. For example, Guangdong has a cap that increases from 388 MtCO₂e in 2013 to 660 MtCO₂e in 2015 with no change in coverage.⁷⁹ Absolute emissions do not fall.

The one possible exception is Beijing, which is reported as having the only pilot that requires annual absolute emission reductions for existing facilities in the manufacturing and service sectors. Power and heating plants are not expected to reduce absolute emissions by the ETS.⁸⁰

Credits are allowed in the pilot schemes (for details, see Table 137). The credit program is similar to the Clean Development Mechanism (CDM). The National Development and Reform Commission (NDRC) approves all projects. As of February 2014, 178 methodologies have been registered, of which 173 originate from CDM methodologies and five Land Use, Land-Use Change, and Forestry (LULUCF)-related non-CDM methodologies.⁸¹

⁷⁶ Pers. Comm. Ranping Song, WRI, China.

⁷⁷ Han, Guoyi, et. al. (2012). China's Carbon Emission Trading: An Overview of Current Development. FORES and Stockholm Environment Institute. [Online]. Retrieved from <http://www.sei-international.org/mediamanager/documents/Publications/china-cluster/SEI-FORES-2012-China-Carbon-Emissions.pdf>. Accessed 27 August 2014.

⁷⁸ Chen, K. (2012). Point Carbon. China tells pilot ETS regions to set absolute CO₂ caps. Retrieved from <http://www.pointcarbon.com/news/1.1717739>. Accessed 5 June 2012.

⁷⁹ International Carbon Action Partnership (ICAP). (2014). ETS Map. Retrieved from <https://icapcarbonaction.com/ets-map>. Accessed 22 August 2014.

⁸⁰ Song, R.; and Lei, H. (2014). Emissions Trading in China: First Reports from the Field. World Resource Institute (WRI). Retrieved from <http://www.wri.org/blog/2014/01/emissions-trading-china-first-reports-field>. Accessed 22 August 2014.

⁸¹ Government of China. (2014). Partnership for Market Readiness Presentation. World Bank, Washington, D.C. Retrieved from https://www.thepmr.org/system/files/documents/China%27s%20domestic%20offset%20scheme%20-20140226_0.pdf. Accessed 22 August 2014.

TABLE 137: CHINA-CERTIFIED EMISSION REDUCTION (CCER) ALLOWANCES IN THE PILOT SCHEMES⁸¹

	Beijing	Tianjin	Shenzhen	Guangdong	Chongqing	Hubei	Shanghai
% of CCER for offset	5%	10%	10%	10%	8%	10%	5%
Geographical requirement	At least 50% from Beijing	N/A	N/A	At least 70% from Guangdong	Only from Chongqing	Only from Hubei	N/A

The REDD+ demand estimate for China is based on a projection developed from information on the pilot programs. It is assumed that the pilots continue until replaced by a national scheme in 2020. Information was available to build models for Guangdong, Hubei, and Beijing, covering about 63 percent of emissions based on numbers extracted from the ICAP ETS map.⁸² Projected offset volumes are, therefore, grossed up by a factor of 1/0.63.

Emissions and cap growth rates were derived from the data or assumed to be 10 percent, approximately in line with historical GDP growth⁸³. Coverage percentages are taken from the ICAP ETS map. Offset percentages are taken from an NDRC presentation to the World Bank’s PMR.⁸¹

Total offset demand is estimated to be 2,346 MtCO_{2e} during the 2015–2025 period. Our low guidance assumes that no REDD+ credits are allowed. The mid guidance assumes that 2.5 percent of the offset demand comes from REDD+. The high guidance assumes that 5 percent of the offset demand comes from REDD+. Demand guidance varies between 0 and 117 MtCO_{2e} with a mid guidance of 59 MtCO_{2e}; purchases are assumed to commence in 2015 and last to 2025.

Relatively low REDD+ percentages are used, as China appears primarily interested in reducing air pollution and emissions. Hence, it seems unlikely that significant amounts of international REDD+ will be allowed, as this path does not actively support domestic pollution reduction goals.

There are a number of limitations with this analysis. The ICAP data or our interpretations of it may turn out to be incorrect. Assumed growth rates may differ from those calculated or assumed. The model may fail to capture one or more important scheme elements. The timing assumptions may not be well based, and assumptions about volumes of REDD+ credits may not be well founded.

Korea

South Korea has pledged to decrease its emissions 30 percent relative to Business As Usual (BAU) by 2020, which equates to 4 percent below 2005 levels. Korea passed a national cap-and-trade in 2012 and emissions trading commenced on January 12, 2015. The ETS has three phases: phase I, 2015–2017; phase II, 2018–2020; and phase III, 2021–2026. Approximately 60 percent of the country’s annual GHG emissions will be capped.⁸⁴

⁸² International Carbon Action Partnership (ICAP). (2014). ETS Map. Retrieved from <https://icapcarbonaction.com/ets-map>. Accessed 22 August 2014.

⁸³ World Bank. (2014). GDP growth data. Retrieved from <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?page=1>. Accessed on 1 August 2014.

⁸⁴ IETA. (2013). South Korea—A Case Study Guide to Emissions Trading. Retrieved from http://www.ieta.org/assets/Reports/EmissionsTradingAroundTheWorld/edf_ieta_korea_case_study_may_2013.pdf. Accessed 28 August 2014.

Offsets will be limited to a maximum of 10 percent of allowance obligations and must be Korean Certified Emissions Reductions (KCERs) to uncapped industries that verifiably produce additional emissions reductions. KCERs are not tradable. International offsets are excluded from the first two phases of the Korean ETS. Phase III allows international units to be used to meet up to 10 percent of an entity’s surrender obligations, but the volume must not exceed the number of domestic offsets used for each compliance year.⁸⁴ This effectively limits the use of international units to a maximum of 5 percent of the allowance obligation.

The estimation of REDD+ demand for Korea is based on a projection that uses reported caps between 2015 and 2017. The caps are projected out to 2025, assuming that the cap decline rate remains constant. International credits are allowed from 2021 to 2025 and limited to 5 percent of the cap, giving a total of 119 MtCO_{2e}. The low guidance assumes Korea does not allow any REDD+ credits into the scheme. The mid guidance assumes 15 percent of the offset volume from phase III comes from REDD+, and the high guidance assumes that 30 percent of the offset volume comes from REDD+.

Demand guidance varies between 0 and 36 MtCO_{2e} with a mid guidance of 18 MtCO_{2e}; purchases are assumed to commence in 2021 and last to 2025.

C.3.4 Canada, Mexico, and the United States

North America and Mexico are the most interesting possibilities for REDD+ demand in the Compliance Growth scenario during the 2015–2025 period. The EPA proposals on the Clean Air Act section 111 (CAA s111) are one of the most important developments since the previous report. These proposals embody United States’s national plan of action to combat greenhouse gas emissions through direct regulation. In this scenario demand guidance is developed assuming that CAA s111 has an incremental impact over current actions.

The rationale for the sources of demand included in this section are identified in Table 148.

TABLE 148: RATIONAL FOR INCLUDING VARIOUS SOURCES OF DEMAND FROM NORTH AMERICA AND MEXICO

Source	Comment	REDD+ Assessment	Juris-dictional	Detailed Analysis
American Carbon Registry (ACR)	The ACR was founded in 1996 as a GHG registry and is currently the third-most common forest carbon standard by volume after the CDM and VCS, though ACR has greater market share in the United States. ⁸⁵	In 2011 and 2012, the ACR introduced international REDD+ methodologies and a standard for nested REDD+ projects. Given their recent entry into international REDD+, demand for REDD+ credits under the ACR is not estimated.	Yes	No

⁸⁵ Ecosystem Market Place. (2012). State of the Forest Carbon Markets 2012: Leveraging the Landscape. In 2011 CDM captured 28 percent, VCS 25 percent, and ACR 8 percent of the forest carbon market. The remainder was split among other standards, including internal standards.

California	California's Global Warming Solutions Act of 2006 requires GHG emissions to be reduced to 1990 levels by 2020. The regulation commenced in January 2013 with the scheme having three compliance periods: 2013–2014, 2015–2017, and 2018–2020.	To date California has not finalized its REDD protocols but has developed protocols supporting the creation of domestic credits in U.S. forests and urban environments. It is interested in expanding this program beyond U.S. borders.	Yes	Yes
Climate Action Reserve (CAR)	Analyzed under California. The CAR is a U.S. domestic nonprofit standard and registry. The CAR was founded in 2001 to encourage voluntary emissions reporting in California and to develop compliance-grade standards for quantifying and verifying GHG emissions reduction projects.	Currently has a Mexican REDD+ pilot program	Yes	Yes (under CA)
Mexico	Mexico implemented a carbon tax on fossil fuel use in early 2014. The tax is based on estimates of the carbon content of fossil fuels.	Climate Action Reserve is trialing REDD+ for eventual inclusion in the Californian scheme.	Likely	Yes
Quebec	The Quebec Climate Change Plan (CCAP) to 2020 includes a cap-and-trade program with planned linkage to California. Credits are modeled from the California program, with a limit set at 8 percent of compliance obligations for each compliance period.	There is no mention of forestry protocols, but it is assumed in the analysis that Quebec follows Californian rules on REDD credits.	Likely	Yes
RGGI	RGGI does not currently accept international offsets. At the US\$10 price trigger, RGGI can accept international offset units, such as Certified Emissions Reductions (CERs). ⁸⁶	No demand for REDD+	N/A	Yes
USA-CAA sIII	In 2014 the United States EPA introduced carbon pollution emission guidelines for existing stationary sources or Electric Utility Generating Units (EGUs). The EPA is proposing state-specific rate-based goals for carbon dioxide emissions from the power sector.	No direct REDD+ demand, but possible indirect effects	N/A	Yes

⁸⁶ IETA. (2013). Regional Greenhouse Gas Initiative. Retrieved from http://www.ieta.org/assets/Reports/EmissionsTradingAroundTheWorld/edf_ieta_rggi_case_study_may_2013.pdf

Western Climate Initiative (WCI)	The WCI is comprised of one U.S. state and four Canadian provinces that have signed agreements to use a market-based approach to reduce GHG emissions to 15 percent below 2005 levels by 2020. On 14 December 2011, Quebec confirmed that it had adopted a cap-and-trade regulation that would link with California, with obligations coming into force on 1 January 2013. ⁸⁷ British Columbia, Ontario, and Manitoba so far have not joined.	No direct REDD+ demand; analyzed under California, Quebec, and USA–CAA s111	N/A	Yes (under CA and QB)
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California/Western Climate Initiative

California’s Global Warming Solutions Act of 2006, known locally as Assembly Bill (AB) 32, requires GHG emissions to be reduced to 1990 levels by 2020. The regulation commenced in January 2013 with the scheme having three compliance periods: 2013–2014, 2015–2017, and 2018–2020. The first compliance period covers only power generation, but scheme coverage is expanded in the second compliance period to cover distributors of transportation, residential, and commercial fuels, resulting in approximately 85 percent of California’s GHG emissions being covered.⁸⁸

The cap-and-trade program includes several cost containment mechanisms in order to ease compliance cost, including the use of offsets (credits). During each compliance period a covered entity may use offsets to meet up to 8 percent of its compliance obligation. During the first and second compliance periods, 25 percent of the 8 percent (or 2 percent) can come from sector-based credits, including REDD. Currently California’s cap-and-trade regulation recognizes REDD credits as sector-based offsets and not REDD+ credits.

In the third compliance period, 50 percent of the 8 percent (or 4 percent) can come from sector-based credits, including REDD. To date California has not finalized its REDD protocols but has developed protocols supporting the creation of domestic credits in U.S. forests and urban environments, and is interested in expanding this program beyond U.S. borders.⁸⁹ Demand for REDD credits is affected by the inclusion of early action credits and the future supply of non-REDD compliance or sector-based credits, which will compete for the share of demand allocated to sector-based credits.

Early action credits are allowed into the scheme with no sub-limit (other than the 8 percent max for all offsets). Based on current rulemaking, credits derived from Climate Action Reserve (CAR)

⁸⁷ Government of Quebec. (December 2011). Cap and Trade System for Greenhouse Gas Emissions Allowances. Retrieved from <http://www.mddep.gouv.qc.ca/changements/carbone/Systeme-plafonnement-droits-GES-en.htm>. Accessed 16 April 2012.

⁸⁸ World Bank. (2012). State and Trends of the Carbon Market 2012. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19_035_Cvr&Txt_LR.pdf. Accessed 27 August 2014.

⁸⁹ Government of California. (2011). California Air Resources Board. Compliance Credit Protocol US Forest Projects. Retrieved from <http://www.arb.ca.gov/regact/2010/capandtrade10/copusforest.pdf>. Accessed 27 August 2014.

methodologies backdated to 2005 may constitute supply for early action credits, contingent on verification by an ARB-accredited verification body.⁹⁰

The CAR is a U.S. domestic nonprofit standard and registry. The CAR was founded in 2001 to encourage voluntary emissions reporting in California and to develop compliance-grade standards for quantifying and verifying GHG emissions reduction projects. The CAR program was specifically designed to satisfy California's future emissions trading scheme standards, and is currently undergoing review to become a California Air Resources Board (ARB) accredited credit and project registry.

As early as 2007, the ARB sent a signal to early actors by adopting⁹¹ several CAR protocols including a Forest Protocol, which enables accounting and crediting of emission reductions and removals from reforestation, Integrated Forest Management (IFM) and avoided conversion project activities based in the United States.⁹² The potential supply of early-action credits derived from the CAR may absorb total credit demand in the first compliance period (ending in 2014).⁹³ In subsequent periods, supply from domestic sources will be more difficult to ramp up.⁹⁴ Coupled with the likelihood of REDD credits trading at discounts to other credits, the market may favor REDD as the dominant supplier of sector-based credits potentially available in the third compliance period.

After being approved by the CAR board on October 23, 2013, the first international forest sector protocol, the Mexico Forest protocol is currently being piloted. The Protocol provides standardized guidance for carbon enhancement projects within a REDD+ framework and addresses eligibility, baseline, inventory, permanence, social and environmental safeguards, and MRV requirements.

The CAR is working closely with landowners to test the protocol and develop software to standardize monitoring and reporting activities. This deliberate process is intended to ensure the protocol is as clear and accurate as possible before being released for general use. Additionally, the Reserve will work to facilitate investment by private entities, particularly entities operating in both Mexico and the United States, in the project credits generated under the protocol.

The protocol received further support when, on 29 July 2014, California Governor Jerry Brown and Mexican environmental and forestry officials signed a Memorandum of Understanding aimed at enhancing cooperation to reduce greenhouse gas emissions, an agreement that could eventually expand the market for forest carbon credits.⁹⁵

A projection is used to forecast potential Californian demand for REDD+. It is based on the assumption that after 2020 the California cap continues to decline at 3.5 percent. As yet, no caps have been set after the end of phase III (i.e., 2020). It is assumed that emissions fall at 0.86 percent based on historical

⁹⁰ Government of California. (2012). California Air Resources Board. Final Regulation Order, Subchapter 10 Climate Change, Article 5, Sections 95900, p 245. Retrieved from http://www.arb.ca.gov/cc/capandtrade/september_2012_regulation.pdf. Accessed 27 August 2014.

⁹¹ Adoptions were later unwound and protocols re-submitted with environmental impact assessment and formal review: Point Carbon Research. (2010). 'US Credit Markets in 2010', Carbon Market Analyst – North America, March 1, 2010.

⁹² See Section 3.8 Project Location (Eligibility Rules), 'Forest Project Protocol Version 3.3', available at <http://www.climateactionreserve.org/how/protocols/forest/dev/version-3-3/>

⁹³ World Bank. (2012). State and Trends of the Carbon Market 2012. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf. Accessed 27 August 2014.

⁹⁴ IETA. (2012). Greenhouse Gas Markets 2012: New Markets, New Mechanisms, New Opportunities, 2012.

⁹⁵ Government of California. (2014). MOU between California and Mexico. Retrieved from http://gov.ca.gov/docs/7.28_Climate_MOU_Eng.pdf. Accessed 30 July 2014.

declines before the scheme starts. Sector-based offsets are assumed to stay at 4 percent. If no limit is applied to REDD+ under the sector-based sub-limit, then the demand for REDD+ credits is assumed to equal a share of the sector-based demand. This share will be driven by credit pricing, which reflects production costs and transaction costs and risks associated with sourcing and validity of REDD+ credits.

It is further assumed that REDD protocols are not established until the start of phase III in 2018 and that the potential supply of early-action credits derived from the CAR can be ignored. The low guidance is based on California deciding not to include REDD. While this is plausible, current evidence suggests that REDD credits will be allowed in the scheme. The mid-point guidance assumes that REDD+ accounts for 15 percent of the sector-based demand. The high guidance assumes that REDD+ accounts for 30 percent of the sector-based demand.

Demand guidance varies between 0–61 MtCO₂e with a mid guidance of 31 MtCO₂e; purchases are assumed to commence in 2018 and last to 2025, assuming no impact from CAA s111.

Quebec

The Quebec Climate Change Action Plan (CCAP) to 2020 is the successor to an earlier plan launched in 2006, which was a major step forward in climate change leadership. The CCAP 2020 includes new measures and will enable Quebec to achieve its target to reduce emissions 20 percent below 1990 levels. The CCAP includes a cap-and-trade program that will commenced in 2013 and covered about 75 industrial and power facilities.

The provisions dealing with credits are modeled from the California cap-and-trade program, with a limit set at 8 percent of compliance obligations for each compliance period. Currently Quebec does not have a forest protocol.⁹⁶ In the absence of Quebec-issued forestry credits, and subject to any linking rules, forestry credits may be able to reach Quebec compliance entities via the California cap-and-trade program – either as U.S. domestic forestry credits or international REDD+ credits.

The REDD+ demand estimate for Quebec over 2015–2025 assumes that Quebec allows offsets in an expanded U.S. scheme in response to CAA s111. A projection is used to forecast potential Quebec demand for REDD+. It mirrors the rule set in California. The Quebec cap is forecast past 2020 to decline by the same rate the California cap is forecast to decline by (i.e., 3.5 percent).

Sector based offsets are assumed to remain at 4 percent. If no limit is applied to REDD+ under the sector-based sub-limit, then the demand for REDD+ credits is assumed to equal a share of the sector-based demand. The share will be driven by credit pricing, which reflect costs of production, but also transaction costs and risks associated with sourcing and validity of REDD+ credits.

It is further assumed that REDD protocols are not established until the start of California phase III in 2018 and that the potential supply of early-action credits derived from the CAR can be ignored. The low guidance is based on Quebec deciding not to include REDD+. The mid-point guidance assumes that REDD+ accounts for 15 percent of the sector-based demand. The high guidance assumes that REDD+ accounts for 30 percent of the sector-based demand.

⁹⁶ Government of California. (2012). California Environmental Protection Agency. Air Resources Board. Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions, Staff Report: Initial Statement of Reasons, pp. 37-38. May 9, 2012. Retrieved from <http://www.arb.ca.gov/regact/2012/capandtrade12/isormainfinal.pdf>. Accessed 27 August 2014.

Demand guidance varies between 0–9 MtCO₂e with a mid guidance of 5 MtCO₂e, purchases are assumed to commence in 2018 and last to 2025, assuming that Quebec allows offsets in an expanded U.S. scheme in response to CAA s111.

Mexico

Mexico implemented a carbon tax on fossil fuel use in early 2014. The tax is based on estimates of the carbon content of fossil fuels, with the carbon tax rate for natural gas being set to zero. Mexican CDM offsets can be used for compliance.⁹⁷ At the stage of writing no details are available on the types and limits of CDM offsets including potential use of l-CERs and t-CERs.

The tax covers approximately 40 percent of the total GHG emissions.⁹⁸ However, further changes to the law have been flagged by *Secretaría del Medio Ambiente y Recursos Naturales* (SEMARNAT). While it is still speculative, the recently signed MOU between California and Mexico combined with the Climate Action Reserve trialing of a REDD+ methodology increases the likelihood that forest credits (REDD+) will eventually find their way into the Mexican scheme.

The REDD+ demand estimate for Mexico assumes that Mexican demand depends only on Californian demand. A projection is used to estimate demand from 2018–2025 with REDD+ purchases starting concurrently with California’s cap-and-trade scheme phase III. The carbon tax is assumed to have no impact out to 2020 due to its modest level.

From 2021 it is assumed that Mexico aims to achieve a goal of 30 percent below BAU by 2025. A cap is created in 2021 that declines to the target, providing an estimate of the level of effort required by 2025. It is assumed that Californian offset rules are followed. In the low guidance case it is assumed that no offsets are generated as a result of Mexico delaying action beyond the projection period. In the mid guidance 15 percent of the volume is expected to come from REDD+, and in the high guidance 30 percent of the volume is expected to come from REDD+.

Demand guidance varies between 0 and 110 MtCO₂e with a mid guidance of 55 MtCO₂e; purchases are assumed to commence in 2018 and last to 2025.

Regional Greenhouse Gas Initiative (RGGI)

The Regional Greenhouse Gas Initiative (RGGI) is a collaboration among nine northeastern states to limit emissions from large power plants via a cap-and-trade program. The program held its first auction of allowances in 2008. As the program is oversupplied with allowances, prices languish around the auction floor price of US\$2. The program includes provisions for credits; however, lacking a stronger price signal, no credits have been created.

A compliance entity can meet up to 3.3 percent of its compliance obligation with credits (and 5 percent or 10 percent if allowance prices reach certain thresholds). Five credit types are allowable, one of which is afforestation. As afforestation projects need only to be on lands without forest cover for ten years, what other programs term “reforestation” falls within the RGGI definition of afforestation. All credits

⁹⁷ Government of Mexico. (2014). Carbon tax presentation to the Partnership for Market Readiness, World Bank.

⁹⁸ World Bank. (2014). State and Trends of Carbon Pricing 2014. Retrieved from <http://www.worldbank.org/en/news/feature/2014/05/28/state-trends-report-tracks-global-growth-carbon-pricing>. Accessed 27 August 2014.

must be generated in RGGI member states, precluding the possibility of international REDD+ credits.⁹⁹ However, at the US\$10 price trigger RGGI can accept international offset units, such as Certified Emissions Reductions (CERs).¹⁰⁰

Anecdotal evidence gathered during interviews suggested that CAA s 111 has generated non-RGGI states' interest in RGGI; however, given that the U.S. EPA does not allow the use of out-of-sector GHG offsets, it seems unlikely that RGGI will use international credits.

No demand is assumed from RGGI over the period 2015–2025.

United States–Impact of Clean Air Act (CAA) section 111.

In the United States a number of state-based initiatives predate federal action, such as California's Global Warming Solutions Act of 2006 and the RGGI, commencing in 2008. Major federal initiatives include the unsuccessful American Clean Energy and Security Act 2009 (Waxman-Markey Bill) as well as the Clean Energy Jobs and American Power Act 2009 (Kerry-Boxer Bill).

The U.S. EPA has taken a position that GHG emissions pose a health threat and, under the 2009 Clean Air Act (CAA), it has powers to set standards for large sources and suppliers in the United States.¹⁰¹ Recent EPA proposals on new¹⁰² (September 2013); modified¹⁰³ (June 2014); and existing¹⁰⁴ (The Clean Power Plan, June 2014) power plants set carbon pollutions performance standards.

On June 18, 2014 the U.S. EPA introduced carbon pollution emission guidelines for existing stationary sources or Electric Utility Generating Units (EGUs). The EPA is proposing state-specific rate-based goals for carbon dioxide emissions from the power sector and guidelines for states to follow in developing plans to achieve the state-specific goals.

Key points

- Emissions intensity targets are specified per state and expressed as CO₂ per net megawatt hour¹⁰⁵. The goals represent CO₂ emission rates achievable by 2030 after a 2020–2029 phase-in period on

⁹⁹ Regional Greenhouse Gas Initiative. (n.d.). CO₂ Offsets. Retrieved from <http://www.rggi.org/market/offsets>. Accessed 27 August 2014.

¹⁰⁰ International Emissions Trading Association. (2014). Regional Greenhouse Gas Initiative. The World's Carbon Markets: A Case Study Guide to Emissions Trading. Retrieved from <http://www.ieta.org/assets/EDFCaseStudyMarch2014/rggi%20case%20study%20march%202014.pdf>. Accessed 27 August 2014.

¹⁰¹ EPA. (2011). EPA Website. Retrieved from <http://www.epa.gov/climatechange/emissions/ghgrulemaking.html>. Accessed 18 July 2011.

¹⁰² Federal Registry. (2013). Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units. Retrieved from <http://www.gpo.gov/fdsys/pkg/FR-2014-01-08/pdf/2013-28668.pdf>. Accessed 1 August 2014.

¹⁰³ Federal Registry. (2014). Carbon Pollution Standards for Modified and Reconstructed Stationary Sources: Electric Utility Generating Units. Retrieved from <http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13725.pdf>. Accessed 1 August 2014.

¹⁰⁴ Federal Registry. (2014). Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units. Retrieved from <http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf>. Accessed 1 August 2014.

¹⁰⁵ Net generation is defined as the total amount of electric energy generated, measured at the generator terminals, less the total electric energy consumed at the generating station.

an output weighted-average basis collectively by all of a state's affected EGUs. The EPA also allows conversion of intensity targets to mass based targets consistent with cap-and-trade.¹⁰⁶

- The state goals are based on the EPA's assessment of the best system for emissions reductions (BSER) from a combination of emission rate improvements and limitations on overall emissions at affected EGUs that can be accomplished through any combination of one or more measures from the following four sets of measures or building blocks:
 - Reducing the carbon intensity of generation at individual affected EGUs through heat rate improvements
 - Reducing emissions from the most carbon-intensive affected EGUs in the amount that results from substituting generation at those EGUs with generation from less carbon-intensive affected EGUs (including natural gas combined cycle [NGCC] units that are under construction)
 - Reducing emissions from affected EGUs in the amount that results from substituting generation at those EGUs with expanded low- or zero-carbon generation
 - Reducing emissions from affected EGUs in the amount that results from the use of demand-side energy efficiency that reduces the amount of generation required
- In meeting their targets, states may use existing measures including renewable energy standards and demand-side energy efficiency programs.
- States may participate in multi-state programs that already exist or may create new ones. States participating in a multi-state emission budget trading program would jointly demonstrate that the multi-state program is achieving the required level of CO₂ emission performance on a multi-state basis, based on the CO₂ emission performance of all affected EGUs in the multi-state group implementing the program.
- The EPA is not proposing that out-of-sector GHG offsets can be applied to demonstrate CO₂ emission performance by affected EGUs in a state plan. However, the EPA allows offsets to be included in a state plan provided that affected EGUs achieve the required level of emission performance.
- Where international partner jurisdictions are involved, emissions projections would include the effects of all flows within the emission budget trading program, but emission performance for state plans would be assessed based only on the CO₂ emission performance of affected EGUs in the subset of the program represented by U.S. states.

¹⁰⁶ The Clean Power Plan assigns each state an emissions rate goal, in pounds of carbon dioxide (CO₂) per megawatt hour (MWh), but also gives states an option to translate this goal into a mass-based goal, in pounds of CO₂.

Analysis

Under the Clean Power Plan, states must meet EPA-specified emissions intensity targets that are specified per state and expressed as CO₂ per net megawatt hour.¹⁰⁷

There are three general approaches U.S. states may take in response to CAA s111:

1. Develop a broad coverage (multiple gases and sectors) cap-and-trade scheme similar to California's scheme and possibly link with California.
2. Develop a narrow based (power and CO₂ only) cap-and-trade scheme similar to RGGI and possibly link with RGGI states. Both these approaches require the conversion of energy intensity targets to mass based targets.
3. Take direct action similar to Colorado and substitute carbon-intensive generation (e.g., coal) with generation from less carbon-intensive sources (e.g., CCS or natural gas).

All three options can include renewable portfolio standards and energy efficiency measures on the supply and demand side. Both options 1 and 2 should result in the substitution of carbon-intensive generation with generation from less carbon-intensive sources.

EPA does not allow the use of out-of-sector GHG offsets to demonstrate CO₂ emission performance standards in a state plan. Therefore it seems unlikely that RGGI will use international offsets, even if the importation price of US\$10 is reached and import of international credits is allowed. Therefore, international credit demand for RGGI under CAA s111 RGGI is assumed to be zero.

The situation may be different in California. The EPA allows offsets to be included in a state plan provided that affected EGUs achieve the required level of emission performance. If the emissions reductions under the cap-and-trade plan deliver deeper cuts to the power sector, then offsets can be used. Furthermore, because California is a broad coverage cap-and-trade program, offsets can be used in other sectors outside power generation.

From a REDD+ demand perspective the EPA regulations do not directly generate demand but may do so indirectly through schemes like California's. Therefore, the demand impacts of the EPA's regulations are uncertain and depend on the response of various states. This uncertainty is further complicated by pending litigation, which may delay the implementation of these rules.

Modeling

Given the uncertainties, the impact of CAA s111 is modeled by assuming that California's cap-and-trade scheme is sufficiently restrictive such that it meets the new EPA rules and all sectors can use offsets. It is also assumed that at least one state neighboring California joins in the cap-and-trade scheme and that Quebec allows REDD offsets. Oregon and Washington are plausible choices to include in an expanded California scheme linked to Quebec. Based on interviews it appears that Washington is a more likely candidate.

¹⁰⁷ Federal Registry. (2014). Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units. Retrieved from <http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf>. Accessed on 1 August 2014.

It is also assumed that RGGI, as previously argued, does not allow international offsets but could still become an expanded scheme and furthermore that all other states undertake direct action and do not generate demand for international offsets.

CAA s.111 projections aggregate the additional demand from Quebec with demand from Washington. A theoretical cap is constructed based on Washington's emissions and on California's rules. The cap is projected from 2018 to 2025, which is the presumed date that Washington joins California and Quebec. The Washington cap is assumed to decline by the same percentage as California (i.e., 3.5 percent).

Sector based offsets are assumed to remain at 4 percent. If no limit is applied to REDD+ under the sector-based sub-limit, then the demand for REDD+ credits is assumed to equal a share of the sector-based demand. The low guidance is based on Quebec and Washington not allowing REDD+ credits. The mid-point guidance assumes that REDD+ accounts for 15 percent of the sector-based demand. The high guidance assumes that REDD+ accounts for 30 percent of the sector-based demand.

Demand guidance varies between 0 and 23 MtCO₂e with a mid guidance of 12 MtCO₂e over the 2018-2025 period from added demand coming from Quebec and Washington (in addition to demand from California).

C.3.5 Central and South America

A number of countries in Central and South America are actively evaluating various forms of domestic actions to reduce GHG emissions. Primarily this region is a source of supply; however, with ambitious targets, the region may become a source of demand. The general trend is for Europe to support demand using payments for results and for the United States to provide financial support for capacity development. Several countries were investigated and prioritized on the basis of activity with the World Bank's Partnership of Market Readiness Program (for details, see Table 159).

TABLE 159: RATIONAL FOR INCLUDING VARIOUS SOURCE OF DEMAND FROM CENTRAL AND SOUTH AMERICA.

Source	Comment	REDD+ Assessment	Juris-dictional	Detailed Analysis
Brazil	Aims to reduce emissions by 36.1 percent–38.9 percent below BAU by 2020 as part of voluntary commitment. Mitigation plans cover forestry, agriculture, energy, iron, steel, and other industry, transportation, mining, and building sectors. ¹⁰⁸	Uncertain, but potential internal demand for REDD+	Yes	Yes

¹⁰⁸ The World Bank. (2014). Annual Report 2014–Partnership for Market Readiness. Washington DC. Retrieved from <https://www.thepmr.org/content/pmr-annual-report-fy14>. Accessed 01 August 2014.

Chile	Introduced a carbon tax with probable implementation in 2015.	Details of the offsets arrangements are not yet final but are likely to incorporate REDD. ¹⁰⁹	Unclear	Yes
Colombia	Colombia has an internal voluntary market with limited demand but is exploring a payment-for-performance agreement with REM including contributions from Germany, Norway, and the UK.	REDD as part of an expanded REM fund with additional contributions from Germany, Norway, and the UK; currently limited details on timing, price, and fund.	Yes	No; not estimated due to a lack of details
Costa Rica	Carbon neutrality goal by 2021. Designing and developing a domestic carbon market, including building domestic market infrastructure. ¹⁰⁸	REDD+ is likely to be part of efforts to reach Costa Rica's carbon neutrality goal.	Yes	Yes
Peru	National Strategy for Climate Change focuses on curbing deforestation, increasing renewable and hydro-sourced energy to 40 percent of national mix, and improving methane capture from waste. ¹⁰⁸	No demand	Unclear	No

There is considerable uncertainty around some of the demand estimates due to the lack of details. In the case of Brazil, the city programs are on hold. Instead of completely discounting demand from Brazil, it is assumed that the start dates for the city programs are delayed. Costa Rica is the largest source of demand due to its ambitious carbon-neutral goals.

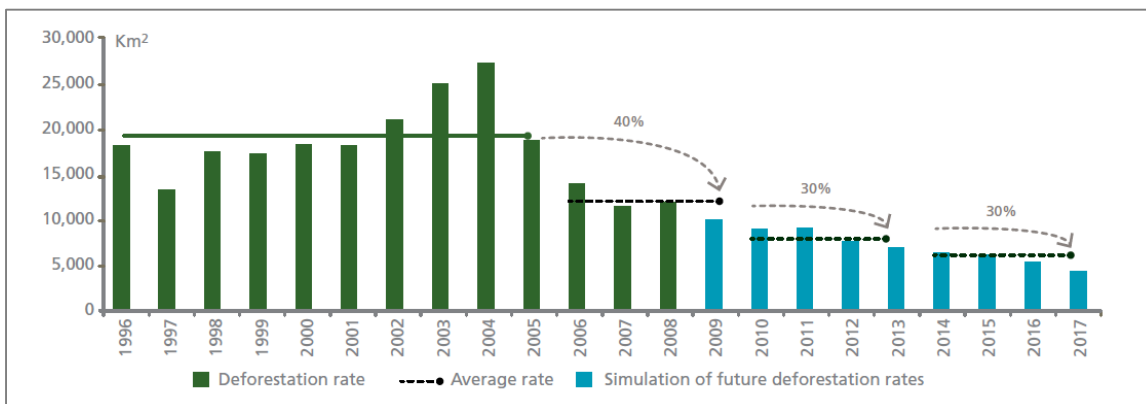
Brazil

Brazil is usually viewed as a source of REDD+ credits for high marginal abatement cost countries and has made impressive strides to reduce emissions from deforestation (see

Figure 1). Brazil has set a goal of reducing emissions by 36.1 to 38.9 percent below BAU by 2020 as part of a voluntary commitment. Mitigation plans cover forestry, agriculture, energy, iron, steel, and other industry, transportation, mining, and building sectors. These ambitions coupled with the development of citywide emissions trading schemes for Rio de Janeiro and Sao Paulo create the possibility of internal demand for REDD.

¹⁰⁹ Pers. Comm. Tassara, P.; and Noguera, L. VCS Chile.

FIGURE 21: BRAZIL'S FOUR-YEAR TARGET FOR REDUCING DEFORESTATION IN THE AMAZON¹¹⁰



Both the citywide emissions trading schemes are currently on hold and Brazil is exploring various carbon pricing systems to select suitable instruments for implementation, possibly a carbon tax.¹¹¹

The demand estimate for Brazil for the 2015–2025 period is based on limited data, but the Rio ETS is targeting 209 MtCO₂e by 2030. A projection assumes that the Rio and Sao Paulo ETS schemes start in 2016 and target 2030. Few details are available for the Sao Paulo scheme, but a volume of 290 MtCO₂e is estimated from scaling up the Rio ETS by the ratio of emissions in the base year of 2008. The city programs are assumed to be the only sources of REDD+ demand.

The low guidance arises in the event that the citywide ETS does not start during the projection period. The mid-point guidance assumes that of the emissions reductions, 15 percent comes from REDD+. The high guidance assumes that 30 percent comes from REDD+.

Demand guidance varies between 0 and 10 MtCO₂e with a mid guidance of 5 MtCO₂e; purchases are assumed to commence in 2016 and last to 2025.

Chile

Chile is implementing a carbon tax, which is expected to come into force during the 2016–2017 period.¹¹² Revenue estimates are US\$247-265 million per year with US\$5 per tCO₂. An additional US\$0.10 charge applies per ton for local pollutants, including particulate matter, sulfur dioxide, and nitrous oxides. The CO₂ tax applies to emissions from imported diesel vehicles and stationary sources with generation capacity higher than 50MW.¹¹³ The revenue estimates apply to the electricity generation sector only.

The REDD+ demand estimates for Chile assume that if offsets are allowed, there will be a limit of about 10 percent. This information is currently unknown. Revenue is assumed to be the same from year to year, as is the tax rate, with the tax starting in 2016 and running to 2025. The revenue divided by the

¹¹⁰ Government of Brazil. (2014). Activity Report 2013 Amazon Fund. Retrieved from http://www.amazonfund.gov.br/FundoAmazonia/fam/site_en. Accessed 25 August 2014.

¹¹¹ The World Bank. (2014). Annual Report 2014–Partnership for Market Readiness. Washington, D.C. Retrieved from <https://www.thepmr.org/content/pmr-annual-report-fy14>. Accessed 01 August 2014.

¹¹² Pers. Comm. Tassara, P., and Nogueira, L., VCS Chile.

¹¹³ Government of Chile. (2014). Presentation at a technical committee meeting in Cologne Germany.

tax rate is assumed to be a good approximation of the volume of emissions and, after the offset percentage is applied, of the total volume. For the low guidance, it is assumed that no REDD+ offsets are allowed. The mid guidance assumes that 15 percent of the potential offset demand comes from REDD+, and the high guidance assumes that 30 percent of the potential offset demand comes from REDD+.

Demand guidance varies between 0 and 16 MtCO₂e with a mid guidance of 8 MtCO₂e; purchases are assumed to commence in 2016 and last to 2025.

Costa Rica

Costa Rica made a pledge in 2007 to become carbon neutral by 2021. This commitment was incorporated into the 2011–2014 National Development Plan (NDP). Costa Rica intends to establish a domestic voluntary carbon market as the primary instrument to achieve carbon neutrality. The primary incentive for participation will be the ability to claim a carbon neutral certification. Voluntary market participants will purchase verified GHG emission reductions or CO₂ removal by sinks.¹¹⁴

The projection model for Costa Rica is simple. It assumes that emissions continue to grow and are offset. Offset volumes are assumed to be equal to emissions and to increase annually from a low in 2020 of 18.0 MtCO₂e to 31.5 MtCO₂e in 2030. Only the 2020–2025 period is included in the offset demand calculation, giving a total demand potential of 128 MtCO₂e. The low guidance assumes that Costa Rica is unable to implement its policy. The mid-point guidance assumes that 25 percent of the abatement comes from REDD+, and the high guidance assumes that 50 percent comes from REDD+.

Demand guidance varies between 0 and 64 MtCO₂e, with a mid guidance of 32 MtCO₂e; purchases are assumed to commence in 2020 and last to 2025.

C.3.6 Africa and the Middle East

A number of sources of potential demand were investigated in Africa and the Middle East (see Table 1620). The most likely source of potential REDD+ demand is currently South Africa, which has plans for a carbon tax with offsets.

¹¹⁴ Government of Costa Rica. (2014). Costa Rica Market Readiness Proposal (MRP) Partnership for Market Readiness Final Report. Retrieved from https://www.thepmr.org/system/files/documents/Costa%20Rica_MRP_Final_19-02-2013_0.pdf. Accessed 20 August 2014.

TABLE 16: RATIONAL FOR INCLUDING DEMAND FROM VARIOUS SOURCES IN AFRICA AND THE MIDDLE EAST

Source	Comment	REDD+ Assessment	Juris-dictional	Detailed Analysis
Jordan	Currently exploring scaled-up crediting for NAMAs in renewable energy, water (energy efficiency in pumping, waste water treatment, etc.), and/or solid waste management sectors and developing capacity for data collection, baseline setting, and an MRV system. ¹¹⁵	No demand	Unclear	No
Morocco	Currently piloting carbon market-based approaches in selected sectors and building carbon market infrastructure, including GHG registry and MRV framework. ¹¹⁵	No demand	Unclear	No
South Africa	Currently refining design features of proposed carbon tax and complementary offset mechanism, as well as strengthening MRV capacity. ¹¹⁵	Possible REDD+ demand	Unclear	Yes
Tunisia	Developing sectoral crediting mechanisms in the cement and electricity sectors (pilot in at least one of the sectors) and developing a national registry of mitigation initiatives and financing sources. ¹¹⁵	No demand	Unclear	No

South Africa

The South African government is proposing a carbon tax of R120 per tCO₂e to be introduced in 2015. The tax rate of a R120 per tCO₂e will be increased at a rate of 10 percent per annum until the end of 2019 to provide a clear long-term price signal. In 2019 the rate of increase will be reviewed for 2020. The carbon tax will apply to all direct, stationary sources of emissions, including process emissions. The tax provides a tax-free threshold and offset percentage for each covered industrial sector.¹¹⁶

There is a lack of data to build this model, which is based on 2000 electricity sector emissions. A 10-percent offset rate is applied to the emissions and assumed constant for the 2016–2025 period (i.e., 10 years), giving total offset volumes of 179 MtCO₂e. The low guidance assumes that no REDD+ is allowed in the scheme. The mid guidance assumes that 15 percent of the offset volume comes from REDD+, and the high guidance assumes that 30 percent of the offset volume comes from REDD+.

¹¹⁵ The World Bank. (2014). Annual Report 2014–Partnership for Market Readiness. Washington, D.C. Retrieved from <https://www.thepmr.org/content/pmr-annual-report-fy14>. Accessed 01 August 2014.

¹¹⁶ Government of South Africa. (2013). Treasury. Carbon Tax Policy Paper. Retrieved from <http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf>. Accessed 28 August 2014.

Demand guidance varies between 0 and 54 MtCO₂e with a mid guidance of 27 MtCO₂e; purchases are assumed to commence in 2020 and last to 2025.

C.3.7 Aviation

In 2010, the 37th Session of the ICAO Assembly adopted the following goals for aviation:

- A global annual average fuel efficiency improvement of 2 percent until 2020 and an aspirational global fuel efficiency improvement rate of 2 percent per annum from 2021 to 2050; and
- A collective medium-term global aspirational carbon neutrality goal of keeping the global net carbon emissions from international aviation from 2020 at the same level.

To achieve the carbon neutrality goal, the aviation industry is developing a roadmap for the development of a single market-based mechanism for aviation to be implemented from 2020 that can be adopted at ICAO's next Assembly in 2016.¹¹⁷

During 2013, the International Air Transport Association (IATA) 69th Annual General Meeting overwhelmingly endorsed a resolution on implementing a carbon-neutral growth strategy from 2020.¹¹⁸

Aviation demand estimates for REDD+ use a projection model that is based on emission projections from ICAO.¹¹⁹ The emission projection assumes a moderate improvement in technology and operational efficiency. The ICAO projection in 2012 was compared to the actual emissions and rebased to account for actual emissions being lower than expected.

The emissions were projected assuming the same emissions growth rates in the ICAO model. The year 2020 was used as the base for carbon neutrality, and emissions higher than the 2020 level are counted (i.e., from 2021 to 2025) for a total of 421 MtCO₂e. The low guidance assumes that no action is taken. The mid guidance assumes that 15 percent comes from REDD+, and the high guidance assumes that 30 percent comes from REDD+.

Demand guidance varies between 0 and 142 MtCO₂e with a mid guidance of 71 MtCO₂e; purchases are assumed to commence in 2020 and last to 2025.

C.4 BLUE SKY

The Blue Sky scenario represents the high demand or speculative scenario. It encompasses optimistic demand from a range of sources. The main difference between the Blue Sky and Compliance Growth scenarios is the inclusion of demand from U.S. and Canadian national schemes, demand from Japan and New Zealand, and increased demand for REDD+ from Australia. Of the demand elements the most important new source of demand is the United States, which is assumed to adopt a broad coverage

¹¹⁷ International Civil Aviation Organization (ICAO). (2013). Reducing Emissions from Aviation through Carbon-Neutral Growth. Working Paper. Retrieved from <https://www.iata.org/policy/environment/Documents/atag-paper-on-cng2020-july2013.pdf>. Accessed 28 August 2014.

¹¹⁸ International Air Transport Association (IATA). (2013). Press release. Retrieved from <http://www.iata.org/pressroom/pr/Pages/2013-06-03-05.aspx>. Accessed 28 August 2014.

¹¹⁹ International Civil Aviation Organization (ICAO). (2012). Global Aviation CO₂ Projections. Retrieved from http://www.icao.int/environmental-protection/GIACC/Giacc-4/CENV_GIACC4_IP1_IP2%20IP3.pdf. Accessed 28 August 2014

national cap-and-trade scheme in response to industry lobbying to simplify the plethora of state-based regulatory schemes that might arise in response to CAA s111.

C.4.1 United States

In this scenario, a U.S. national scheme is modeled on the American Clean Energy and Security Act of 2009.¹²⁰ The Act targeted 720 million tons of emission reductions from deforestation in developing countries in 2020 and 6,000 million tons cumulatively by 2025. Financing for these reductions was provided by allocating 5 percent of allowances to this purpose, with flexibility to change this percentage to achieve the targets.^{120,121}

The U.S. national scheme is assumed to start in 2018. The projection assumes the same level of ambition as the original Act but delayed to 2025. This approach requires 750 MtCO₂e of emission reductions per year to meet the 6,000 million target; a US\$5 per ton price implies that US\$3.75 billion annually needs to be allocated from emissions allowances.

The average allocation of allowances, assuming 5 percent are allocated to finance forest initiatives, is 253 million allowances, giving an indicative carbon price of US\$15 per tCO₂e, which is within the EPA's price estimates for allowances (e.g., prices of US\$16–17 per tCO₂e in 2013 rising to US\$23–24 per tCO₂e in 2020).¹²¹

U.S. demand is assumed to be 6,000 MtCO₂e during the 2015–2025 period, with the scheme starting in 2018 with 30 percent of abatement coming from REDD+, giving 1,800 MtCO₂e of potential REDD+ demand.

C.4.2 Canada

Currently only state-based schemes in Canada offer insight into what a future Canadian scheme might look like. For the purposes of this analysis, Canada is assumed to follow the United States and implement like-for-like rules. Canada's emissions are approximately 10.7 percent of those of the United States.

A projection model is used that assumes Canada accepts cumulative forest abatement challenge of 643 MtCO₂e to 2025. This is spread evenly from year to year, starting 2018. It is also assumed that Canada allows the same proportion of REDD+ credits into its scheme as the United States does. The 643 MtCO₂e is calculated based on the proportion the U.S. Waxman-Markey target of 6,000 million tons cumulatively, using the relative size of Canadian to U.S. emissions.

Canadian demand is assumed to be 643 MtCO₂e over the 2015–2025 period, with the scheme starting in 2018 with 30 percent of abatement coming from REDD+, giving 193 MtCO₂e of potential REDD+ demand.

¹²⁰ Congress of the United States. (2009). The American Clean Energy and Security Act 2009. Retrieved from <http://www.gpo.gov/fdsys/pkg/BILLS-111hr2454eh/pdf/BILLS-111hr2454eh.pdf>. Accessed 25 August 2014.

¹²¹ United States Environmental Protection Agency. (2010). EPA Analysis of the American Power Act. Retrieved from http://www.epa.gov/climatechange/Downloads/EPAactivities/EPA_APA_Analysis_6-14-10.pdf. Accessed 25 August 2014.

C.4.3 Japan

Japan's new target of a 3.8-percent reduction from 2005 levels is a net increase of 3 percent on 1990 levels (of 1,234 MtCO₂e)¹²² by 2020.¹²³ This figure compares to their previous target of a 25-percent reduction by 2020 compared to 1990 levels.¹²⁴ It is reasonable to expect that Japan's ambitions should expand in the Blue Sky scenario.

Japan's 2012 emissions were 1,343 MtCO₂e.¹²² Japan's expanded ambitions are modeled by assuming that in 2020 Japan achieves its interim goal of 3 percent lower than 1990 levels (1,271 MtCO₂e) and introduces a cap on non-LULUCF emissions with a target of 25 percent lower than 1990 levels by 2025.

Assuming 10 percent of the abatement can come from offsets, Japan's total offset demand for the 2020–2025 period is 655 MtCO₂e. Assuming that 30 percent of this demand can come from REDD+ gives a demand of 196 MtCO₂e.

C.4.4 New Zealand

New Zealand's commitment under the Kyoto Protocol was to maintain 2008–2012 average net emissions at 1990 levels.¹²⁵ The government further committed to 2020 and 2050 targets, conditional on certain global agreements and actions including international rules addressing LULUCF. Emissions in 2020 are to be 10 percent to 20 percent below 1990 levels, and by 2050 the aim is to cut GHG emissions to 50 percent below 1990 levels.¹²⁶

New Zealand compliance entities have been able to use unlimited international units to meet their emissions reduction liability with only qualitative restrictions. International units include Kyoto units and approved overseas units,¹²⁷ which could arguably include REDD+ units issued under a future UNFCCC mechanism. The New Zealand Government intends to introduce a legal mechanism that will allow the regulator to set quantitative limits on the use of international credits by liable entities, bringing New Zealand in line with the European Union.¹²⁸

¹²² UNFCCC. (n.d.). Greenhouse Gas Inventory Data. Retrieved from

<http://unfccc.int/di/DetailedByParty/Event.do?event=go>. Accessed on 26 August 2014.

¹²³ Government of Britain. (2013). Reduction in Japanese carbon emissions target for 2020: Statement by Edward Davey. Department of Energy and Climate Change, London. Retrieved from <https://www.gov.uk/government/news/reduction-in-japanese-carbon-emissions-target-for-2020-statement-by-edward-davey>. Accessed on 26 August 2014.

¹²⁴ United Nations Framework Convention on Climate Change. (2011). Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention. Retrieved from <http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf>. Accessed on 26 August 2014

¹²⁵ Government of New Zealand. (2012). New Zealand Ministry for the Environment. International Climate Change Policy, The Kyoto Protocol. Retrieved from <http://www.mfe.govt.nz/issues/climate/international/policy.html#consultation>. Accessed on 27 August 2014.

¹²⁶ Government of New Zealand. (2012). New Zealand Ministry for the Environment. Targets. Retrieved from <http://www.climatechange.govt.nz/reducing-our-emissions/targets.html>. Accessed 27 August 2014.

¹²⁷ See Section 63 of the New Zealand *Climate Change Response Act 2002*, along with the definition of “unit” in Section 4 and questions and answers on the use of international credits, available at: <http://www.climatechange.govt.nz/emissions-trading-scheme/about/questions-and-answers.html>.

¹²⁸ Government of New Zealand. (2012). Ministry of Environment. Updating the New Zealand Emissions Trading Scheme: A consultation document. Retrieved from <http://www.climatechange.govt.nz/consultation/ets/consultation-ets-changes.pdf>. Accessed 27 August 2014.

In December 2012, New Zealand stated it would not participate in a second commitment period of the Kyoto Protocol.¹²⁹ This decision prevented New Zealand from transferring or acquiring Kyoto units since 1 January 2013.¹³⁰ As a result, it is unclear how the New Zealand ETS will engage in the international carbon market from 2013 onward.

New Zealand demand is based on an expected shortfall of 75 MtCO₂e to 105 MtCO₂e for the 2013–2020 period if a comprehensive global agreement is reached.¹³¹ The median demand is 90 MtCO₂e, which is assumed to be spread evenly from 2020–2025. Assuming that 30 percent of the demand comes from REDD+, New Zealand demand is 27 MtCO₂e.

C.5 IMPACTS OF INCREASING REDD+ ON OTHER DEMAND

The impact of moving from the high guidance in the Compliance Growth scenario to the Blue Sky scenario is quantified in Table 17. The Blue Sky scenario represents a significant increase in demand from Australia, Canada, Japan, New Zealand, and the United States. Demand from other countries is assumed to be in line with high-volume guidance from the Compliance Growth scenario.

TABLE 17: DEMAND IMPACTS OF MOVING FROM THE HIGH GUIDANCE COMPLIANCE GROWTH TO BLUE SKY SCENARIO IN MTCO₂e

Region/Country/Sector	High REDD+ Compliance Growth Scenario	Blue Sky Scenario	Increase
Aviation	142	142	0
Australia	126	379	+253
Brazil	10	10	0
Canada	9	193	+184
China	117	177	0
Chile	16	16	0
Costa Rica	64	64	0
Japan	0	196	+196
Korea	36	36	0
Mexico	55	55	0
New Zealand	0	27	+27
South Africa	54	54	0
USA	38	1,800	+1,762

¹²⁹ CMP 8 Decision Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9, Annex I, Part A amending Annex B of the Kyoto Protocol, footnote 15. (Decision number not assigned at the date of publication).

¹³⁰ CMP 8 Decision Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9, paragraphs 13 and 15 (Decision number not assigned at the date of publication).

¹³¹ World Bank. (2012). State and Trends of the Carbon Market 2012. Calculation applied from NZ Fifth National Communication. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19_035_Cvr&Txt_LR.pdf. Accessed 27 August 2014.

C.6 UNFCCC COMPARISONS

The bottom-up approach of the Blue Sky scenario is compared against a top-down view of a global UNFCCC agreement to limit the global temperature rise to 2 °C with a high chance (≥ 66 percent) and medium chance (50 percent to 66 percent) during the 21st century.¹³²

In the high confidence case the model projects global emissions between 2005 and 2020 and then assumes that emissions fall from 2020 to 2025 from 59 GtCO₂e to 40 GtCO₂e¹³², the 2025 target needed to be confident (≥ 66 percent) of not exceeding a 2 °C temperature rise during the century.

In the moderate confidence case the model projects global emissions between 2005 and 2020 and then assumes that emissions fall from 2020 to 2025 from 59 GtCO₂e to 44 GtCO₂e¹³², being the 2025 target needed to be moderately confident (50-60 percent) of not exceeding a 2 °C temperature rise over the century.

In both cases AFOLU is separated out in the emissions projections in 2010 and assumed not to grow. Emissions growth is assumed to come from the balance. Starting in 2020 emissions less AFOLU are capped, the uncapped sector being 11.8 GtCO₂e (AFOLU) and the capped sector being 47.2 GtCO₂e, giving a total of 59 GtCO₂e.

The top-down projection assumes that 2.5 percent of the cap is allowed for offsets and that offsets come from the uncapped sector being AFOLU. Uncapped and capped emissions then decline to achieve the target total emissions of 40 GtCO₂e or 44 GtCO₂e. Uncapped emissions fall due to abatement opportunities being used to create offsets. Capped emissions fall due to the decline in the cap and take account of offsets use so that uncapped, capped, and offsets are equal to the 2025 target of confident (40 GtCO₂e) or moderately confident (44 GtCO₂e).

Assuming REDD+ accounts for 50 percent of the 2.5 percent allowed for offsets, then total REDD+ demand over the 2015–2025 period—with actual demand starting in 2020—is 2,997 MtCO₂e (≥ 66 percent) and 3,021 MtCO₂e (50–60 percent).

C.7 SUMMARY OF REDD+ MARKET DEMAND

The annual demand provides an indication of the timing of demand. Status Quo demand peaks between 2015 and 2019 and then falls away. Total demand for this scenario is presented in Table 18.

TABLE 18: TOTAL DEMAND SUMMARY FOR THE STATUS QUO SCENARIO (MTCO₂e)

	Low	Mid	High
ISFL	30	41	69
FCPF-C	50	70	117
JCM	0	77	193
Norway	86	136	236

¹³² United Nation Environment Programme. (2013). Emissions Gap Report. Retrieved from http://www.unep.org/pdf/UNEP_EmissionsGapReport2013.pdf. Accessed 26 August 2014.

REDD Early Movers	6	8	14
Voluntary	41	104	120
Total	213	437	749

The falloff in demand in the Status Quo scenario may be compensated for in the Compliance Growth scenario if demand from California materializes after 2020. Under either mid or high guidance the demand ramps up after 2020 and compensates for any falloff under the Status Quo scenario. Total demand is shown in Table 19.

TABLE 19: TOTAL DEMAND SUMMARY FOR THE COMPLIANCE GROWTH SCENARIO (MTCO_{2e})

		Low	Mid	High
	Aviation	0	71	142
Asia and Oceania	Australia	0	63	126
	China	0	59	117
	Korea	0	18	36
North America and Mexico (no impact from CAA sIII)	California	0	31	61
	CAA sIII	0	12	23
	RGGI	0	0	0
	Mexico	0	55	110
Central and South America	Brazil	0	5	10
	Chile	0	8	16
	Costa Rica	0	32	64
Africa and the Middle East	South Africa	0	27	54
Status Quo		437	437	437
Moderate Total		437	816	1,196

The bottom-up Blue Sky scenario compared to the top-down UNFCCC scenario shows that demand, mainly due to the United States, rapidly ramps up and exceeds the top-down UNFCCC demand on the assumptions used in the various projections. Total demand is shown in Table 20.

TABLE 204: THE TOTAL DEMAND FOR REDD+ IN THE BLUE SKY SCENARIO FROM DIFFERENT REGIONS AND COUNTRIES

	Country/Region	REDD+ Assumption (%)	Demand (MtCO_{2e})
Major Emitters	USA	30	1,800
	EU	0	0
	Korea	30	36
	Japan	30	196
	Mexico	30	55
Brazil, Russia, India, China, and South Africa (BRICS)	Brazil	30	10
	Russia	0	0
	India	0	0
	China	5	117
	South Africa	30	54
Resource-Rich	Australia	30	379
	Canada	30	193
Other	Chile	30	6
	Costa Rica	50	64
	New Zealand	30	54
Sectoral	Aviation	30	142
Status Quo			213
Total			3,302

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