



Artemisinin Scenario Analysis

Summary of findings

May, 2009

THE BOSTON CONSULTING GROUP

Context for this document

The Boston Consulting Group (BCG) has undertaken an analysis of future ACT demand and artemisinin supply

- Integrated information from all available sources
- Pressure tested assumption
- Modeled multiple scenarios and sensitivities

BCG would like to thank the many stakeholders and experts that provided input to this work

- See final page for a complete list

This study was undertaken on behalf of the Bill and Melinda Gates Foundation

Our goal for this document is to share our analysis of:

- ACT/Artemisinin market
- Potential supply shortages in the near future

Key findings

1

Demand for ACTs expected increase to ~275M treatments per year by 2015

- AMFm uptake is main cause of increase in demand
- Potential decrease in treated malaria cases due to better interventions and diagnostics not expected to impact ACT demand until after 2015

2

Under current conditions artemisinin supply will not be stabilized in the future

- Based on the existing market dynamics Artemisinin supply will go through boom-bust cycles
 - Shortages & price spikes followed by oversupply and unsustainably low prices
- Driven by two factors in the current supply chain:
 - Lack of credible demand forecasts
 - Long agricultural production time (2 yrs)

3

Present level of artemisinin cultivation (~7,000 HA) is not enough to meet current demand

- Cultivation has dropped off dramatically since 2006 and safety stocks will be consumed over the next two years
- ~23,000 HA of cultivation are needed to meet peak demand in 2015
- This level of cultivation was reached in 2006, but only after prices spiked to over \$1000/kg

4

Without intervention, artemisinin supply shortage likely in 2011/12

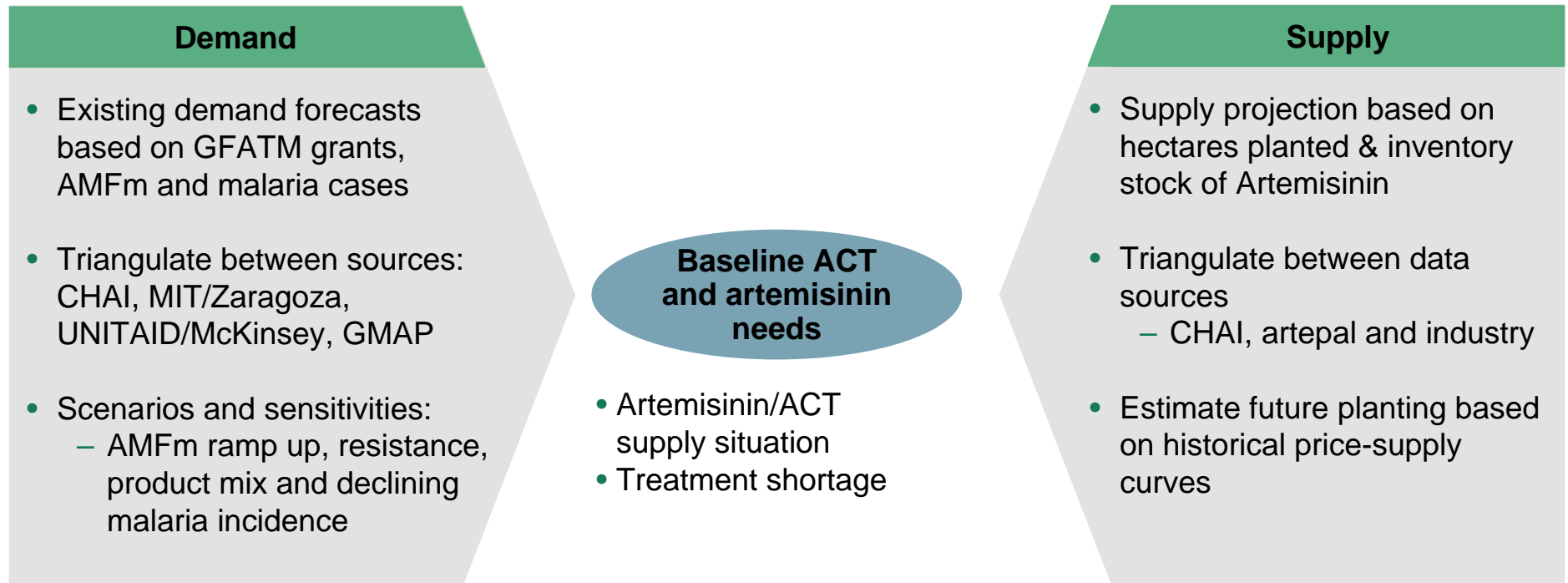
- Lack of credible ACT demand forecast makes manufacturers reluctant to engage in long term contracts
- High food prices have made alternative crops more attractive to farmers
- Large numbers of extractors going bankrupt in the past makes financing difficult to secure for remaining players

Agenda

Market overview

- ACT demand forecast and assumptions
- Supply forecast and assumptions
- Market outlook: present-2020
- Near term Artemisinin situation: 2010-2011

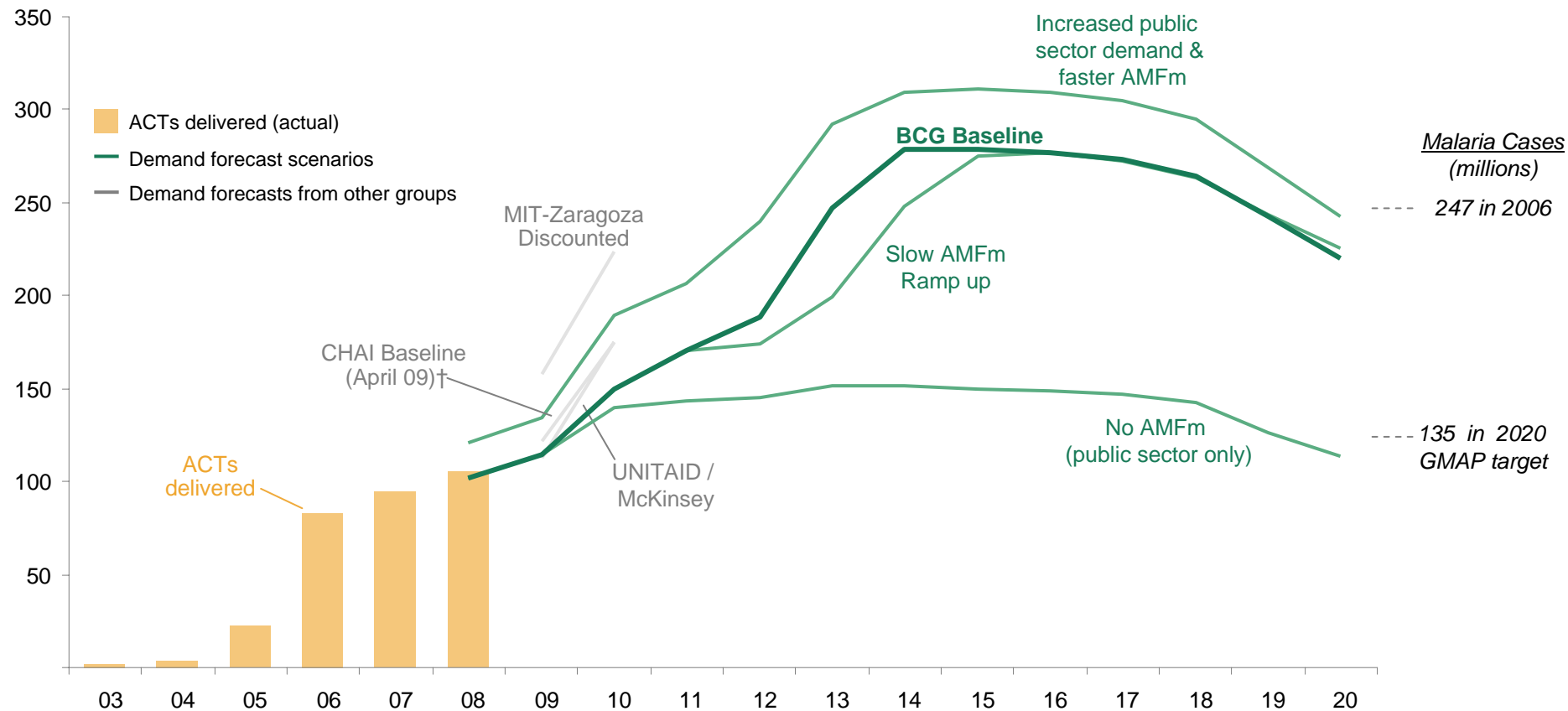
Market dynamics based on Supply and Demand analysis



Demand analysis: Strong increase in ACT demand expected over next 5 years

Total ACT Demand

Millions of treatments



(†) Recently updated CHAI baseline

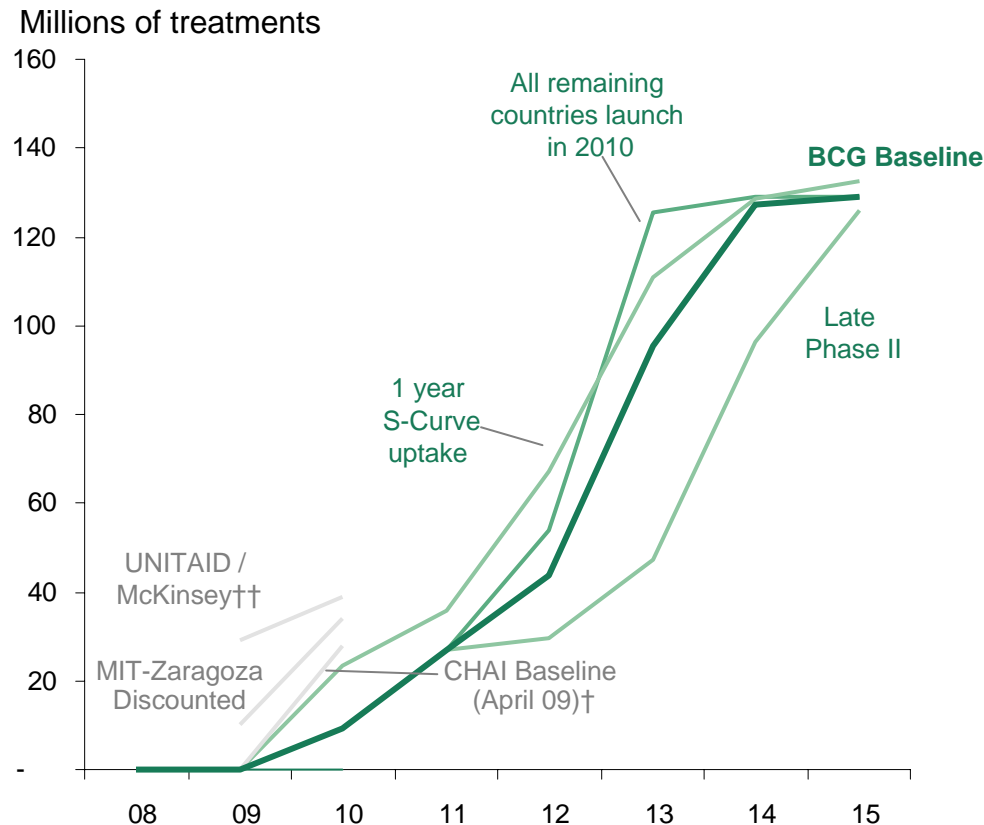
Note: 2008 Actual treatments projected from actual Novartis distribution of Coartem and assuming constant market share

Source: Clinton Foundation "Update on the Artemisinin Supply Situation" April 2009; Clinton Foundation "Global Forecast of ACT Demand" June 2008; Clinton Foundation "An Analysis of Global ACT Demand under Affordable Medicines Facility for malaria", June 2008; Roll Back Malaria "RBM Global ACT Forecast 2009, 2010"; WHO "World Malaria Report 2008"; Roll Back Malaria "Global Malaria Action Plan 2008"; BCG Analysis

AMFm launch main driver of ACT demand increase

AMFm demand scenarios

Scenario assumptions



- **Baseline scenario assumes Phase 2a and 2b countries launch at different times:**
 - Phase I starts in Q1 2010 and includes the following countries: Benin, Cambodia, Ghana, Kenya, Madagascar, Nigeria, Rwanda and Uganda
 - Phases II.1 and II.2 start in Q1 2012 and Q1 2013 respectively and include the next remaining 30 countries that make up 95% of malaria cases worldwide
- **Uptake modeled under 2 year S-curve reaching maximum of 50% private sector market share (of all malaria drugs)**
 - Previous Tanzania trial reached 60% in 5 months but only covered two districts and used more attractive packaging than will be used under complete rollout
- **Remaining scenarios shift either phases, start dates or uptake speed**

(†) Recently updated CHAI Baseline

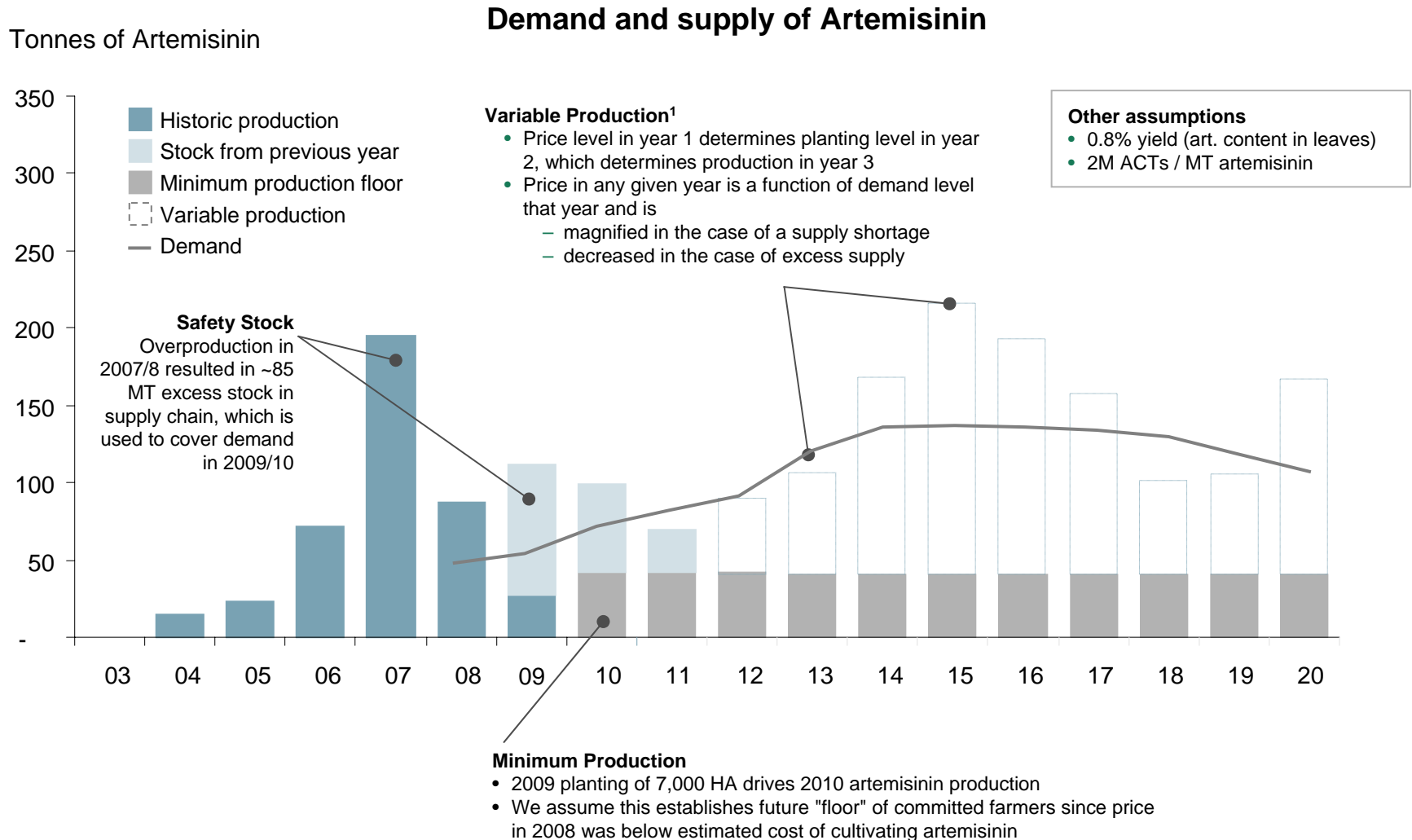
(††) UNITAID / MCKinsey includes premium private sector demand

Source: Clinton Foundation "Update on the Artemisinin Supply Situation" April 2009; Clinton Foundation "Global Forecast of ACT Demand" June 2008; Clinton Foundation "An Analysis of Global ACT Demand under Affordable Medicines Facility for malaria", June 2008; Roll Back Malaria "RBM Global ACT Forecast 2009, 2010"; WHO "World Malaria Report 2008"; Roll Back Malaria "Global Malaria Action Plan 2008"; BCG Analysis

BCG Baseline demand assumptions

	Assumption	Baseline	Rationale
Public Sector	Global Fund Rounds <ul style="list-style-type: none"> Round 8 Round 9 Round 10 	\$2.6B \$400M \$800M	<ul style="list-style-type: none"> Expected disbursements predicted using CHAI dynamic model
	Other public sector donors		<ul style="list-style-type: none"> Using public values from respective reports
Private Sector	AMFm Phase I <ul style="list-style-type: none"> Start date, Countries 	Q1-2010, 8	<ul style="list-style-type: none"> Application approvals scheduled for Sep 2009 8 of the 11 selected countries will join Ph.I 18 month length of Ph.I plus 6 months to prepare Ph. II.1 Ph.II.2 starts one year after Ph.II.1 The 38 countries included in the AMFm make up 95% of malaria cases worldwide
	AMFm Phase II (part 1) <ul style="list-style-type: none"> Start date, Countries 	Q1-2012, 15	
	AMFm Phase II (part 2) <ul style="list-style-type: none"> Start date, Countries 	Q1-2013, 15	
	AMFm uptake	<i>S-curve reaching 50% market share over 2 years</i>	<ul style="list-style-type: none"> Tanzania trials ramped up to 60% in 5 months but only in two districts and with more attractive packaging than will be used in future
	Premium private sector	<i>12M treatments in 09, ramps down as AMFm ramps up</i>	<ul style="list-style-type: none"> Based on CHAI dynamic model (see appendix slide 6 for detail)
Overall	Long term ramp down	<i>ACT treatments begin decrease after 2015 due to decrease in Malaria cases</i>	<ul style="list-style-type: none"> Based on GMAP model's prediction of impact of diagnostic and preventative measures (RDTs, vaccines, bednets)
	Artemisinin requirements	<i>2 Million treatments of ACT per tonne of Artemisinin</i>	<ul style="list-style-type: none"> Based on average dosage for Coartem treatment and Artemisinin required per dosage (see appendix slide 7 for detail)

Supply Model: We forecast future supply based on current stock & anticipated responses to future market conditions

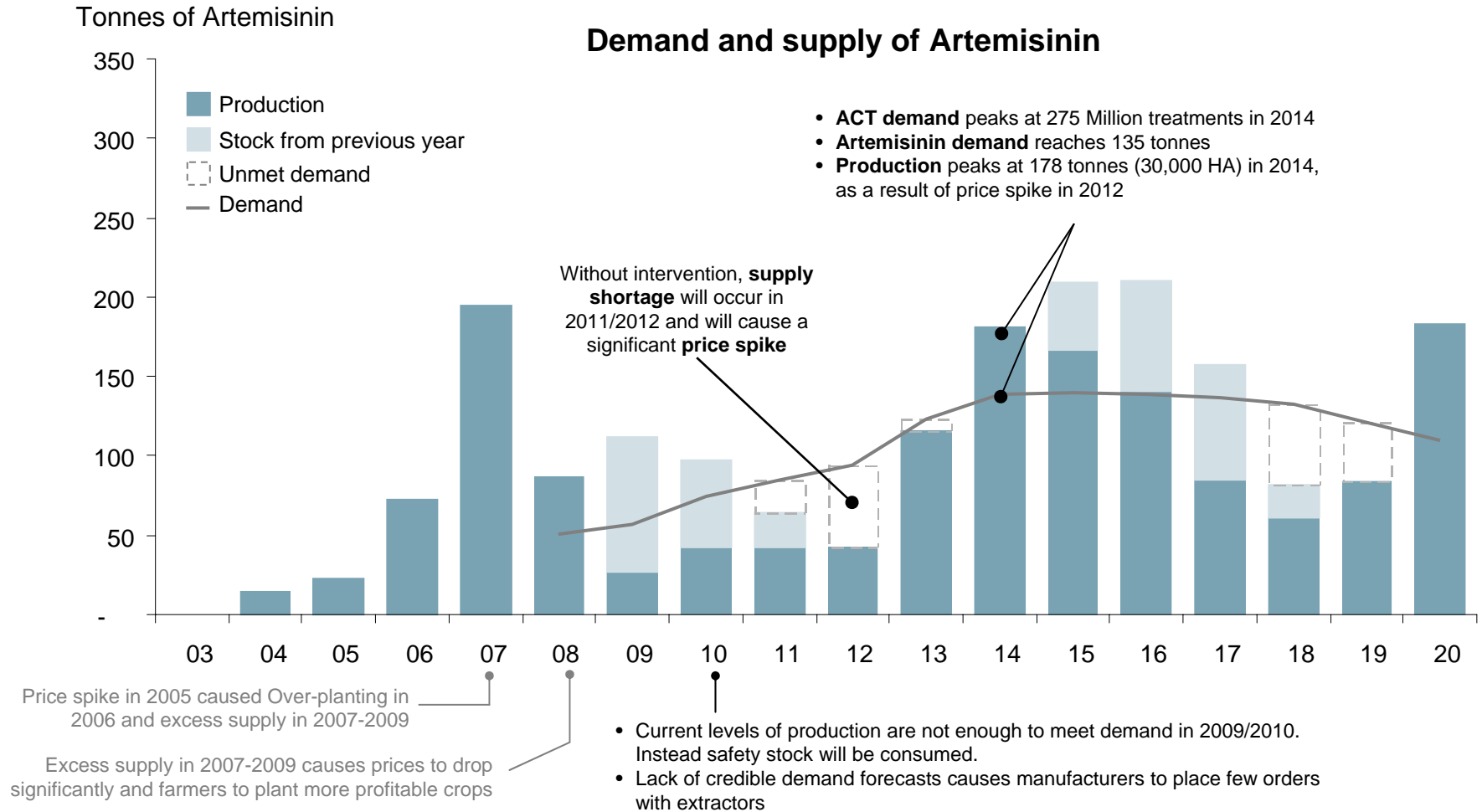


1. See appendix slide 16 for detailed model logic
Artemisinin Scenario Analysis_vfinal for distribution.ppt

Baseline supply assumptions

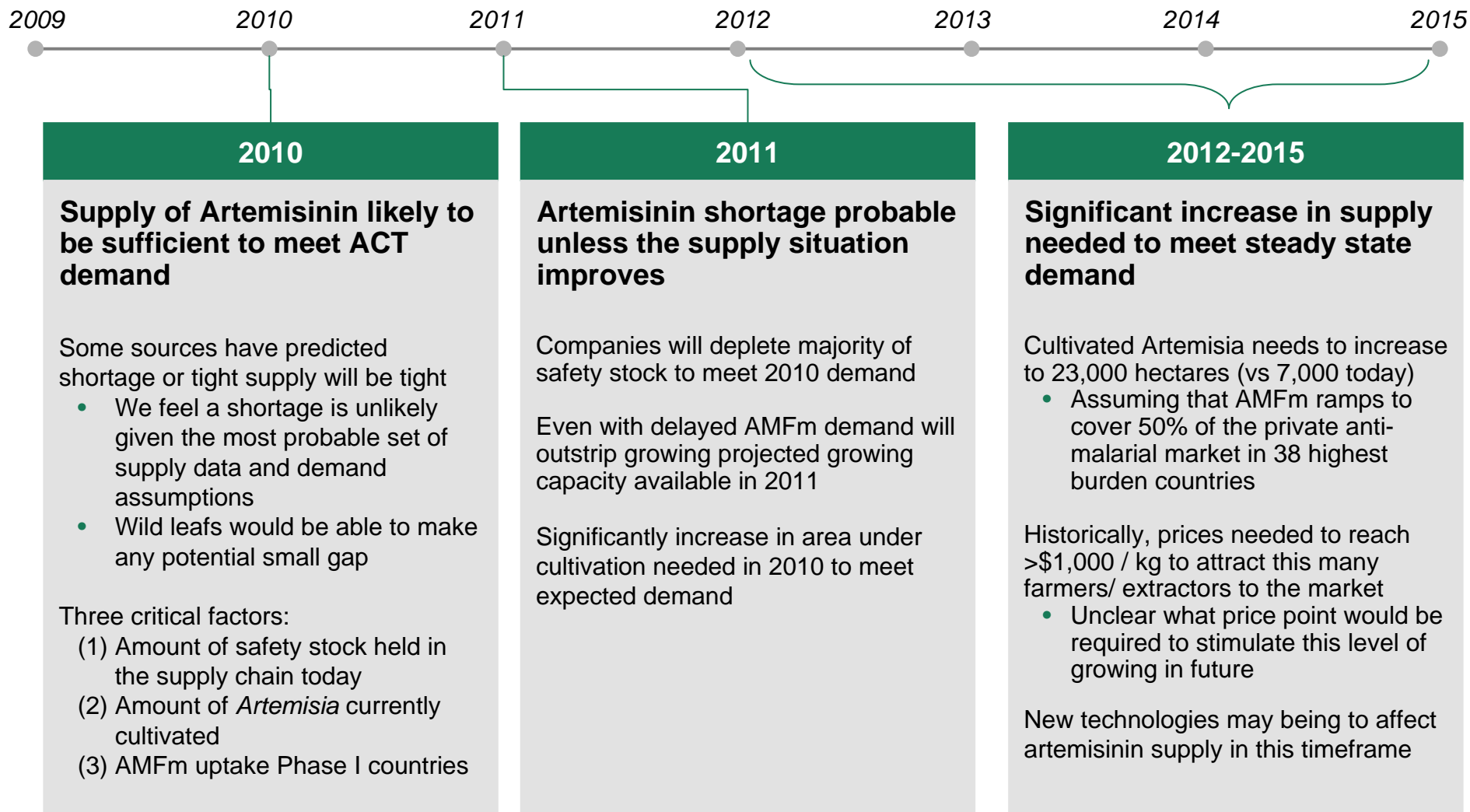
	Assumption	Baseline	Rationale
Existing supply	Current safety stock Tonnes	85 tonnes	<ul style="list-style-type: none"> Based on information from Malcolm Cutler, Sanofi, and Novartis
New planting	2009 planting Hectares (HA)	7,000 HA	<ul style="list-style-type: none"> Mid-level range of CHAI estimates (Nov. 2008) and Artepal findings (March 2009)
	Minimum future planting HA	7,000 HA	<ul style="list-style-type: none"> Estimated as the level of current long term contracts. Since prices in 2008 were below estimated cost of cultivation and planting was ~7,000 HA
	Farmer decision criteria	-	<ul style="list-style-type: none"> Planting level is based on prior year's demand and supply shortage/excess (see appendix slide 16 for model logic)
Planting yield	Land yield tonnes leaves/HA	1.5 tonnes/HA	<ul style="list-style-type: none"> Midpoint of Artepal range; conservative end of M. Cutler estimate of 1.5 – 4.5
	Leaf yield Kg art./ Kg leaves	.8%	<ul style="list-style-type: none"> Range within estimates from Artepal, M. Cutler, CNAP, and extractors (0.4-1.2%), 0.8% is average yield in China today
	Purification process efficiency	50%	<ul style="list-style-type: none"> Midpoint of 40% - 60% range provided by Artepal

Lack of credibility in demand forecast and long lead times cause cycles of supply excess and shortage



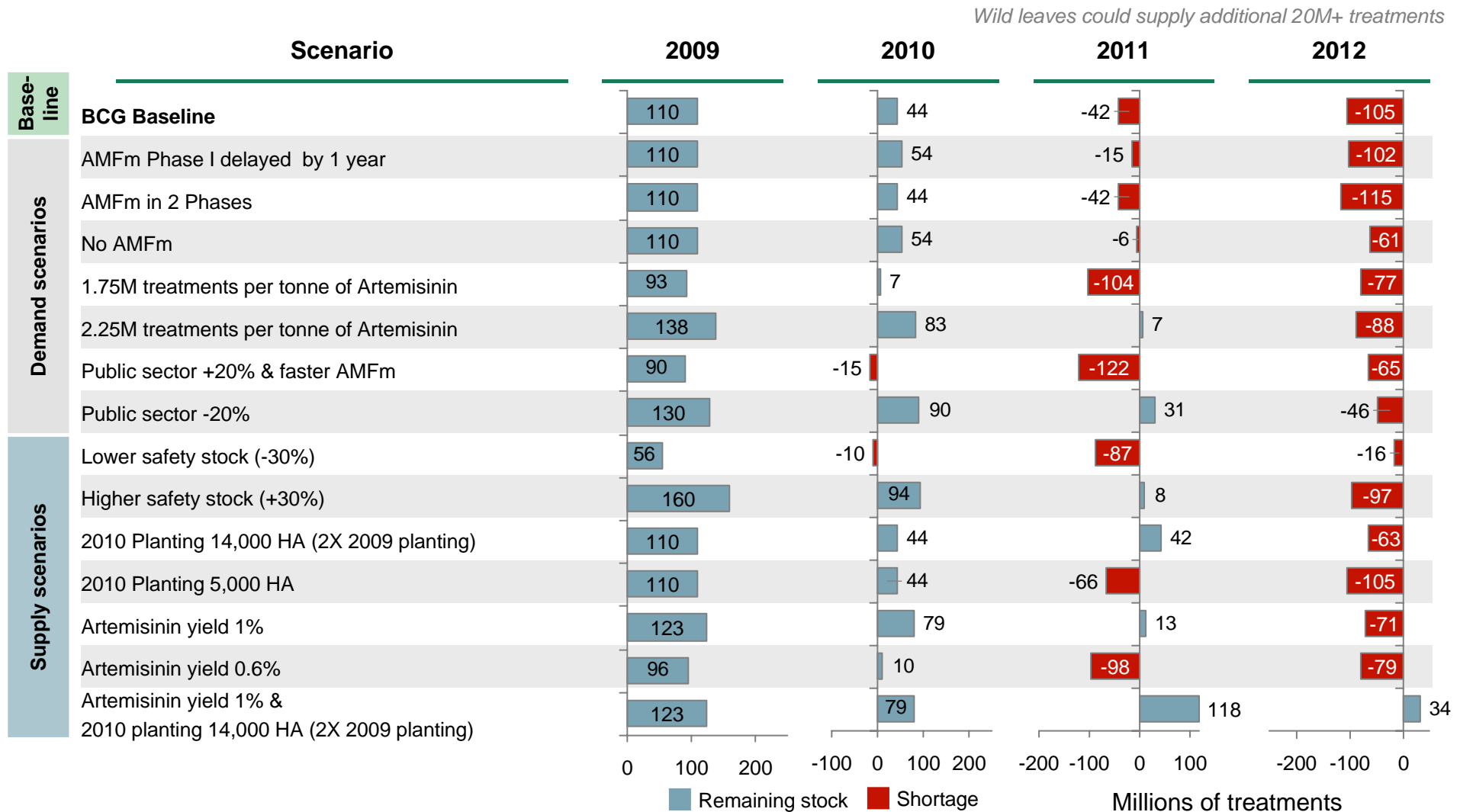
Source: Clinton Foundation "Global Forecast of ACT Demand" June 2008; Roll Back Malaria "RBM Global ACT Forecast 2009, 2010", WHO "World Malaria Report 2008"; Roll Back Malaria "Global Malaria Action Plan 2008", BCG Interviews, BCG Analysis

Our current view of the Artemisinin situation



Action needed to ensure supply in 2011/2012

Shortage in 2010 is unlikely given current AMFm schedule



Acknowledgements

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