



Changing the Way the World Cooks

May 16, 2016



A Little Perspective on Fire & Cooking

Originally: fire via preserving natural burning ember

Paleolithic Era: fire created through friction or with flint

Neolithic Era: coal use in China

3rd Century B.C.: closed clay stoves in

Ch

577 A.D.: early match in China

Middle Ages: brick/mortar stoves in Europe – 1st use of chimney

16th Century: design improvements – fire chamber

18th Century: Europe's 1st completely enclosed fire stove; cast iron wood stoves in qty

19th Century: wood stove improved; modern match (1805); gas stove developed (1820s) & commercialized (1860s); electric stove developed (1892)

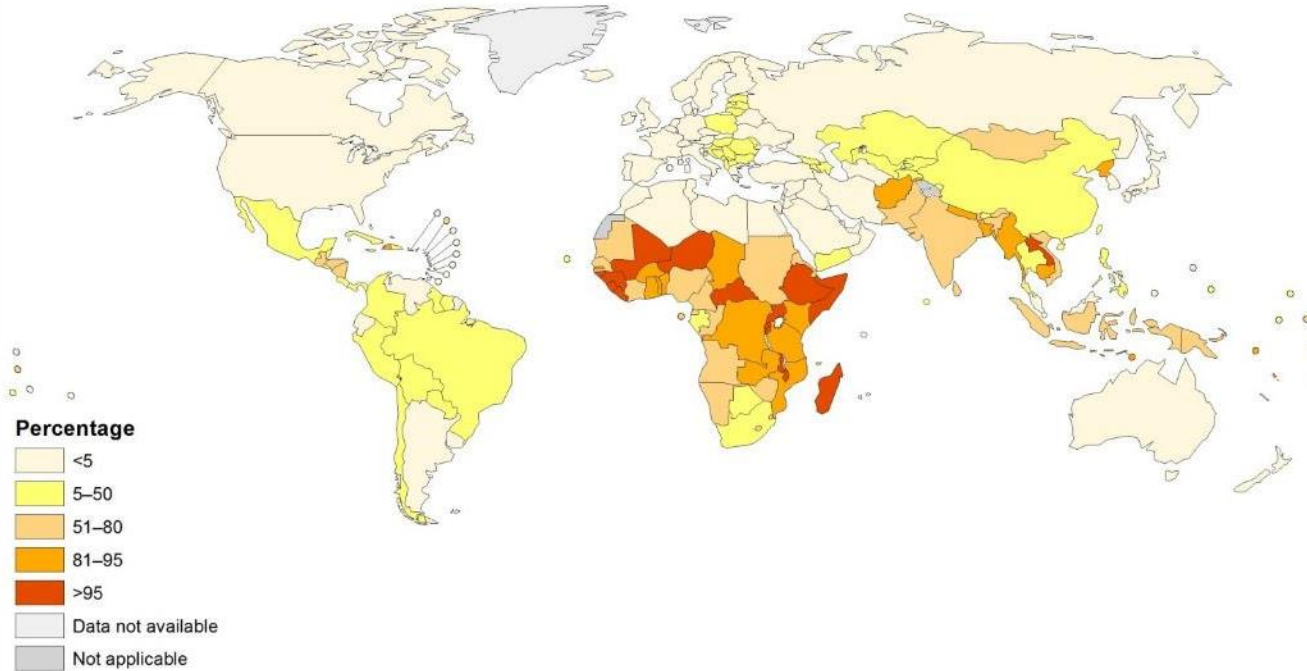
20th Century: modern stoves commercialized, including electric, glass-ceramic, and electromagnetic induction stoves, and microwave ovens



Question: How many cookstoves do you have?

And yet... About 2.8 Billion People Still Use Solid Fuels for Home Cooking and Heating

Population using solid fuels (%), 2010
Total



A Little Perspective on Air Quality

(PM_{2.5} as an indicator)



Chicago, IL: August 16, 2000
 PM_{2.5} < 10 µg/m³

Chicago, IL: August 26, 2000
 PM_{2.5} = 34 µg/m³

Home with Open Fire (Guatemala)
 Peak PM_{2.5} = 8670 µg/m³
 Typical 24-hr : 100s-1000 µg/m³

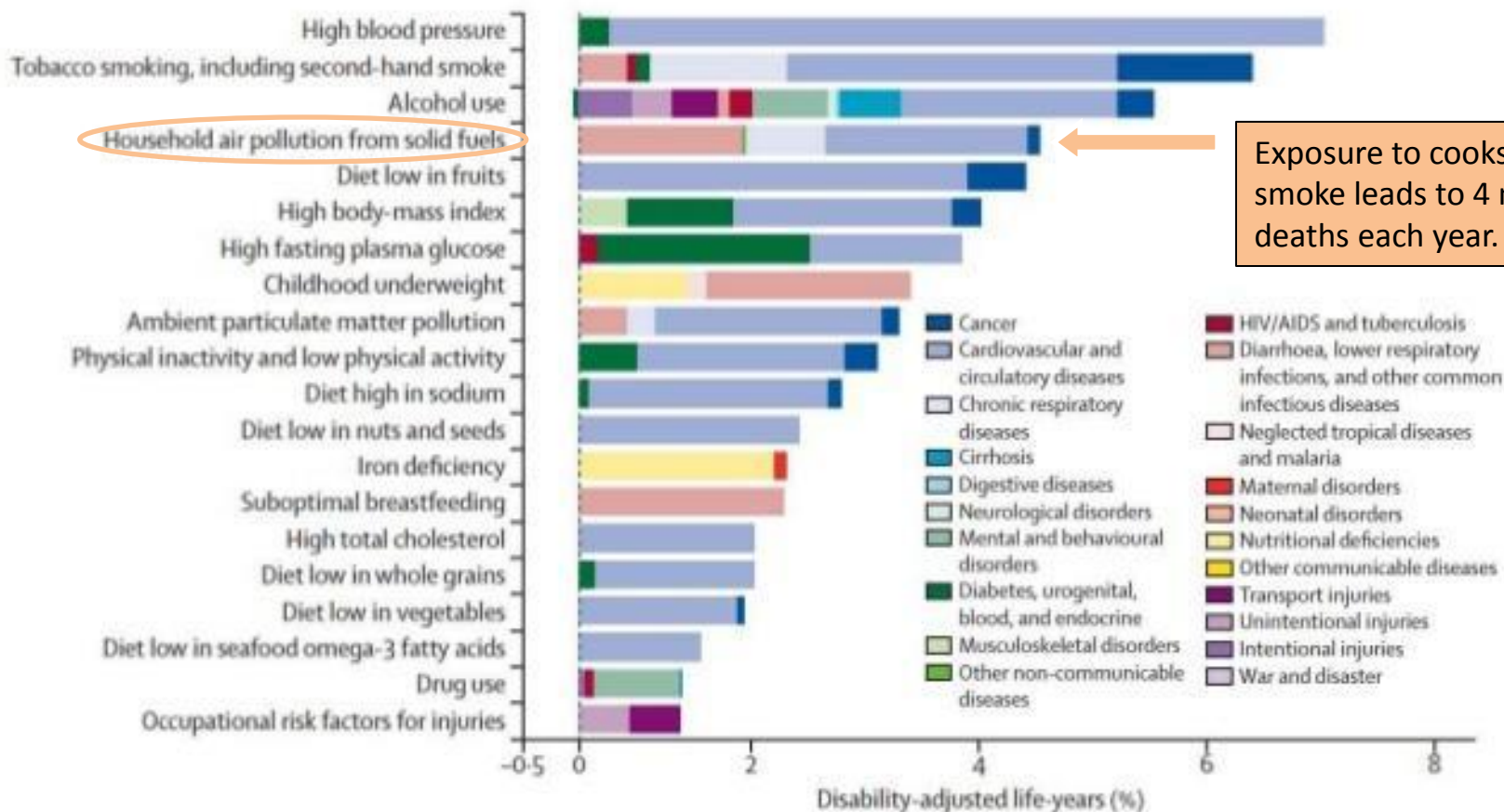
Some Pollutants in Indoor Smoke

Criteria Pollutants: PM_{2.5}, CO, NO₂,
Toxics: formaldehyde, benzene, 1-3 butadiene, benzo[α]pyrene
For Coal: SO₂, As, Pb, Hg, & F

	Annual		24-hour	
	EPA Standard	WHO Guideline	EPA Standard	WHO Guideline
PM _{2.5}	12.0 µg/m ³	10.0 µg/m ³	35 µg/m ³	25.0 µg/m ³

Exposure to cookstove smoke is the 4th worst health risk factor in the world – and the 2nd worst for women and girls (and 1st, 2nd or 3rd worst for most of South Asia, most of Sub-Saharan Africa & Southeast Asia, respectively)

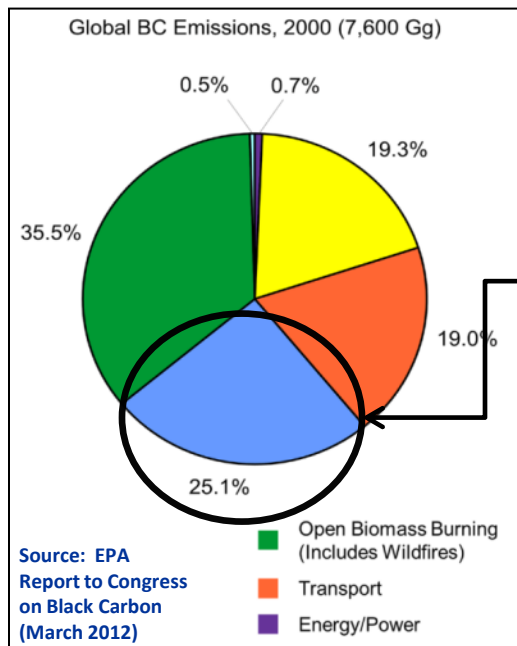
Burden of disease attributable to 20 leading risk factors in 2010, expressed as a percentage of global disability-adjusted life years, both sexes



Exposure to cookstove smoke leads to 4 million deaths each year.

Climate change impacts/opportunities

- CO₂: Cookstoves have a strong warming effect on long-term climate
 - Today's better stoves reduce fuel use by 30-50% or more in field settings
 - Typical savings from an improved stove = ~0.5-4.0 tCO₂-e/year or more
- Black Carbon (Bounding Study, 2013)
 - Clean cookstoves have an uncertain, but net warming impact on near-term climate
 - Clean cooking follows only diesel engines as promising mitigation measures to reduce BC warming



Cookstoves represent 21% of the global black carbon inventory.

“Emissions from residential cookstoves are both a large source of BC globally and a major threat to public health. ... Mitigation in this sector represents the area of largest potential public health benefit of any of the sectors considered in this report.”

EPA Report to Congress on Black Carbon
March 2012

Additional Impacts of Solid Fuel Use



Time loss for women and children



Women's & girl's personal safety in conflict zones



Contributes to deforestation



Contributes to loss of critical habitat

Cooking interventions must be tailored to a policy goal

Policy Priority	Performance Indicator
Forestry, habitat preservation	Fuel use savings
Women's & girls' empowerment	Fuel use and time savings
Climate change, long-term	Reduction of emissions of GHG (fuel use as proxy)
Economic development and poverty reduction	Fuel use savings, fuel expenditures savings, health-relevant emissions
Climate change, near-term	Reduction of emissions of short-lived climate pollutants (e.g., black carbon)
Health	Reduction of air pollutant emissions and exposures



Fuel saving wood and charcoal stoves



Fuel saving wood stoves w/2 burners & chimney



Low-emission wood/pellet fan ("gasifier") stoves



Clean fuels (e.g., electricity, LPG, biogas, ethanol)

(Source: adapted from Anenberg et al, *Environmental Science and Technology*, May 7, 2013)

The Social Dimensions



**Philips stove in use in India –
the women love it and it
emitted no noticeable smoke**

**But they were also using the
traditional stove at the same time.**



**They needed to
work with the
manufacturer to
adapt the stove
to cook the local
bread evenly.**

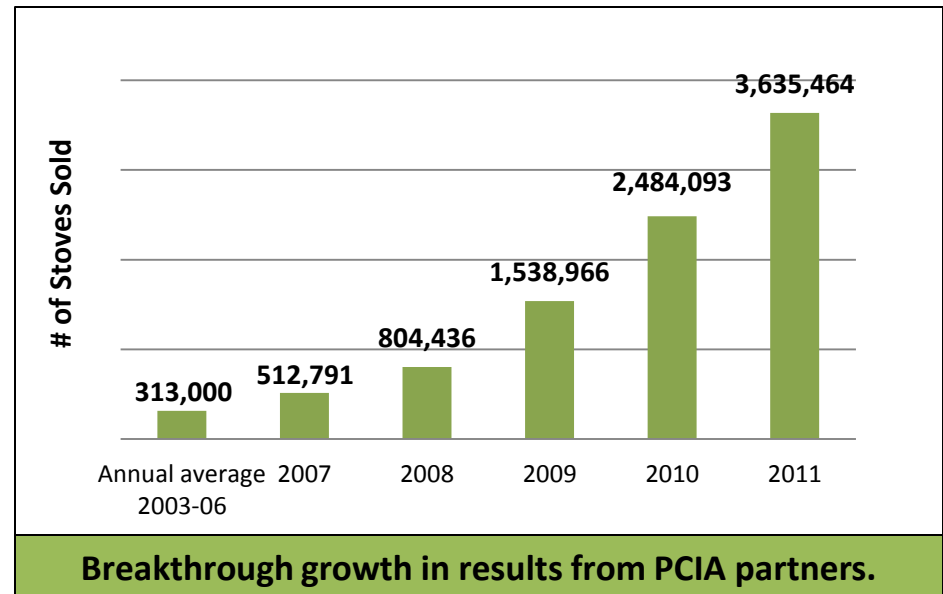


**Stove performance
often depends
critically on how
the cook – cooking
habits, how fuel is
fed in, etc.**

Simple to explain – but complex to solve

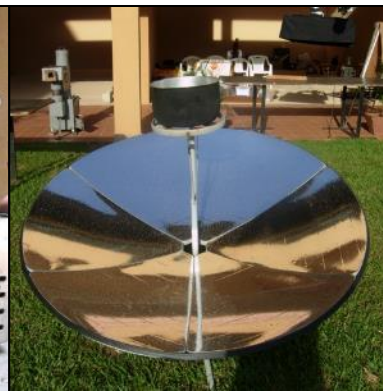
EPA leadership via Partnership for Clean Indoor Air

- **PCIA Launch:** at the 2002 World Summit on Sustainable Development
- **PCIA Goal:** Increase the use of clean, reliable, affordable, efficient, and safe home cooking and heating practices that reduce exposure to indoor air pollution.
- **Breakthrough Growth:**
 - from 13 to over 600 partners
 - partners' reported results were more than doubling every two years



Progress that led to renewed momentum

- Development of **new stove technologies and fuels**
- Development of **cheaper and more accurate monitoring tools**
- **Demonstrated successes** in the field
- Private sector interest in **Base of Pyramid**
- Availability of **innovative financing** (carbon, micro, impact investment)
- **Strong empirical evidence** on health and environmental effects
- Policy interest in near-term **climate mitigation opportunities**
- Ownership and **excitement at national country level**
- Convergence of players and **new approaches**



How to ramp up PCIA at a dramatic scale?

- Strategy
 - Take PCIA out of the U.S. Govt to an external host
 - Develop a vision for a much larger scale approach
 - Explore possible organizations that could host the effort
 - Idea: do a competitive solicitation to spin out PCIA
- Timing
 - Began this work in September 2006
 - Efforts late in the Bush Administration
 - Decide to wait to tee up for incoming administration
- Proposed to Obama Administration in June 2009
 - AA McCarthy very supportive and takes to Administrator Jackson
 - Administrator Jackson engages Secretary of State Clinton in September
 - Connect with Sec. Clinton's Office of Global Partnerships in Oct-November
 - We combine forces with UN Foundation December 2009 – March 2010
 - Launch Global Alliance for Clean Cookstoves in September 2010

Launch of the Global Alliance for Clean Cookstoves

(9/21/2010)



Vision: *Universal adoption of clean and efficient cooking solutions*

Mission: to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions

Key Milestone: *100 million households adopt clean and efficient stoves and fuels by 2020*

1300+ Partners and Growing

Donor Countries

Canada
Denmark
Finland
France
Germany
Ireland
Malta
Netherlands
Norway
Spain
Sweden
United Kingdom
United States

Private Sector



Deutsche Bank



Johnson & Johnson

BAKER & MCKENZIE



UN & Multilateral



ASIAN DEVELOPMENT BANK



THE
WORLD
BANK



UNHCR
The UN Refugee Agency

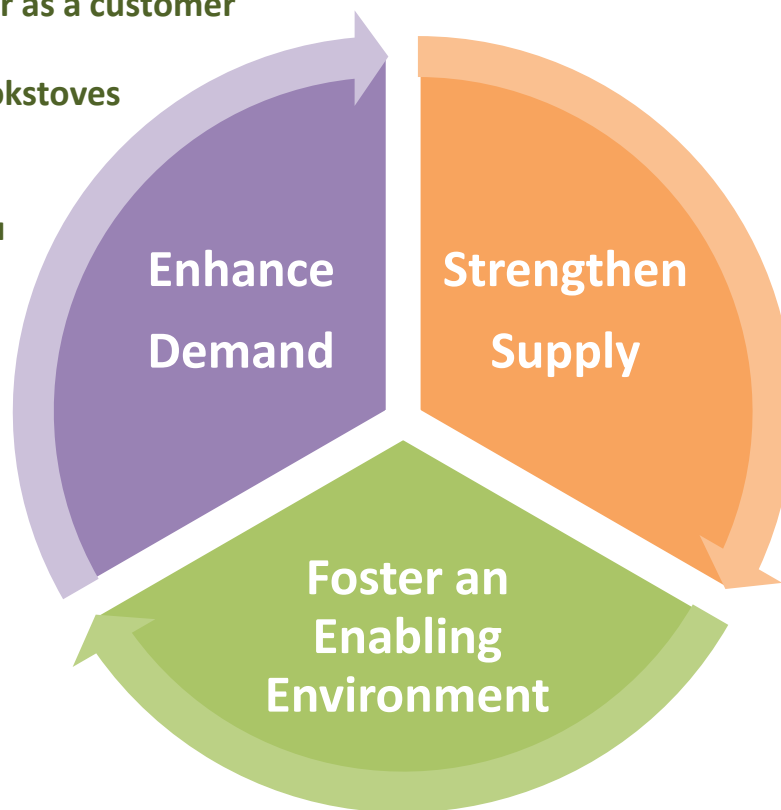


National Partners

Afghanistan
Bangladesh
Burkina Faso
Cambodia
China
Colombia
El Salvador
Ethiopia
Ghana
Guatemala
Italy
Kenya
Laos
Lesotho
Malawi
Mexico
Mongolia
Nepal
Niger
Nigeria
Rwanda
Sri Lanka
South Africa
Tanzania
Peru
Viet Nam
Uganda

A three-pronged strategy has been developed to spur the clean cookstove market.

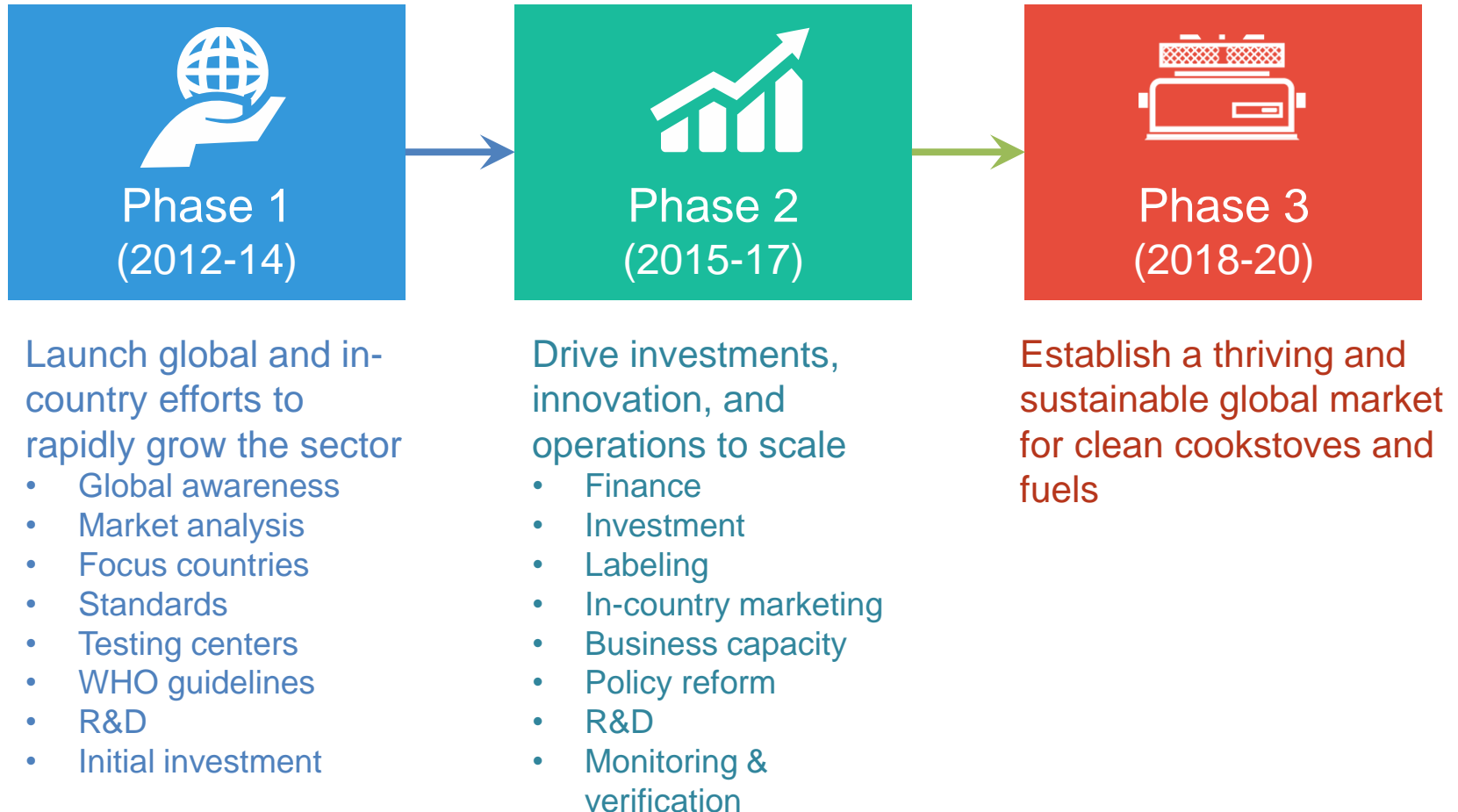
- Understand and motivate the user as a customer
- Reach the last mile
- Finance the purchase of clean cookstoves and fuels
- Develop better cookstove technologies and a broader menu of options



- Finance clean cookstoves and fuels at scale
- Access carbon finance
- Build an inclusive value chain for clean cookstoves and fuels
- Gather better market intelligence
- Ensure access for vulnerable populations (humanitarian)

- Promote international standards and rigorous testing protocols, locally and globally
- Champion the sector to build awareness
- Further document the evidence base (health, climate, and gender)
- Engage national and local stakeholders
- Develop credible monitoring and evaluation systems

The Alliance has a three phased approach to reaching its goals



Original 5-Year U.S. commitment to Clean Cooking and the Global Alliance for Clean Cookstoves (2010-2015)

U.S. 5-Year Commitment through 2015

- Original commitment: \$50 million across 6 agencies
 - ❖ diplomacy
 - ❖ research
 - ❖ market development/field activities
 - ❖ financing
 - ❖ technical assistance
- Eventual investment: \$114 million across 11 federal agencies



Examples of how the USG commitment has driven the sector forward to date:

- USG diplomacy drove the Alliance's early growth (State)
- Lab testing has served as foundation for Alliance's global strategy to set up regional testing centers (EPA)
- Led progress in establishing global standards (EPA)
- Issued two of the largest loans for cookstoves businesses ever undertaken (OPIC)
- Field efforts in Haiti, Bangladesh, Kenya, & Nigeria (AID)
- Only integrated climate-health-AQ research effort (EPA)
- Only current major stove technology R&D effort (DOE)
- Leading the major global health effects studies (NIH)
- Completed one of the most advanced field health evaluation's of cookstoves ever undertaken (CDC)
- Leading stove adoption research for the sector (AID)
- Researching innovative business models (AID)

Anticipated U.S. Support 2016-2020: up to \$175 million

- Diplomacy
- Research (\$47 million)
- Market development/field activities (\$3 million)
- Financing (up to \$125 million, plus renewal of OPIC's commitment of up to \$50 million)
- Technical assistance

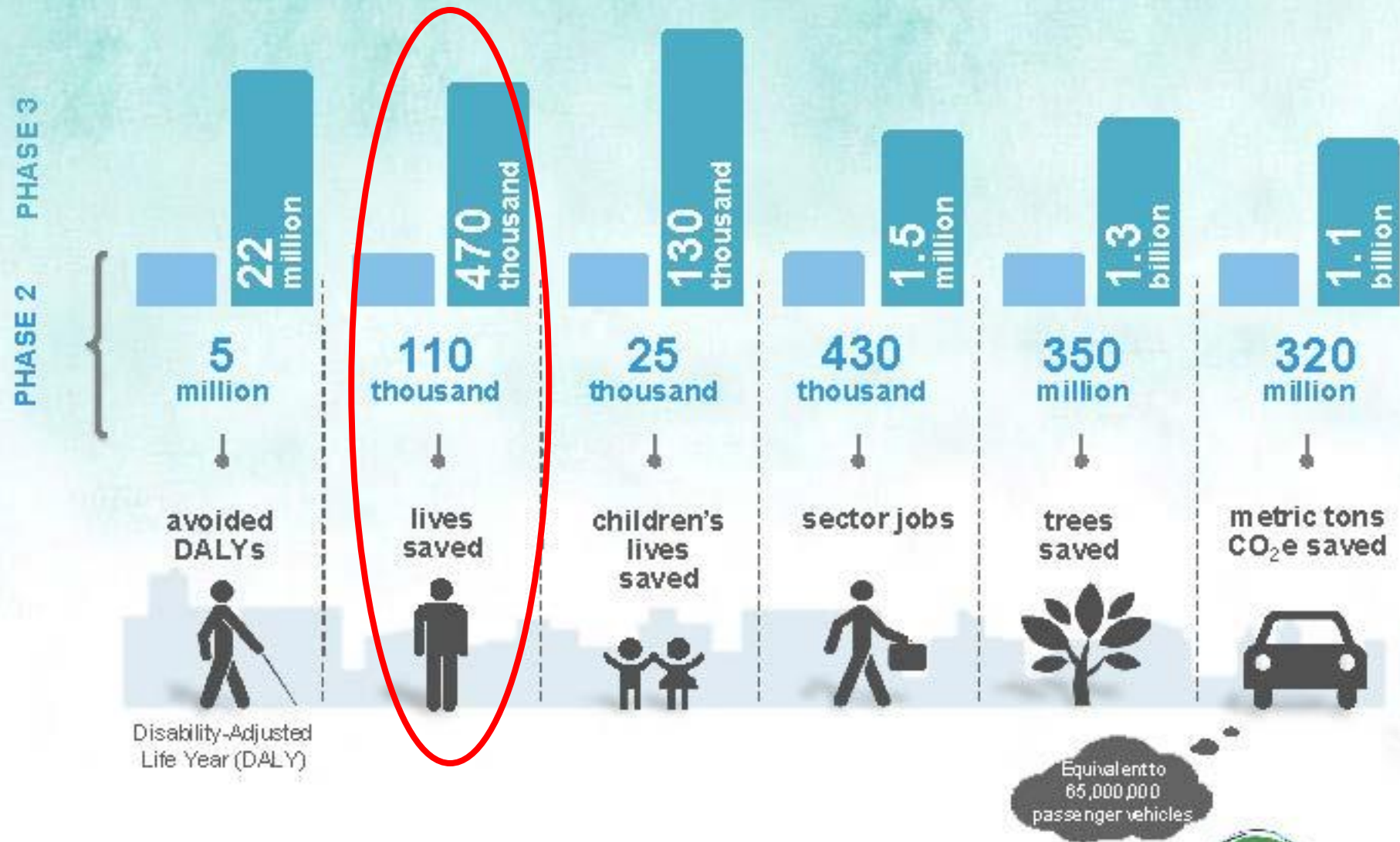


Anticipated U.S. investment 2010-2020: up to \$332 million

Examples of how the USG support will seek to drive the sector forward through 2020:

- USG diplomacy drove the Alliance's early growth (State)
- Mobilize private financing via development credit (AID) and debt financing (OPIC)
- Continue leadership in laboratory and field testing of clean cookstoves and fuels (EPA)
- Continue leadership in setting global standards (EPA)
- Expand integrated climate-health-AQ research (EPA)
- Lead major global health effects studies, enhance exposure science, and develop biomarkers (NIH)
- Continue field health evaluations with a particular focus on clean fuels (CDC)
- Lead stove adoption research (AID, CDC, NIH)
- Field efforts in key countries (AID)

Projected Impacts – Global



Some Key Lessons Learned

- Partnerships take time
 - ❖ Dedicated staff to pull it off
 - ❖ Matching top-down leadership with bottom-up support
 - ❖ Finding the “doers” – both inside and outside the U.S. government
 - ❖ Shared value varies by partner (host, countries, private, NGO...)
 - ❖ Building and evolving relationship with host organization
 - ❖ Power of a forcing event
- Strategy balanced many tensions
 - ❖ Strategy vs. luck – “strategic serendipity”
 - ❖ Moving forward vs. waiting for the optimal (and uncertain) window of opportunity
 - ❖ Big vision to inspire vs. achievable goals
 - ❖ Getting the data right vs. paralyzed by lack of certainty
 - ❖ Having a clear actionable strategy vs. evolving as you go
- Be vigilant on communications:
 - ❖ Be clear about what solutions can deliver which goals
 - ❖ Leverage high-level partners and ambassadors
 - ❖ Be prepared for the pushback when it comes

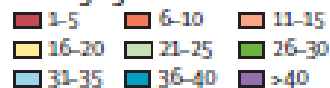
For More Background or Information

- [Global Alliance for Clean Cookstoves](#)
- WHO's [Household Air Pollution Website](#)
- State Department's Clean Cookstoves [Webpage](#)
- Syracuse University/Maxwell School [Evaluation](#) of State Department's role in establishing the Global Alliance for Clean Cookstoves
- Harvard Business Review [Case Study](#) of State Department's Partnerships Office

Appendix Slides

Global Burden of Disease Study 2010

Ranking legend



Risk factor

	Global	High-income Asia Pacific	Western Europe	Australasia	High-income North America	Central Europe	Southern Latin America	Eastern Europe	East Asia	Tropical Latin America	Central Latin America	Southeast Asia	Central Asia	Andean Latin America	North Africa and Middle East	Caribbean	South Asia	Oceania	Southern sub-Saharan Africa	Eastern sub-Saharan Africa	Central sub-Saharan Africa	Western sub-Saharan Africa
High blood pressure	1	1	2	3	4	1	2	2	1	2	4	1	1	2	1	1	3	6	2	6	5	6
Tobacco smoking, including second-hand smoke	2	2	1	2	1	3	3	3	2	4	5	2	3	5	3	3	2	3	5	7	12	10
Alcohol use	3	3	4	4	3	2	4	1	6	1	1	6	2	1	11	5	8	5	1	5	6	5
Household air pollution from solid fuels	4	42	14	23	20	5	18	11	3	12	7	13	9	1	4	7	2	2	2
Diet low in fruits	5	5	7	7	7	5	6	5	3	6	7	4	5	10	6	8	5	9	8	8	11	13
High body-mass index	6	8	3	1	2	4	1	4	9	3	2	9	4	3	2	2	17	2	3	14	18	15
High fasting plasma glucose	7	7	6	6	5	7	5	10	8	5	3	5	7	6	4	4	7	1	6	10	13	11
Childhood underweight	8	39	38	37	39	38	38	38	38	32	23	13	25	18	21	14	4	8	9	1	1	1
Ambient particulate matter pollution	9	9	11	26	14	12	24	14	4	27	19	11	10	24	7	19	6	32	25	16	14	7
Physical inactivity and low physical activity	10	4	5	5	6	6	7	7	10	8	6	8	9	8	5	7	11	7	11	15	15	16

Exposure to cookstove smoke is the:

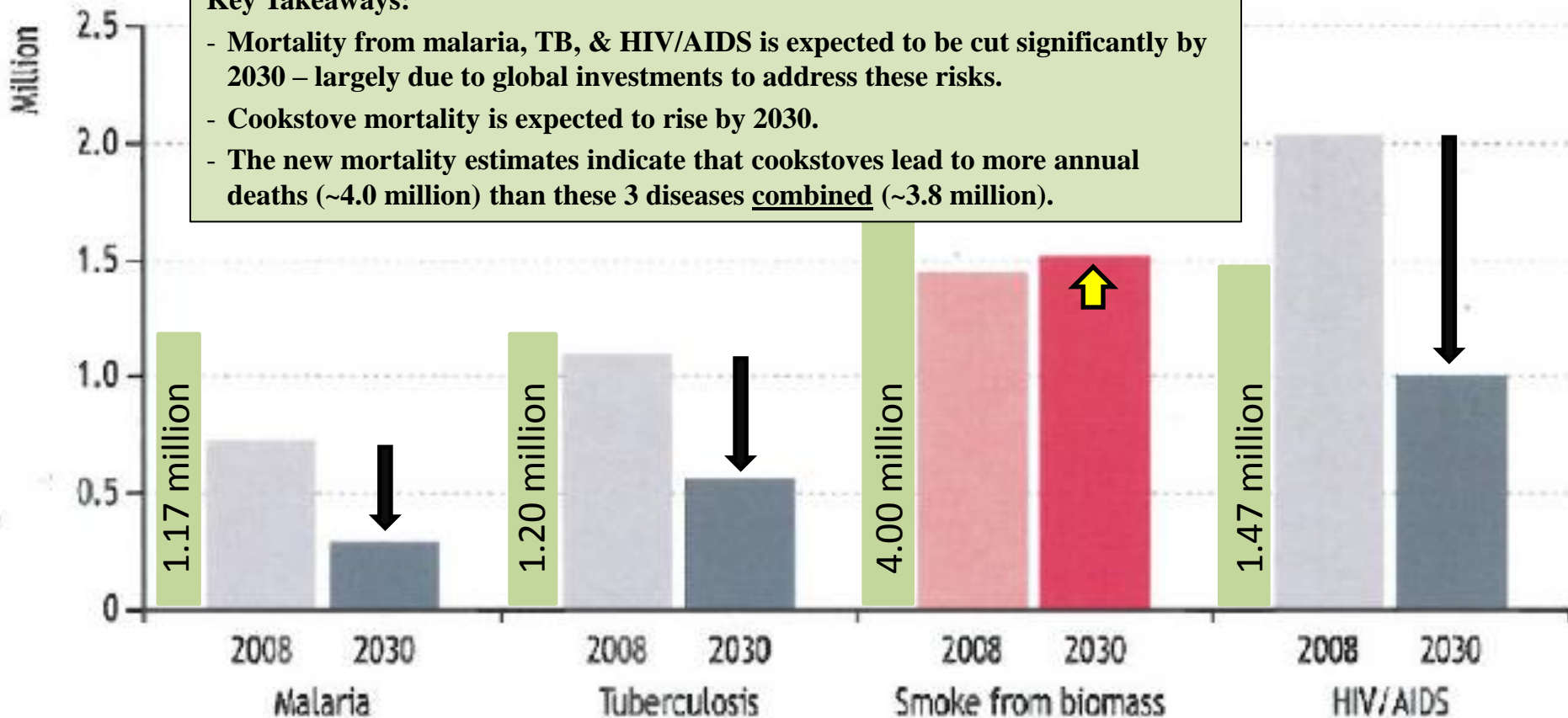
- South Asia: the single worst health risk factor
- Sub-Saharan Africa: 2nd worst health risk factor
- Southeast Asia: 3rd worst health risk factor
- East Asia: 5th worst health risk factor

Trends in Key Health Risks

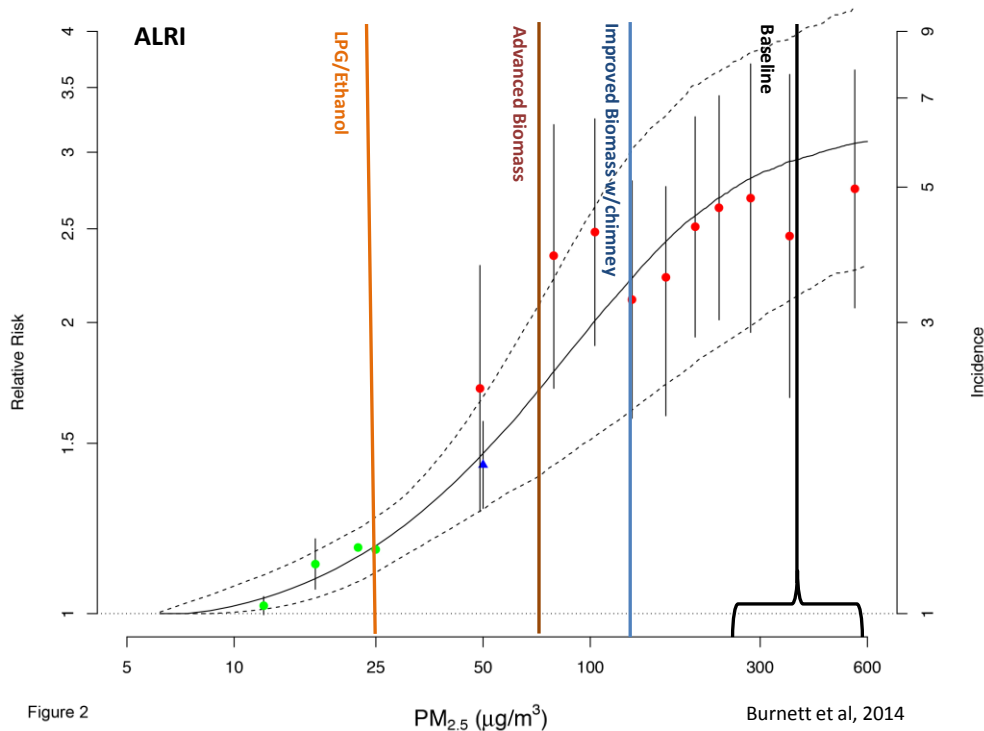
Figure 5: Premature annual deaths from household air pollution and other diseases

Key Takeaways:

- Mortality from malaria, TB, & HIV/AIDS is expected to be cut significantly by 2030 – largely due to global investments to address these risks.
- Cookstove mortality is expected to rise by 2030.
- The new mortality estimates indicate that cookstoves lead to more annual deaths (~4.0 million) than these 3 diseases combined (~3.8 million).



Integrated exposure-response functions have several implications



Dose-Response Curves are:

- More linear for some health end-points (e.g., COPD, lung cancer, ischaemic heart disease, and likely blood pressure)
- Less linear for some health end-points (e.g., stroke)

The position of the Baseline and other Lines may vary by location & specific intervention – they are placed here per approximate reductions achieved or anticipated in current NIH studies.

Key Points:

- For all health end points, achieving the majority of possible health benefits requires very substantial exposure reductions.
- Significant health benefits should still accrue for partial exposure reductions:
 - for health end points with more linear D-R functions, and
 - at population scales

- ambient air pollution
- ▲ second hand smoke
- household air pollution
- active smoking

Beware the Message on Cookstoves & Black Carbon

- Don't blame climate change on the basic need of women in developing countries to cook food for their families.



"Climate experts say we should tell villagers in developing countries to reduce the amount of cooking smoke they generate to help fix global warming. You know, it's as if these people don't hate us enough already. I mean, they live in mud huts, they have thatch roofs, their clothes are made of straw. We pull up in a bunch of Humvees and SUVs going, 'Hey, you want to cut the smoke out of here?'"

Jay Leno
April 17, 2009

PCIA Results

- **Developed PCIA Website and Published 30 Quarterly Bulletins**
- **Organized five Biennial Forums:** the fifth, held in Peru in 2011, had 250 participants from 42 countries
- **Organized and chaired an ISO International Workshop Agreement Meeting:** over 90 participants unanimously approved 1st-ever Cookstove Guidelines for 4 performance measures
- **Developed and Disseminated Cookstove Best Practice Guidance on 4 priority areas:**
 - Meeting the social and cultural needs of local communities;
 - Improving technologies, fuels and practices for reducing indoor air pollution and fuel use;
 - Developing commercial markets for clean and efficient technologies and fuels; and
 - Monitoring and evaluating health, social, economic and environmental impacts.



Phase 1 Accomplishments



Fostering and Enabling Environment

- 27 Alliance research studies, leveraging ongoing related efforts to maximize value and ensure rapid delivery of results
- Over 30 countries engaged in the development of ISO standards
- Interim international standards established in four critical areas of technology performance including indoor and total emissions, efficiency, and safety
- WHO Indoor Air Quality Guidelines announced
- 13 testing centers around the world enhanced through grants and many more engaged in training and collaborative opportunities
- Global Burden of Disease shows and global community accepts that HAP is 4th highest public health risk, and 2nd highest for women, in the developing world



Strengthening Supply

- Over \$50m in investment resources that are supporting production and distribution of cookstoves
- 3 different capacity building mechanism developed in support of 100 enterprises
- 5 different financing mechanism in place to support innovation and growth that have supported 40 enterprises; including a women's empowerment fund
- \$15m to support innovation in the sector
- Attracted over \$170m in carbon finance



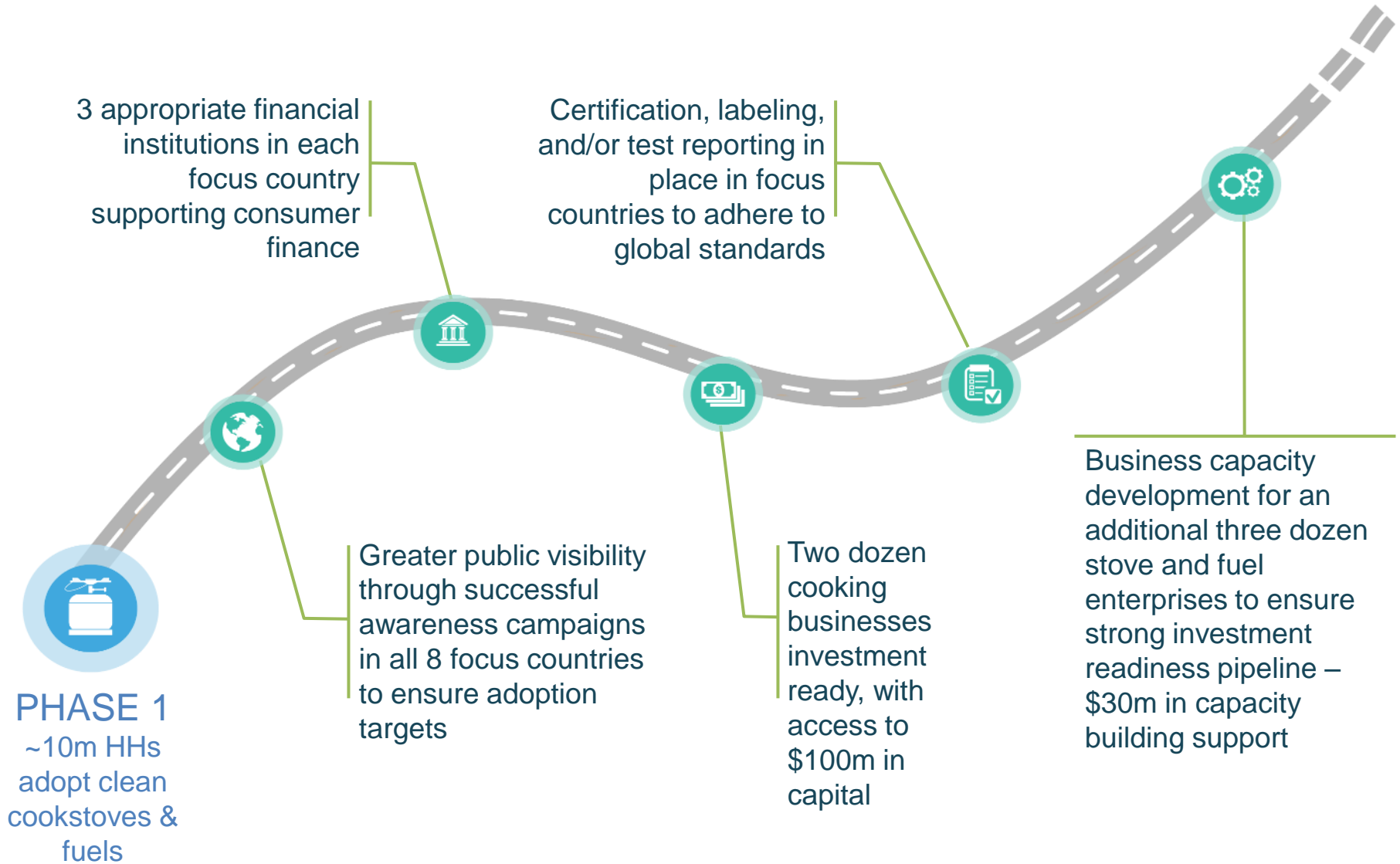
Enhancing Demand

- Customer segmentation studies completed in 3 focus countries
- Customer financing and distribution studies in progress – 2 large national/Pan African banks finalizing plans for support of consumer finance
- 4 Alliance Ambassadors have come on board to champion the cause
- Growing in-country media attention

Phase 2 represents a significant shift towards demand creation while continuing to strengthen supply and the enabling environment.



By the end of Phase 2, the Alliance will strive for 40m HH adopting clean cookstoves and fuels.



Phase 2 Roadmap (cont.)

Meaningful policy and regulatory reforms to enable cookstoves and fuels markets, particularly in Alliance focus countries

Refugees and IDPs in four SAFE focus countries adopt clean cooking solutions

Research results demonstrating the net environmental and climate benefits of clean cooking, including reduction of environmental degradation, black carbon, and air pollution

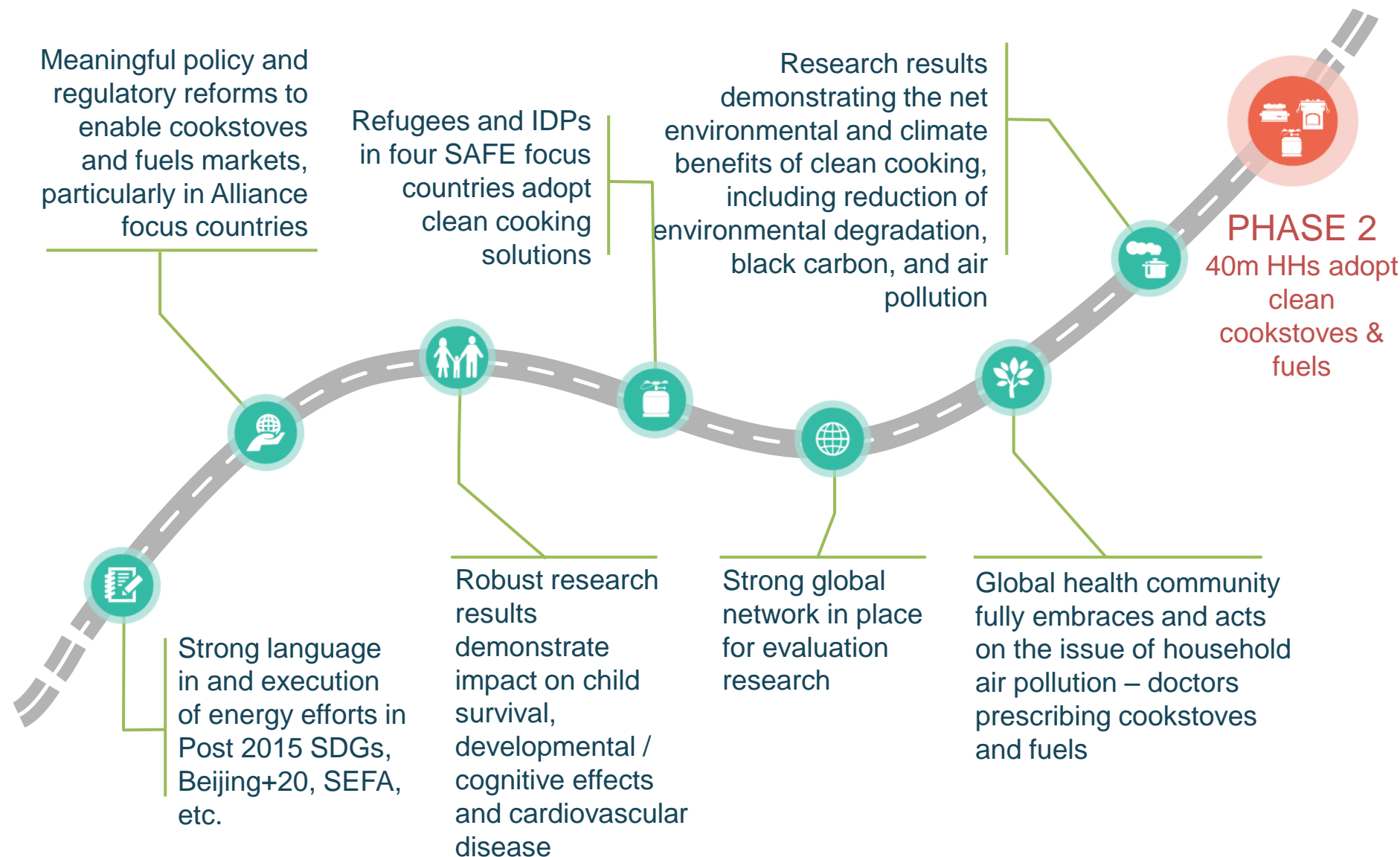
PHASE 2
40m HHs adopt clean cookstoves & fuels

Strong language in and execution of energy efforts in Post 2015 SDGs, Beijing+20, SEFA, etc.

Robust research results demonstrate impact on child survival, developmental / cognitive effects and cardiovascular disease

Strong global network in place for evaluation research

Global health community fully embraces and acts on the issue of household air pollution – doctors prescribing cookstoves and fuels



Alliance strategy on clean fuels is country-specific:

major efforts in China and India; market-specific enabling activities elsewhere



China

- National and province level awareness raising campaign
- Major emphasis on driving sales of electric induction stoves and clean fuels such as LPG where possible, and efficient and cleaner biomass solutions (including pellets and briquettes) in other regions
- Improve government investment and policies for targeted innovation, distribution, and infrastructure
- Explore potential for greater expansion of biogas into cooking and heating sector



India

- National and state level awareness raising campaign
- Major emphasis on driving sales of electric induction stoves and clean fuels such as LPG where infrastructure (e.g., access to electricity and/or LPG) and income levels make it possible
- Substantial parallel efforts to promote efficient and cleaner biomass solutions
- Improve government investment and policies for targeted innovation, distribution, and infrastructure



Ghana

- Targeted awareness raising campaigns in at least five regions, with a focus on fuels
- Continued engagement with partners and ministries to address challenges of the LPG market, and as those are addressed, to expand the LPG market accordingly
- Share successful briquette enterprise case studies with ministries to support scale up



Kenya

- Targeted awareness raising campaigns in 28 of 47 counties
- Build capacity for briquette community to scale up production and distribution of these fuels, and to share best practices across the sector
- Continued engagement with partners and relevant ministries to address market barriers to LPG such as affordability and distribution infrastructure