

Beyond 2020 and 100 Million Clean Stoves: Roadmap to a Billion Improved Stoves

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Abstract

Provide a vision for how we can accelerate cookstove construction and adoption well beyond the near term, and achieve universal clean cooking within our lifetimes.

Persuadable: Book and Concept

- Book by Al Pittampalli, copyright 2016.
- Paul Anderson is currently reading it. Important to introduce in this Stove Summit.
- “... the genuine willingness and ability to change your mind in the face of new evidence.” A mark of leadership.
- Contrast “confidence, consistency and conviction” with “humility, inconsistency and radical open-mindedness” (Examples given.)
- Good leaders are persuadable.

A. Introduction: Racing to stand still

- The world has about three billion persons who cook on stoves that are seriously deficient and mainly utilize solid fuels of biomass or coal.
- If 6 persons per household, that constitutes 500 million households needing better cookstoves.
- Ambitious plan of the GACC to upgrade 100 million households between 2010 and 2020. This will naturally focus on the easiest one-fifth of the needy households
- As of 2016, the number of improved stoves is seriously deficient. Also, new stoves do wear out, so allowance is needed for replacement stoves.

- Many stoves that are counted are in fact only marginally better than what the households were using. For example, should production of the KCJ (Kenyan Ceramic Jiko) stoves be counted? All improvements are not equal improvements.
- The WB and GACC have classified stoves, recognizing Advanced Clean Cooking as being separate from the simpler category of Improved cooking (see chart).

FIGURE 1.1:
Overview of Improved and Clean Cooking Technologies

	Improved Solutions		Clean Cooking Solutions		
	Legacy and Basic ICS	Intermediate ICS	Advanced ICS	Modern Fuel Stoves	Renewable Fuel Stoves
					
					
					
Key Features	Small functional improvements in fuel efficiency over baseline technologies; typically artisan produced	Rocket style designs with highly improved fuel efficiency and moderate gains in combustion efficiency; some with high-end materials	Fan jet or natural draft biomass gasifiers with very high fuel and combustion efficiencies; may require pellet/briquette fuel	Rely on fossil fuels or electricity, have high fuel efficiency, and very low particulate emissions	Derive energy from renewable non-woodfuel energy sources; some are supplementary rather than primary cookstoves
What's Included?	<ul style="list-style-type: none"> • Legacy biomass and coal chimney^a • Basic efficient charcoal • Basic efficient wood 	<ul style="list-style-type: none"> • Portable rocket stoves • Fixed rocket chimney • Highly improved (low CO₂) charcoal stoves 	<ul style="list-style-type: none"> • Natural draft gasifier (TLUD or side-loading) • Fan gasifier/fan jet • TChar stoves 	<ul style="list-style-type: none"> • LPG and DME • Electric and Induction • Natural gas • Kerosene^b 	<ul style="list-style-type: none"> • Biogas • Methanol • Ethanol • Solar ovens • Retained heat cookers
Potential Impact:	Moderate			High	

Classification of Stoves by ESMAP and GACC (2015)

The State of the Global Clean and Improved Cooking Sector

<https://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdf>

- **Improved Solutions**

- Legacy and Basic ICS – Simple & Traditional
- Intermediate ICS – Rocket & Highly Improved Charcoal

- **Clean Cooking Solutions**

- **Advanced ICS [Micro-gasification of dry biomass]**
 - Fan Jet
 - TLUD – Fan Assisted (FA) & Natural Draft (ND)
 - TChar
- Modern Fuel Stoves – LPG, Electric & Nat. Gas
- Renewable Fuel Stoves – Biogas, Ethanol & Solar

- And in the category of the gasifier stoves that use solid dry biomass, even the most ambitious tallies can only show less than one million stoves, and that information is sketchy and includes 400,000 Oorja stoves made before 2010.
- And by some estimations, between 2010 and 2020, the world's population in the impoverished regions that need clean cooking will have grown by approximately 100 million households.

- We might not be racing to stand still. We could be racing and falling even further behind.
- The details of these numbers are not as important as the fact that we need to face the realities and the challenges.
- My objective is to illuminate a possible pathway for solving the cookstove problem of the world, not just for the initial 100 million stoves.

B. Broad definitions and targets

- Many households in impoverished societies have more than one cookstove. This reflects having different cooking tasks (such as small tea and snacks, full meals, heating bath water, and occasional larger gatherings) and using different fuels. This is called “stove stacking” and is to be expected, and even encouraged to promote efficiencies of time and fuel. Therefore, the number of stoves needed is better estimated as one BILLION clean cookstoves.
- Stove live-expectancy might average 5 years, so just for replacements the production of stoves could be 200 million PER YEAR. This is big business, and so is the business of various fuel supply chains.

- But the needy populations are mostly poor or extremely poor. IMO, efforts to solve the cookstove problem with entities with executive structures with Western World affluent society salaries and profit margins are simply asking for disappointment. The exception could be if corporate owners / shareholders would accept “societal benefits” as partial payment. But there is very little evident sense of “sacrifice” by affluent persons and entities. (For further discussion separate from this presentation.)
- In 2012 I stated in my keynote address to the ETHOS conference a projection to have 30 million TLUD gasifier stove as part of the goal of 100 million stoves by 2020. What has happened with TLUD stoves between 2012 and 2016 is documented in the TLUD history available on the Internet. Now, 4 years later, the goal needs to be restated as 7 million by 2020 and 30 Million by 2022.

- And let's extrapolate further. How do we accomplish one billion clean-burning stoves into 500 million households, and preferably by 2026? The answer: Divide and conquer. The following figures are based on HouseHolds (HH). These estimates do NOT count those stoves that are merely secondary stoves in the households. As secondary stoves, they might be excellent. Let the market decide.

Other Stoves for 250 Million Households

- 1. Allocate 100 million households to the advance clean cooking technologies that do not use solid fuels. That would be 100 million HH to be serviced by LPG, Biogas, alcohol, electricity, solar, etc. by 2026.
- 2. Allocate 50 million households that would use solid coal in appropriately designed gasifier stoves. This could be where biomass fuel is scarce and appropriate coal is plentiful, such as in Mongolia.
- 3. Allocate 50 million households that would use highly improved charcoal-burning stoves.
- 4. Allocate 50 million households that would use solid biomass in Rocket-style cookstoves

TLUD Stoves for 250 million households

- 5. For TLUD and other micro-gasifier stoves, the target is 250 million households by 2026 to have micro-gasifier cookstoves using dry biomass as fuels, with this being renewable and sustainable fuels. That is over 8 times larger than the earlier 30 million stove target by 2020. The breakdown would require annual TLUD production in the following estimated numbers:

Projections for TLUD Stove Growth to 2026

Year	New units	Factor of growth over previous year	Cumulative total (rounded)	
2015	4 K	~2	15 K	
2016	10 K	2.5	25 K	
2017	50 K	5 (Can be done in one company. Easily done with several companies)	75 K	
2018	250 K	5 (Early expansion areas include India, southern Africa, Ghana, Haiti, Guatemala, Mexico, Vietnam, + .)	325 K	
2019	1 Million	4 (20 times the 2017 production)	1.3 million	
2020	3.3 M	3.3 (66 times...)	4.3	
2021	10 M	3 (200 times)	15 million	
2022	20 M	2 (400 times ...) (Was the 2020 goal)	35 M	
2023	33 M	1.6 (640 times ...)	70 M	
2024	50 M	1.5 (1000 times)	120 Million	
2025	70 M	1.4 (1400 times ...)	190 M	
2026	90 M	1.3 (20% replacement)	280 + M	

- That all sounds bold and brash, but if you are at all interested, I will now give some solid evidence to support that these projections are plausible. We need to discuss key topics:
 - Acceptance by users.
 - Fuel supply chain.
 - Options for financing.
 - Char-production and income earning.

C. TLUD-ND Success in West Bengal, India

- In a densely populated rural area of the Ganges Delta between Kolkata, India and the Bangladesh border, within a radius of about 12 miles (20 km), over 11,000 households are using the Champion natural draft TLUD stove manufactured by Servals of Chennai. This includes seven villages with adoption rates between 25% and 40% of the households. The stoves are purchased for US\$15 each after a project subsidy of about 50% of cost.
- Details include: Carbon credits, support services, fuel supply, charcoal sales, stove maintenance and service included, successful marketing to BOP (Base of Pyramid) households, job creation.
- Manufacturer Servals has capacity to produce 5000 stoves per month, but is currently only producing 500 per month. Plans for expansion of efforts into other areas of India. Sponsors / funding would be appropriate.

Micro-Gasification Stoves

- **Gas-burning stoves**
- **That make their own gases**
- **From low-value biomass fuels.**
- **And at low-cost for the stove and the fuel!!**



C. TLUD-ND Success in West Bengal, India

- Reference: *Boiling Point* article (in review for publication in February 2017).
 - **Char Production and Other Enablers for Cookstove Acceptance:**
 - **Case Study of Champion TLUD Gasifier Stoves in the Ganges Delta, India**
- Four co-authors.
- Embargo on release until publication or if with permission of the authors and the editors of *Boiling Point*.

D. TLUD-FA entry in southern Africa.

- A project lead by David Lello of Ekasi Energy PTY LTD.
- Stove: FAABulous 2 in 1 Appliance (includes stove and home energy).
- Show and discuss.
- Pellet fuel and mass manufacturing with existing industrial capacities.
- Note similarities to “Juntos B” TLUD of 2004.
- PAYG financing of the advanced model.
- The Ekasi business plan is available to qualified associates and investors.

FABulous

TWO IN ONE HOME POWER



A COMPLETE OFF-GRID ENERGY SOLUTION IN ONE SIMPLE TO USE APPLIANCE



SAFER



CHEAPER



GREENER

FAABulous 2 in 1 Power Appliance User Features

#1 Removable Gasifier Canister

- Simple 2 stage fuel combustion canister, with no moving parts.
- Vertical handle allows easy one hand operation to load, reload and empty the fuel canister without moving the pot or stand.
- Additional gasifiers canisters available with varying power outputs makes upgrading easy.

#2 Fan Assisted Combustion

- Better combustion and smoke reduction from the time the fuel is lit. No waiting time as experienced with ND (Natural Draft) gasifier designs.
- Simple heat/combustion control with fan speed controller.
- Reduced heat loss and safer operation as bottom fed air directs the combustion heat up.



#3 Exchangeable Pot Underskirt

- Faster cooking times with cone shaped underskirt for optimised heat transfer to the pot.
- Spilled liquids trapped in a liquid catch ring and do not enter and extinguish the fire.
- Optional cast iron frying / grilling attachment when removing and replacing the pot skirt on the pot stand.

#4 Smart Base Power Option

- Battery power for night time electrical needs with built-in PV Solar Home System with lighting & phone charging output ports.
- Affordable payments terms with a "Rent to Own" PAYG scheme which allows the unit to be paid off as it is used.
- Easy tracking of energy use with a Bluetooth Smart Mobile App.

- E. Implementation notes:

- The ND and FA versions of TLUD stoves are compatible and can be mutually supportive for projects in the same area. Example would be fuel supply chains that serve both ND and FA stoves.

- Different TLUD stoves for different household socio-economic conditions.

- Different TLUD stoves relating to fuel types and sizes of cooking tasks.

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F. Financial issues for implementation

- 1. There are many financial sources including profit-making businesses (both large and small), philanthropy, government attention to the needs of its people, and the people themselves.
- 2. Basic TLUD stoves for under US\$30. Add-on features to meet aspirational desires of households.
 - Specifics: The case study of West Bengal, India
 - a. No philanthropy thus far. (also no outside assistance such as from the GACC.)
 - b. Initial start-up funding of approx.. \$250,000 to reach the “critical mass” of about 4000 stoves in one small area. Funding is being recovered via carbon credit trading. Each stove earns 4 credits (approx.. value of $\$2.20 \times 4 = \8.80 per year.)
 - c. Stove life / maintenance is based on the life of the carbon credit project, which is 18 years.

- d. Initial payment normally \$15, but for impoverished BOP households the payment for one stove is only \$9.80 plus three monthly payments of \$3 that is covered by earning from charcoal sales.
- e. Charcoal buy-back (at \$0.12 per kg of TLUD char) earns about \$3 per household per month (\$36 to \$43 per year.) This is cash into the hands of the household.
- f. Fuel supply chain is established, with approx. \$900,000 annual sales of sustainable forest and orchard wood.

Notes

- Quote from Daniel Burnham, architect of the Chicago Worlds Fair of 1893: “Make no little plans; they have no magic to stir men’s blood ...”
- Note: Why 2026? In 2001, Dr. Thomas B. Reed, a key person in TLUD stove history, set a goal to have a billion gasifier stoves in use before he turns 100 years old in 2026. Dr. Reed is now 90 and in good health.
- Paul Anderson reserves to right to change his mind and to correct any errors or emissions in this presentation.
- We should all be “persuadable” to favor what can truly be beneficial to the less advantaged people whom we desire to serve.

- Be involved!!

- Rotary

Questions and Discussion