

# Scale-up of TLUD Stoves with PWG in 2017-2018

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# Submitted Abstract

- Following the highly successful pilot project with 11,000 Champion TLUD stoves in Deganga, major roll-out activities are underway in Uluberia and other communities close to Kolkata, West Bengal, India. Sales of over 3000 stoves per month in late 2017 are increasing with additional projects described in the presentation to show some variations of the financial arrangements. Significant TLUD stove activities are also discussed regarding South Africa, Ghana, Uganda, and Honduras. Projections for 2018 and beyond are presented for cooking with PWG w/ CCC (Pyrolytic WoodGas with Close-Coupled Combustion).

# Outline

- What is PWG or PW Gas?
- TLUD design activities in 2017
- Project growth in West Bengal, India
- Ghana and Honduras and Uganda
- Assam Tea Estate experiences with TLUD stoves
- Look ahead for 2018

# What is PWG or PW Gas?

- **Pyrolytic Woodgas** is what is actually combusted in TLUD cooking.
- Shortened to be **PWG or PW Gas**, to be in the same category as LPG or LP Gas, which also **is an intermediate fuel**, that is, it is derived or created from a primary or raw fuel. Crude oil or natural gas can yield LPG. Solid dry biomass (such as wood and agro-refuse) can yield PWG.
- In general, **gases burn more cleanly than solids**, partly because of the ease of mixing of air (with O<sub>2</sub>) and other gases.
- **PWG is associated with charcoal-making stoves**, NOT with full combustion that includes char-gasification (char-burning).
- PWG is associated with **simple, straight-forward, basic pyrolysis**.
- PWG is **NOT producer gas** or syngas or other gasification products that **might** be called woodgas, but are not PYROLYTIC Woodgas.

# Matching fuels and stoves to get clean burning.

- LPG with TRHB (Tank, Regulator, Hose, Burner)
- PWG with CCC (Close Coupled Combustion) Such as: TLUD ND or FA
- Electricity with PG-HE (Power Grid and Heating Element)
- Biogas with DTHB (Digester, Tank, Hose, Burner)
- Solar with (SC-PP) (Solar Collector and Pot Positioning)
- Alcohol with TpDB (Tank(pressurized), Distributor, Burner)
- Alcohol with CEB (Container, Evaporator, Burner)
- Kerosene with CEB (Container, Evaporator, Burner)
- Charcoal with (please specify): BBQ or KCJ, “improved” or brazier....
- Stickwood with Rocket or 3-Stone or Mud or campfire or fireplace  
....

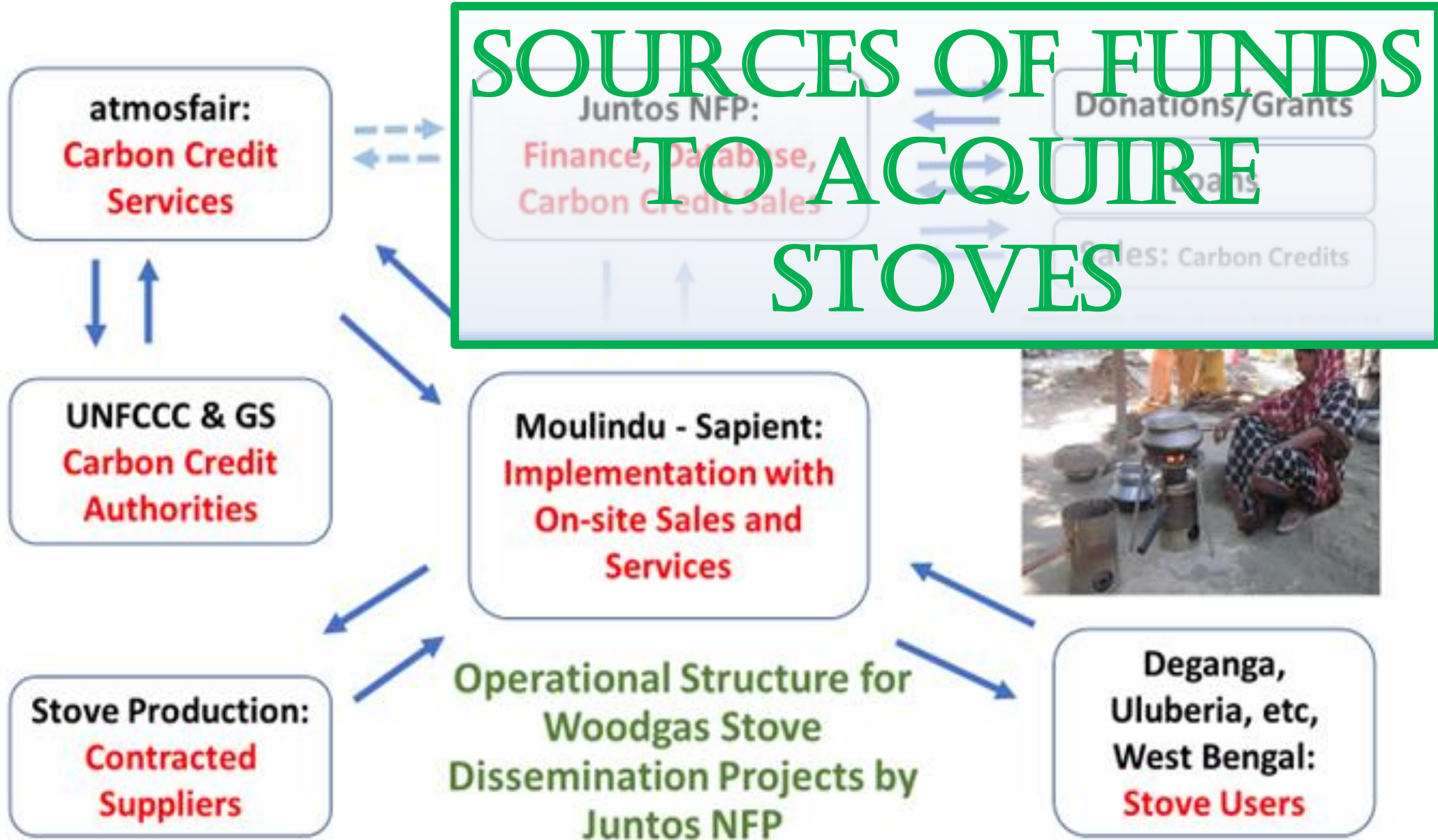
# TLUD design activities in 2017

- Mini-TLUD – Honduras
- FAABulous TLUD – South Africa
- Insert for changing the fuel chamber capacity in the Champion TLUD
- Akha TLUD Stove in Bangladesh (Report by Dr. Julien Winter.)
- Harris 3-level mixing for improved TLUD combustion

## Project growth in West Bengal and Assam, India.

- Pilot project had 11,000 Champion TLUD stoves in use by early 2016.
- Expansion project started in March 2017, adding 3500 more stoves per month, totaling 35,000 in 2017.
- Industry-sponsored 4000 additional TLUD stoves on tea estates in Assam. (further details later)
- Total of about 50,000 Champion stoves in use today, and growing.

# Business model for TLUD stove project expansion





# Ghana and Honduras and Uganda

This report is available in full at  
[www.drctlud.com](http://www.drctlud.com)

## ***CHANGING LIVES OF TEA ESTATE LABORERS WITH TLUD GASIFIER STOVES***



This slide deck has been adjusted in a few ways by Paul Anderson, with permission of the authors. Additions and changes are presented in **red type**. Monetary amounts are presented in **US\$**, using the mid-January 2018 exchange rate of INR 64 = US\$ 1.

***WEST JALINGA TEA ESTATE  
SAPIENT INFOTECH  
ATMOSFAIR, BERLIN***

This slide deck is posted, with authors permission, at [www.drctlud.com](http://www.drctlud.com) . A short version presented by Paul Anderson at the ETHOS Conference in Kirkland, WA, USA on 26 – 28 Jan 2018, is also posted there.

# Assam Tea Estate results

- Report with 25 PowerPoint slides is available in the “Quick Picks” at: [www.drtylud.com/](http://www.drtylud.com/) Provides important background info.
- Project started in 2016. **Now 4000 stoves installed.**
- Source of funding of the stoves are the tea estates that provide the stoves to the households of their workers.
- Fuel is provided by tea estates as part of employment contracts.
- The slides are loaded with data and presented in small print for individual reading, not for a lecture room large screen.
- A selection of the slides are provided here:

## *How the TLUD addresses the need*

- ***Needs of the poor***
  - ***Saving in fuel cost*** : 50 – 60% saving in fuel and fuel cost.
  - ***Indoor Air Pollution***: Significantly reduces emissions.
  - ***Improved quality of life*** : Longer cooking duration; better flame control; Frees up time.
- ***Needs of the Economy***
  - ***Energy Conservation***: Saves fuel : TLUD efficiency is 39% Vs 9% for 3 stone stove; use of alternate energy
  - ***Entrepreneurship***: Catalyses economic activity at the grassroots ; fuel sizing and distribution, biochar collection
- ***Needs of the Planet***
  - ***Deforestation***: Versatility of fuel; including waste materials at almost zero cost; Tree felling not necessary.
  - ***Climate Change***: Reduces net addition of CO<sub>2</sub> into the atmosphere; Process carbon-neutral if the resultant charcoal is burned.; carbon-negative if charcoal is taken out and used as a soil conditioner;

**A TLUD STOVE GENERATES 4 CARBON CREDITS PER YEAR**



# THE MANAGEMENT RESPONSE

- Identification of efficient cooking solution – save wood & reduce carbon dioxide emissions
- Pilot project to check suitability of technology
- Providing efficient TLUD cook stove to Labor Communities



# USER TRAILS

- Superb adaptation by labor communities
- They felt distinct advantage of using this stove
- Wood savings a real attraction for them and charcoal buyback gives them extra income
- Other benefits like better Indoor Air Quality also felt
- A huge lift in the overall cooking experience as the stove teaches them organized cooking



**The final five slides contain the financial data.**

# ***THE ECONOMIC BENEFITS OF THE PROJECT***





**Per 1000 stoves, during 7 years,  
investment = US\$ 153,125.**

## *Tea Estate Investment*

All calculations are with a base of 1000 stoves

1.	Cost of stove - @INR 3150 per stove ( one time ) [US\$ 49.22 ]:	3150000	[US\$ 49,220 ]
2.	Implementation cost @INR750 per stove ( one time ) [ \$ 11.72 ]	750000	[US\$ 11,720 ]
3.	UN+GS Registration Fees \$4500 ( one time ) [ US\$ 4500 ]	300000	[US\$ 4,500 ]
4.	Annual verification fees @INR500000 [US\$ 7812.50 ] X 7 Years	3500000	[US\$ 54,688 ]
5.	Annual UN+GS Issuance Fees \$4500 X 7 years [ US\$ 4500 ]	2100000	[US\$ 31,500 ]
<b>Total Project cost ( 7 Years ) (for 1000 stoves)</b>		<b>9800000</b>	<b>[U S\$ 153,125 ]</b>

**For the total of 4000 TLUD stoves on Jalinga Tea Estate, that is US\$ 1,071,875 during 7 years.**

**On a “per stove” basis, that is US\$ 153 during the total of 7 years, or US\$ 22 per year average.**

**There are also some annual expenses of general support covered by Jalinga Tea Estate.**

# The Charcoal Economics

All calculations are with a base of 1000 stove deployed & Assumption of 100 MT coal usage for driers per month.  
**Per month. MT = Metric Ton**

- Cooking 2 meals per day, each TLUD in use generates 25 kg/mo. X 1000 = 25 MT
- 25 MT of charcoal generated every month as cooking by-product
- Purchased @ INR 4000 per MT = INR 100,000 per month [ US\$ 1,563 / mo. ]
- \*\*\*\*\*
- \*\*\*\* **Costs associated with “Dryer-Coal”** (the coal used for drying the tea) \*\*\*\*
- Cost of dryer-coal INR 7500 per MT [ US\$ 117 ] [Rather low-quality coal].
- @ 75:25 Coal / Char ratio. There is a 25 MT dryer-coal savings per month
- Gross cost savings per month =  $25 \times 7500 = \text{INR } 187,500$  [ US\$ 2930 per mo.]
- Net cost savings per month =  $\$2930 - \$1563 = \text{US\$ } 1367$
- Cost saving per year = \$16,404 and Cost savings during 7 years = US\$ 114,828

# Carbon Credit Economics

- Because charcoal replaces coal, each stove generates 2 CER per year.
- Current Market Price of each CER = 4 € [ US\$ 4.76 ]
- 1000 stoves = 2000 CER X 4 € = 8000 € [ US\$ 9520; or US\$ 9.52 per stove ]
- 8000 € = INR 6L per annum; X 7 yrs = 42L [ US\$ 66,640; or \$ 66.64 per stove ]
- For the total of 4000 stoves, this carbon credit value is US\$ 266,560 in 7 years. ]

**Note: CER prices are highly volatile & will depend upon prevailing prices at the time of sale**

**Note: This does not include an equal amount of money from the OTHER 2 carbon credits generated because the TLUD stoves reduce fuel consumption. Part of those credits cover contracted obligations and expenses related to atmosfair, the agency that processes the carbon credit transactions. The other part (approx. \$ 26,600 in 7 years) goes to Jalinga to partially cover the verification expenses (lines 4 & 5 in slide 21)**

# Economic Summary

Calculations are per 1000 TLUD stoves.

Total investment in 7 years 98 L [US\$ 153,125 ]

## REVENUE:

From 2 CER per year X 7 years = 42 L [ US\$ 66,640 ]

From part of other CER (previous slide) [ US\$ 26,600 ]

From coal savings X 7 years = 73 L [ US\$ 114,828 ]  
[ 187,500 X12months]

Total Revenue in 7 years per 1000 stoves 133 L [ US\$ 208068 ]

Gross net gain is 119 L [ US\$ 54,943 ]  
[Or nearly US\$ 220,000 from 4000 stoves.]

“Gross” because some expenses are not noted here, such as for charcoal collection, stove maintenance, support personnel, and specific admin.

- **Calculations are per 1000 TLUD stoves.**
- **Total investment in 7 years** **98 L** **[US\$ 153,125 ]**
- **REVENUE:**
  - From 2 CER per year X 7 years = 42 L [ US\$ 66,640 ]
  - From part of other 2 CER (previous slide) [ US\$ 26,600 ]
  - From coal savings X 7 years = 73 L [ US\$ 114,828 ]
  - [ 187,500 X12months]
- **Total Revenue in 7 years per 1000 stoves** **133 L** **[ US\$ 208,068 ]**
- **Gross net gain is** **35 L** **[ US\$ 54,943 ]**
- [Or nearly US\$ 220,000 from 4000 stoves.]
- “Gross” because some expenses are not noted here, such as for charcoal collection, stove maintenance, support personnel, and specific admin.

# Summary of Full Impact

- The Charcoal-related aspect alone provides a return on investment (ROI) of 136 % in 7 years, or ~5% per annum, while covering all of the expenses to have the stoves in use.
- This does NOT count the other returns and benefits from using those stoves:
  - A. Value to atmosphere for its part of the 2 carbon credits per stove from less fuel usage
  - B. Assisting Jalinga Tea Estate to show that it is carbon neutral.
  - C. Better forestry protection because fewer trees are cut.
  - D. Healthier kitchens and homes because of less smoke. (savings on health care)
  - E. Happier cooks -- less attending to the stoves (time savings) , cleaner kitchens, cleaner pot bottoms, generally better kitchens
  - F. US\$ 131,250 income into the pockets of the households from selling the charcoal. (About INR 100 or US\$ 1.56 per month (\$ 19/yr) per Household)
  - G. Other benefits?? Consider better labor relations because management brought these stoves to the households
  - H. The world's atmosphere has 112,000 fewer tons of CO<sub>2</sub>e because of these stoves being used.

The Charcoal-related aspects paid the bills and provided a return on investment (ROI) of 136 %, or 5% per annum.

## And in addition:

- A. Money from additional 2 carbon credits per stove for less fuel usage.
- B. Jalinga Tea Estate is carbon neutral.
- C. Better forestry      D. Healthier kitchens with less smoke.
- E. Happier cooks -- less attending to the stoves (time savings), faster cooking, cleaner kitchens, cleaner pot bottoms, generally better kitchens.
- F. US\$ 131,250 income into the pockets of the households from selling their charcoal.
- G. Other benefits?? Consider better labor relations because management brought these stoves to the households
- H. The world's atmosphere has 112,000 fewer tons of CO<sub>2</sub>e because of these stoves being used.

## Look ahead for 2018

- Continued growth around West Bengal of about 3000 per month.
- An additional, privately sponsored TLUD stove project in Budge-Budge, south of Kolkata, anticipating 25,000 stoves during 2018.
- Ghana stove project gets underway
- Possible small grant for TLUD stove improvement research in Honduras.
- Juntos NFP (headed by Paul Anderson) is seeking major donors.