UNHCR's Waste to Value Sanitation Portfolio

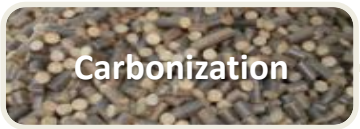
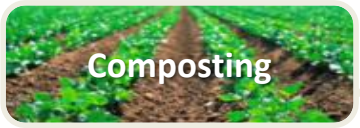
Murray Burt
Senior WASH Advisor

Protracted Emergency Situations

Focus on improving long term access to WASH services by adopting more cost efficient technology solutions

Waste-to-value sanitation solutions

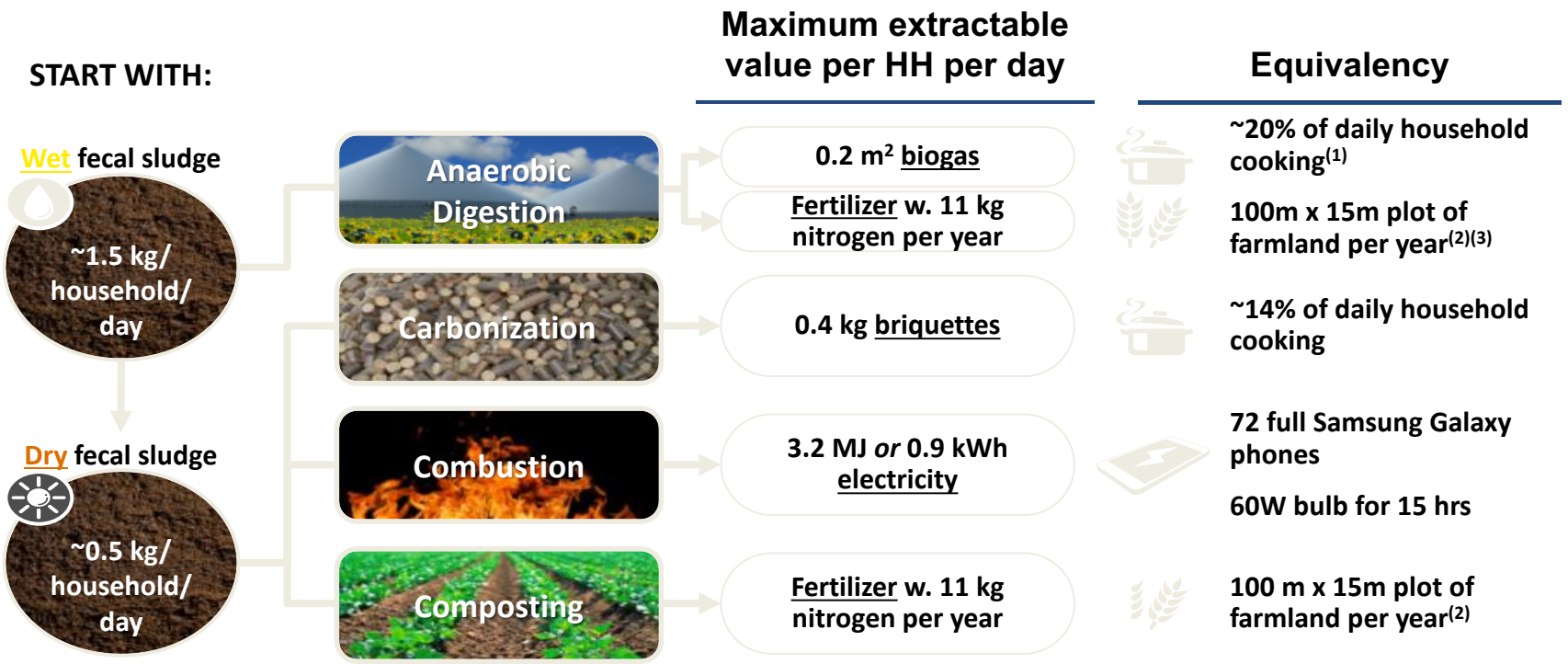
can process human waste to yield four major types of byproducts...

Waste processing method	Byproducts that address refugee needs	Current solutions
	**Biogas** *(cooking, lighting)*	All camps and all refugees need cooking fuel... ...Wood, kerosene, ethanol currently used for cooking... ...However, no single source can meet 100% of demand
	**Briquettes** *(cooking)*	
	**Electricity** *(lighting, charging mobile phones, pumps, infastructure)*	Solar panels and lanterns are well-received by refugees... ...And the price of solar will decrease even further
	**Fertilizer** *(slurry, biochar, compost for agriculture)*	Not all populations practice agriculture... ...Even fewer camps have space for farming... ...Plus, fertilizer can't be moved far (too heavy to be efficient)

1. Anaerobic digestion produces both biogas and fertilizer as byproducts, and produces as much fertilizer per kg of waste processed as composting methods.

UNHCR
The UN Refugee Agency

WTV solutions will not cover an entire household energy needs. But it can contribute to renewable supplies

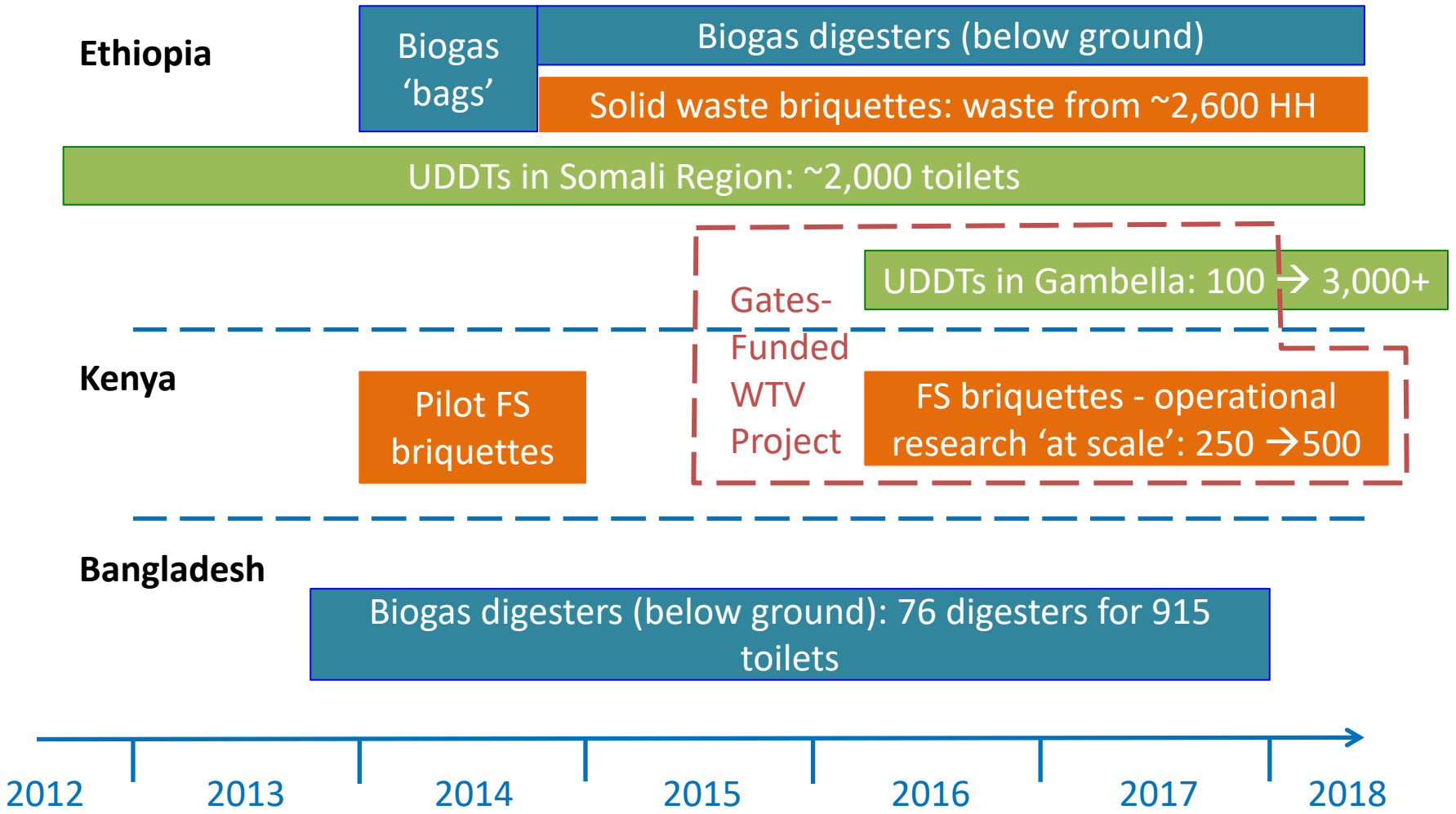


1. **100% of cooking needs could be achieved with additional substrate from manure of 1-2 dairy cows, or 1 cow + 1.5kg organic waste/grass.**
2. Assumes 6% Nitrogen content of dried fecal sludge (Resource Recovery through Wetlands, Herbert Aalbers, 1999) and 60-120 kg/Hectare for maize.
3. Anaerobic digestion slurry is better fertilizer than fresh fecal sludge; nitrogen content is the same but is in more usable form (ammonium); P, K, Mg, Ca contents are similar; pH is higher (LTC Bonten, "Bioslurry as a fertilizer"; C.N. Macharia, "Nitrogen Use Efficiency and Maize Yield."

Additional sources include: "Sustainable Recovery of Energy from Fecal Sludge in India," EAI & BMGF, 2011, p. 105; "Fuel potential of faecal sludge: calorific value results from Uganda, Ghana and Senegal" Journal of Water, Sanitation and Hygiene for Development, 2014; interview with Andrew Foote of Sanivation

UNHCR
The UN Refugee Agency

Timeline for Solution Development



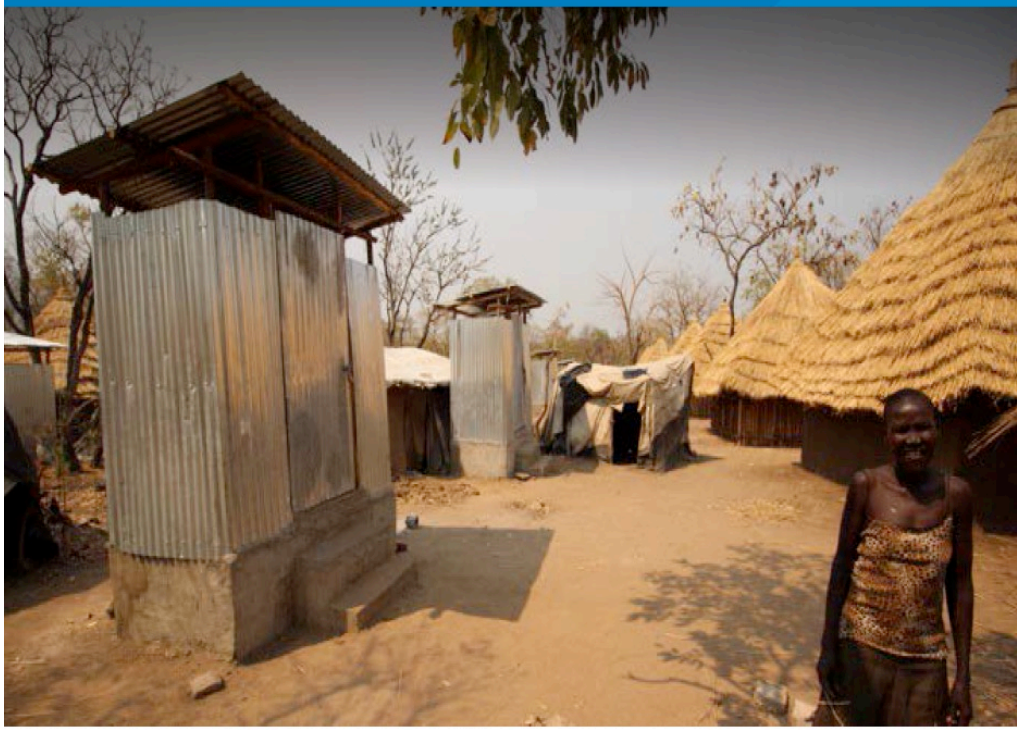
UNHCR
The UN Refugee Agency

OXFAM

UNHCR
The UN Refugee Agency

Urine Diversion Dry Toilets

Standard Operating Procedures for Refugee Camps



Angus McBride and Caroline Muturi, 2017

http://wash.unhcr.org/download/unhcr-uddt-sops/

Double Vault UDDTs

- $ Infrequent emptying reduces costs
- Waste easy to handle
- Good P, K fertiliser & source of organics
- Safety for use on crops not guaranteed (CDC)
- High in organics: decomposition may cause nitrogen leaching
- Long wait for first batch of reuse product
- Long wait to assess impact of fertiliser

Credits: Angus McBride

User Perceptions

- Very positive
- No smell
- No flies

http://wash.unhcr.org/download/unhcr-uddt-sops/

UDDT Waste as Organic Fertiliser

Solutions to safety & efficacy issues are not great

- **Composting:**
  - technically complex (testing feedstock blends)

Photo credit: Oxfam

- **Multiple barrier approach:**
  - acceptance issues
  - tight supervision needed
- **Use on non-food crops:**
  - lack of experience (UNHCR)
  - respond poorly to fertiliser (esp. trees)
  - land tenure issues

http://wash.unhcr.org/download/unhcr-uddt-sops/

UNHCR The UN Refugee Agency

Sanivation Briquette Process

Sanivation

Solid Fuel Briquettes from Container-Based Toilet waste

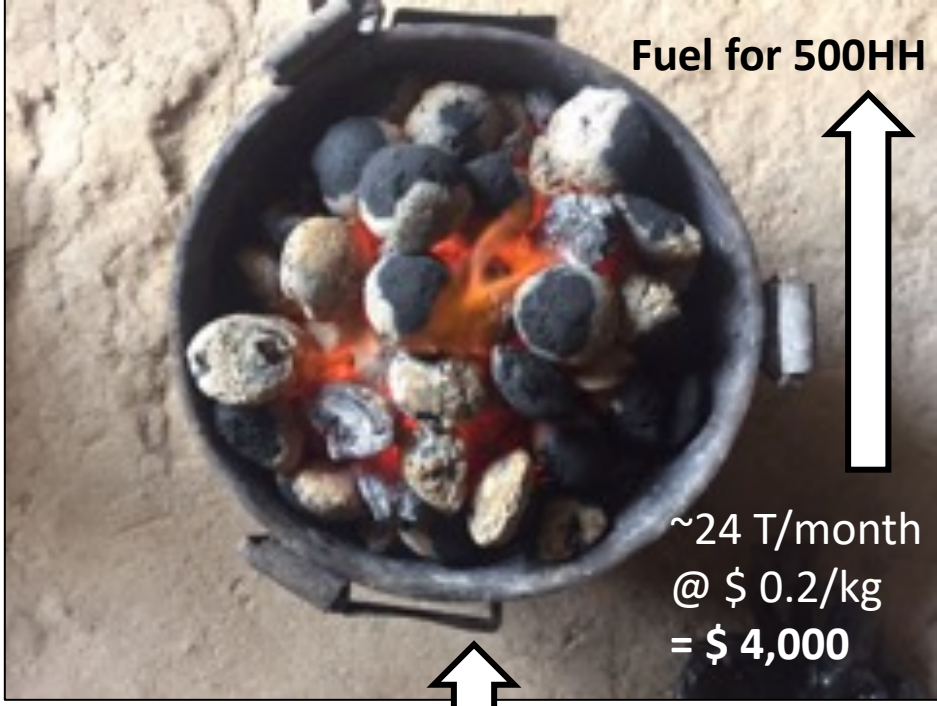
Sanivation Ltd.

Full sanitation chain as a service

- 2014 pilot (30 toilets)
- 2016-17 Op. Res. (250 toilets)
- 2018-19 Financial model (500 toilets)
- UNHCR processes challenging

Sanivation

UNHCR
The UN Refugee Agency



Photos: Sanivation Ltd

Solid Waste To Briquettes in Ethiopia

2,572 HH → Collection → 900kg Solid Waste /month → Carbonisation, Pressing, Drying → 180kg briquettes /month → 3 HH monthly needs (60kg /HH/month)

UNHCR
The UN Refugee Agency

Producing briquettes for 50% (30,000) of camp residents – will require alternative feedstocks

Alternative feedstocks include:

- rufa grass
- maize cobs
- bamboo
- mira waste

Detailed financial, economic and environmental analysis required

UNHCR
The UN Refugee Agency

Biogas Digesters: Bangladesh

53 fixed dome digesters
915 toilets: 19,760 users
10 – 18 toilets per digester
60% of FSM

53 communal kitchens
~10% cooking needs covered
450 families served
44 litres/person/day biogas

Photo credit: UNHCR Bangladesh

UNHCR
The UN Refugee Agency

Biogas Digesters: Lessons

Photo credit: UNHCR Ethiopia

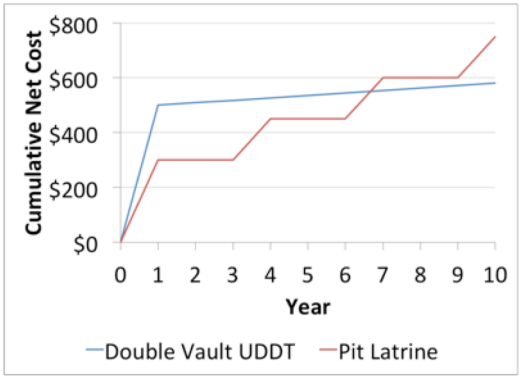
- Below ground-domed digesters best
  - Relatively simple to operate
  - above ground biogas bag digesters in Ethiopia (see left)
- Communal kitchens shared by small group workable but gas metering advisable
- Digestate a good potential fertiliser but requires some ‘maturation’ and appropriate application

UNHCR
The UN Refugee Agency

Provisional Financial Analysis

UDDT

Gambella
Ethiopia



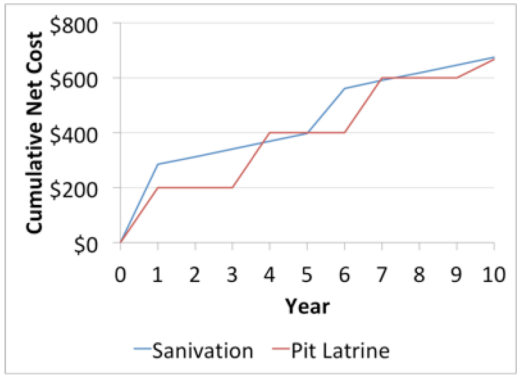
Payback: 5-6 years

(vs.: pit latrine)

Net ~$60/HH/year

Sanivation

Kakuma
Kenya



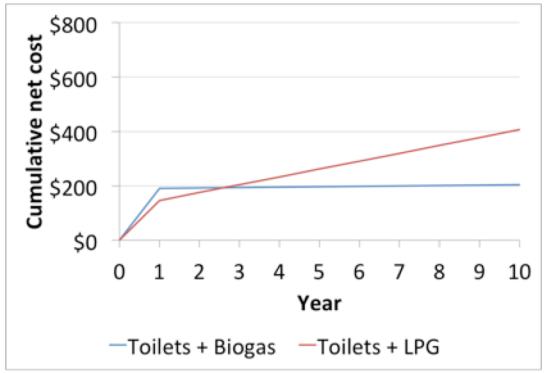
Payback: 10 years

(vs.: pit latrine)

Net ~$60-70/HH/year

Biogas

Cox's Bazaar
Bangladesh



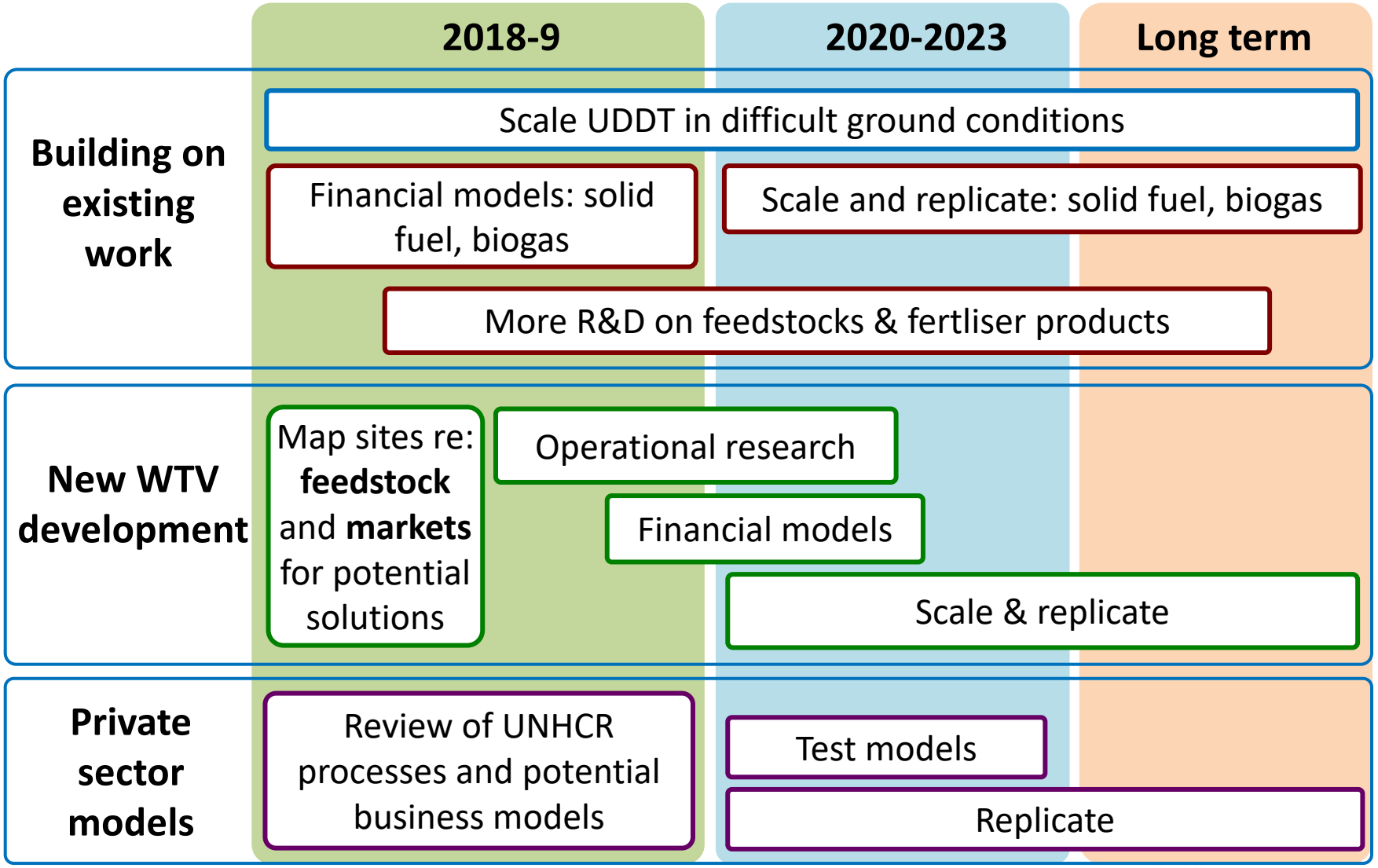
Payback: 2.5-3 years

(vs.: pit emptying, LPG)

Net ~$21/HH/yr

UNHCR
The UN Refugee Agency

Future WTV Development



UNHCR
The UN Refugee Agency

wash.unhcr.org