Adapting To Climate Change And Sustainable Energy

EU-GIZ ACSE

Biogas Tool Kit

Produced under the: Tuvalu Biogas Project
Funded by: European Union (EU) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH – Adapting to Climate Change and Sustainable Energy programme – Components 1 (ACSE) and 3 (EU PacTVET)

Coordinated by: The Pacific Community (SPC)
Implemented by: The Pacific Community (SPC)

Author: Teuleala Manuella-Morris (Local Project Monitoring & Evaluation Consultant, SPC)
Edited technically by: Dr Sarah Hemstock
Photographers: Dr Sarah Hemstock Teuleala Manuella-Morris Kaio Taula Josephine Frasad

Published by: The Pacific Community (SPC)

Coordinated by: The Pacific Community (SPC)

Fundedy by: Tuvalu Biogas Project

Produced under the: Tuvalu Biogas Project

Energy Programme – Components 1 (ACSE) and 3
Adapting to Climate Change and Sustainable Energy Programme (TU TVET)
I t  i s  a  p l e a s u r e  t o  a c k n ow l e d g e  t h e  p e o p l e  w h o  h ave  co nt r i b u te d  t o  t h e  p ro d u c t i o n  o f  t his  h and b ook  t hat  w i ll  a s s i s t  t h o s e  i n t er e st e d  i n  i n s t a l l i n g  f a m i l y  b i o g a s  u n i t s  f o r  e n e r g y  a n d  f o o d  s e c u r i t y  f o r  t heir  f a m i l i e s  i n  o r d e r  t o  i n c r e a s e  t heir  r e s i l i e n c e  t o  t h e  i m p a c t s  o f  c l i m a t e  c h a n g e  a n d  i m p r o v e  l i v e l i h o o d s.

T h o s e  a t  t h e  Pa c i f i c  C o m m u n i t y  ( S P C) :  D r  S a r a h  H e m s t o c k  ( n o w  b a s e d  a t  B i s h o p  G ro s s e t e s t e  U n i v e r s i t y,  U K),  A m e l i a  S i g a,  T i t i l i a  R a b u a t o k a ;  R a v i n e s h  N a n d  f r o m  t h e  G I Z  O f f i c e  i n  S u v a,  F i j i;  t h e  M i n i s t r y  o f  P u b l i c  U t i l i t y  &  I n f r a s t r u c t u r e  a n d  t h e  D e p a r t m e n t  o f  E n e r g y  i n  t h e  T u v a l u  G o v e r n m e n t :  A v a f o a  I r a t a ,  K a p u a  f e  L i f u k a ,  N i e l u  M e s a k e ,  M o l i p i  T a u s i ,  S u l u f a i g a  U o t a ,  K a i o  T a u l a ;  b i o g a s  t r a i n e e s  a n d  a l l  I s l a n d  K a u p u l e  o n  a l l  i s l a n d s  i n  T u v a l u ;  i s l a n d  c o m m u n i t i e s  a n d  t h o s e  w h o  a r e  r e c i p i e n t s  o f  t h e  T u v a l u  B i o g a s  P r o j e c t.

S p e c i a l  a c k n ow l e d g e m e n t,  a l s o,  t o  S i k e l i  R a i s u q e  w h o  h a s  p ro v i d e d  i nva l u a b l e  h e l p  a n d  t e c h n i c a l  e x p e r t i s e  i n  t h e  d e s i g n  a n d  s e t - u p  o f  t h e  d i g e s t e r s.

F o r e m o s t  t o  t h e  E u r o p e a n  U n i o n  a n d  G I Z  f o r  p r o v i d i n g  f u n d s  t o  e n a b l e  o u r  h o u s e h o l d s  i n  T u v a l u  t o  b e n e f i t  f r o m  t h i s  p r o j e c t  w h i c h  h a s  r e d u c e d  e x p e n d i t u r e  o n  L P G  a n d  k e r o s e n e  s t o v e s  f o r  d o m e s t i c  u s e  a n d  h a s  i m p r o v e d  t heir  f o o d  s e c u r i t y.

T h e  e x p e r i e n c e s  o f  a l l  t h o s e  m e n t i o n e d,  a n d  m a n y  o t h e r s,  i n  i n s t a l l i n g  a n d  u s i n g  b i o g a s  s y s t e m s  o n  a  f a m i l y  b a s i s  h a v e  c o n t r i b u t e d  t o  t h e  i n f o r m a t i o n  c o n t a i n e d  i n  t h i s  b o o k l e t.  T h e  a i m  o f  t h i s  w o r k  i s  t o  e n a b l e  o t h e r  f a m i l i e s  t o  s h a r e  t h e  b e n e f i t s  o f  u s i n g  l o c a l  r e s o u r c e s  f o r  s e c u r i n g  t heir  e n e r g y  a n d  f o o d  s o u r c e s  t o  b u i l d  t heir  r e s i l i e n c e  t o  t he  i m p a c t s  o f  c l i m a t e  c h a n g e.

L a s t  b u t  n o t  t h e  l e a s t  s p e c i a l  t h a n k s  g o e s  t o  T i t i l i a  R a b u a t o k a  a t  S P C  f o r  a s s i s t i n g  w i t h  t he  e d i t i n g  w or k  a n d  E s e t a  L a u t i  f o r  t h e  t r a n s l a t i o n  w ork  i n t o  T u v a l u a n.

F a k a f e t a i  l a s i  a n d  t h a n k  y o u  s o  m u c h!
BIOGAS TOOLKIT

Section 1: How to purchase a biogas system

1.1: INTRODUCTION

This handbook is meant for households who are interested in lowering high costs of energy sources for cooking purposes for their families. High costs of using kerosene and gas stoves for cooking will not build family resilience to the impacts of climate change. Therefore, on the consumption side, the high cost of these sources needs to be addressed. This handbook is meant for households who are interested in lowering high costs of energy sources.

Coffee Roy Family Foundation, 2015

The handbook described in this handbook is designed to be used at household level and consists of:

i. A biogas digester of a floating dome design, made from rotamold water tanks.

ii. A pig pen with concrete floor, fencing and a tin-sheet roof with plastic guttering. Roof provides shade and protection for the pigs and acts as a catchment for fresh water.

iii. A water tank for collecting water from the pigpen roof.

iv. Materials to construct a family garden (fencing and tools).

v. A cooking stove to use with the digester and all tools required to run the biogas system.

The biogas digester on Nanumea Island

Photo: Dr Sarah Hemstock, 2010

Other benefits of using biogas are also shown on pages 7 and 9 through success stories from households with biogas stoves.
The aim of this handbook is to:

1. Promote biogas as one of the best methods to build resilience to impacts of climate change by securing the basic needs of any household and that is, food and energy production.

2. Improve household income (from saving on cooking fuel such as wood, kerosene or gas)


The most relevant benefits of biogas generation for households in Tuvalu are:

- Improvement in household income (from savings on cooking fuel)
- Improved housing by using the digestate to fertilise family gardens;
- Food security (breeding of pigs and by using the digestate to fertilise family gardens);
- Water security – the water tank and pig pen roof collection area provides an alternative part of the system; and
- Food production – can be easily kept clean using fresh water from the water tank that is also supplied as fresh water collection and storage facility.

Cost of materials required for a single biogas system sourced in 2016 from Kasabias Ltd, one of the suppliers in Fiji. Quotes used here were in Fijian dollars since most of the materials were ordered from Fiji. Costs were sourced in 2016 from Kasabias Ltd, one of the suppliers in Fiji.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Item</th>
<th>Speciﬁcation</th>
<th>Unit</th>
<th>Quantity</th>
<th>Cost (FJ$)</th>
<th>Total (FJ$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digester</td>
<td></td>
<td>each</td>
<td></td>
<td>75.00</td>
<td>75.00</td>
</tr>
<tr>
<td>2</td>
<td>Ingco Hose clip</td>
<td>10mm 30mtr coil</td>
<td>mtr</td>
<td>10</td>
<td>28.00</td>
<td>280.00</td>
</tr>
<tr>
<td>3</td>
<td>Steel Welded Mesh</td>
<td>20 x 8 x 668 g</td>
<td>can</td>
<td></td>
<td>9.90</td>
<td>99.00</td>
</tr>
<tr>
<td>4</td>
<td>Goat Fencing Wire</td>
<td>900mm x 50m (3')</td>
<td>mtr</td>
<td>14</td>
<td>23.30</td>
<td>326.20</td>
</tr>
<tr>
<td>5</td>
<td>Handy Pack Black Rubber Washer</td>
<td>100gram Packet</td>
<td>pkt</td>
<td>5</td>
<td>11.20</td>
<td>56.00</td>
</tr>
<tr>
<td>6</td>
<td>Tengy Cement</td>
<td></td>
<td>bag</td>
<td>8</td>
<td>31.03</td>
<td>248.24</td>
</tr>
</tbody>
</table>
| 7   | Timber Pine Post | 3 x 100 H4 | 8

Figure 2: Pig pens for the biogas project in Funafuti

Figure 3: A family food garden on Nanumaga Island

Table 1: Cost of materials required for a single biogas system

Table 2: List of Suppliers

The following suppliers (Table 2) were utilised for installing biogas systems in Tuvalu under the EU-Co-protection of the communities to the impacts of climate change; and providing information to future projects and stakeholders who are interested in installing and the Alfoa Tuvalu Biogas Project on Nanumea (2010), the USP-EU GCCA Project on Nanumaga (2013) and the EU-SPC-Tuvalu government Biogas Project (2018).
Section 2: Installation of Biogas Systems

**STEP 1: PREPARATION OF THE DIGESTER**

- Cut the top off the Outside Tank and cut the bottom off the Inside Tank.

- Obtain two Rotamold tanks – the Outside Tank should be larger than the Inside Tank.

- Ensure two round bottom tanks – the Outside Tank should be larger than the Inside Tank.

- In the middle of the floor of the Outside Tank place a level to check the base from the digester to be installed in the outer tank to stop producing gas.

- Put a plug and pour 50 cm from the bottom of the Outside Tank. This will allow the liquid fertilizer to flow out from the digester.

- Also make a number of drainage 20 cm from the top of the Outside Tank. This will allow the liquid fertilizer to flow from the digester.

- Make sure the Outside Tank and the position of the Inside Tank is level and parallel to each other.

- The channel that is formed between the Outside Tank and the Inside Tank should be large enough to allow air to circulate.

**Table 2: Contacts of suppliers for biogas systems**

<table>
<thead>
<tr>
<th>Supplier name</th>
<th>Address</th>
<th>Email</th>
<th>Phone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasabias Ltd</td>
<td>167 Suva St., P.O Box 14416, Fiji</td>
<td><a href="mailto:kasea@kasabias.com">kasea@kasabias.com</a></td>
<td>+679 3315 622</td>
<td>Construction materials for pig pens</td>
</tr>
<tr>
<td>Steel Mills Limited</td>
<td>75 Suva St., P.O Box 139, Fiji</td>
<td><a href="mailto:jasveer@gurbachansm.com">jasveer@gurbachansm.com</a></td>
<td>+679 3345241</td>
<td>This supplier can supply the biogas</td>
</tr>
<tr>
<td>RC Manubhai &amp; Co</td>
<td>GPO Box 14416, Suva, Fiji</td>
<td><a href="mailto:exportmgr@rcmanubhai.com">exportmgr@rcmanubhai.com</a></td>
<td>+679 3384316</td>
<td>This supplier can provide biogas</td>
</tr>
<tr>
<td>Marco Polo</td>
<td>PO Box 5332, Suva, Fiji</td>
<td><a href="mailto:keven@marcopolo.com">keven@marcopolo.com</a></td>
<td>+679 3275036</td>
<td>This supplier can provide biogas</td>
</tr>
</tbody>
</table>

**Figure 5: Fitting the hose-lock and pipe in center of Inside Tank, Nanumea Island**

(Note: These units can be bought pre-prepared, these instructions however, relate to building your own digester from two tanks.)
STEP 2: INSTALLING THE DIGESTER

- Put the Outside Tank on the base and put the open end of the Inside Tank first with its bottom and valve on top, into the Outside Tank.
- Lead the hose from the digester to the knob in the stove and tighten.

Figure 6: Digester in place with hose leading to biogas stove inside the house, Vaitupu Island (Photo: Kaio Taula, 2018)

STEP 3: MAKING METHANE GAS

- Put half of any size of the bucket with pig manure and the other half with water.
- Mix manure and water to have good mixture and pour through the humid mixture into the digester.

Figure 7: Beneficiary pouring animal manure into digester, Niutao Island (Photo: Kaio Taula, 2018)

- Once the methane gas is accumulated in the digester the top tank started to rise. Therefore, it is best to put bags of sand or bricks on top of the top tank as shown in the picture shown in step 2.

Figure 8: Boiling water using a biogas stove, Vaitupu Island (Photo: Kaio Taula, 2018)

STEP 4: USING THE DIGESTER

- Liquid can be collected from the digester and used as quick fertilizer for home food.
- Liquid from the reservoir at the back was extracted in Tuvalu since 2009 and were mixed.

4.1 LESSONS LEARNT

Section 4: Best Practices

- Only manure in the digester will be the outcome.
- This is safer to use when there is no outlier of gas. The explosion will not be fatal.
- The use of the stove first, the lid and other gas stove.

3.1 SAFETY TIPS FOR THE USE OF THE UNIT

Section 3: Safety

- Gilf keep any size of the bucket with pig manure and the other tank with water.
- Fill the outside tank with oil that is more than 20 degrees above zero.
- Light the stove (for cooking) to (light gas) to
- Ignite the stove (for cooking) to
- Mix manure and water in good mixture and pour through the humid mixture into
- Fill the outside tank with oil that is more than 20 degrees above zero.

Step 2: Installing the Digester

mixed with soil or added to the compost to pick up the element of the compost.
- The crude methane in the digester can be used as fertilizer for the home gardens.
- The digester can be used in the house that is in the house.

SUCCESS STORIES ON BIOGAS IN TUVALU

4.2 SUCCESS STORIES ON BIOGAS IN TUVALU

- Biogas at the household level, had been practised in Tuvalu since 2009, and were installed, on the island of Nanumea with four units. This project was implemented and funded by Alofa Tuvalu which was a Non-Government Organisation (NGO).
- Four years later in 2013, seven biogas units were installed in the neighboring island of Nanumaga. This was by the same organisation, but this time it was funded by the European Union - Global Climate Change Alliance (EU-G2CA). This was funded by the European Union Global Climate Change Alliance Project (EU-G2CA). This was funded by the European Union Global Climate Change Alliance Project (EU-G2CA). This was funded by the European Union Global Climate Change Alliance Project (EU-G2CA). This was funded by the European Union Global Climate Change Alliance Project (EU-G2CA). This was funded by the European Union Global Climate Change Alliance Project (EU-G2CA).
The European Union (EU) and implemented by the USP Pacific Centre for Environment and Sustainable Development (PACE-SD).

Here are some success stories on the use of the biogas units in Nanumea Island, which was in mid-March 2015.

In March 2015, Cyclone Pam hit Tuvalu and most of the outer islands including Nanumea. Two households with biogas units were interviewed by Radio Tuvalu several months after the cyclone.

Two households with biogas units were interviewed by Radio Tuvalu several months after the cyclone.

For example, the village of Kauata which was severely affected by Cyclone Pam. The local school and most of the houses including Nanumea were destroyed. Ms. Fayanu of the two households with biogas units on Nanumea said, "I didn’t spend any money for cooking. My children’s friends who came to stay with us after Cyclone Pam felt they were cooking with firewood and they were small and said, ‘I can’t cook with smoke.’"

Two households with biogas units were interviewed by Radio Tuvalu several months after the cyclone.

For example, the village of Kauata which was severely affected by Cyclone Pam. The local school and most of the houses including Nanumea were destroyed. Ms. Fayanu of the two households with biogas units on Nanumea said, "I didn’t spend any money for cooking. My children’s friends who came to stay with us after Cyclone Pam felt they were cooking with firewood and they were small and said, ‘I can’t cook with smoke.’"

Two households with biogas units were interviewed by Radio Tuvalu several months after the cyclone.

For example, the village of Kauata which was severely affected by Cyclone Pam. The local school and most of the houses including Nanumea were destroyed. Ms. Fayanu of the two households with biogas units on Nanumea said, "I didn’t spend any money for cooking. My children’s friends who came to stay with us after Cyclone Pam felt they were cooking with firewood and they were small and said, ‘I can’t cook with smoke.’"

FOR MORE INFORMATION:
Phone: 688 20060
energytu8@googlegroups.com