# BC Clean Air Research Fund

---

## Final Report

April 1, 2012 to March 31, 2013

---

April 26th/2013

Graham Haywood , 604-894-2333

# PROJECT OVERVIEW

## *Abstract*

Our project seeks to accomplish the following goals:

- To determine the potential air quality health benefits and cost savings (community and individual) of replacing old, inefficient wood-burning stoves with newer, efficient and cleaner burning ones
- To determine the impact that a pilot replacement program and communication/social marketing has on the community's understanding, receptiveness and interest in replacing inefficient woodstoves with efficient cleaner burning ones
- To determine the economic opportunity for developing a community-based bio-energy supply operation in the Lil'wat community
- To provide some real-life experience for Lil'wat/Ts'zil university students in environmental monitoring

Our methodology included research on the air quality impacts of wood burning stoves, reviewing projects with similar social marketing goals, initial community door-to-door surveying, onsite air quality monitoring, a follow up survey and primary/secondary research to explore economic development opportunities for developing community –based bio-energy projects.

**Research, Surveying and Communications**

Research into air quality impacts involved drawing information from government[1] and non-profit[1] based wood and air quality sites. The door to door surveying attempts at most homes on the reserve involved one on one interviews and stove quality assessments. Pamphlets promoting the use of dry seasoned wood were delivered to homes on the reserve and it was noted the residents appreciated this timely information. The same pamphlets (see attached) were on hand throughout the winter and were handed out once again this spring to encourage wood collection and wood seasoning now. Top-line survey results helped inform the following key communication messages :1. Burn dry firewood and 2. Maintain stoves and chimneys or replace them. The benefits that most resonated with survey participants include; reduced costs, less work, better air quality indoors and safety.

The communication campaign including the door to door visits included workshops, postings on the Lil'wat Nation facebook pages, as well as articles in band newsletters. All copies and associated video or information links are attached. The follow up survey completed this spring focused on determining the impact of our communication program and showed:

- 56% of survey respondents recalled hearing/seeing messages about wood burning and air quality during the campaign dates. The message they recalled hearing/seeing was consistent with the messaging about 'burning dry wood' or that 'wet wood is a waste'. Other messages the recalled related to stove maintenance, what not to burn and the importance of only using fallen trees for

[1] http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/wood-bois-eng.php , http://www.bcairquality.ca/topics/wood-burning-appliances.html, http://burndryfirewood.com/, http://www.nwcleanair.org/aqprograms/woodHeating.htm

wood. The majority of respondents heard the message through the home visit or pamphlet, but newsletters also were mentioned.

- New concerns about air quality in the area were somewhat apparent, however new concerns about indoor air quality were not.
- 85% or 18 of 21 of the respondents adopted cleaner burning behaviours during the past heating season, with drier wood, operating the stove more effectively and cleaning the chimney topping the list of new behaviours.

**Air Quality Monitoring**

While we concluded that the communication campaign was somewhat successful, the survey respondents didn't note anything about the stove exchange or the results of that effort in the home that we were using as a pilot. The pilot home selection and air monitoring process was not as successful as we would have liked. While initial air quality monitoring and some record taking was completed, the follow up air quality monitoring was not conclusive.

Specific issues included:

1) Discrepancies with the methodology : The air quality monitor was placed near outside doors, so the measurements could have been influenced by infiltration through this space.
2) Inadequate record keeping: While tables and forms were created as well as a participant responsibilities form, the participant in the study was not thorough with the record keeping and therefore it was difficult to correlate these records with the air quality readings (see end of Appendix 3).
3) Incomplete readings: The post-exchange air quality readings were incomplete. Despite resetting the air quality monitor and conducting two multiday periods of readings, the recordings only captured a fraction of the time. We are further exploring if this is an equipment malfunction or user.

These challenges were unfortunate, but a learning experience for the students and all involved. Due to inaccurate stove purchasing/ installation cost estimates, and difficulties finding a second participant, we were only able to exchange one stove.

Despite the challenges, when amalgamating the pre stove exchange data into hourly averages some trends ( not causes) seem to show up. Out of the 289 hours of monitoring, 135 of those hours or 47% of total hours recorded poor air quality (According to the air quality manufacturer, poor air quality is when levels reach over 1.2 million particle counts/m3). Periods of worse air quality seem to occur during the night or in the evening. This could be due to stoking and then smoldering fires, but it is not conclusive. Based on the limited records, the stove was lit at 5pm and again at 10pm. The occupant was typically out of the house during the day.

The economic feasibility study ( Appendix 6) assessed a variety of biomass economic opportunities for the band and concluded that there were many opportunities, with the most pressing short-term recommendations relating to;

- securing access to biomass and promoting biomass opportunities to current and potential biomass purchasers , and
- generating economic activity through using biomass energy more efficiently in on-reserve buildings.

Medium term suggestions include;

- investigating on-reserve biomass heating technology for larger buildings,
- reviewing the potential for growing bioenergy crops, and

- exploring the possibilities to generate small to large sources of power and heat to use on reserve or to sell to larger customers such as BC Hydro.

Next steps include presenting the economic opportunities results with the Lil'wat Administration and sharing the results of this project with other First Nations communities.

## Clean and Efficient Heating Checklist

Burning dry firewood can save money and protect you and your family's health. A properly installed and operated wood-burning stove should produce little smoke.

- ☐ Start a small fire with dry kindling then add a few pieces of wood.
- ☐ Give the fire plenty of air - fully open the air controls until the fire is roaring.
- ☐ Burn the fire to heat the chimney or flue before adding more wood.
- ☐ Keep space between the firewood as you add more to the fire.
- ☐ Check for local burn bans and avoid fireplace and wood stove use while in effect.
- ☐ Avoid burning garbage, treated lumber, or saltwater driftwood. Burning these items can damage your stove and cause serious health issues.
- ☐ Have your stove and chimney professionally inspected and serviced yearly if possible.
- ☐ If available, refer to your owner's manual for start-up guidelines.
- ☐ A smoldering fire, "dirty" glass doors, or smoke from the chimney are all signs that the fire needs more air or your wood is too moist.

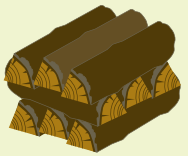
Properly dried wood is lighter, has cracks in the grain on the end, and sounds hollow when knocked against another piece of wood.


# WET WOOD IS A WASTE

## BURN DRY FIREWOOD TO SAVE MONEY AND HEALTH

## Four Easy Steps to Dry Firewood

STEP 1
**SPLIT**



STEP 2
**STACK**

STEP 3
**COVER**


STEP 4
**STORE**

Burn Wise Program of U.S. EPA

EPA

EPA 456/F-10-003

Photo: Gary Elthie

## Wood Smoke and Your Health

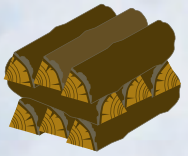
Small particles and pollutants in wood smoke can trigger asthma attacks. Wood smoke has also been linked to heart attacks in people with heart disease.

Even occasional exposure to wood smoke can cause watery eyes, stuffy noses and chest tightness. Everyone may experience symptoms, but children and elders are especially vulnerable.

# FOUR EASY STEPS TO DRY WOOD

### STEP 1
## SPLIT

- Start with the right sized wood
- Split wood dries much faster
- Split the wood in a range of sizes to fit your stove, but no larger than 6 inches in diameter
- Split small pieces for kindling



### STEP 2
## STACK

- Stack wood to allow air to circulate
- Build the stack away from buildings
- Keep wood off the ground. Stack it on rails
- Stack wood in a single row with the split side down

### STEP 3
## COVER

- Cover the top of the stack to protect it from rain or snow
- Make sure there is space between the cover and the stacked wood - don't let the cover rest directly on top
- Keep the sides open so air can circulate through the stack


### STEP 4
## STORE

- Allow enough time to dry
- Softwoods take about 6 months
- Hardwoods take about 12 months
- Cracked ends on the wood typically means it is dry enough to burn


### Is your wood dry? Take the moisture meter test.

Wet wood can create excessive smoke which is wasted fuel. Moisture meters that allow you to test the moisture level in wood are available in all sizes and can cost as little as $20. Properly dried wood should have a reading of 20% or less. Dry wood creates a hotter fire. Hotter fires save wood - ultimately saving you time and money.

**WET WOOD IS A WASTE**

www.epa.gov/burnwise

**Appendix 2:** *High Level Survey Results and High level Communications Messaging*

# CENTRE *for* SUSTAINABILITY
WHISTLER

*Creating the future* ***today***.

whistlercentre.ca

# Lil'wat Nation Wood Stoves for Cleaner Air Project

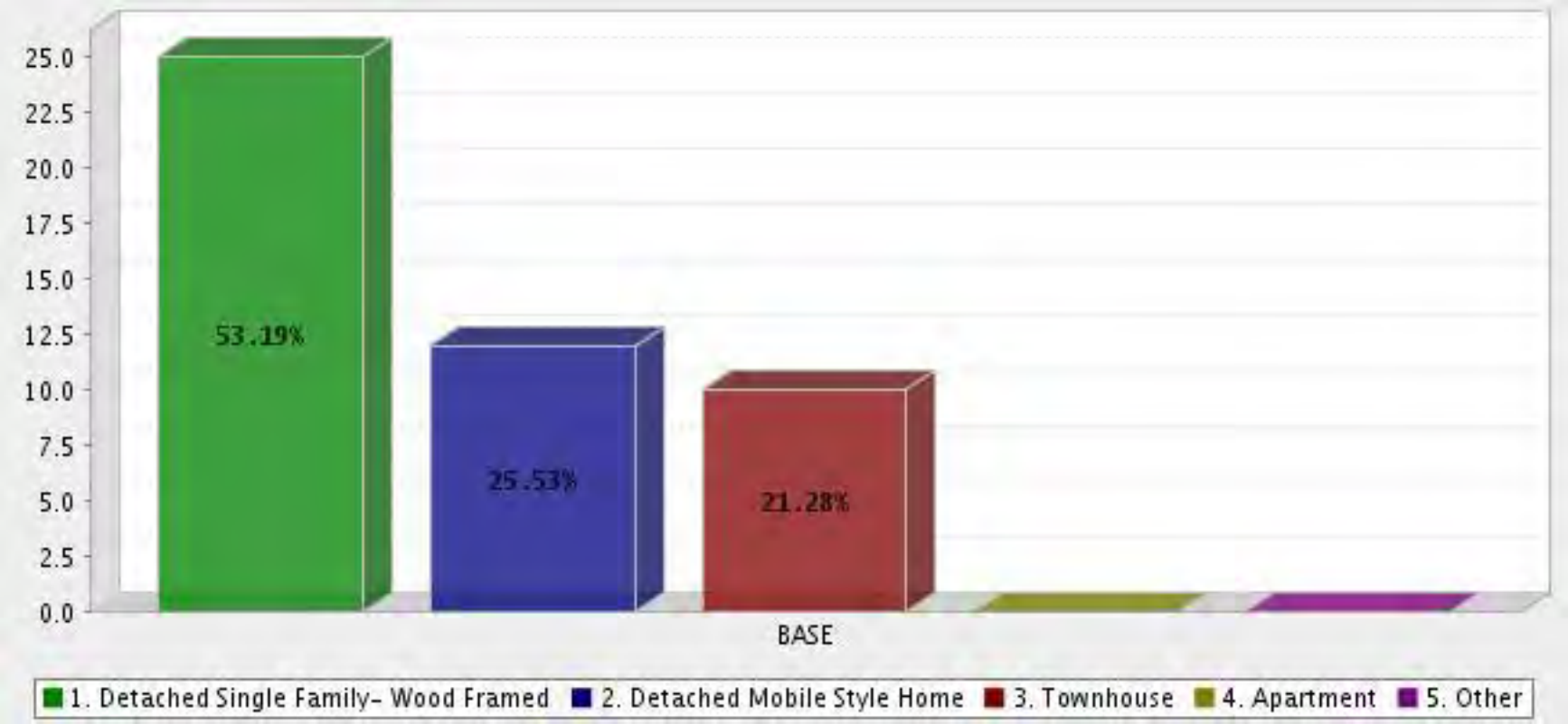
Dan Wilson

Fraser Basin Council

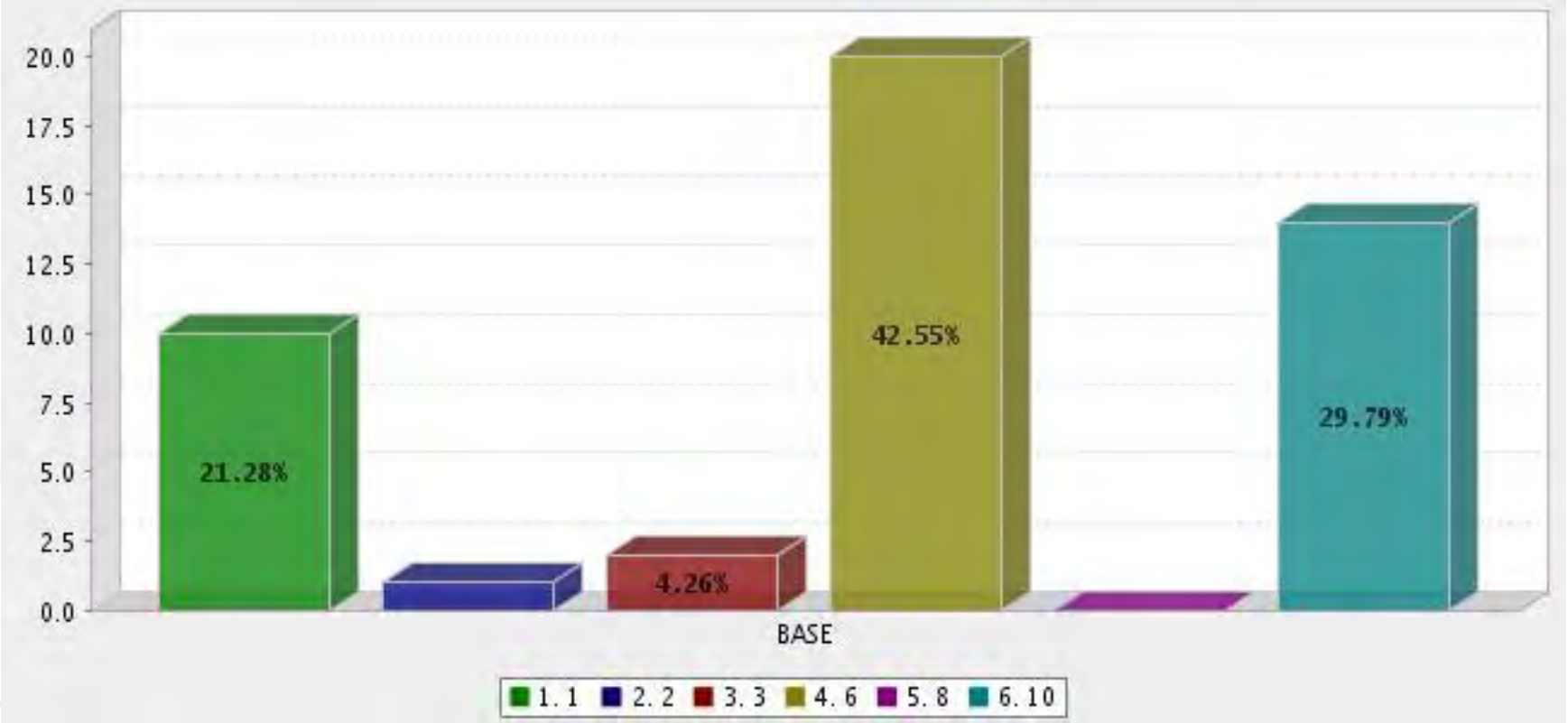
"The British Columbia Ministry of Environment provided support for this project through the BC CLEAR fund as administered by the Fraser Basin Council"

CENTRE for SUSTAINABILITY WHISTLER

# Note the type of home



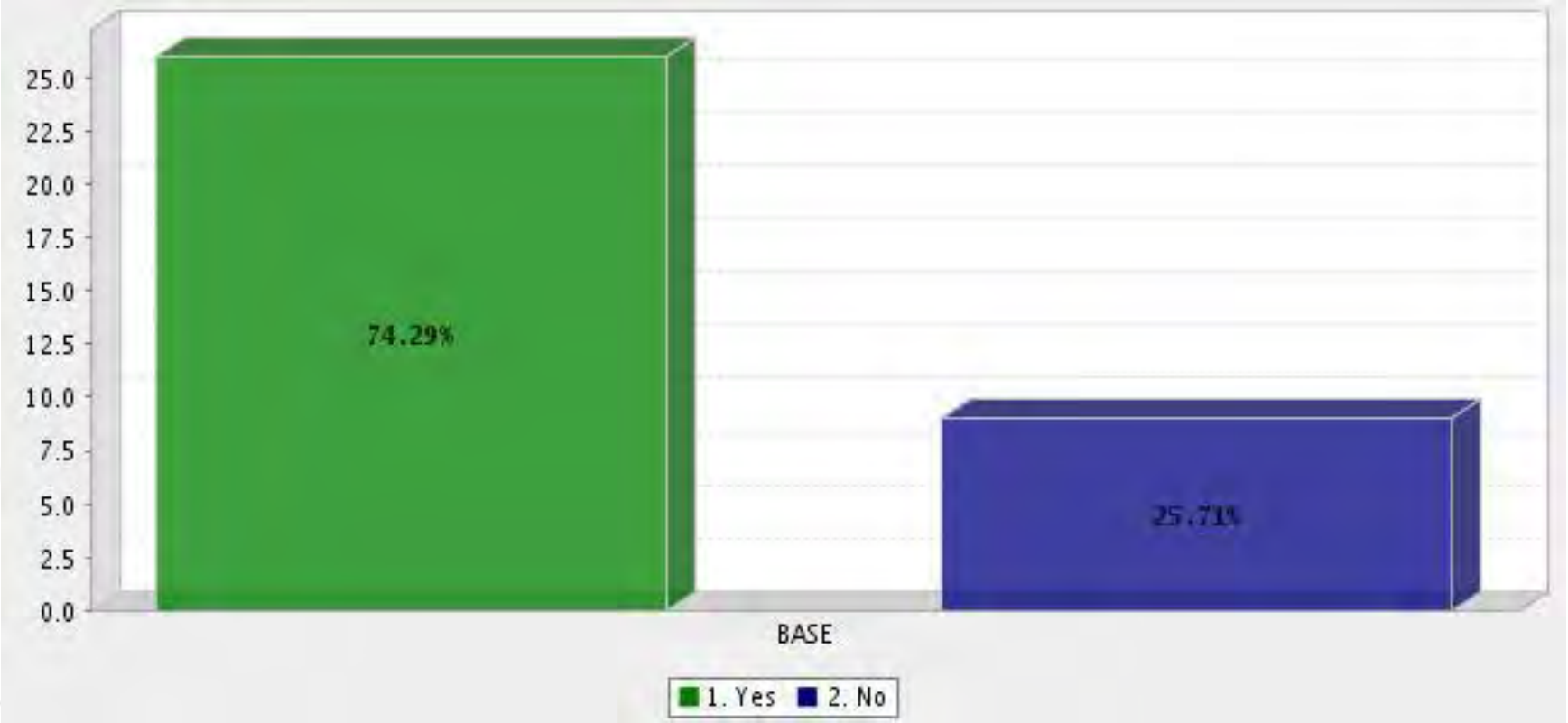
# Note Location IR






CENTRE for SUSTAINABILITY WHISTLER

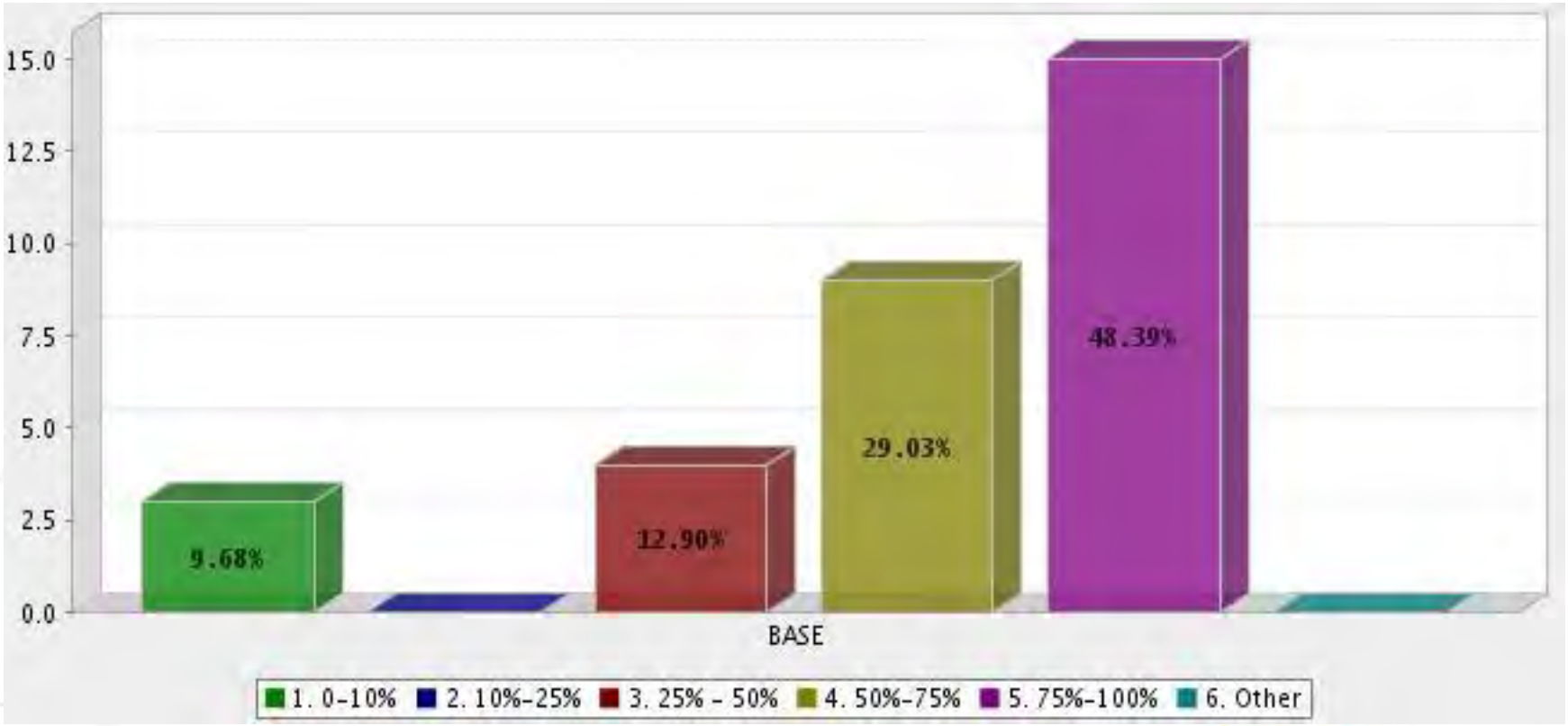
# Are you the primary Wood Stove burner in the home?






CENTRE for SUSTAINABILITY WHISTLER

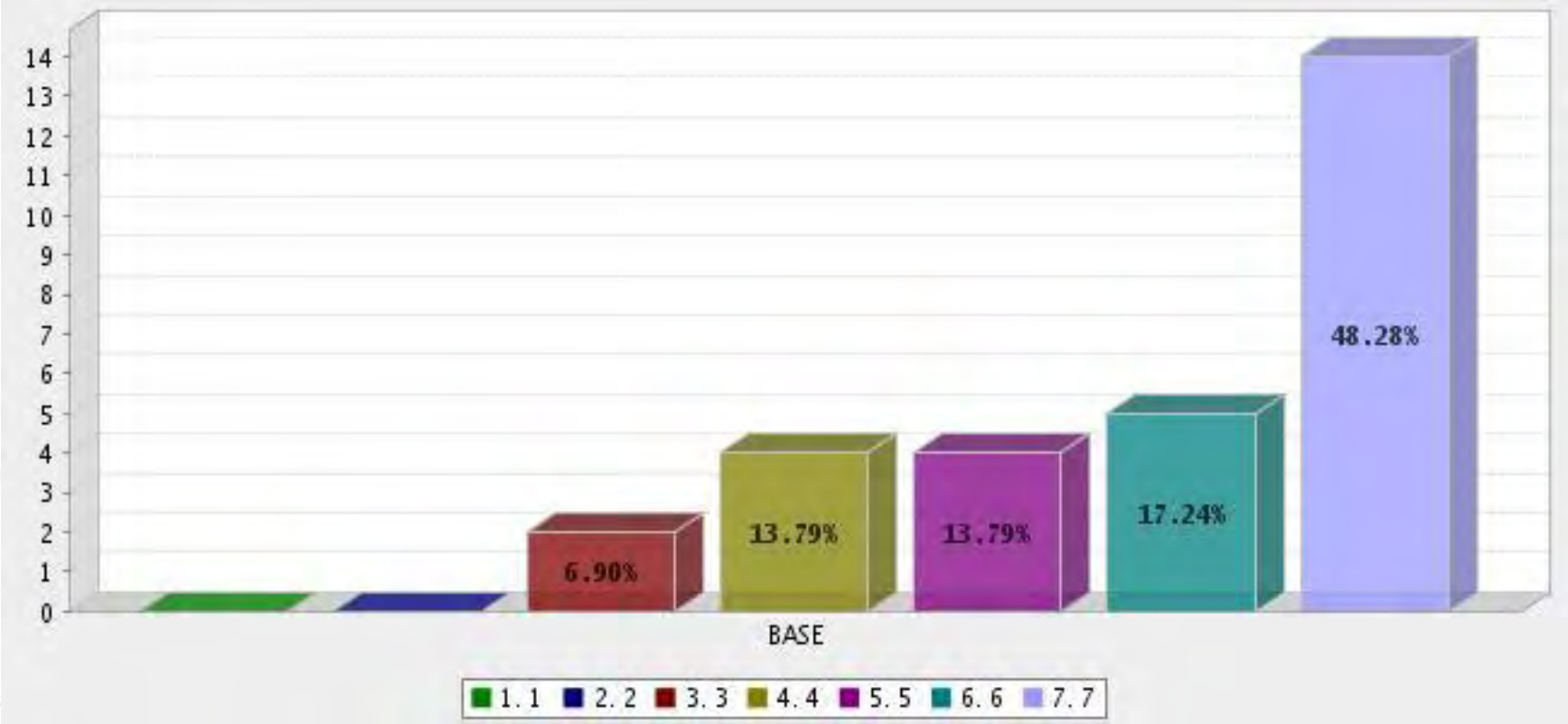
# What percentage of your space heating comes from wood sources?






CENTRE for SUSTAINABILITY WHISTLER

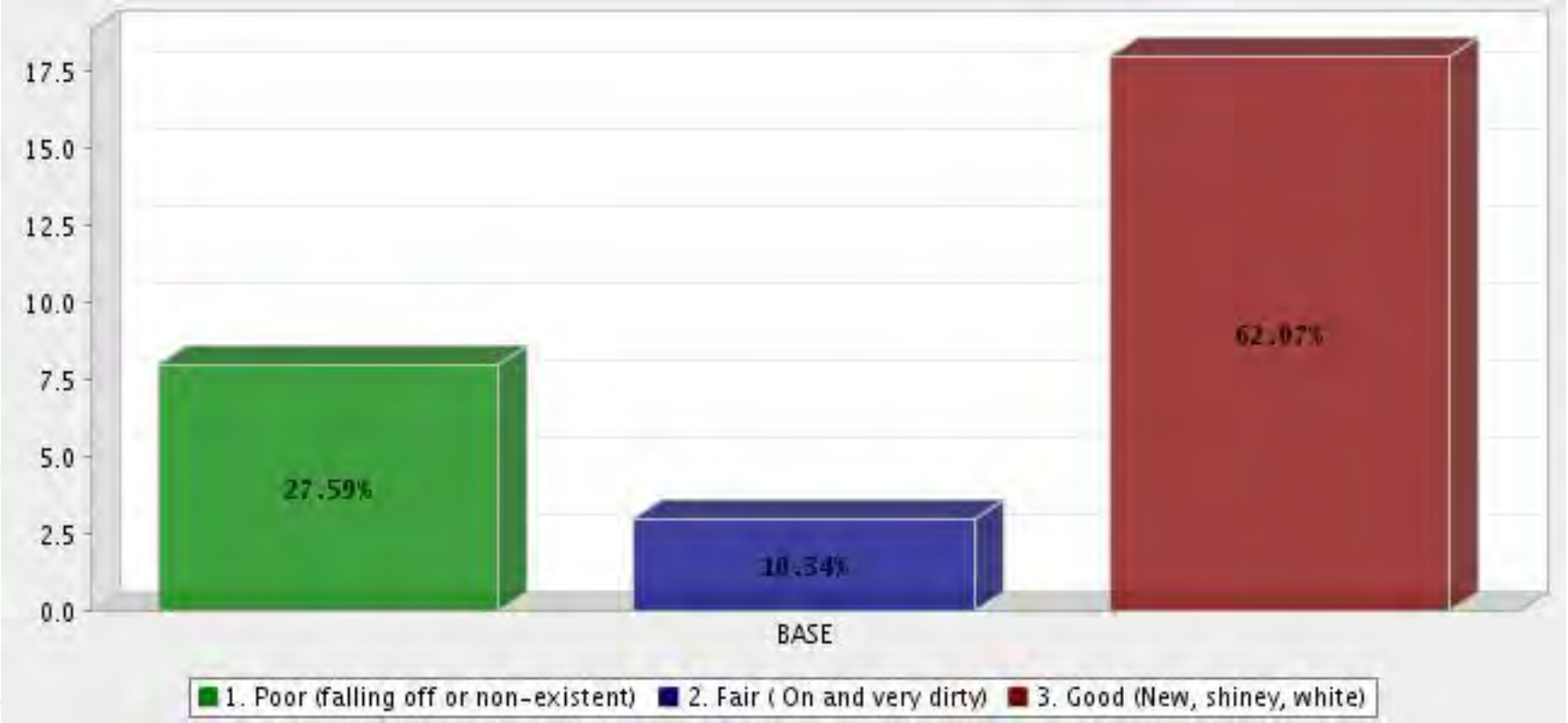
# During the heating months from October to April How many days of t...



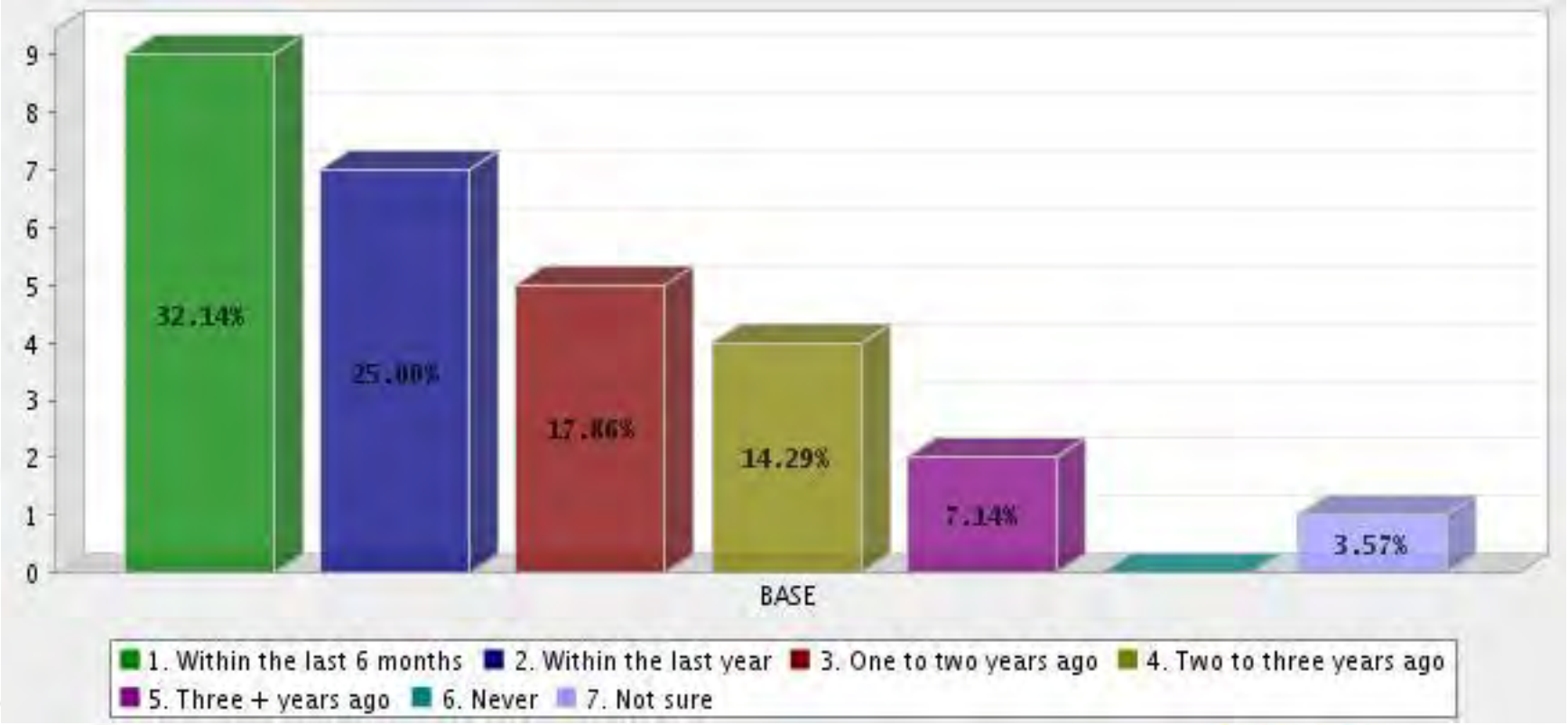



CENTRE for SUSTAINABILITY WHISTLER

# Gasket


17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
27.59%
10.34%
62.07%
BASE
1. Poor (falling off or non-existent)
2. Fair ( On and very dirty)
3. Good (New, shiney, white)

# When was the last time the chimney was cleaned?

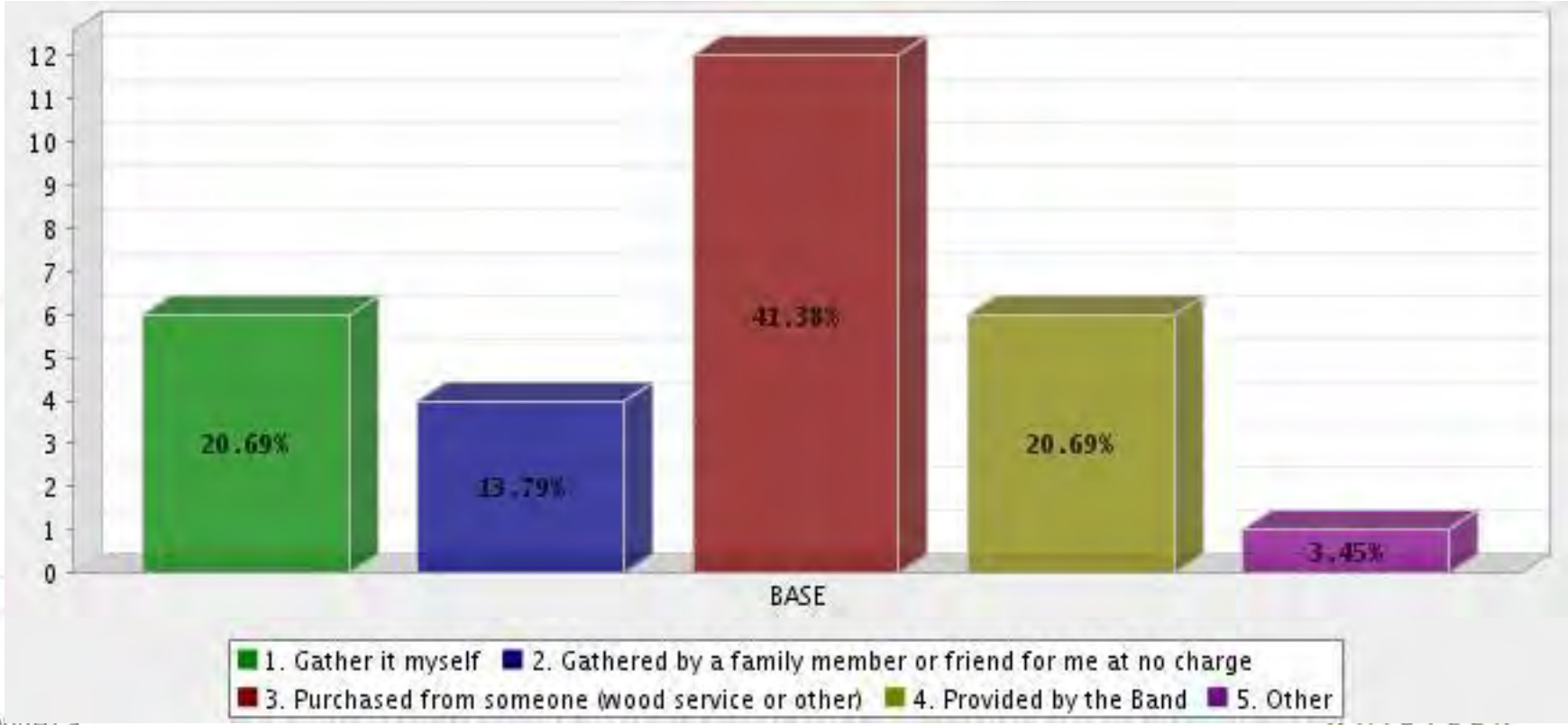




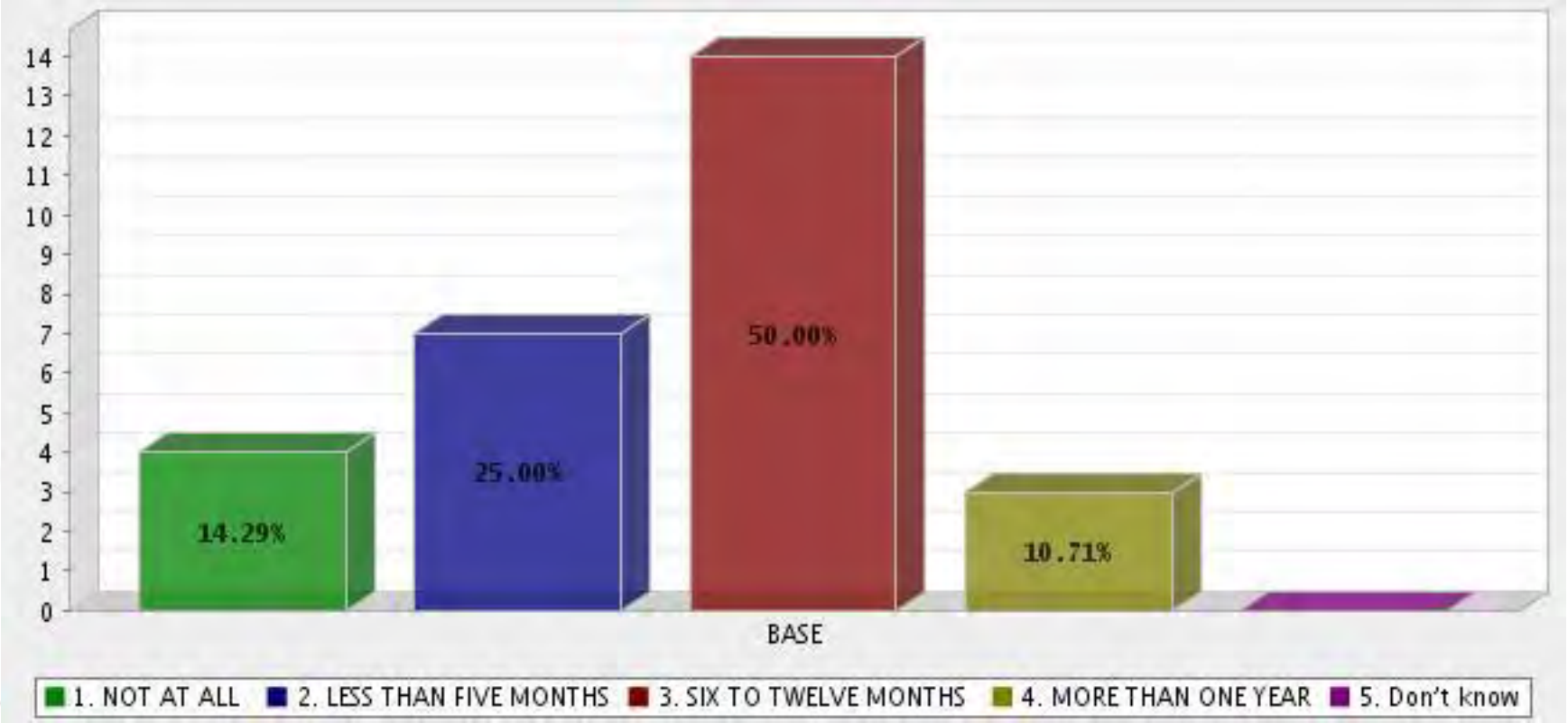

CENTRE for SUSTAINABILITY WHISTLER

# How do you get most of your fire wood? The largest source?

- 1/3 Self collected or Family/friends
- 2/3 Purchased (wood service or band) or other



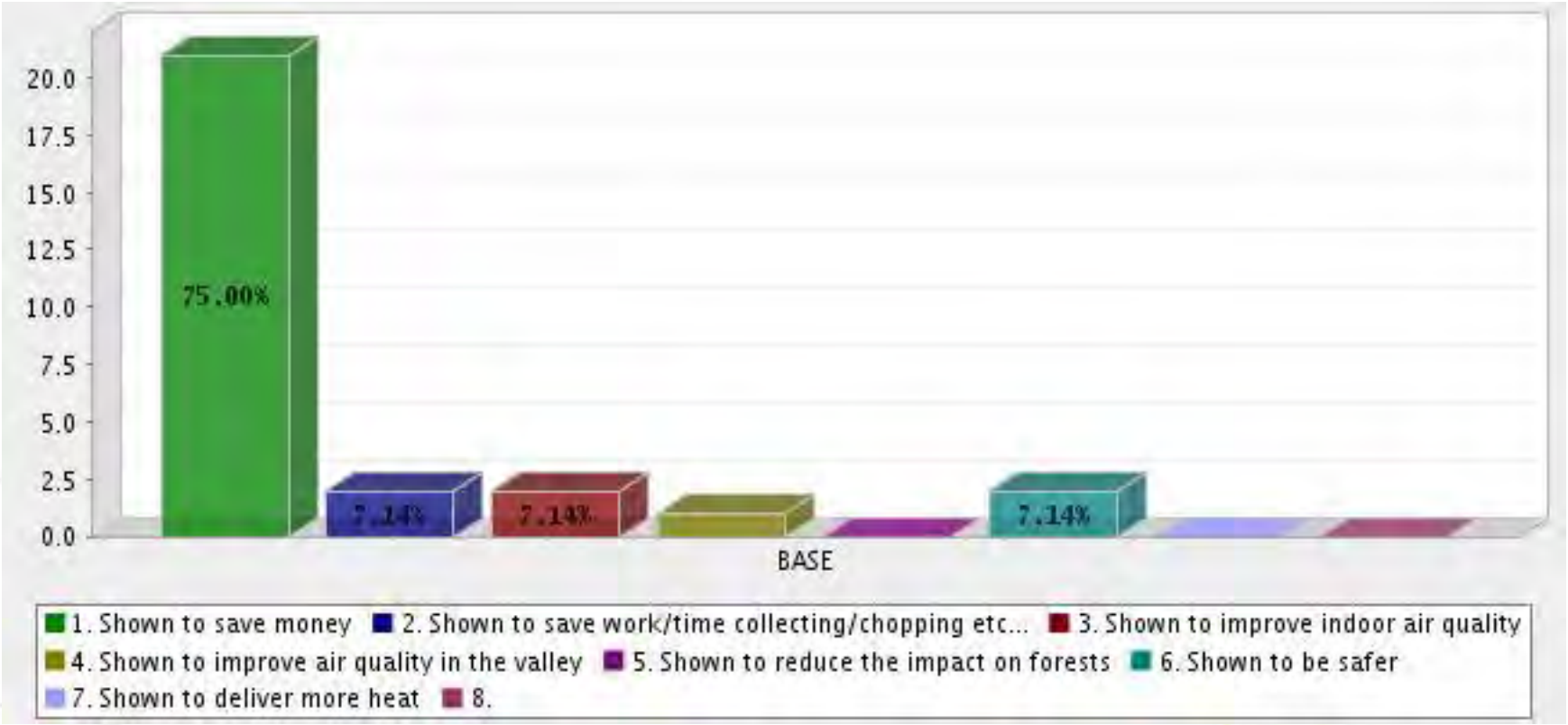
# How long do you or the people you get your wood from typically dry/...






CENTRE for SUSTAINABILITY WHISTLER

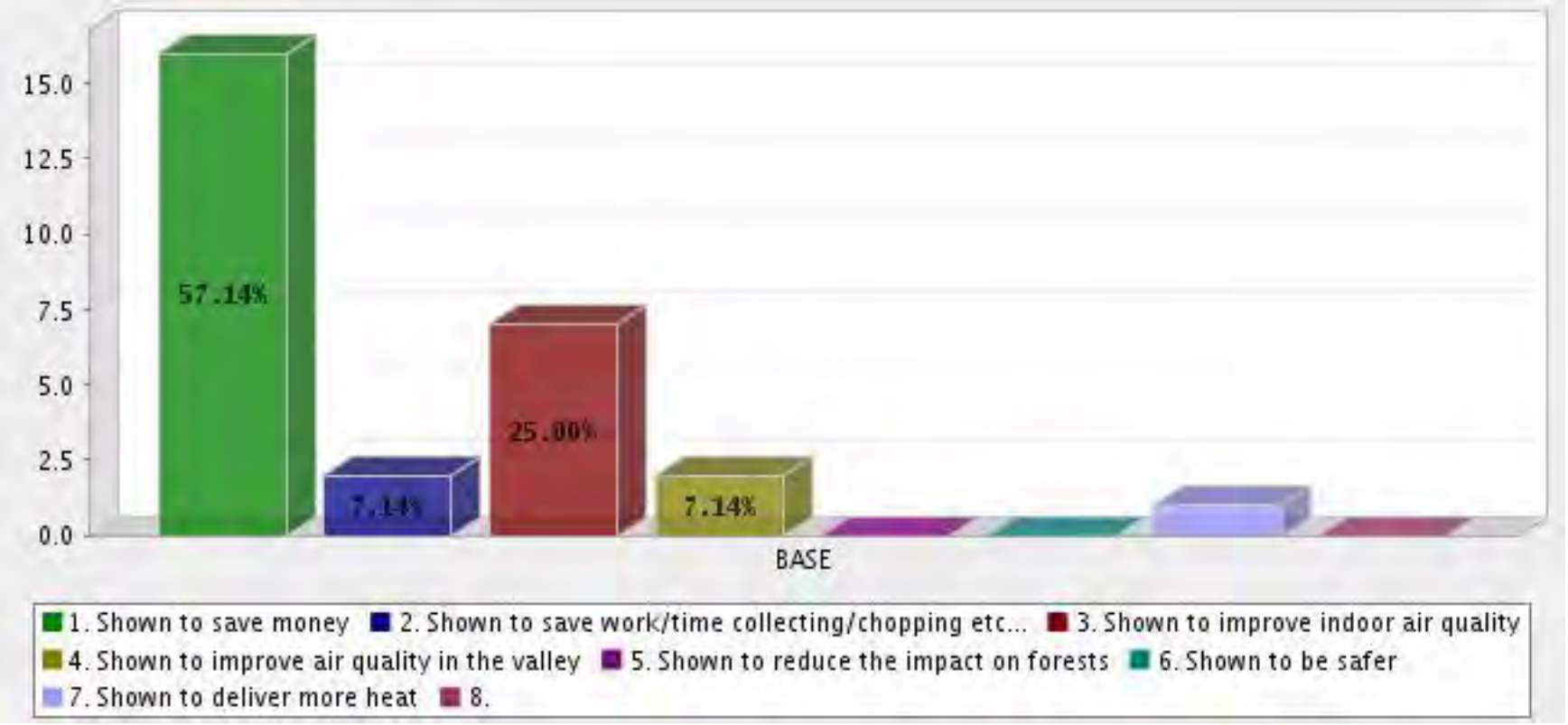
# Which of the following benefits from improved burning practices is ...






CENTRE for SUSTAINABILITY WHISTLER

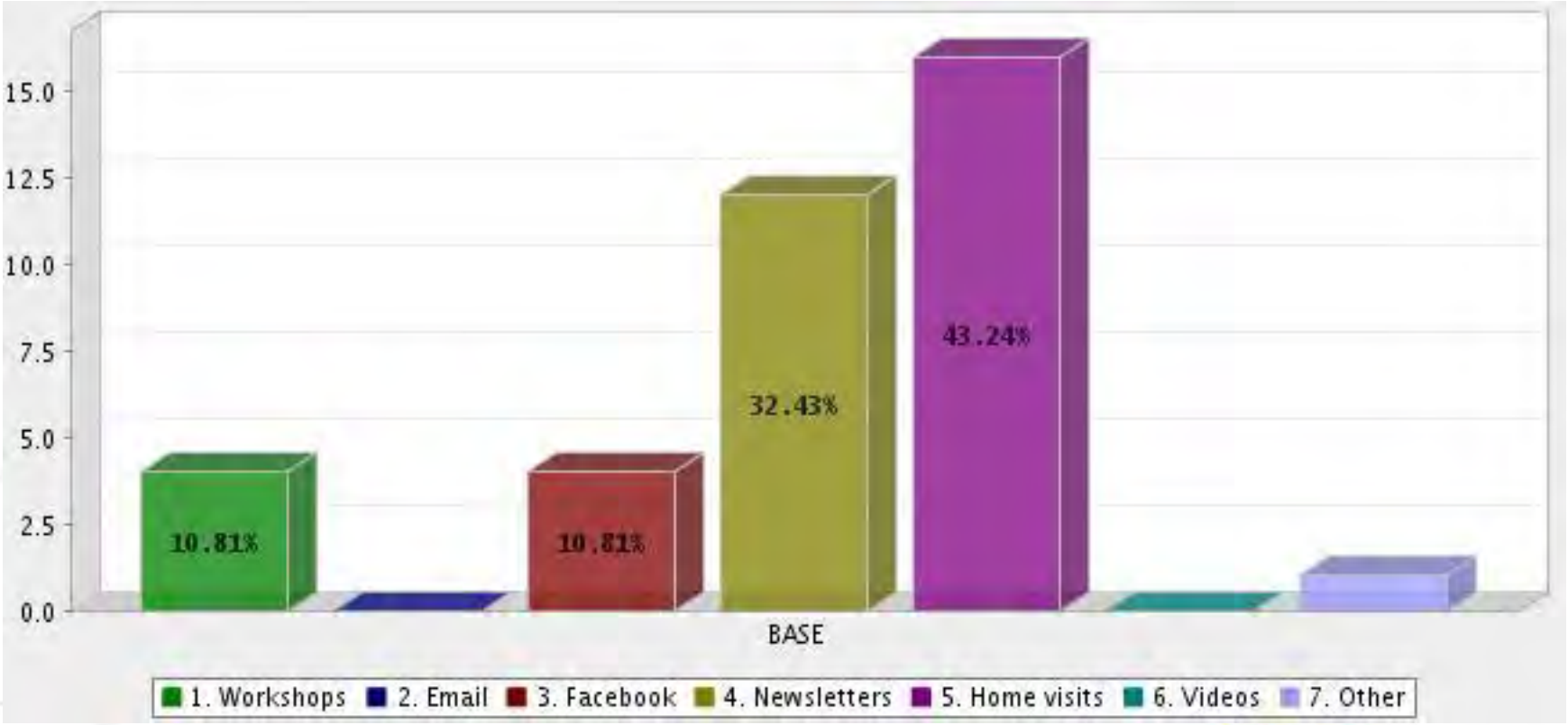
# And next most?






CENTRE for SUSTAINABILITY WHISTLER

# What are the best ways to communicate with you about wood burning t...






CENTRE for SUSTAINABILITY WHISTLER

# Campaign Goal:

•Those who burn primarily wood for heat, and are using old stoves, not burning seasoned firewood and proper burning to change behaviour.

Target:  High likleyhood of a new behaviour and a gap between ideal and reality.

- Clean stoves – barrier of cost
- Seasoned wood – Infrastructure? Knowledge?
- Non- wood products – Low opp, maybe opp with magazines
- Stove changeout -  High opp - cost

# Messages:

- Burn seasoned firewood
- Maintain or replace stoves

Benefits:

Reduced costs

Less work

Better Air Quality Indoors

Safer

# Messages:

- Burn seasoned firewood
- Maintain or replace stoves

Mediums September -March

- Facebook
- Newsletters
- Workshop x 2 – November?

Stove change out story….

# THANK YOU

CENTRE for SUSTAINABILITY
WHISTLER

*Creating the future* ***today***.

whistlercentre.ca

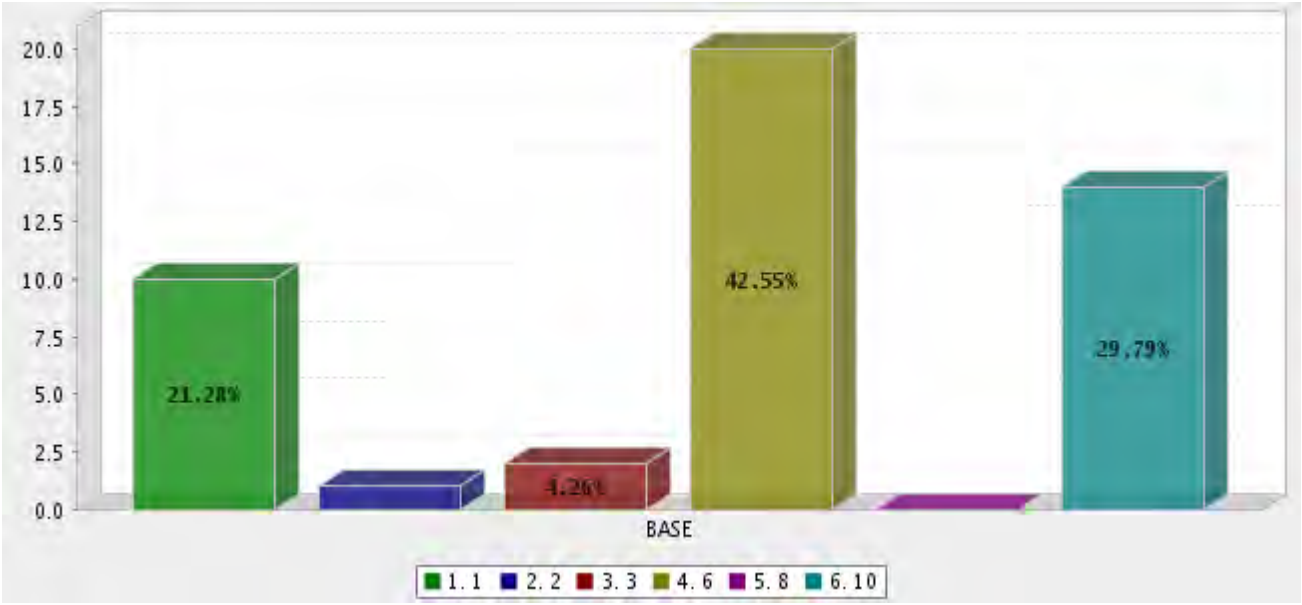
**Appendix 3:** *Detailed Survey One Results*

# CLEAR Project

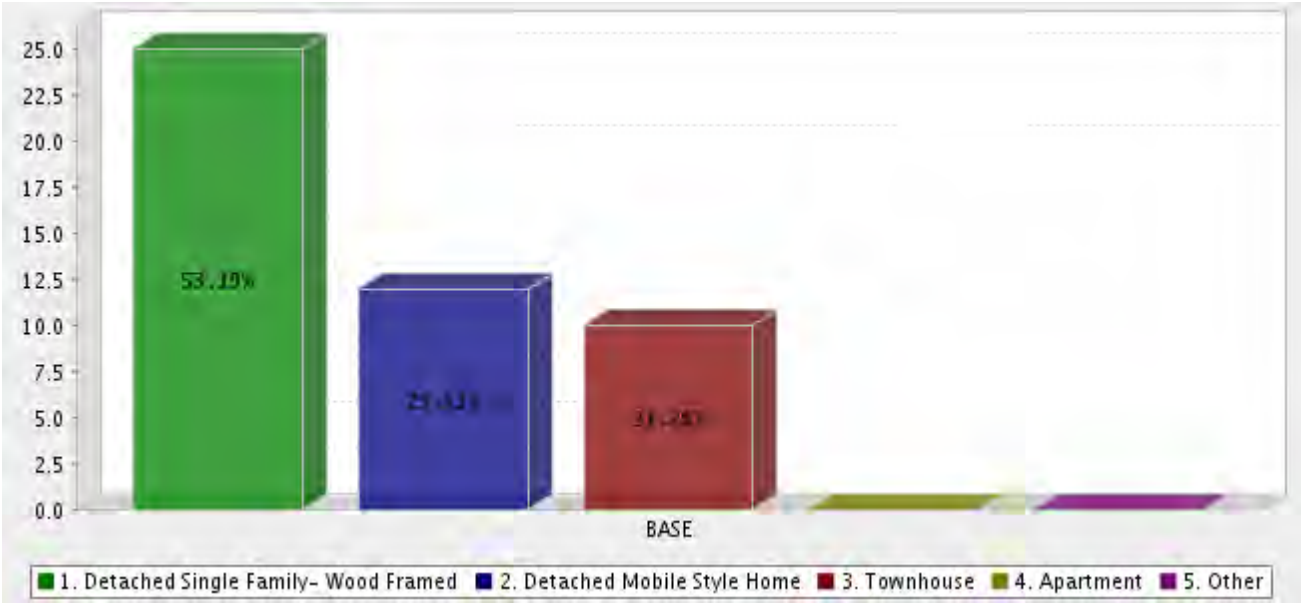
dwilson@whistlercentre.ca

# Survey Overview

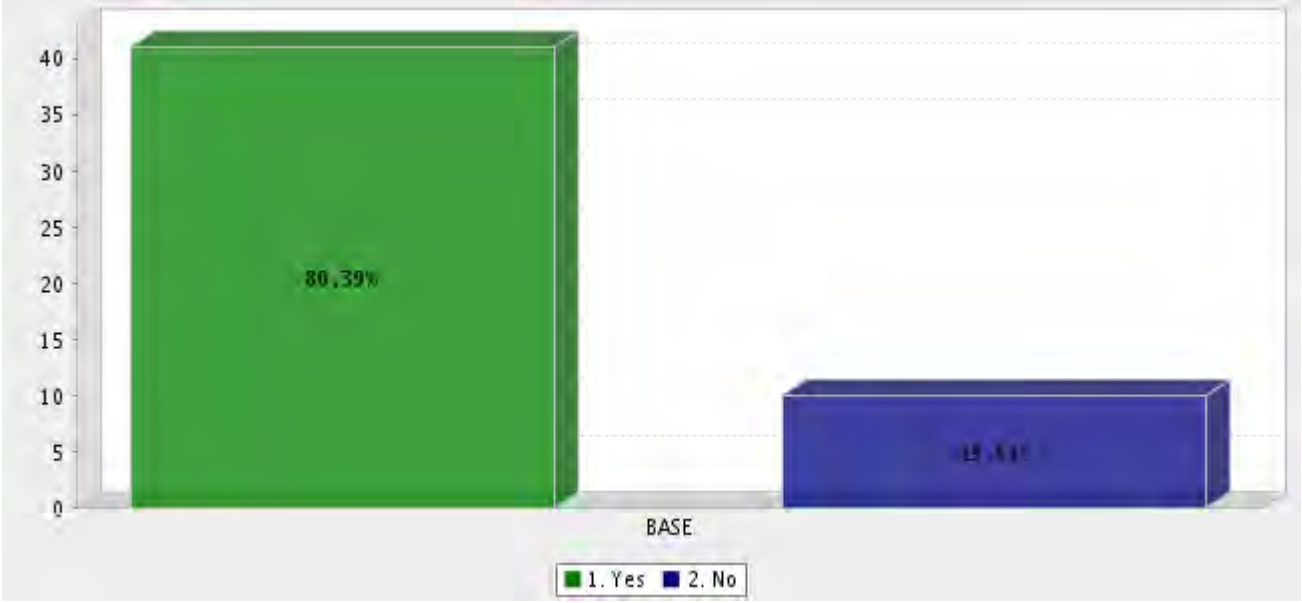
# Note Location IR



# Note the type of home

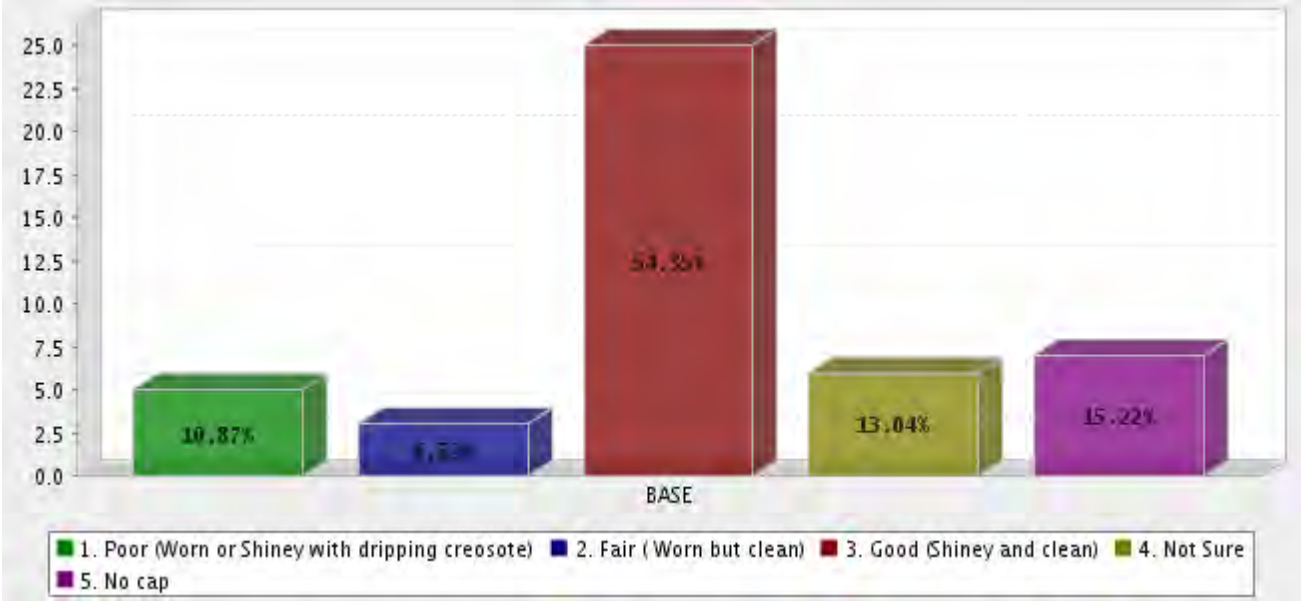


## Does the home have a chimney?

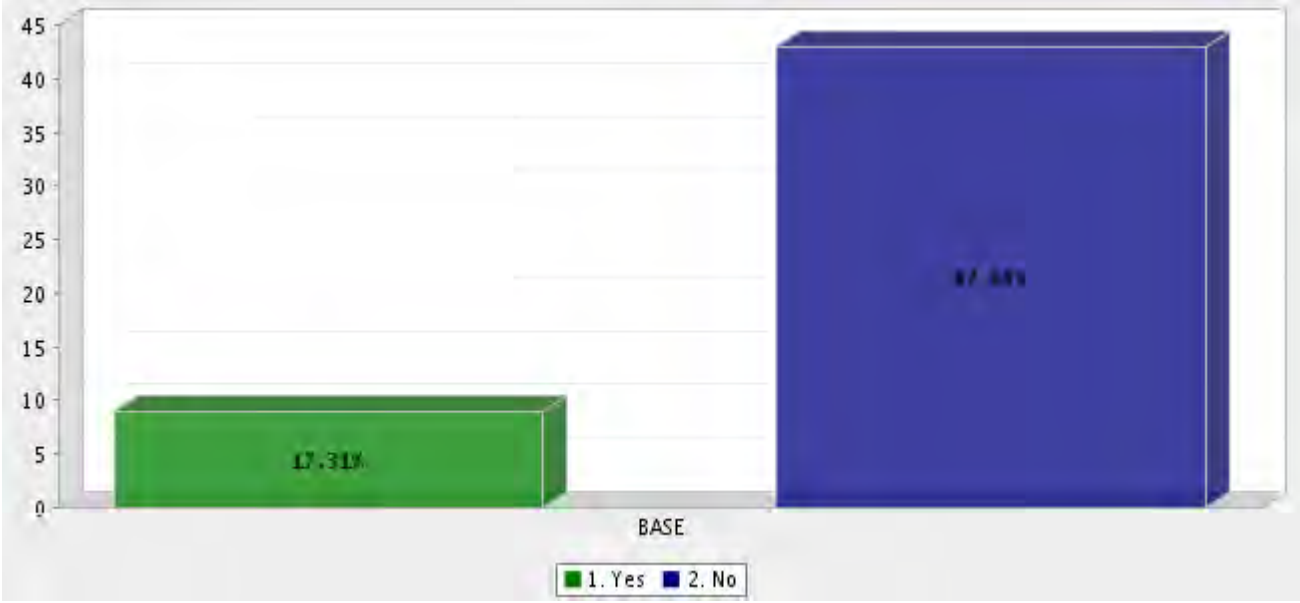


# Condition of the Chimney Cap (Photo of house, photo of cap)

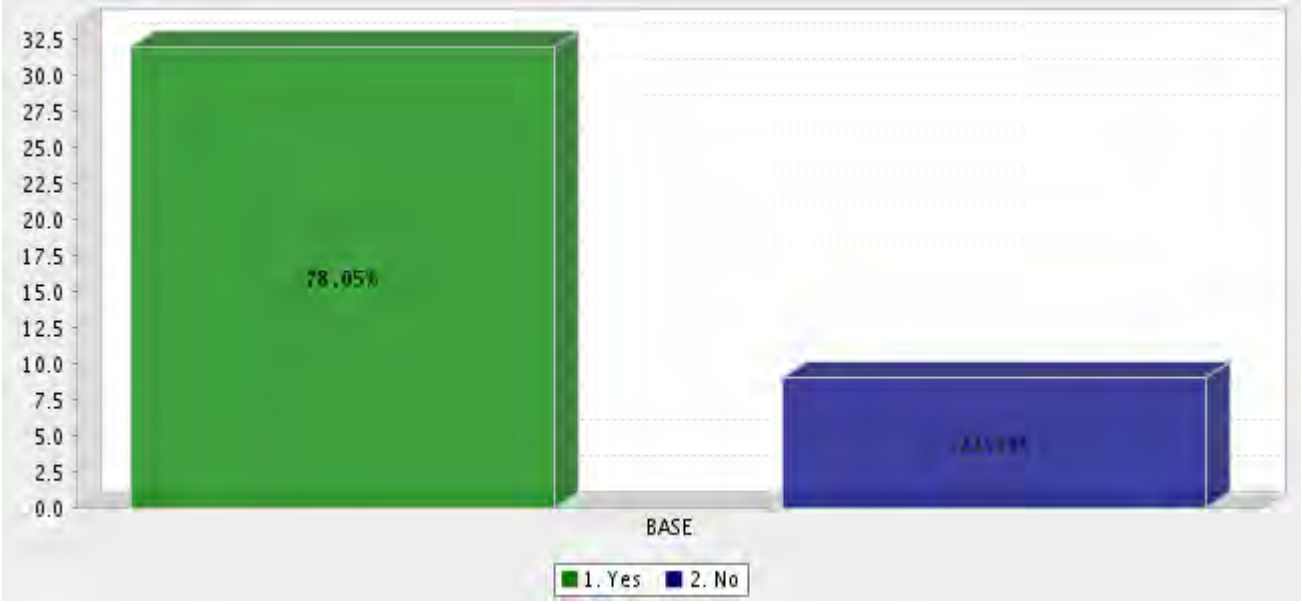
# Chimney Cap Condition



## Is this your fourth survey since last doing the long survey?

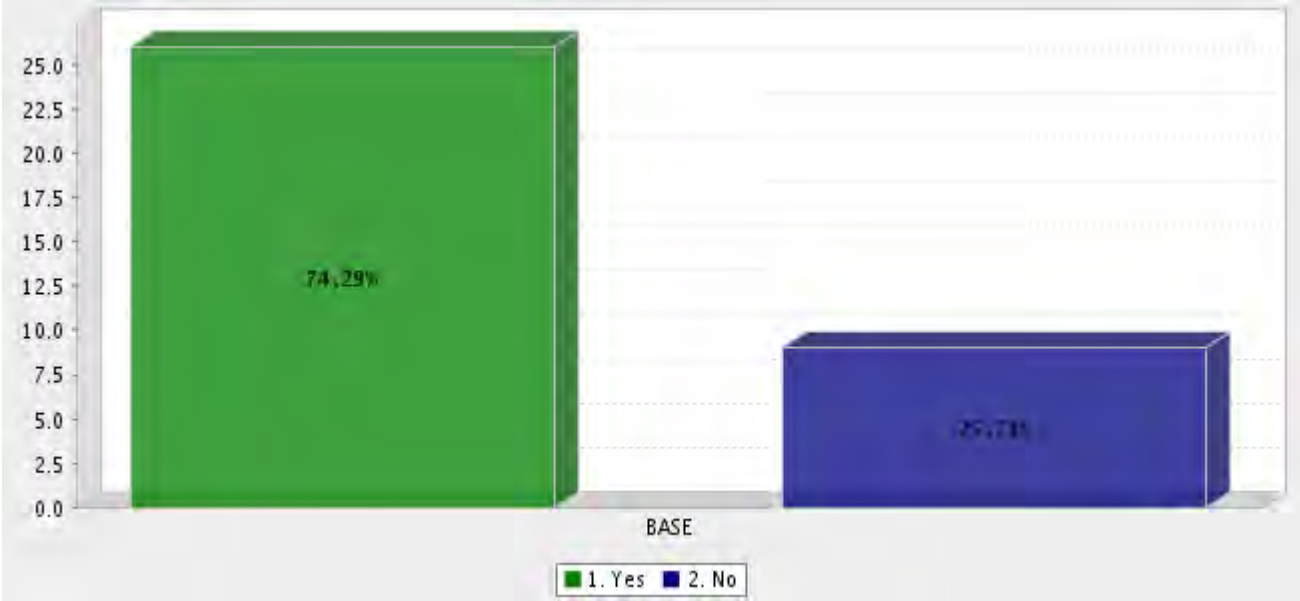


## Do you have a wood/pellet burning stove?

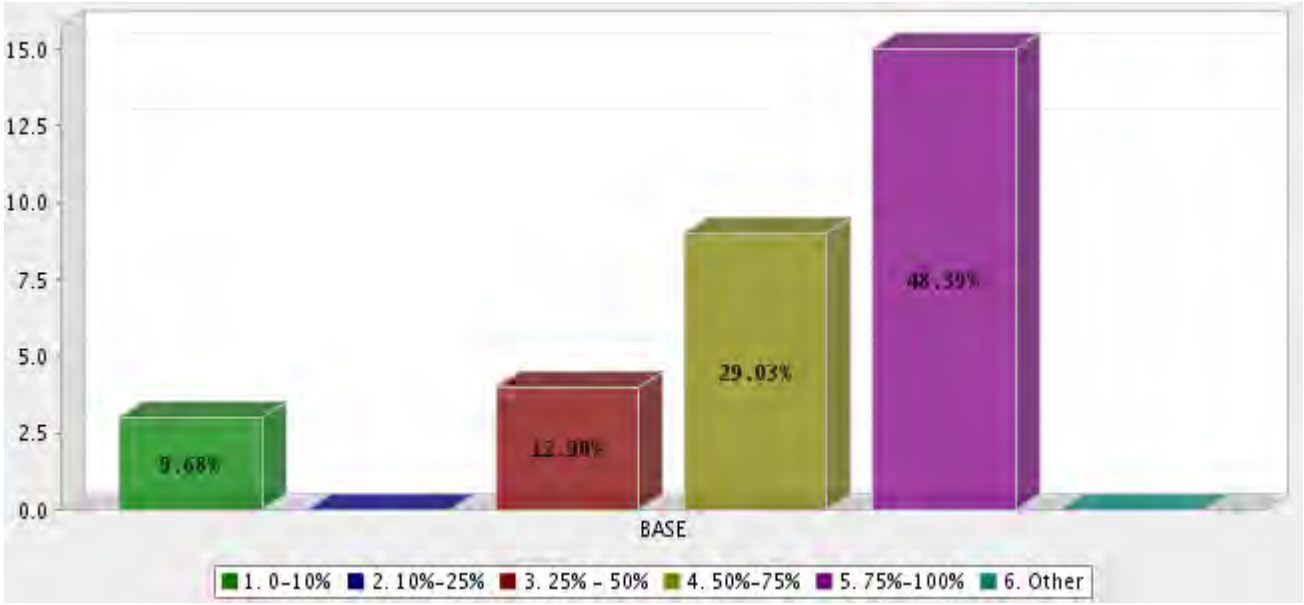


## Do you or someone living in the home own or rent this residence?

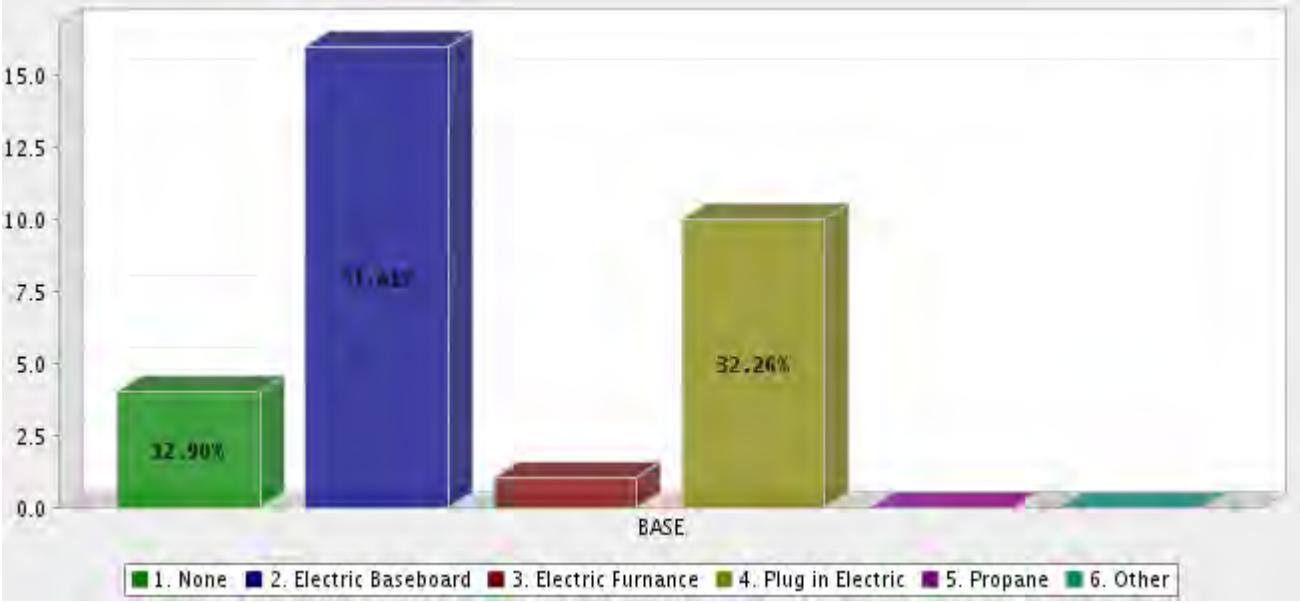
## Are you the primary Wood Stove burner in the home?



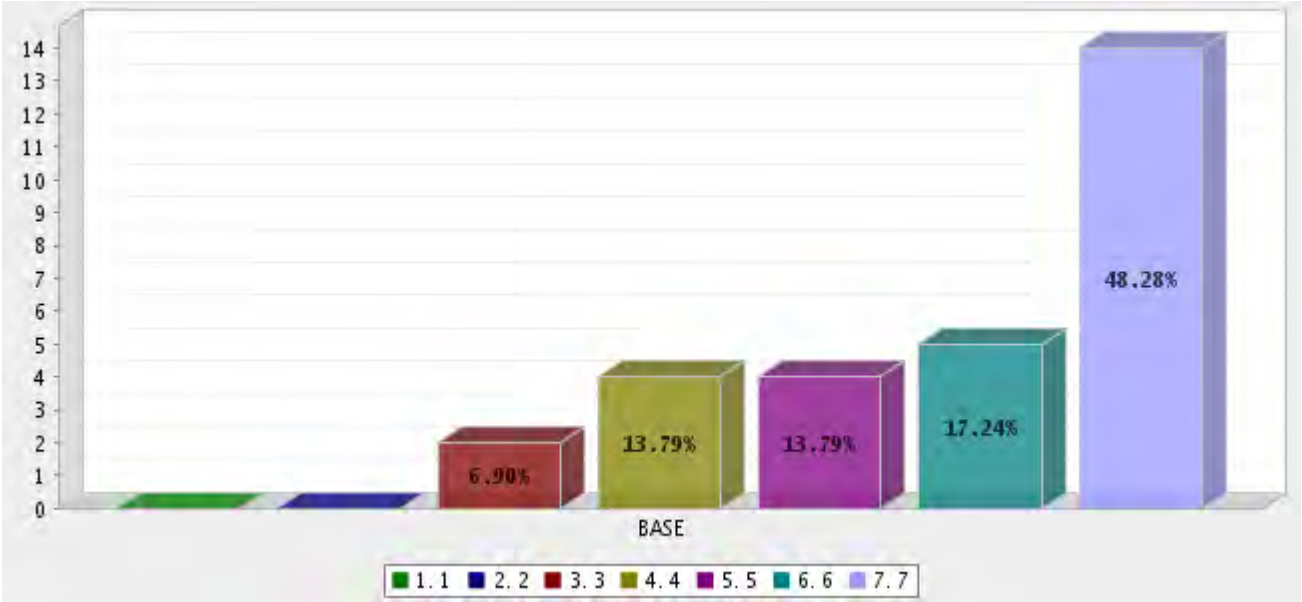
## What percentage of your space heating comes from wood sources?



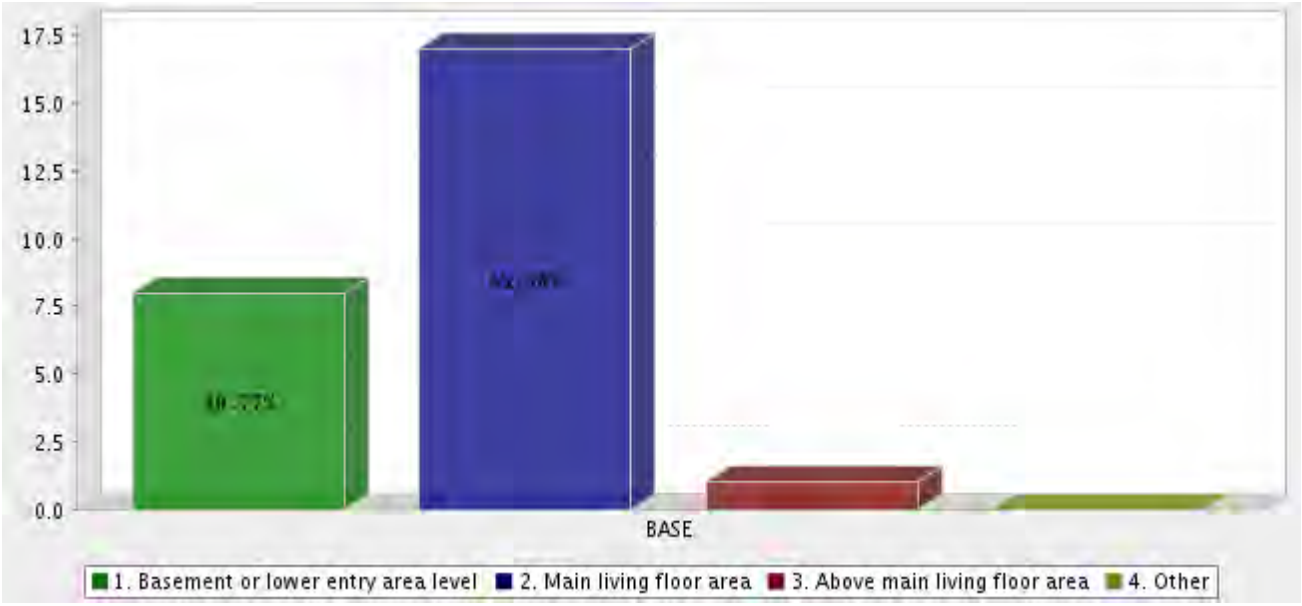
## What is your other heating source?



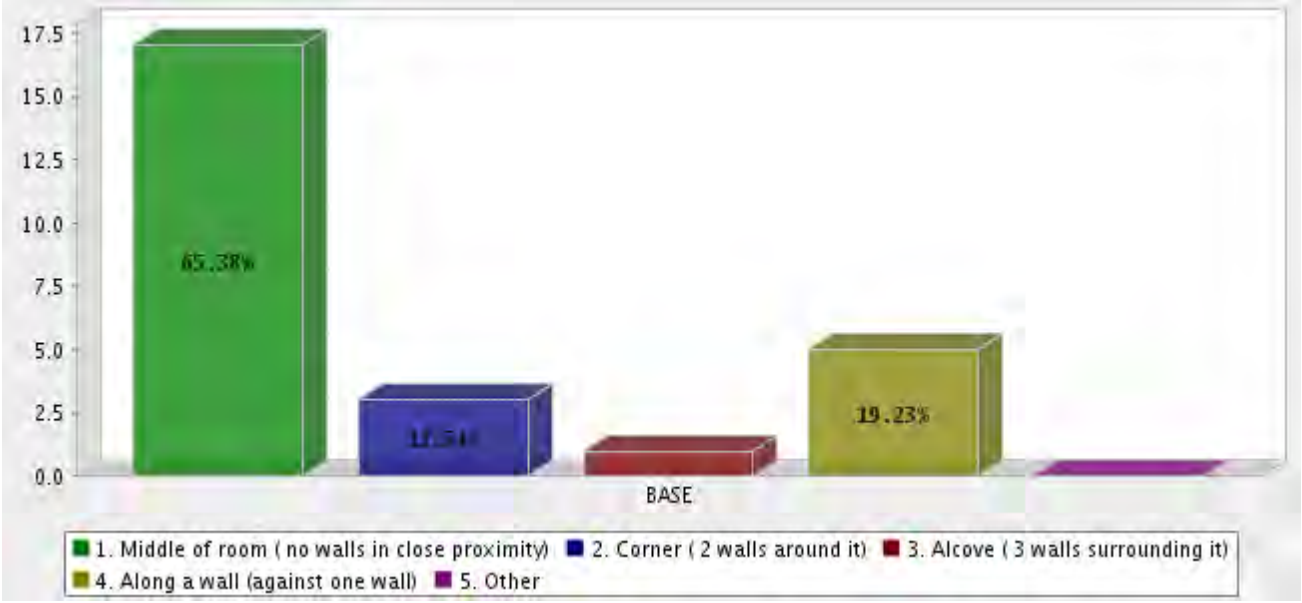
**During the heating months from October to April**
**How many days of the week do you use your wood stove? If Range take the average… e.g. 5-7, so would that be 6?**



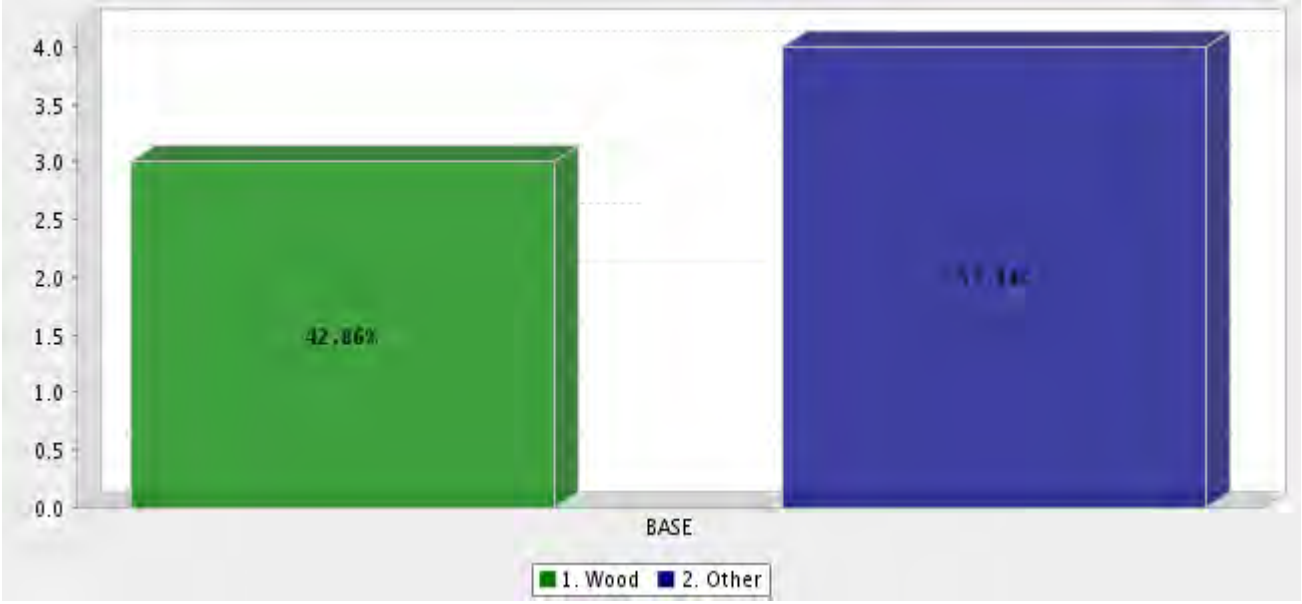
# Where is the stove?



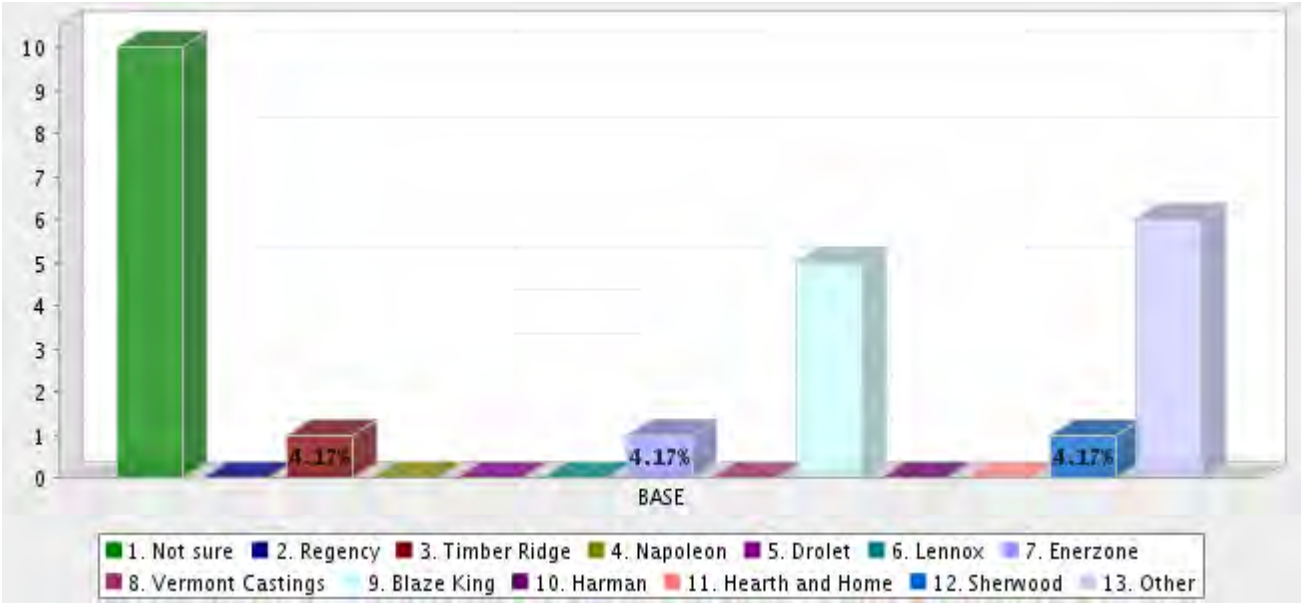
# Type of location



# Wall materials surrounding stove

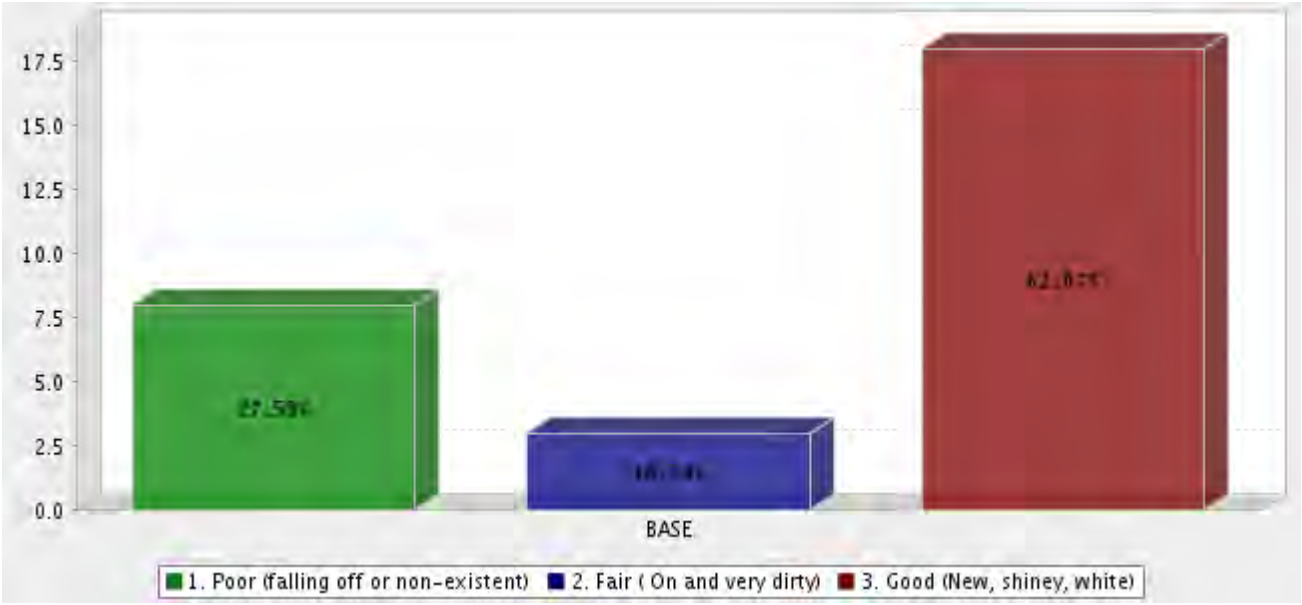


# What brand of stove?

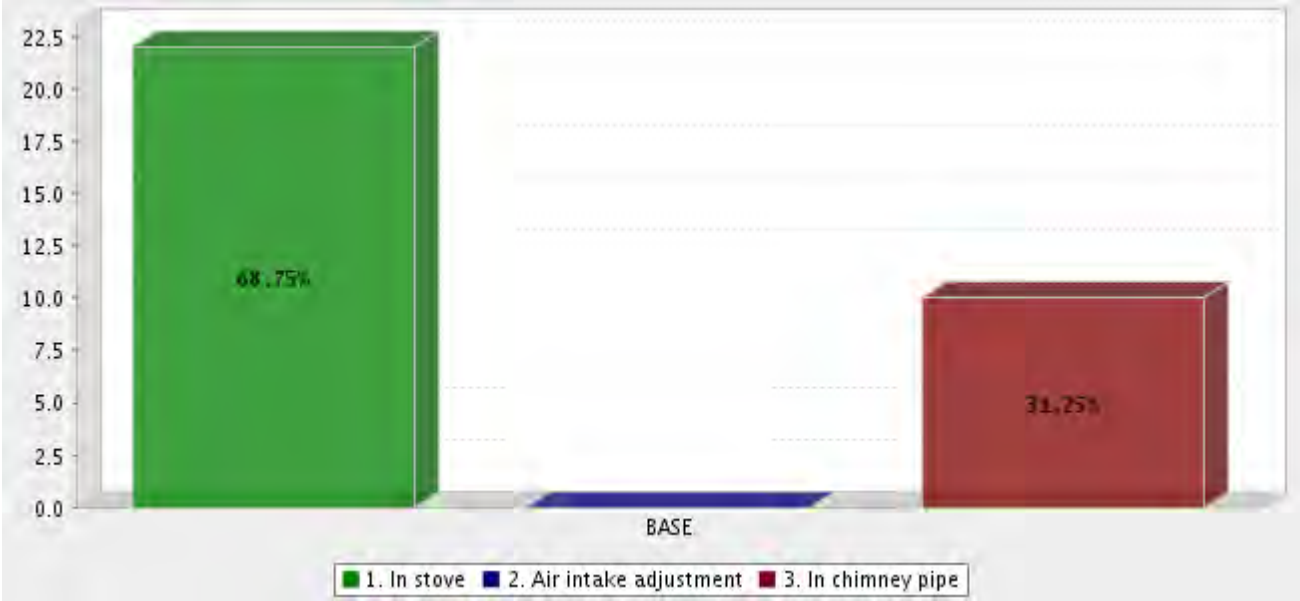


## Condition of the Stove Door Gasket ( Photo of open door/gasket and area around stove?)

# Gasket

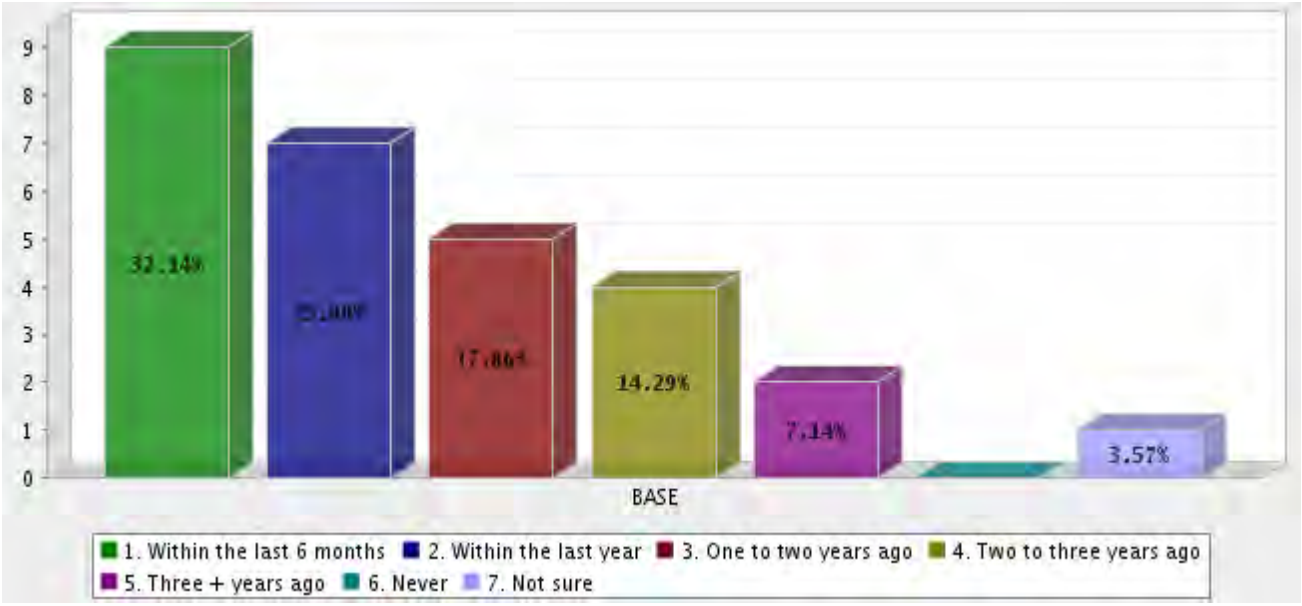

17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
BASE
1. Poor (falling off or non-existent)
2. Fair ( On and very dirty)
3. Good (New, shiney, white)

## What type of Dampers? (Select all that apply)

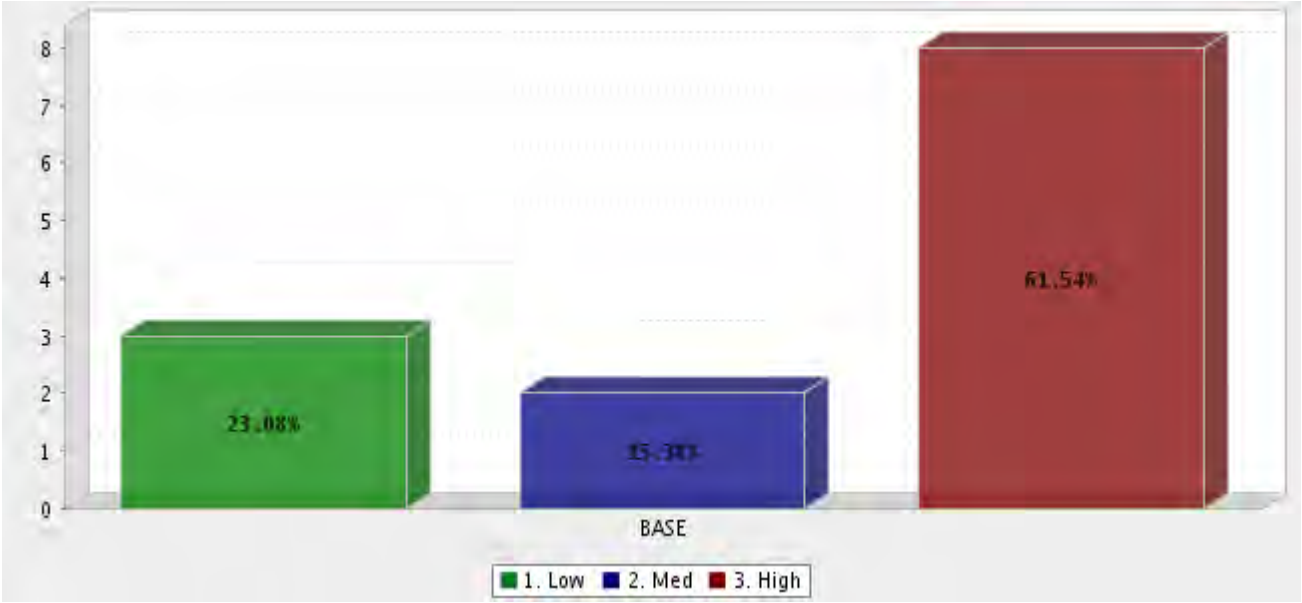


**Upon tapping the pipe, does it have a muffled hollow sound as opposed to a ping?**

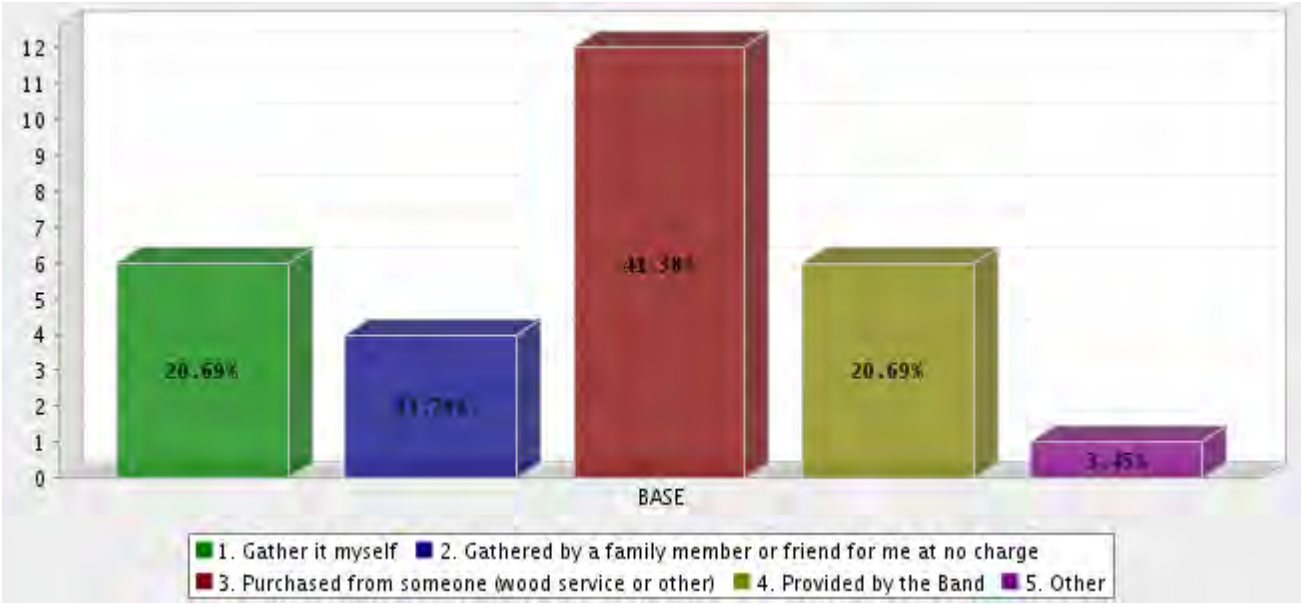
## When was the last time the chimney was cleaned?



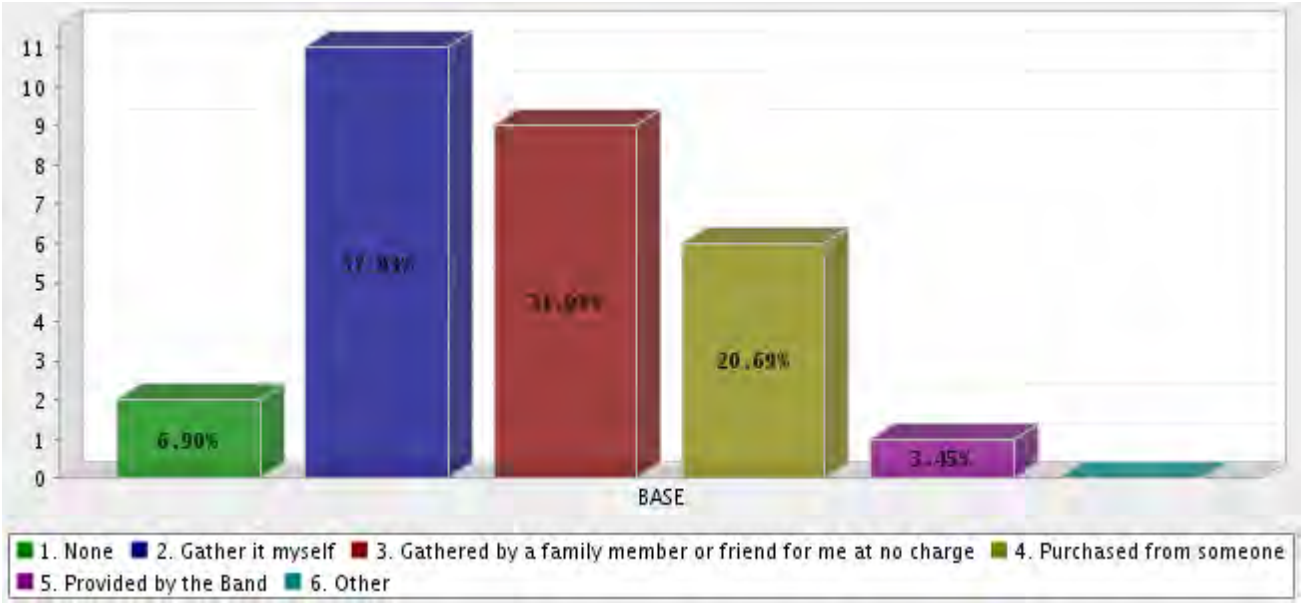
**Having a clean chimney generally prevents fires and unhealthy smoke. What is the liklihood of having or continuing to have the chimney cleaned on an annual basis**



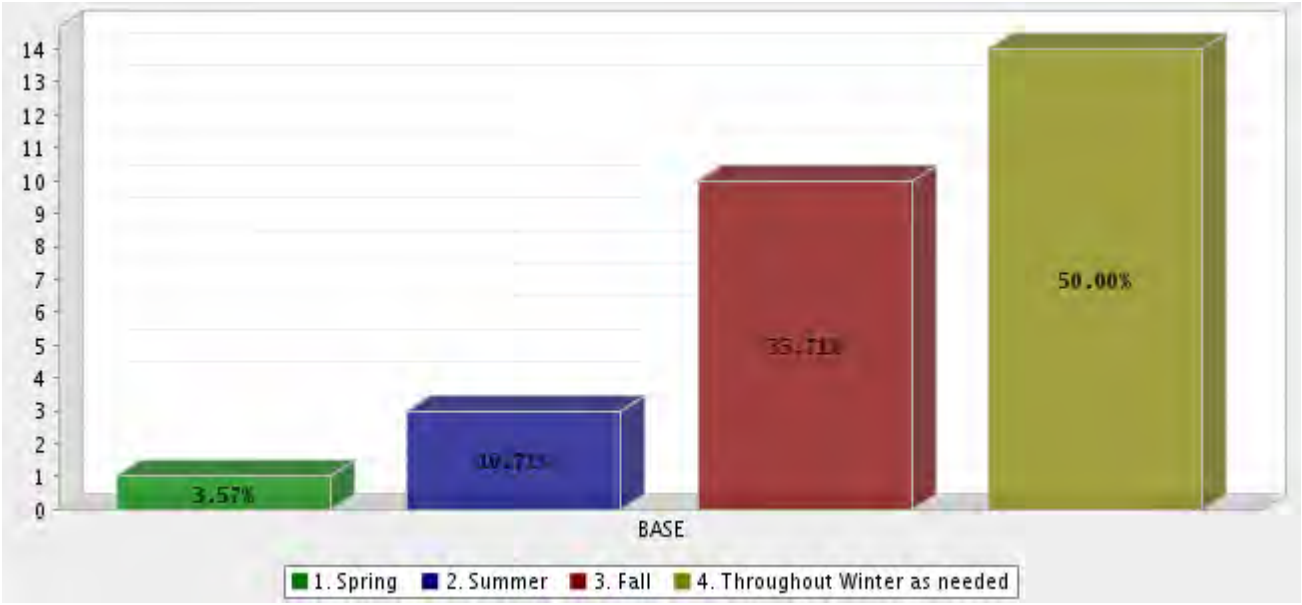
## How do you get most of your fire wood?  The largest source?



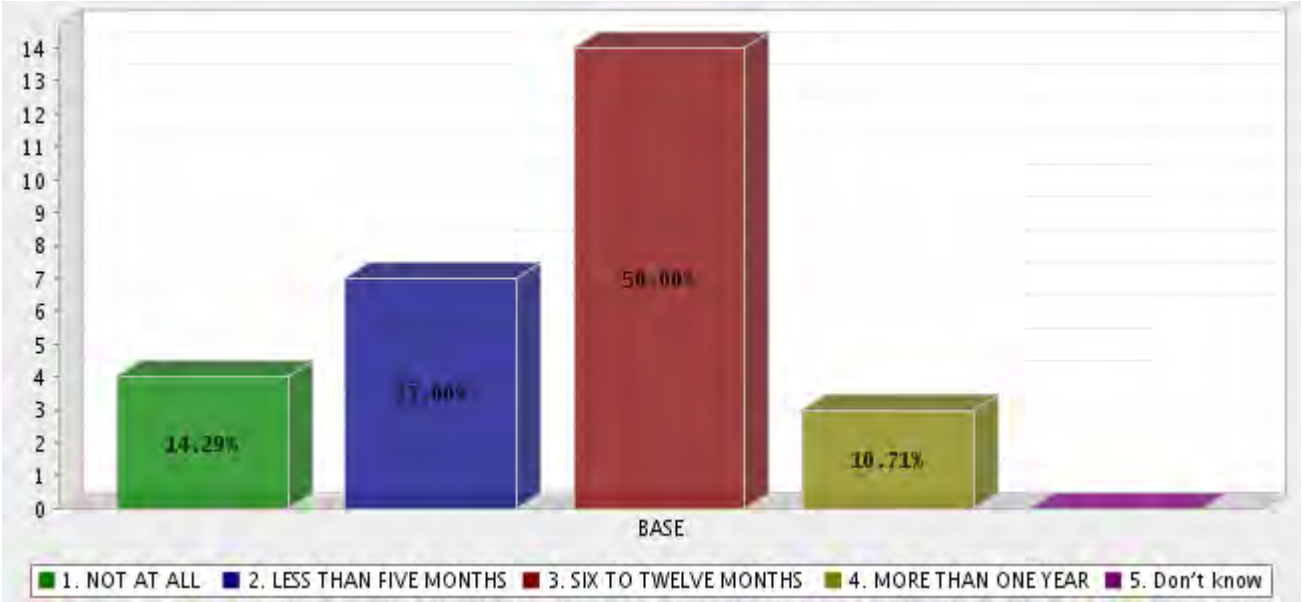
## What is your second largest source?



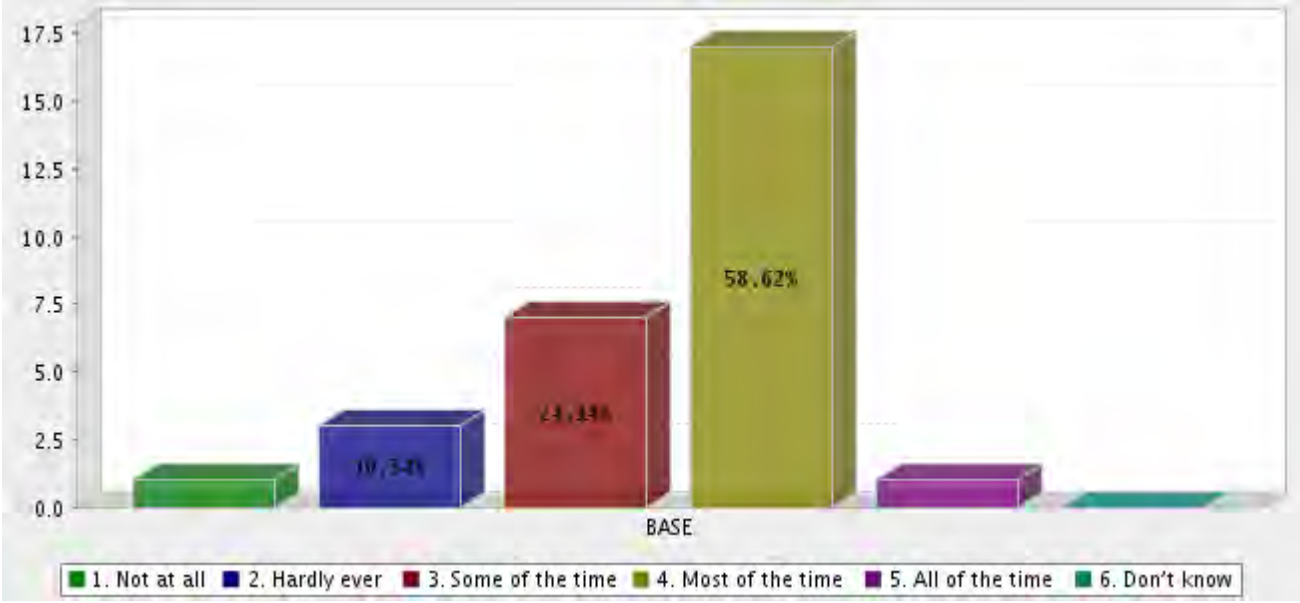
## When do you typically get most of your wood for the heating season?



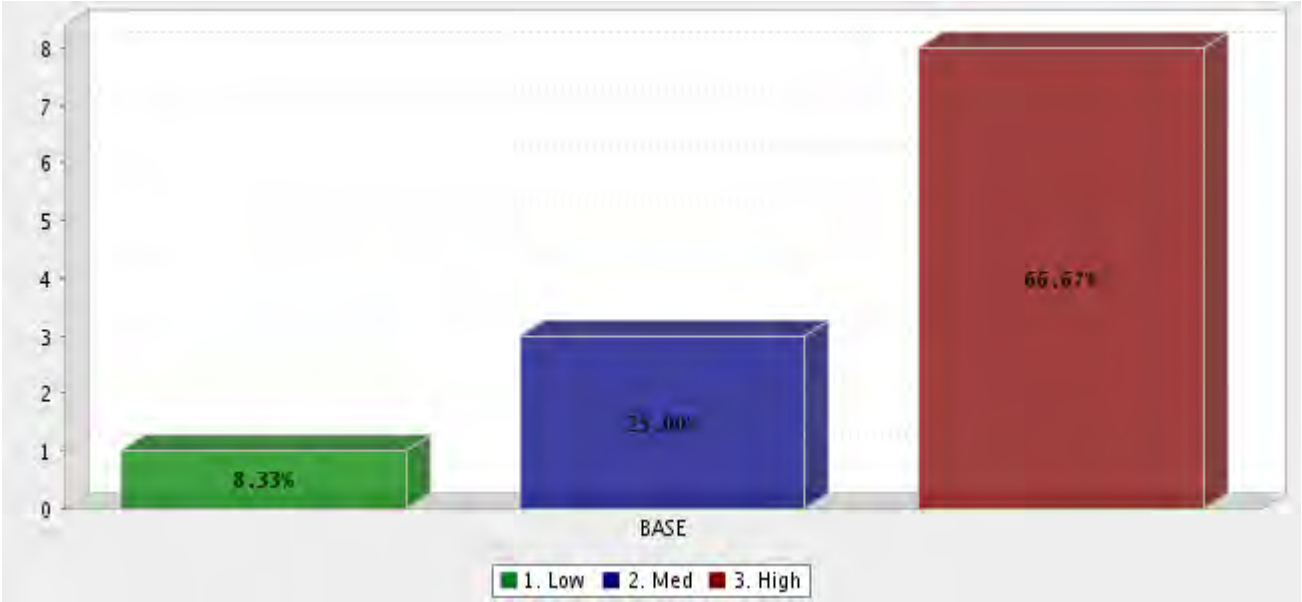
## How long do you or the people you get your wood from typically dry/season your new firewood before the heating season?



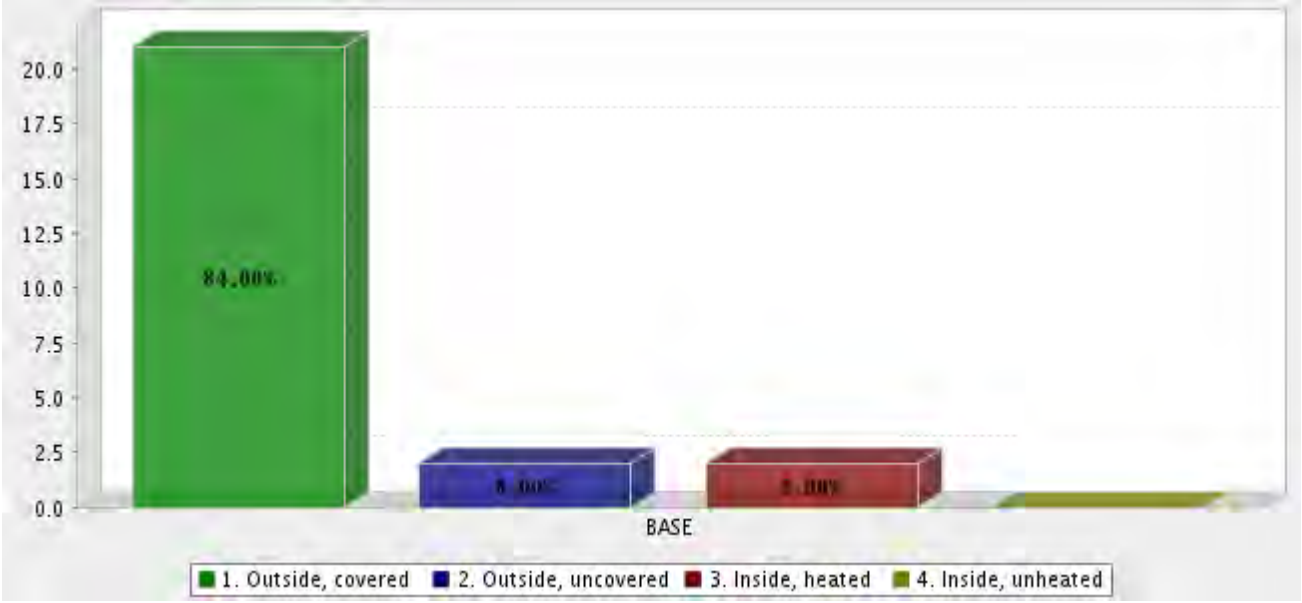
## Do you usually have your firewood split before it is dried or seasoned?



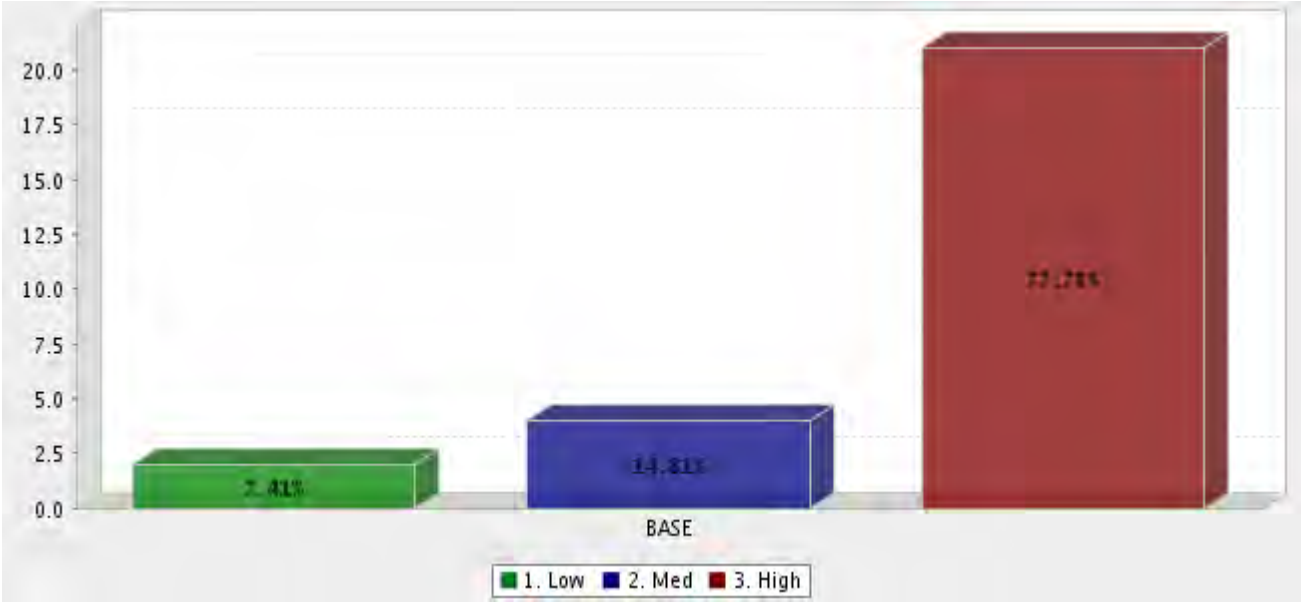
**In many cases unseasoned and unsplit wood is more moist and can generate unhealthy smoke when burned.What is the likelihood of ensuring or continuing to ensure wood is split and seasoned (dryed) for at least 6 months before burning?**



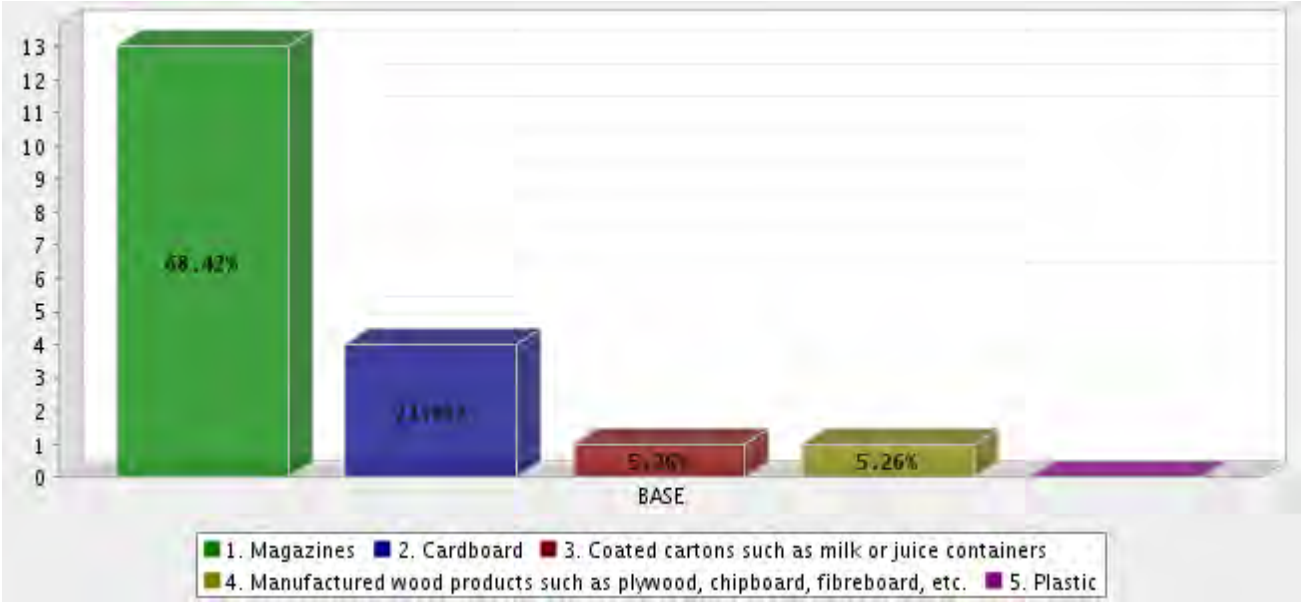
## How do you store the majority of your wood?



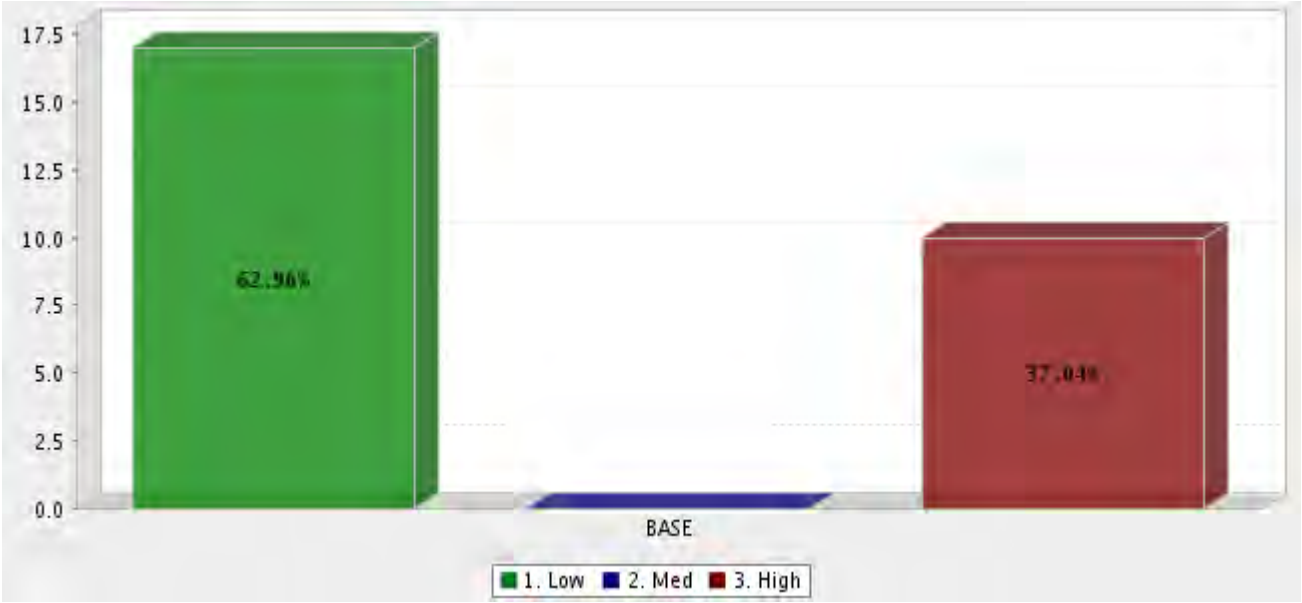
**In many cases uncovered wood is more moist and can generate unhealthy smoke.What is your likelihood of storing or continuing to store the majority of your wood in a covered area (inside or outside)**



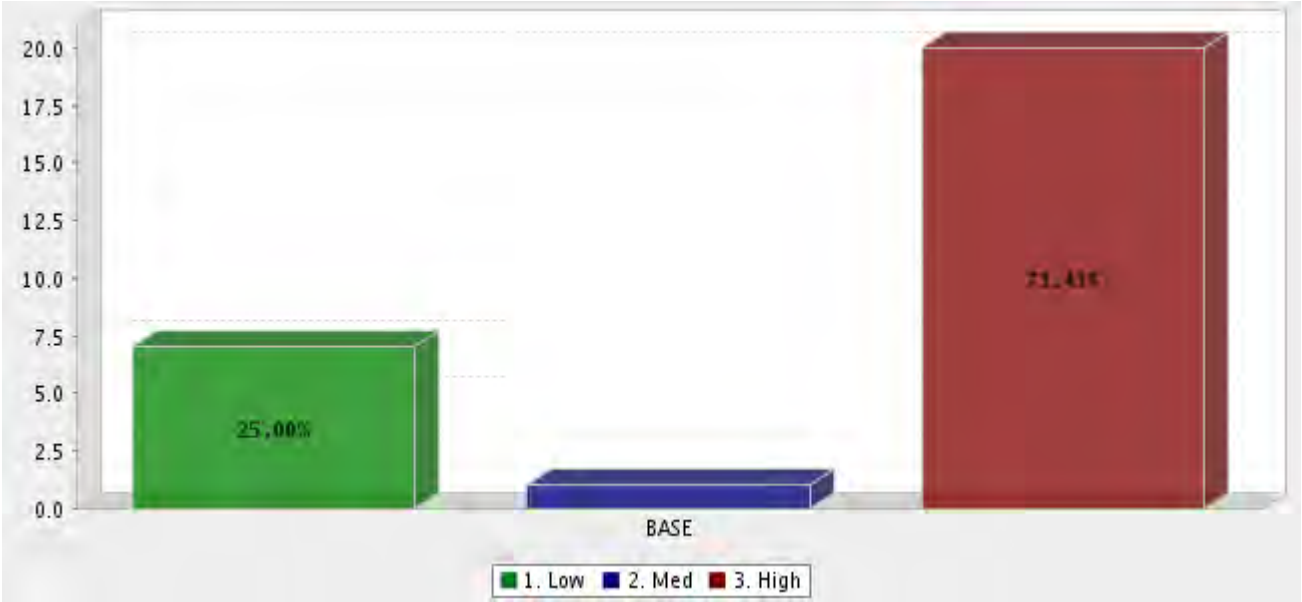
## Which of the following materials do you sometimes burn in your stove? (Select all that apply)



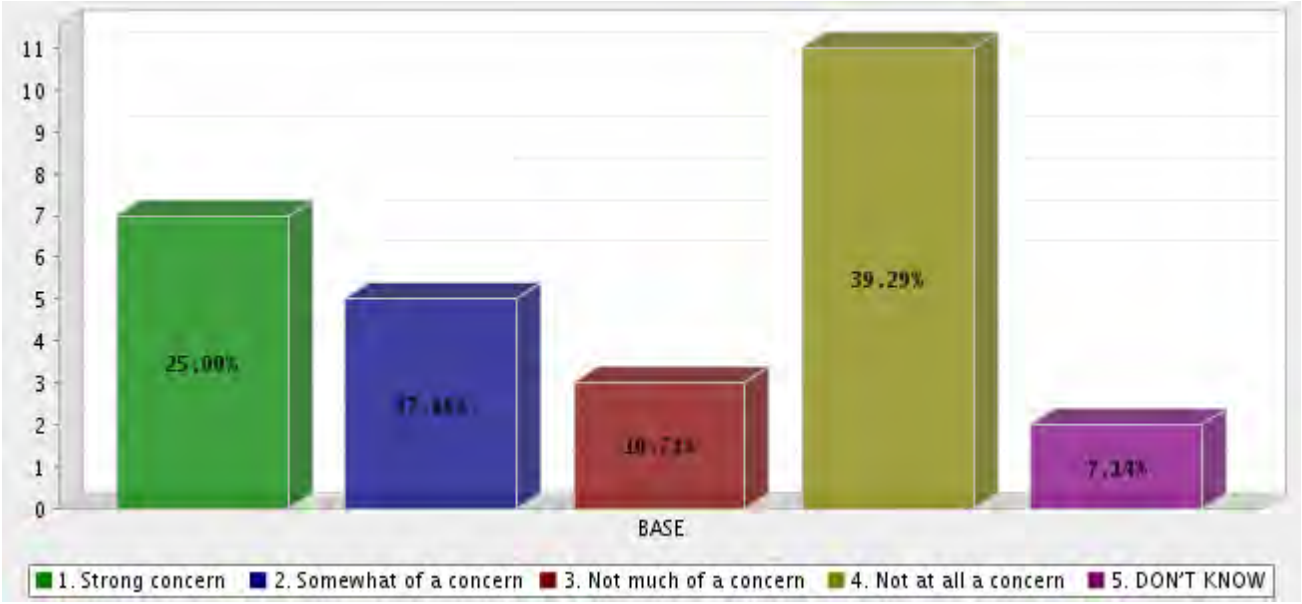
**In many cases non-wood products can generate unhealthy smoke. What's the likelihood that you would consider staying away from burning non-wood products in the future?**



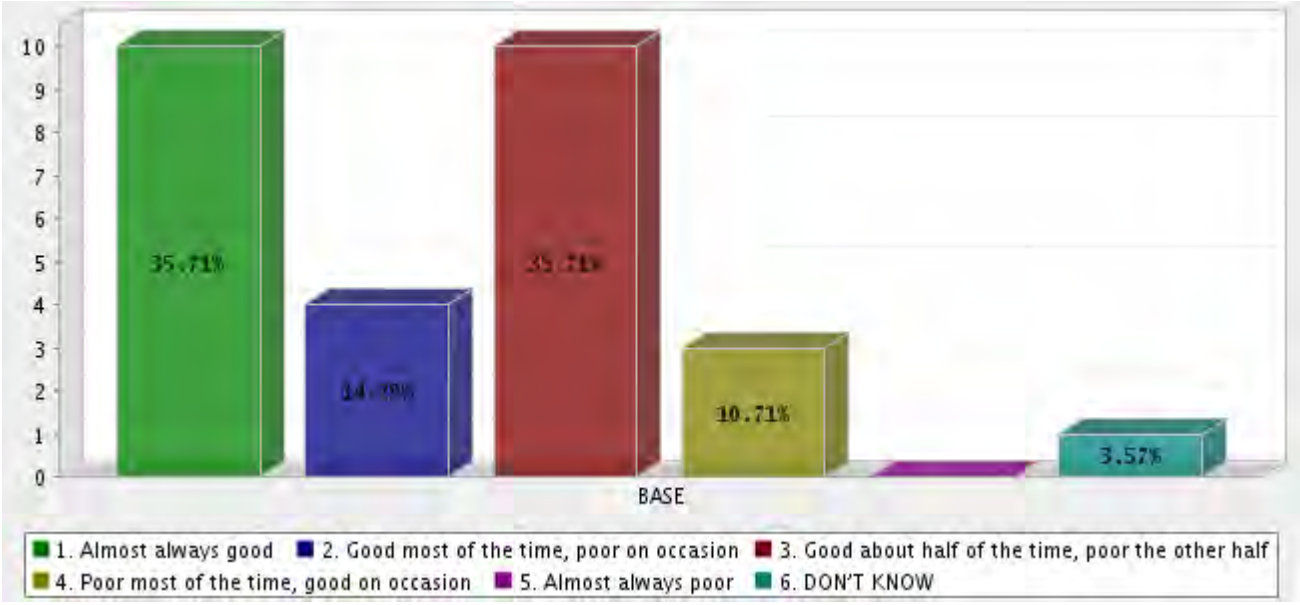
**In some cases where stoves are old, replacing your stove with a cleaner burning updated version can help improve burning. What is the likelihood that you would consider replacing your stove for a cleaner burning and more efficient one?**



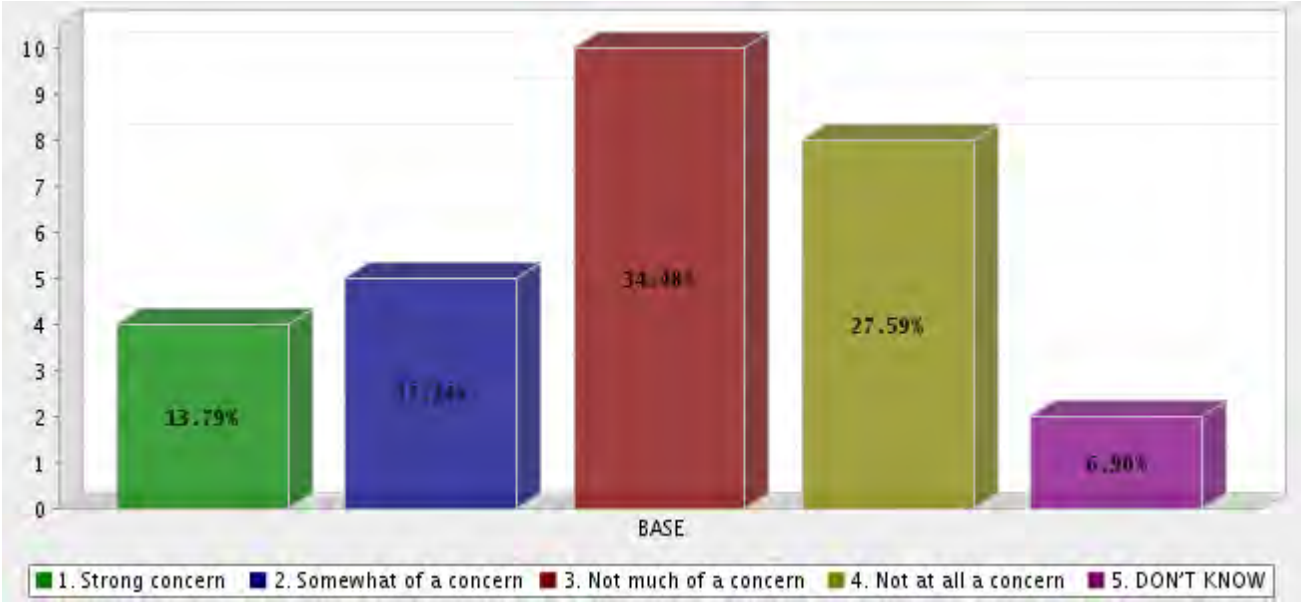
**To what extent is indoor smoke from your stove a concern to you and those who live here?**



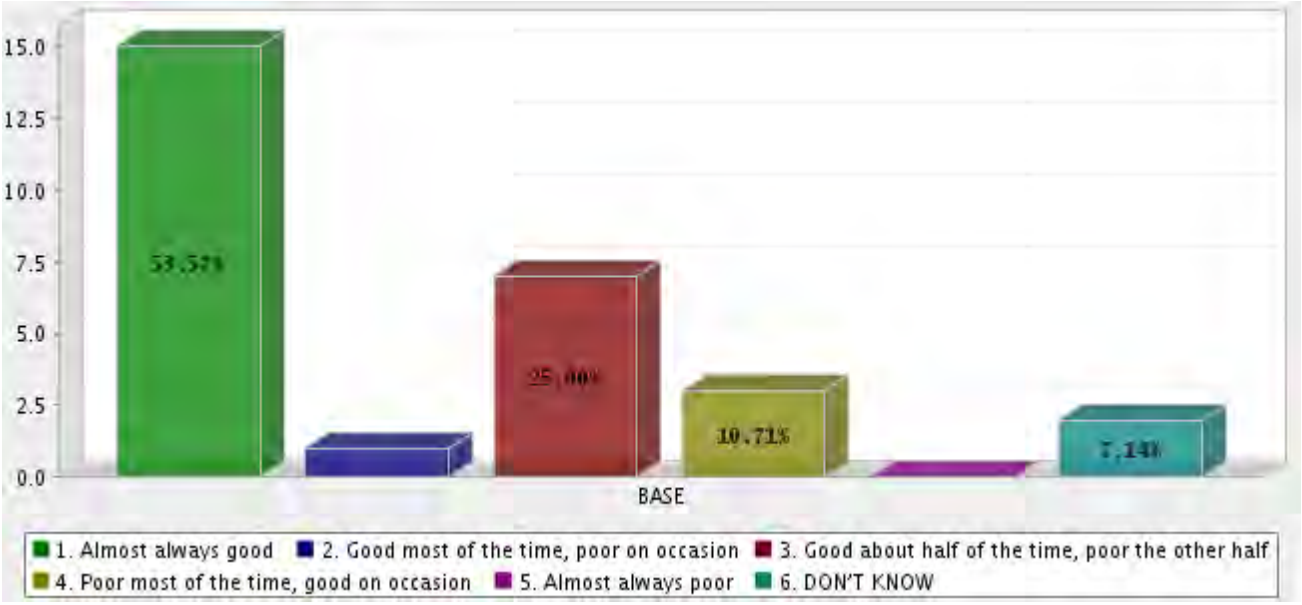
**Which of the following statements best describes how you feel about the air quality in your home**



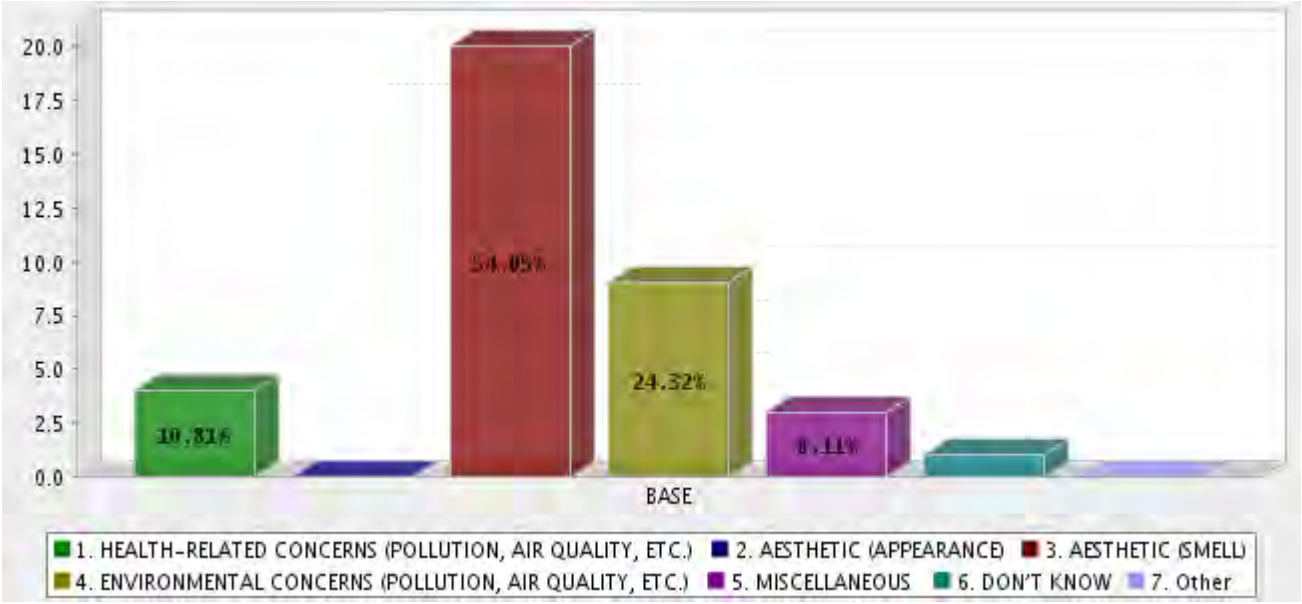
## To what extent is chimney smoke in your local area a concern to you and your family?



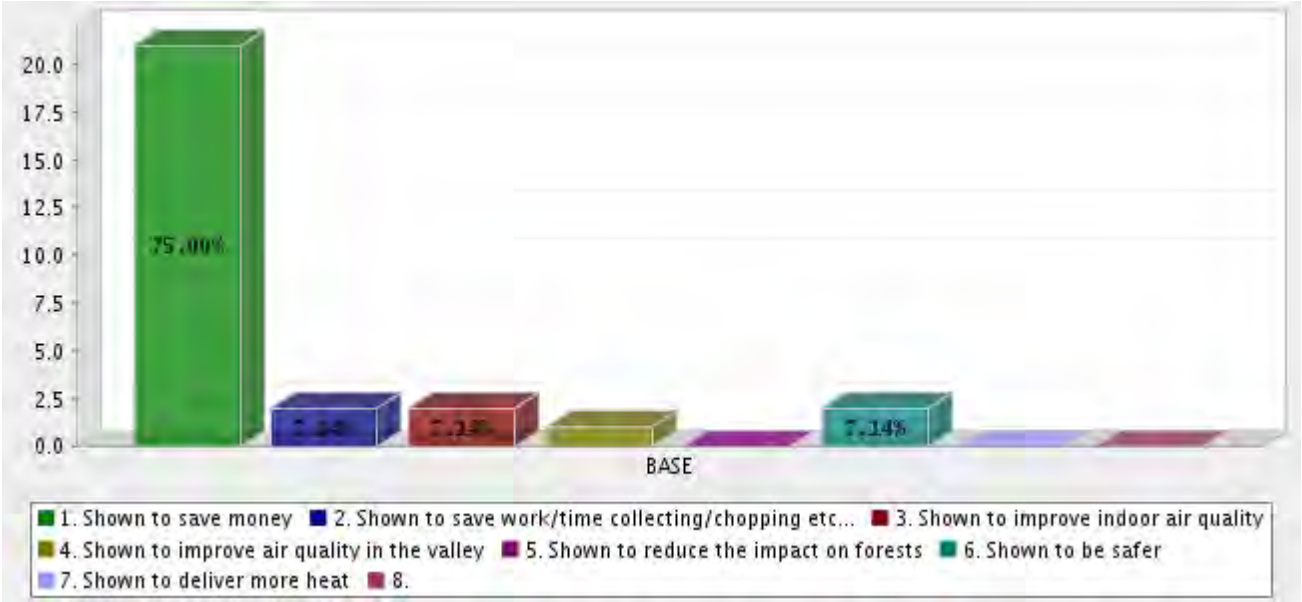
**Which of the following statements best describes how you feel about the air quality in the area that you live?**



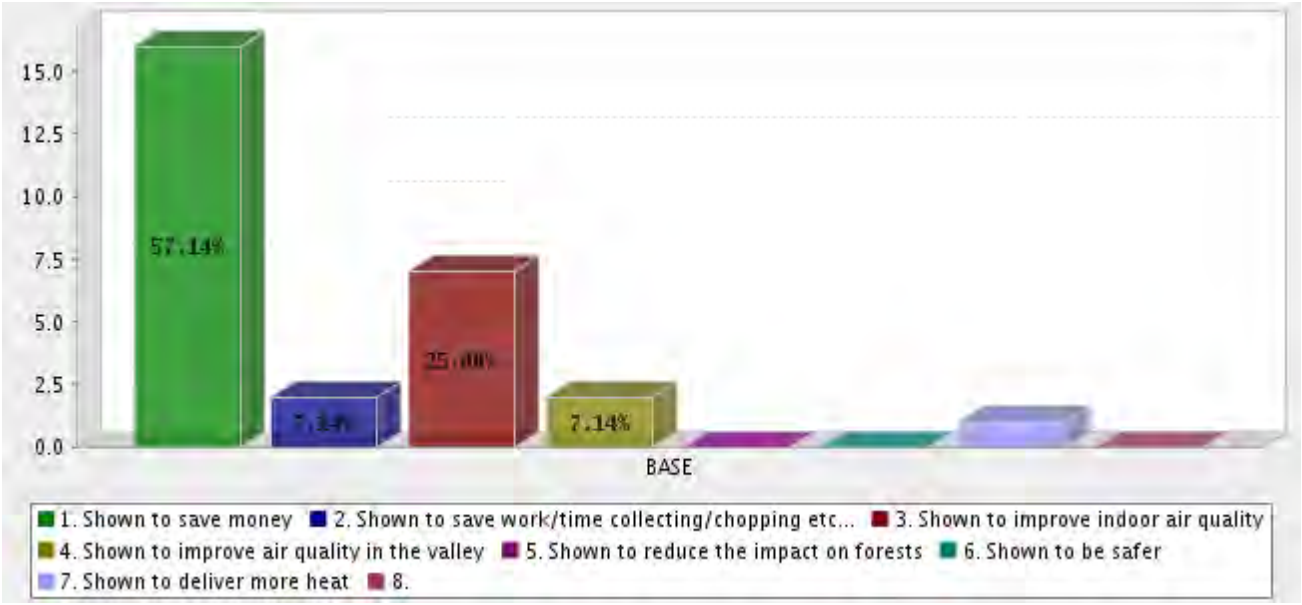
**If you noted smoke as a concern why was that? DO NOT READ Answers, CHECK AS MANY AS APPLY. PROBE**



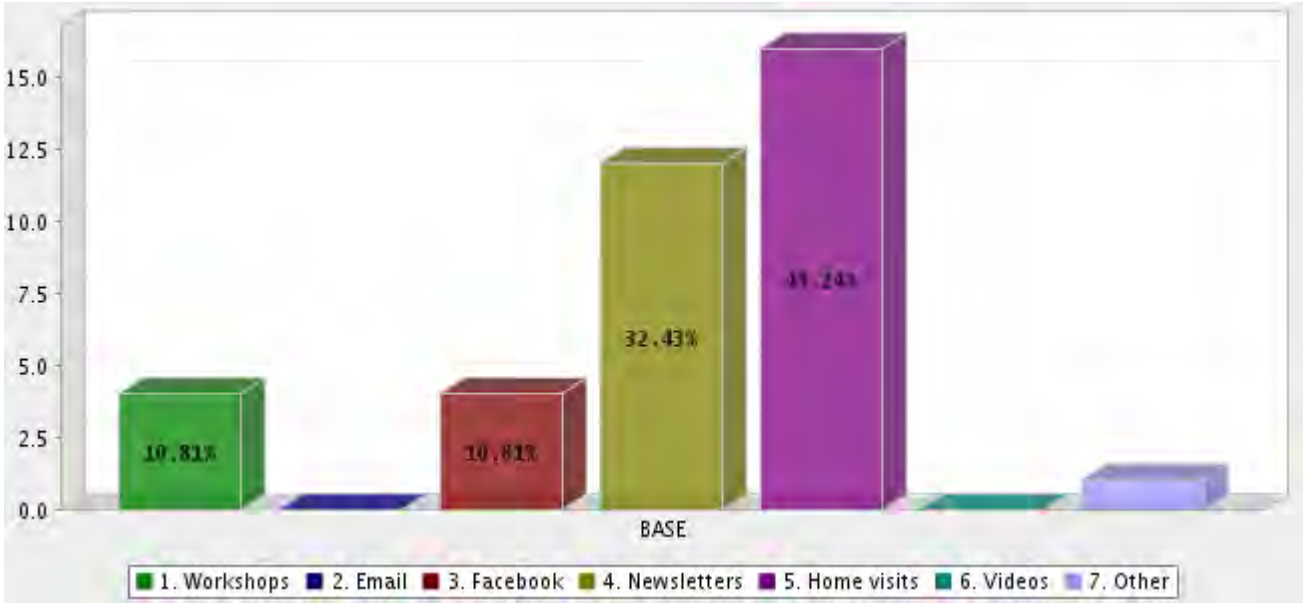
## Which of the following benefits from improved burning practices is most important to you?



## And next most?



**What are the best ways to communicate with you about wood burning techniques and air quality? Do not read. Check those that are mentioned.**



## Note the type of home

## How long have you lived in this home?

| | |
|---|---|
| 4697098 | |
| 4697101 | |
| 4697254 | 40 |
| 4697288 | 4 |
| 4697289 | 65 |
| 4697290 | 10. |
| 4697291 | 1968 |
| 4697410 | |
| 4699829 | |
| 4699920 | 12 |
| 4702805 | 5 |
| 4722593 | 4 |
| 4722594 | 19 |
| 4722595 | 22 |
| 4722596 | 17 |
| 4722597 | 19 |
| 4722598 | 19 |
| 4722599 | 60 |

| | |
|---|---|
| 4723069 | 60 |
| 4723070 | 50 |
| 4723071 | 12 |
| 4726489 | 21 |
| 4736254 | 40 |
| 4736255 | 13 |
| 4736615 | 28 |
| 4736616 | 18 |
| 4814786 | |
| 4815124 | 27 |
| 4815126 | 2 |
| 4815127 | 11 |
| 4815128 | 2 |
| 4815130 | 10 |
| 4819436 | 11 |
| 4819467 | 11 |
| 4819490 | 11 |
| 4819729 | 7 |
| 4820263 | 60 |
| 4820264 | 5 |
| 4820282 | 12 |

| | |
|---|---|
| 4824333 | 32 |
| 4824334 | 28 |

## What percentage of your space heating comes from wood sources?

## What is your other heating source?

## How many hours a day/night (24 hour period) is the wood stove burning? If Range take the average… e.g. 5-7, so would that be 6?

| | |
|---|---|
| 4697098 | 24 |
| 4697101 | 24 |
| 4697254 | 0 |
| 4697288 | 6 |
| 4697289 | 24 |
| 4697290 | 6 |
| 4697291 | 12 |
| 4697410 | 23 |
| 4699829 | 6 |
| 4699920 | |
| 4702805 | 21 |
| 4722593 | 24 |
| 4722594 | 20 |
| 4722595 | 12 |
| 4722596 | 24 |

| | |
|---|---|
| 4722599 | 24 |
| 4723069 | 24 |
| 4723070 | 12 |
| 4723071 | 24 |
| 4726489 | 21 |
| 4736254 | 24 |
| 4736255 | 24 |
| 4736615 | 12 |
| 4736616 | 12 |
| 4814786 | 3 |
| 4815124 | 6 |
| 4815126 | 12 |
| 4815127 | 12 |
| 4815128 | 12 |
| 4819436 | |
| 4819467 | |
| 4819490 | |
| 4819729 | |
| 4820263 | 12 |
| 4820264 | 12 |
| 4820282 | 12 |

| | |
|---|---|
| 4824333 | 12 |
| 4824334 | 24 |

## Where is the stove?

## Type of location

# What brand of stove?

| | |
|---|---|
| 4723069 | Kemt |
| 4723070 | ? |
| 4723071 | Ocanogan |
| 4815124 | Woodsman |
| 4815128 | Kirkland |
| 4824333 | Mnt ? |

## What year was the stove installed? Can you estimate? If provided 5 years ago.. do the quick math 2012-5= 2007. So that would be 2007?

| | |
|---|---|
| 4697098 | |
| 4697101 | |
| 4697254 | 0 |
| 4697288 | |
| 4697289 | 20 |
| 4697290 | 10 |
| 4697291 | 12 |
| 4697410 | |
| 4699829 | |
| 4699920 | |
| 4702805 | 5 |
| 4722593 | 3 |
| 4722594 | 2004 |
| 4722595 | 1 |
| 4722596 | 11 |

| | |
|---|---|
| 4722598 | 12011 |
| 4722599 | 2 |
| 4723069 | 4 |
| 4723070 | 10 |
| 4723071 | 12 |
| 4726489 | 5 |
| 4736254 | 20 |
| 4736255 | 13 |
| 4736615 | 1 |
| 4736616 | 18 |
| 4814786 | 4 |
| 4815124 | 2011 |
| 4815126 | 5 |
| 4815127 | 11 |
| 4815128 | 30 |
| 4819467 | 2001 |
| 4819490 | 2001 |
| 4819729 | 2007 |
| 4820263 | 30 |
| 4820264 | 30 |
| 4820282 | 30 |

| | |
|---|---|
| 4824333 | 30 |
| 4824334 | 10 |

## Barriers to Cleaning Chimney

## Help me understand your answer? Any other reasons?

| | |
|---|---|
| 4697101 | |
| 4697254 | No stove |
| 4697288 | |
| 4697291 | Not needed |
| 4702805 | |
| 4722596 | Cost |
| 4722598 | Cost |
| 4814786 | |
| 4819729 | Hardlly used |
| | |

# Noted Barriers to seasoning wood: Help me understand your answer?

| | |
|---|---|
| 4697101 | |
| 4697254 | |
| 4697288 | |
| 4697289 | They should know. |
| 4702805 | |
| 4722594 | |
| 4722596 | Need woodshed |
| 4814786 | |

# Noted Barriers to Storing Wood undercover: Help me understand your answer?

| | |
|---|---|
| 4697101 | |
| 4697254 | |
| 4697288 | |
| 4697289 | Got one |
| 4697291 | No shed |
| 4702805 | |
| 4722594 | |
| 4722596 | Space for the wood |
| 4736255 | Needwoodshed |
| 4736615 | Woodsheld |
| 4814786 | |

## Noted Barriers to refraining from burning non-wood products: Help me understand your answer?

| | |
|---|---|
| 4697101 | |
| 4697254 | |
| 4697288 | |
| 4697289 | None |
| 4697290 | None |
| 4697291 | None |
| 4702805 | |
| 4722593 | Just to start |
| 4722595 | Just wood to burn |
| 4722596 | Eletric hurts my nose |
| 4722599 | Cost |
| 4723069 | Nome |
| 4723070 | None just news paper |
| 4726489 | Just start |
| 4736254 | None |
| 4736255 | None |
| 4736615 | Need new pipe |

| | |
|---|---|
| 4736616 | None |
| 4814786 | |
| 4815127 | Nothing just wood |
| 4824333 | None other |
| 4824334 | No |

## Noted Barriers to Replacing the Stove for a New one: Help me understand your answer?

| | |
|---|---|
| 4697101 | |
| 4697288 | |
| 4697291 | New |
| 4702805 | |
| 4722593 | Mew yet |
| 4722596 | It is newyet |
| 4722599 | New yet |
| 4723069 | Still new |
| 4723071 | New yet |
| 4736255 | New yet |
| 4824333 | Depends make |

## What are the best ways to communicate with you about wood burning techniques and air quality? Do not read. Check those that are mentioned.

## OTHER?

| | |
|---|---|
| 4819490 | Mail mail |

# JUST A FEW MORE: How many people live in the home?

| | |
|---|---|
| 4697254 | 4 |
| 4697288 | |
| 4697289 | 2 |
| 4697290 | 1 |
| 4697291 | 2 |
| 4702805 | |
| 4722593 | 2 |
| 4722594 | 6 |
| 4722595 | 2 |
| 4722596 | 2 |
| 4722599 | 2 |
| 4723069 | 2 |
| 4723070 | 2 |
| 4723071 | 1 |
| 4726489 | 6 |
| 4736254 | 2 |

| | |
|---|---|
| 4736255 | 2 |
| 4736615 | 3 |
| 4736616 | 5 |
| 4815124 | 1 |
| 4815126 | 2 |
| 4815127 | 6 |
| 4815128 | 1 |
| 4819490 | 2 |
| 4819729 | 6 |
| 4820263 | 1 |
| 4820264 | 4 |
| 4820282 | 2 |
| 4824333 | 2 |
| 4824334 | 4 |

## How many over 60 Years of age?

| | |
|---|---|
| 4697254 | 0 |
| 4697288 | |
| 4697289 | 0 |
| 4697290 | |
| 4697291 | 0 |
| 4702805 | |
| 4722593 | 0 |
| 4722594 | 0 |
| 4722595 | 0 |
| 4722596 | 0 |
| 4722599 | 2 |
| 4723069 | 1 |
| 4723070 | 0 |
| 4723071 | 0 |
| 4726489 | 0 |
| 4736254 | 1 |

| | |
|---|---|
| 4736255 | 0 |
| 4736615 | 00 |
| 4736616 | 0 |
| 4815124 | 0 |
| 4815126 | 0 |
| 4815127 | 0 |
| 4815128 | 0 |
| 4819729 | 0 |
| 4820263 | 0 |
| 4820264 | 0 |
| 4820282 | 0 |
| 4824333 | 0 |
| 4824334 | 0 |

# How many under 10?

| | |
|---|---|
| 4697254 | 2 |
| 4697288 | |
| 4697289 | 0 |
| 4697290 | 0 |
| 4697291 | 0 |
| 4702805 | |
| 4722593 | 0 |
| 4722594 | 1 |
| 4722595 | 0 |
| 4722596 | 0 |
| 4722599 | 0 |
| 4723069 | 0 |
| 4723070 | 0 |
| 4723071 | 0 |
| 4726489 | 2 |
| 4736254 | 0 |

| | |
|---|---|
| 4736255 | 0 |
| 4736615 | 0 |
| 4736616 | 1 |
| 4815124 | 0 |
| 4815126 | 0 |
| 4815127 | 1 |
| 4815128 | 0 |
| 4819729 | 2 |
| 4820263 | 0 |
| 4820264 | 2 |
| 4820282 | 0 |
| 4824333 | 0 |
| 4824334 | 0 |

# Notes for surveyor....

| | |
|---|---|
| 4736254 | Need new stove |
| 4736255 | Stove gpt rusty |
| 4736615 | Need mew stove |
| 4736616 | O |
| 4815124 | |
| 4815125 | No |
| 4815126 | Taken it out give it to son |
| 4815127 | None |
| 4815128 | Needs stove |
| 4815129 | |
| 4815133 | |
| 4815134 | |
| 4819729 | |
| 4820263 | New stove |
| 4820264 | Cleaned |
| 4820282 | Need new stove |

| | |
|---|---|
| 4824333 | Just moved in |
| 4824334 | Cap needs |

# Air Quality Methodology and Results

# Lil'wat Nation Cleaner Stoves for Cleaner Air Project – Methodology and Worksheets

**Subject: Indoor Air Quality Monitorin**

**Objective:** To determine if indoor air quality changes for the better or for the worse post stove retrofit

**Indoor Air Sampling Methodology**

Sample 24-hour period, 4 sample days as a baseline and then again post stove change out.

**Technology:**

1) MIGHT NOT USE: Leland Sampler / Personal Environmental Monitor (PEM) with a quartz filter:(filter:

– Organic Carbon / Elemental Carbon (OC/EC)

– Chemical markers (vanillin, acetovanillone, guaiacol, 4 4- ethylguaiacol, levoglucosan, abietic acid, dehydroabietic acid)

2) Dylos 1100 Air Quality Monitor – with PC interface (http://www.dylosproducts.com/index.html) – Recommended by Dr. Brauer


**Equipment Student duties:**

– Calibration and set set-up

– Cleaning

**Set up:**

- To best capture residents' exposures the indoor sampling equipment was placed in the most frequently used living room, as far as possible from windows, doors, and ventilation sources to limit the impacts of infiltration from outside.
- If the stove is in the living room, the monitor should be placed as far away from the stove as possible and away from infiltration locations.
- An attempt was made to schedule pre- and post-exchange sampling on the same days of the week to minimize the effect of weekday/weekend differences in stove use patterns.

**Recording Sheet for Vanessa**

| Building type | Building Age | Sq Footage | Attached Garage? | Pre Exchange Sampling Start Date and Time | Pre exchange sampling average temp | Post-exchange Sampling Start and Time | Post exchange sampling average temp | Old stove location | New stove location |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

**Stove 1 Characteristics:** Age, Brand, location, model

**Stove 2: Characteristics:**

**Student Record Keeping:**

– Documenting equipment readings – post study period

– Downloading & emailing data – after day 1, and post study period

- Downloading study period weather data from environment Canada – temperatures etc....
- Take photos of the home and unit set up in the home
- Provide a sketch/photos of the area where the air quality monitor is set up – windows, doors, walls appliances stove etc...

**Participant Record Keeping**

**Participant: Record of home activities:**

–cooking, cleaning, candles, etc.

–traditional burning (sweet grass, sage, etc...)

**Participant: Record of wood burning activities**

– Loading and stoking

– Size of logs and how many pieces used

-Moisture content

RECORDING ACTIVITY SHEET FOR PARTICIPANT

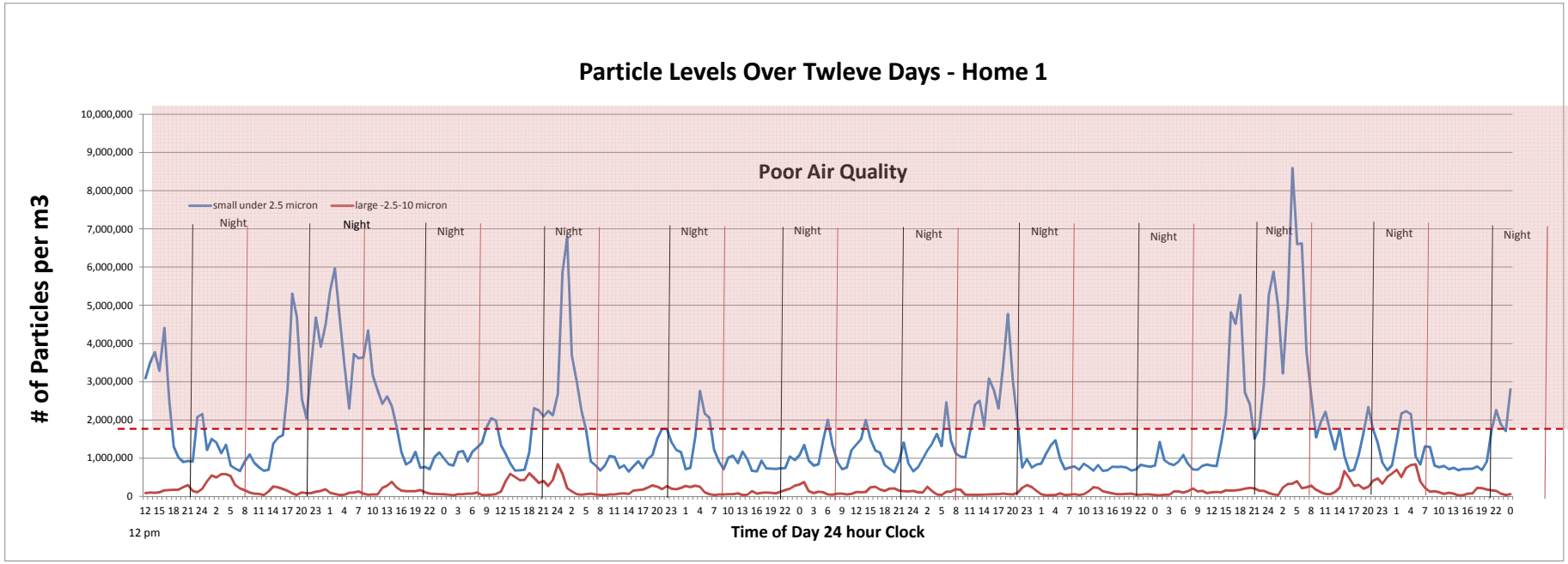
| **Activity** | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
|---|---|---|---|---|
| **O**ccupied/**U**noccupied | e.g O 9:00am or U 9:05am | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Stove **L**it/**U**nlit | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
| | e.g L 9:00am or U 9:05am | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Stove Door **O**pen/**C**losed | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
| | e.g O 9:00am or C 9:05am | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

RECORDING ACTIVITY SHEET FOR PARTICIPANT

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Wood added to stove | **Day 1- Time/Moisture %/Size of logs** | **Day 2 – Time/Moisture %/Size of logs** | **Day 3- Time/Moisture %/Size of logs** | **Day 4- Time/Moisture %/Size of logs** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Cooking | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
| | | | | |
| | | | | |

RECORDING ACTIVITY SHEET FOR PARTICIPANT

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Cleaning/tidying home | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Candles O**n**/Of**f** | **Day 1- Time** | **Day 2 – Time** | **Day 3- Time** | **Day 4-Time** |
| | e.g N 9:00am or F 9:05am | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |


Particle Levels Over Twleve Days - Home 1
# of Particles per m3
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Poor Air Quality
small under 2.5 micron
large -2.5-10 micron
Night
12 15 18 21 24 2 5 8 11 14 17 20 23 1 4 7 10 13 16 19 22 0 3 6 9 12 15 18 21 24 2 5 8 11 14 17 20 23 1 4 7 10 13 16 19 22 0 3 6 9 12 15 18 21 24 2 5 8 11 14 17 20 23 1 4 7 10 13 16 19 22 0
12 pm
Time of Day 24 hour Clock

**Appendix 4:** Communication Strategy Timeline, Story Starters, Newsletters, and *Social Media Communications*

**Lil'wat Clear Communication Pieces**

**Posting one:**

As you cozy up to stay warm during this mid winter cold spell we want to remind you that during the summer, Vanessa Dan and xxxxxxx visited homes to survey and talk to band members about wood stoves, wood burning and clean burning techniques. Survey participants were entered into a draw for a home air purifier and we are pleased to announce the winner of the purifier is xxxxxxx. Congratulations!

As you may be getting new wood deliveries midway through heating seasons here are 4 Steps to ensure that you are burning dry wood:

1. Have your wood split
2. Stack it with lots of air flow
3. Cover it
4. Store it for at least 6 months or make sure your supplier has stored it

Here is a link to a video on wood selection
http://www.youtube.com/watch?feature=player_embedded&v=esOhChmdUq4#!

*Background:*

*As reported earlier, Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

**Posting two:**

Heating with wood is cheap right? While burning firewood to stay warm during the cool weather is aesthetically pleasing, nostalgic and produces are warm moist heat, it isn't free. In fact, a recent energy report for the Lil'wat Nation estimates that as a community, we spend approximately $90,000 per winter on wood heating. In addition, the amount of wood used each year equates to the area of 6 soccer fields of our forests. If you harvest wood yourself, it may not cost your money, but it certainly can cost you time and perhaps even a sore back.

To reduce your costs and time spent on gathering wood , burn dry wood, burn it right and maintain your wood stove, Other benefits of these approaches include:

-improving your air quality in your house and

-providing a safer burning experience

Here are two videos to help you save by burning dry wood right.

Here is a link to a video on wood selection
http://www.youtube.com/watch?feature=player_embedded&v=esOhChmdUq4#!

Here is a link to a video on burning practices:

http://www.nanaimo.ca/assets/Departments/Community~Planning/Environmental~Planning/Burn~It~Smart/WoodStoveOperation.wmv

*Background:*

*As reported earlier, Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

**CONTEST Best Stack photo – send it in**

**Posting 3**

It's your health

"Wood smoke contains a number of substances that can be harmful to you, your family and your neighbours health. Exposure to wood smoke can cause eye, nose, and throat irritation, headaches, nausea and dizziness. It is also associated with making asthma worse." Health Canada, January 2011

Some wood burning pollutants seep into your home directly from opening your wood stove door, leaky gaskets and/or poor burning techniques, but a significant amount can also come into your home from the outdoors.

Beyond smoke inhalation, burning wet wood and using poor burning techniques can build up residue in your chimney and lead to dangerous chimney fires. Last summer we had to respond to ### number alone.

Watch this funny video and ensure that the master burner in your home makes a similar pledge.
http://www.youtube.com/watch?v=Ev4XogvRbME

Here is a link to a video on burning practices:
http://www.cleanaironthecoast.com/index.php/cleanairsociety/videoentry/wood_stove_operation/

**Cleanest Stove Pipe Cap Contest**

**Cleanest Stove Contest.**

**Posting 4**

**Stove Exchanges**

Burning dry wood and maintaining your wood stove is the best way to save money, reduce the amount of wood you need, improve air quality and improve the fire safety in your home. After instilling good burning practices and a well-maintained stove the next best thing you can do is to increase the efficiency of your existing stove unit. If you don't already have a newer stove that is certified by the Environmental Protection Agency (EPA), you may be missing out on additional costs savings and air quality benefits.

Earlier this year we measured the air quality in two homes that were using an older stove unit. Both Darwin Gabriel and ? open their homes to help understand the impact a new stove might make on air quality. The results before the stove exchange showed XXXX.

What do you think happened after the stoves were changed? Like this post if you think the air quality got better.

As always here are a few new videos with burning tips and tips for selecting a new stove.

Video burning rules:

http://www.youtube.com/watch?v=7fDWWOBhWsc

Video Selecting a new stove:

http://www.airwatchnw.org/wp-content/uploads/vid/NWAQC_selecting_a_stove.wmv

**Posting 9 – Seasoned wood and maintenance thinking about next year.**

The snow has melted and home heating season is going to end soon. After a long winter of wood heating your wood pile may be dwindling down . Since burning dry wood and maintaining your wood stove is the best way to save money and reduce the amount of wood you need you may want to start thinking about getting wood for next year. If you purchase wood, it might be a good time to let your wood supplier know that you want to have dry wood in the Fall and throughout next winter.

Dry wood has a moisture content of less than 20%, and has a hollow sound when two split logs are knocked together.

Here are 4 Steps to ensure that you are burning dry wood:

1. Have your wood split
2. Stack it with lots of air flow
3. Cover it
4. Store it for at least 6 months or make sure your supplier has stored it

Here is a link to a video on wood selection

http://www.youtube.com/watch?feature=player_embedded&v=esOhChmdUq4#!

*Background:*

*As reported earlier, Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

**CONTESTS**

# Housing Update...

**By Gayle Andrews**

**Four (4) Houses Construction – UPDATE** The MCB Housing Department did not qualify for houses this year and reapplying in six months for April 2013 – we're still ready to resubmit.

**CMHC – RRAP regular & disability renovations – UPDATE** approval soon project by project, you will be contacted soon for builders inspections by CMHC inspector.

**Conversion – Housing CMHC $25,000.00 – UPDATE** four packages submitted into CMHC.

**COMING SOON – NOVEMBER 2012**

**Basic Home Maintenance Workshop done by CMHC representative – all tenants will be expected to attend. (A lot of free information and a lot of door prizes to assist you with basic home maintenance)**

**Maintenance & Repairs to Ull'us Front Desk to Reception for a work order. (5 w's)**

**Home Insurance Coverage UPDATE – MCB new Home Insurance provider is AON**

## Did you know?

That moisture and mold is preventable and repairable and sometimes nontoxic.

That it takes 48 hours for mold to grow?

There are pamphlets available in Ull'us reception area this pamphlet tells you:

- How to prevent mold from growing
- How to find out if mold is growing in your house; and
- How to clean up small amounts of mold

**Fall is the time to get your home ready for the coming winter, which can be the most grueling season for your home.**

**Woodstoves** – most modern wood stoves burn more efficiently and produce less smoke.

It is time to clean out your stoves, heating systems and chimneys, vents & ducts.

**Dry wood** produces more heat and less *creosote* than wet wood.

**Damaged masonry chimneys** can be lined with stainless steel liners making them safer and easier to clean.

**Septic tanks** – should be pumped out every two years or earlier depending on if more than four people residing in household.

***There are a lot of Basic Home Maintenance guides and information online or available upon request here at Ull'us – leave your name and number at front desk and a copy of CMHC's "First Nations Home Occupants Guide to BASIC HOME MAINTENANCE" can be given or be sent to you.***

REDUCE * REUSE * RECYCLE

# A Message from the Lands & Resources

By Graham Haywood

**Lil'wat Nation Wood Stoves for Cleaner Air Project: Burn Dry Firewood to Save Money and Time**

*As reported in the June and April newsletter, the Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

During the summer, Vanessa Dan visited homes to survey and talk to band members about wood stoves, wood burning and clean burning techniques. During their work, they observed new and old stoves and talked to many of you about the proper care of your stove and the proper seasoning of your wood for this coming winter.

As a reminder, here are the Four Steps to dry wood:

1. Have your wood split
2. Stack it with lots of air flow
3. Cover it
4. Store it for at least 6 months or make sure your supplier has stored it

Most people taking part in the survey noted that they 'purchased their wood from a wood service' with an equal amount 'gathering wood' themselves or 'receiving it from the Band'. If you get your wood from a service provider or the band make sure they deliver dry wood. While a moisture meter can help identify wood with 20% or less moisture content, you can also look for dry cracks in the ends of the split wood or bang two pieces together, listening for a 'hollow' sound.

Remember burning dry wood saves money, saves time and burns cleaner.

Also, I'd like to remind everyone with a stove to remember to get the chimney cleaned at least once every season if wood is your main source of heating. We had 12 chimney fires last year that could have been prevented and saved money by regular cleaning. We've secured a good rate for cleaning for $90 - $110 if you are interested in this service please contact Tristan at 604-902-7417

For more information on the Lil'wat Nation Cleaner Stoves for Cleaner Air Project please contact me at the Lil'wat Nation Lands and Resources office.

# A message from Lands...

By Graham Haywood

Well another winter is over and it's starting to feel like it is a better time to spend some time outside in the sun! But there might be a few more cool nights, so as a final message about wood smoke and clean burning practices, please remember the following:

**Wood Smoke and Your Health**

"Wood smoke contains a number of substances that can be harmful to you, your family and your neighbour's health. Exposure to wood smoke can cause eye, nose, and throat irritation, headaches, nausea and dizziness. It is also associated with making asthma worse." Health Canada, January 2011

Some wood burning pollutants seep into your home directly from opening your wood stove door, leaky gaskets and/or poor burning techniques, but a significant amount can also come into your home from the outdoors.

Beyond smoke inhalation, burning wet wood and using poor burning techniques can build up residue in your chimney and lead to dangerous chimney fires. Over the last year, we had to respond to 12 chimney fires in Lil'wat. Let's get this number down to zero by following the proper wood burning practices… burn dry and seasoned wood!

**Environmental Workshop, Wednesday April 3rd!**

We are hosting a community environmental workshop on clean burning, waste reduction and recycling. This workshop will be taking place from 6:30-8:00 PM at the Xet'olacw Community School. There will be some hand out materials, videos, short talks and other great resources. We will also be handing out prizes and gifts, relating to clean burning and recycling, for those who attend. A light snack and refreshment will be served.

**Framework Agreement on First Nations Land Management**

It has taken several years of applications and waiting lists, but on March 25th Chief Lucinda Phillips signed the adhesion documents for the Framework Agreement on First Nations Land Management. The adhesion documents were also signed by Aboriginal Affairs Minister Bernard Valcourt, and the signing was witnessed by Councilor Josh Anderson. The event took place in Ottawa and was an historic event for Lil'wat, affirming the Nation's commitment to replacing 34 sections of the Indian Act with a Lil'wat Land Code that will be developed by the community over the course of the next two years. Throughout this time Lil'wat Members can expect to receive several communications and information packages that will explain the options that are available to the community for developing the custom Lil'wat Land Laws. There will also be several community information workshops where we need as many community members as possible to attend and provide advice, information and feedback. As well as developing the Land Code, the community will also be needed to help guide an 'Individual Transfer Agreement', which is an agreement Lil'wat will sign with Canada on the extent of the Lil'wat Reserve Lands that will be transferred from Canada to Lil'wat. We will do our best to notify the community of all of the important upcoming dates related to the FNLM, so be sure to keep up to date with all of the information that will be coming your way.

**Land Registrations and Transfers**

As the winter has come to an end and the snow has melted, many community members will surely be thinking about building fences and improving their land. If you feel that you need to define your land boundaries and get your land registered, please make an

# Lands & Resources Update Continued.....

By Graham Haywood

As reported in the April newsletter, the Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of the next year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices. As part of the program beginning in June, Vanessa Dan and Danita Abraham will be visiting homes and creating a baseline of existing woodstoves and attitudes and opinions toward wood burning and clean burning techniques. Please take the time to participate in their 5-15 min survey so that your views inform the design of a communications program that may include workshops, Facebook articles, emails, newsletters etc.

The communications program, combined with some real-life results from replacing or maintaining old wood stoves in a couple of homes in the community, will provide knowledge about the air quality and health impacts of more efficient wood stoves and burning practices. A follow up opinion survey will take place next spring to gauge any changes in opinions and attitudes toward wood stove use in the community.

The "The Stoves for Cleaner Air Project" runs from March 2012 until April 30th/2013 and is a Partnership between the Lil'wat Nation, Whistler Centre for Sustainability, Sea to Sky Clean Air Society, Ts'zil learning Centre and the Fraser Basin Council.

For more information on the Lil'wat Nation Cleaner Stoves for Cleaner Air Project please contact me at the Lil'wat Nation Lands and Resources office.

To ALL the VOLUNTEERS

THAT HELPED MAKE THIS HAPPEN

**2012 LIL'WAT/LILLOOET LAKE RODEO**

***All your hard work is much appreciated.***

We look forward to another great year, next year!

Thank you

# A Message from Lands & Resources....

**Lil'wat Clear Communication Pieces**

**Posting one:**

As you cozy up to stay warm during this mid winter cold spell we want to remind you that during the summer, Vanessa Dan visited homes to survey and talk to band members about wood stoves, wood burning and clean burning techniques. Survey participants were entered into a draw for a home air purifier and we are pleased to announce the winner of the purifier is Ralph Dan Jr. Congratulations!

As you may be getting new wood deliveries midway through heating seasons here are 4 Steps to ensure that you are burning dry wood:

1. Have your wood split
2. Stack it with lots of air flow
3. Cover it
4. Store it for at least 6 months or make sure your supplier has stored it

Here is a link to a video on wood selection http://www.youtube.com/watch?feature=player_embedded&v=esOhChmdUq4#!

*Background:*

*As reported earlier, Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

**Posting two:**

Heating with wood is cheap right? While burning firewood to stay warm during the cool weather is aesthetically pleasing, nostalgic and produces are warm moist heat, it isn't free. In fact, a recent energy report for the Lil'wat Nation estimates that as a community, we spend approximately $90,000 per winter on wood heating. In addition, the amount of wood used each year equates to the area of 6 soccer fields of our forests. If you harvest wood yourself, it may not cost your money, but it certainly can cost you time and perhaps even a sore back.

To reduce your costs and time spent on gathering wood , burn dry wood, burn it right and maintain your wood stove, Other benefits of these approaches include:

-improving your air quality in your house and

-providing a safer burning experience

Here are two videos to help you save by burning dry wood right.

Here is a link to a video on wood selection http://www.youtube.com/watch?feature=player_embedded&v=esOhChmdUq4#!

Here is a link to a video on burning practices:

http://www.nanaimo.ca/assets/Departments/Community~Planning/Environmental~Planning/Burn~It~Smart/WoodStoveOperation.wmv

*Background:*

*As reported earlier, Lil'wat Nation is conducting "The Stoves for Cleaner Air Project" over the course of this year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices.*

# Lands & Resources Update

By: Graham Haywood

**Lil'wat Nation Wood Stoves for Cleaner Air Project:**

The Lil'wat Nation will be conducting "The Stoves for Cleaner Air Project" over the course of the next year. The project aims to generate greater awareness and understanding of the impacts of non-efficient burning wood stoves and burning practices. An educational and communications campaign, possibly combined with some real-life results from replacing or maintaining old wood stoves in a couple of homes in the community, will provide knowledge about the air quality and health impacts of more efficient wood stoves and burning practices. The project will run from March 2012 until April 30th/2013 and is a Partnership between the Lil'wat Nation, Whistler Centre for Sustainability, Sea to Sky Clean Air Society, Ts'zil learning Centre and the Fraser Basin Council.

The project will begin by creating a baseline of existing woodstoves and attitudes and opinions toward wood burning and clean burning techniques. From this experience a communications program that may include workshops, Facebook articles, emails, newsletters etc. will slowly launch in the spring and build into fall 2012. During this time two homes will be selected for the pilot project and air quality measurements of existing wood burning techniques will begin. Into the fall, the same households will monitor air quality results and health impacts using new systems and burning approaches.

A follow up opinion survey will take place next spring to gauge any changes in opinions and attitudes toward wood stove use in the community.

For more information on the Lil'wat Nation Cleaner Stoves for Cleaner Air Project please contact me at the Lil'wat Nation Lands and Resources office.

Also, I'd like to remind everyone that the building season is now upon us and if you are considering building a home within the reserve land, it is definitely a requirement and a good idea to get your land registration process underway. Feel free to drop by the Lands Office to talk more about your land. Have a great April!

*By: David Dorrans*

**Lands, Resources & Public Infrastructure Update**

Things have been busy since the New Year in our department as we work to integrate new people, complete major projects and plan for projects in the coming fiscal year.

**Public Infrastructure**

As you know from last month's newsletter Alex Kleinman (Capital Projects Manager) and Calvin Jameson (Public Works Superintendent) have joined the management team and they are each continuing to get comfortable in their positions. Also, we have moved the Housing department into the Public Infrastructure department – Gayle Andrews and her department have always worked closely with Public Works and Capital Projects. Moving her department into Public Infrastructure will formalize this cooperation and give Gayle more support from Public Infrastructure as well as the On-Reserve Lands department. This will hopefully lead to positive change in the areas of maintenance and new home construction. Thank you to Debbie Alendal for all her work with the Housing department over the last couple of years – so if you can't reach Gayle on Housing matters please contact me in the Lands office at 604-894-2333.

**Appendix 5:** *Follow up Survey results - Detailed*

## Lil'wat Nation's Wood Stoves for Cleaner Air Project Survey Objectives

- To understand changed patterns and attitudes
- To understand motivation for change
- To test recall of communication pieces and messaging

## Survey Script

Hello my name is xxxx and I'm conducting a follow up questionnaire with the Lil'wat Nation's Wood Stoves for Cleaner Air Project on indoor wood burning appliances. The questionnaire includes a brief set of questions and a demonstration on drying wood. Would you like to take part?

*ALL Note: Location of the home IR 1-9*
*1*
*2*
*3*
*6*
*8*
*10?*

1. ALL Note: Male or Female
2. Same person? Yes No
3. Primary wood burner? Yes No

*Wood Stoves and Health-*

4. How often – always, often, sometimes, rarely or never - do you burn the following materials in your wood burning equipment? READ

*Always Often Sometimes Rarely Never Don't know*
*a) Newspapers b) Magazines c) Cardboard*
*d) Coated cartons such as milk or juice containers*
*e) Manufactured wood products such as plywood, chipboard, fibreboard, etc.*
*f) Painted or treated wood*
*g) Plastics*

Is this a change from last season? Why?

5. To what extent is indoor smoke from your stove a concern to you and those who live here?

*1 Strong concern*
*2 Somewhat of a concern*
*3 Not much of a concern*
*4 Not at all a concern*
*9 DON'T KNOW*

*Is this a change? Why?*

6. Which of the following statements best describes how you feel about the air quality in

*Your home? The air quality in my home where I live is: READ AND ROTATE, ONE*

*ANSWER ONLY*
*Almost always good*
*Good most of the time, poor on occasion*
*Good about half of the time, poor the other half*
*Poor most of the time, good on occasion*
*Almost always poor*
*DON'T KNOW*
*Is this a change? Why?*

7. To what extent is chimney smoke in your home a concern to you and your family?

*1 Strong concern*
*2 Somewhat of a concern*
*3 Not much of a concern*
*4 Not at all a concern 9 DON'T KNOW*

Change?

8. To what extent is chimney smoke in your local area a concern to you and your family?

*1 Strong concern*
*2 Somewhat of a concern*
*3 Not much of a concern*
*4 Not at all a concern 9 DON'T KNOW*

*Is this a change? Why?*

9. Which of the following statements best describes how you feel about the air quality in the area where you live? The air quality in the area where I live is: READ AND ROTATE, ONE ANSWER ONLY

*Almost always good*
*Good most of the time, poor on occasion*
*Good about half of the time, poor the other half*
*Poor most of the time, good on occasion*
*Almost always poor*
*9 DON'T KNOW*

10. CRITICAL QUESTION: There are a number of actions that can be taken to reduce the amount of smoke from wood burning equipment.

Can you tell me which of the following you started this doing this heating season that were not done before

Ensure wood is split and seasoned (dryed) for at least 6 months before burning

*Store wood in a covered area (inside or outside)*
*Store wood inside, heated area*
*Replace your stove with a cleaner burning updated version*
*Replace your stove with a pellet stove*
*Had the chimney cleaned on an annual basis*
*Abstain for the most part from from burning non-wood products in your stove*

Learned to operate my stove more effectively

What lead to these changes?

11. Do you recall any messages about wood burning techniques and air quality this past summer/fall and winter?

Yes/no

What was the messaging you recall?

12. Where do you recall hearing/seeing it?

Mark all that apply

*Workshops- Winds of change*
*Email*
*Facebook*
*Newsletters*
*Home visits*
*Videos*

13. Would it be ok to measure the moisture content of the wood you are using to place in your stove?

Measure 3 pieces>

Enter values

1

2

3

Thank you so much for your time today. Here is a small package/reminder to get your wood now for next winter, and season it to save money, improve health for you/family and the community.

# Lil'wat Clear Survey

SurveyMonkey

## 1. Which IR do you live on?

| | Response Percent | Response Count |
|---|---|---|
| 1 | 12.0% | 3 |
| 2 | 0.0% | 0 |
| 3 | 8.0% | 2 |
| 6 | 24.0% | 6 |
| 8 | 4.0% | 1 |
| 10 | 12.0% | 3 |
| **Other (please specify)** | **40.0%** | **10** |
| | **answered question** | **25** |
| | **skipped question** | **0** |

## 2. Are you primary wood stove operator in your household?

| | Response Percent | Response Count |
|---|---|---|
| **Yes** | **64.0%** | **16** |
| No | 36.0% | 9 |
| | **answered question** | **25** |
| | **skipped question** | **0** |

## 3. Do you recall any messages about wood burning techniques and air quality this past summer, fall and winter?

| | Response Percent | Response Count |
|---|---|---|
| **Yes** | **56.0%** | **14** |
| No | 44.0% | 11 |
| **answered question** | | **25** |
| **skipped question** | | **0** |

## 4. If yes, what was the message you recall?

| Response Count |
|---|
| 13 |
| **answered question** **13** |
| **skipped question** **12** |

## 5. Do you recall any other messages?

| Response Count |
|---|
| 15 |
| **answered question** **15** |
| **skipped question** **10** |

## 6. Where do you recall hearing the message?

| | Response Count |
|---|---|
| | 13 |
| **answered question** | **13** |
| **skipped question** | **12** |

## 7. Any other places?

| | Response Count |
|---|---|
| | 12 |
| **answered question** | **12** |
| **skipped question** | **13** |

## 8. Which of the following statements best describes how you feel about the air quality in your home? The air quality in my home is

| | | Response Percent | Response Count |
|---|---|---|---|
| **Almost always good** |  | **42.9%** | **9** |
| Good most of the time, poor on occasion |  | 14.3% | 3 |
| Good about half of the time, poor the other half |  | 19.0% | 4 |
| Poor most of the time, good on occasion |  | 9.5% | 2 |
| Almost always poor | | 0.0% | 0 |
| 9 DON'T KNOW |  | 14.3% | 3 |
| | **answered question** | | **21** |
| | **skipped question** | | **4** |

## 9. Is Air quality concern in area more of a concern than in the past? Why?

| | Response Count |
|---|---|
| | 15 |
| **answered question** | **15** |
| **skipped question** | **10** |

## 10. To what extent is indoor smoke from your stove a concern to you and those who live in your home?

| | Response Percent | Response Count |
|---|---|---|
| Strong concern | 9.5% | 2 |
| Somewhat of a concern | 14.3% | 3 |
| Not much of a concern | 19.0% | 4 |
| **Not at all a concern** | **52.4%** | **11** |
| DON'T KNOW | 4.8% | 1 |
| **answered question** | | **21** |
| **skipped question** | | **4** |

## 11. Have you become more concerned? Why?

| | Response Count |
|---|---|
| | 15 |
| **answered question** | **15** |
| **skipped question** | **10** |

## 12. To what extent is chimney smoke coming from the outdoors into your home a concern to you and those who live in your home?

| | Response Percent | Response Count |
|---|---|---|
| Strong concern | 14.3% | 3 |
| Somewhat of a concern | 14.3% | 3 |
| Not much of a concern | 14.3% | 3 |
| **Not at all a concern** | **47.6%** | **10** |
| DON'T KNOW | 9.5% | 2 |
| | **answered question** | **21** |
| | **skipped question** | **4** |

## 13. Did your level of concern increase from last season? Why?

| | Response Count |
|---|---|
| | 15 |
| | **answered question** | **15** |
| | **skipped question** | **10** |

## 14. Which of the following statements best describes how you feel about the air quality in the area where you live? The air quality in the area where I live is

| | | Response Percent | Response Count |
|---|---|---|---|
| Almost always good |  | 33.3% | 7 |
| **Good most of the time, poor on occasion** |  | **38.1%** | **8** |
| Good about half of the time, poor the other half |  | 4.8% | 1 |
| Poor most of the time, good on occasion |  | 14.3% | 3 |
| Almost always poor |  | 4.8% | 1 |
| 9 DON'T KNOW |  | 4.8% | 1 |
| | | **answered question** | **21** |
| | | **skipped question** | **4** |

## 15. Is Air quality concern in area more of a concern than in the past? Why?

| | Response Count |
|---|---|
| | 15 |
| **answered question** | **15** |
| **skipped question** | **10** |

## 16. To what extent is chimney smoke outdoors in your local area a concern to you and those who live here?

| | Response Percent | Response Count |
|---|---|---|
| Strong concern | 5.0% | 1 |
| Somewhat of a concern | 15.0% | 3 |
| Not much of a concern | 35.0% | 7 |
| **Not at all a concern** | **45.0%** | **9** |
| DON'T KNOW | 5.0% | 1 |
| | **answered question** | **20** |
| | **skipped question** | **5** |

## 17. Is wood smoke outdoors in the local area is a greater concern to you than in the past? Why?

| | Response Count |
|---|---|
| | 13 |
| **answered question** | **13** |
| **skipped question** | **12** |

**18. There are a number of actions that can be taken to reduce the amount of smoke from wood burning equipment. Can you tell me which of the following you started doing this heating season that were not done before.**

| | Response Percent | Response Count |
|---|---|---|
| Ensured wood was split and seasoned (dryed) for at least 6 months before burning | 33.3% | 7 |
| Store wood in a covered area (inside or outside) | 28.6% | 6 |
| Store wood inside, heated area | 9.5% | 2 |
| Replaced stove with a cleaner burning updated version | 28.6% | 6 |
| Replaced wood stove with a pellet stove | 14.3% | 3 |
| Had the chimney cleaned on an annual basis | 33.3% | 7 |
| Stopped from burning non-wood products like magazines, cereal boxes, wrapping paper... in my stove except for starting fires. | 23.8% | 5 |
| **Learned to operate my stove more effectively** | **42.9%** | **9** |
| None | 14.3% | 3 |
| Other (please specify) | 28.6% | 6 |
| | **answered question** | **21** |
| | **skipped question** | **4** |

## 19. If you checked some, what lead to these changes?

| | Response Count |
|---|---|
| | 15 |
| **answered question** | **15** |
| **skipped question** | **10** |

| Page 4, Q4. If yes, what was the message you recall? | | |
|---|---|---|
| 1 | about getting my stove inspected | Apr 11, 2013 10:46 AM |
| 2 | dry wood only | Apr 11, 2013 9:42 AM |
| 3 | just dry wood to burn | Apr 11, 2013 9:37 AM |
| 4 | dry wood mix. for small stove | Apr 11, 2013 9:31 AM |
| 5 | wet wood is a waste | Apr 11, 2013 9:24 AM |
| 6 | wet wood is a waste | Apr 11, 2013 9:08 AM |
| 7 | the dry wood only. for more effective burning | Apr 11, 2013 9:01 AM |
| 8 | dry wood only | Apr 11, 2013 8:51 AM |
| 9 | burn dry wood | Apr 9, 2013 11:52 AM |
| 10 | to clean our own chimminy not up to the band | Apr 9, 2013 9:00 AM |
| 11 | storing wood for drying | Apr 8, 2013 4:24 PM |
| 12 | Don't burn wet wood | Apr 8, 2013 3:37 PM |
| 13 | burn dry wood | Apr 8, 2013 2:53 PM |

| Page 4, Q5. Do you recall any other messages? | | |
|---|---|---|
| 1 | not cutting live trees | Apr 15, 2013 10:39 AM |
| 2 | store wood proprely | Apr 11, 2013 10:46 AM |
| 3 | the egg shells and the potato thing | Apr 11, 2013 9:42 AM |
| 4 | no | Apr 11, 2013 9:37 AM |
| 5 | clean chiminy more often | Apr 11, 2013 9:31 AM |
| 6 | don't burn magazines | Apr 11, 2013 9:24 AM |
| 7 | clean chiminy | Apr 11, 2013 9:08 AM |
| 8 | clean chiminy | Apr 11, 2013 9:01 AM |
| 9 | egg shells and potato peels | Apr 11, 2013 8:51 AM |
| 10 | burn no garbage | Apr 9, 2013 11:52 AM |
| 11 | that elders need help chop wood and pile | Apr 9, 2013 9:00 AM |
| 12 | cutting only fallen trees | Apr 8, 2013 4:24 PM |
| 13 | no | Apr 8, 2013 4:13 PM |
| 14 | no chimney cleaners | Apr 8, 2013 3:37 PM |
| 15 | get wood early in the year | Apr 8, 2013 2:53 PM |

| Page 4, Q6. Where do you recall hearing the message? | | |
|---|---|---|
| 1 | heard someone talking at lgs | Apr 15, 2013 10:39 AM |
| 2 | Vanessa's visit | Apr 11, 2013 10:46 AM |
| 3 | Pamphlet | Apr 11, 2013 9:42 AM |
| 4 | Vanessa's visit | Apr 11, 2013 9:37 AM |
| 5 | Vanessa's pamphlet | Apr 11, 2013 9:31 AM |
| 6 | Vanessa's visit | Apr 11, 2013 9:24 AM |
| 7 | Vanessa's visit | Apr 11, 2013 9:08 AM |
| 8 | Vanessa's visit | Apr 11, 2013 9:01 AM |
| 9 | workshop | Apr 11, 2013 8:51 AM |
| 10 | survey person | Apr 9, 2013 11:52 AM |
| 11 | from newsletters and cmhc workshops | Apr 8, 2013 4:24 PM |
| 12 | around and during eaves dropping | Apr 8, 2013 3:37 PM |
| 13 | newsletter | Apr 8, 2013 2:53 PM |

| Page 4, Q7. Any other places? | | |
|---|---|---|
| 1 | pamphlet | Apr 11, 2013 10:46 AM |
| 2 | Vanessa's visit | Apr 11, 2013 9:42 AM |
| 3 | no | Apr 11, 2013 9:37 AM |
| 4 | no | Apr 11, 2013 9:31 AM |
| 5 | pamphlet | Apr 11, 2013 9:24 AM |
| 6 | pamphlet | Apr 11, 2013 9:08 AM |
| 7 | the pamphlet | Apr 11, 2013 9:01 AM |
| 8 | fromm me | Apr 11, 2013 8:51 AM |
| 9 | no | Apr 9, 2013 11:52 AM |
| 10 | lands & resources - graham | Apr 8, 2013 4:24 PM |
| 11 | ullus banquet hall mawam | Apr 8, 2013 3:37 PM |
| 12 | facebook | Apr 8, 2013 2:53 PM |

| Page 5, Q9. Is Air quality concern in area more of a concern than in the past? Why? | | |
|---|---|---|
| 1 | mold, wood stove not effective heating upstairs of house, i think my upstairs windows were never insulated | Apr 15, 2013 10:40 AM |
| 2 | poor gaskit | Apr 11, 2013 10:46 AM |
| 3 | just when i need to check the stove. hope to remeber to open damper | Apr 11, 2013 9:43 AM |
| 4 | got new door gaskit | Apr 11, 2013 9:38 AM |
| 5 | stove change maybe | Apr 11, 2013 9:31 AM |
| 6 | poor lots of smoke around at night | Apr 11, 2013 9:25 AM |
| 7 | alittle bit | Apr 11, 2013 9:09 AM |
| 8 | yes cause i am so high up the hill | Apr 11, 2013 9:01 AM |
| 9 | grass burning | Apr 11, 2013 8:52 AM |
| 10 | do not burn wood propane & electricity | Apr 9, 2013 1:54 PM |
| 11 | today there are many unknown particals in the air | Apr 9, 2013 11:53 AM |
| 12 | older homes and woodstoves | Apr 8, 2013 4:25 PM |
| 13 | it always is as I have a child with lung disease and asthma | Apr 8, 2013 4:14 PM |
| 14 | Well now that you bring it up, I'm concerned. I guess I may need a new wood stove. | Apr 8, 2013 3:38 PM |
| 15 | yes, because of the information I have been receiving | Apr 8, 2013 2:53 PM |

| Page 6, Q11. Have you become more concerned? Why? | | |
|---|---|---|
| 1 | no | Apr 15, 2013 10:41 AM |
| 2 | no. husband check the stove | Apr 11, 2013 10:46 AM |
| 3 | no. husband check the stove | Apr 11, 2013 9:44 AM |
| 4 | no | Apr 11, 2013 9:38 AM |
| 5 | no. know stove better | Apr 11, 2013 9:31 AM |
| 6 | nop | Apr 11, 2013 9:25 AM |
| 7 | no | Apr 11, 2013 9:09 AM |
| 8 | same stove. may need to be looked at | Apr 11, 2013 9:02 AM |
| 9 | no | Apr 11, 2013 8:52 AM |
| 10 | no, got good stove | Apr 9, 2013 11:54 AM |
| 11 | because of all the asmeha tha our people are getting not only from smoke but other people burnign garbage and cheminacal | Apr 9, 2013 9:02 AM |
| 12 | my son and friends play video games in basement | Apr 8, 2013 4:25 PM |
| 13 | it has a leak but we only use if there is a power outage | Apr 8, 2013 4:15 PM |
| 14 | After seeing your questions and the amount of the word "concern" . | Apr 8, 2013 3:39 PM |
| 15 | Because of the information I have been receiving. | Apr 8, 2013 2:54 PM |

| Page 7, Q13. Did your level of concern increase from last season? Why? | | |
|---|---|---|
| 1 | people seem to burn anything in their stoves, they stink. cant air out a house from the smell | Apr 15, 2013 10:42 AM |
| 2 | it is better then before | Apr 11, 2013 10:47 AM |
| 3 | no. i can see outside now | Apr 11, 2013 9:44 AM |
| 4 | fixed door | Apr 11, 2013 9:38 AM |
| 5 | had chiminy fire this year. need to clesn stove more often it is a small stove | Apr 11, 2013 9:33 AM |
| 6 | not at all | Apr 11, 2013 9:25 AM |
| 7 | no | Apr 11, 2013 9:10 AM |
| 8 | the stove might be inspected by band? | Apr 11, 2013 9:03 AM |
| 9 | not much smoke in the vally | Apr 11, 2013 8:53 AM |
| 10 | no, clean pipes | Apr 9, 2013 11:54 AM |
| 11 | asmatic noe | Apr 9, 2013 9:03 AM |
| 12 | older wood burning stove | Apr 8, 2013 4:26 PM |
| 13 | its always a concern as I have someone with lung disease and asthma living in my home | Apr 8, 2013 4:15 PM |
| 14 | I'm not sure. | Apr 8, 2013 3:40 PM |
| 15 | a little bit. | Apr 8, 2013 2:54 PM |

| Page 8, Q15. Is Air quality concern in area more of a concern than in the past? Why? | | |
|---|---|---|
| 1 | yes, it seems we have more people on the rez with respiratory problems | Apr 15, 2013 10:43 AM |
| 2 | people are learning | Apr 11, 2013 10:47 AM |
| 3 | people are learning | Apr 11, 2013 9:45 AM |
| 4 | just in evening | Apr 11, 2013 9:39 AM |
| 5 | needs a better stove. going threw housing. hopefull this summer | Apr 11, 2013 9:33 AM |
| 6 | at night lots of smoke. some times | Apr 11, 2013 9:26 AM |
| 7 | just so high up the new site hill | Apr 11, 2013 9:10 AM |
| 8 | just where i live. so high up the hill | Apr 11, 2013 9:03 AM |
| 9 | more people burning dry wood | Apr 11, 2013 8:54 AM |
| 10 | no | Apr 9, 2013 1:55 PM |
| 11 | no, | Apr 9, 2013 11:55 AM |
| 12 | changed wood stove and chimney | Apr 8, 2013 4:26 PM |
| 13 | note previous question #13 same answer | Apr 8, 2013 4:16 PM |
| 14 | I don't know. | Apr 8, 2013 3:40 PM |
| 15 | not really. | Apr 8, 2013 2:54 PM |

| Page 9, Q17. Is wood smoke outdoors in the local area is a greater concern to you than in the past? Why? | | |
|---|---|---|
| 1 | no. better | Apr 11, 2013 10:47 AM |
| 2 | just ing the past. people burned at night? | Apr 11, 2013 9:46 AM |
| 3 | same? | Apr 11, 2013 9:39 AM |
| 4 | it is getting cleaner air. | Apr 11, 2013 9:34 AM |
| 5 | has changed in a little bit since the workshop | Apr 11, 2013 9:27 AM |
| 6 | in the day time only smoke goes up | Apr 11, 2013 9:11 AM |
| 7 | it is getting better | Apr 11, 2013 9:04 AM |
| 8 | people are learning | Apr 11, 2013 8:55 AM |
| 9 | wood smoke is ok, no concern | Apr 9, 2013 11:55 AM |
| 10 | proper wood burning practices | Apr 8, 2013 4:30 PM |
| 11 | no | Apr 8, 2013 4:16 PM |
| 12 | no | Apr 8, 2013 3:41 PM |
| 13 | yes, because of the information I have been receiving. | Apr 8, 2013 2:55 PM |

| Page 10, Q18. There are a number of actions that can be taken to reduce the amount of smoke from wood burning equipment. Can you tell me which of the following you started doing this heating season that were not done before. | | |
|---|---|---|
| 1 | changed gaskit | Apr 11, 2013 10:48 AM |
| 2 | working on housing for a better stove. | Apr 11, 2013 9:35 AM |
| 3 | old stove | Apr 11, 2013 9:11 AM |
| 4 | jsut need clan air | Apr 9, 2013 9:18 AM |
| 5 | propane | Apr 8, 2013 4:30 PM |
| 6 | we prefer the baseboard heater over the woodstove | Apr 8, 2013 4:18 PM |

| Page 10, Q19. If you checked some, what lead to these changes? | | |
|---|---|---|
| 1 | husband had more opportunity to get wood this year. previous years he didnt have time to do it. so we were behind on wood all the time | Apr 15, 2013 10:45 AM |
| 2 | Vanessa's visit | Apr 11, 2013 10:48 AM |
| 3 | i learned the stove while lex is not home. | Apr 11, 2013 9:46 AM |
| 4 | door gaskit fixed | Apr 11, 2013 9:40 AM |
| 5 | chiminy fire this spring | Apr 11, 2013 9:35 AM |
| 6 | the pamphlet | Apr 11, 2013 9:28 AM |
| 7 | might need to be inspected | Apr 11, 2013 9:11 AM |
| 8 | same old stove | Apr 11, 2013 9:05 AM |
| 9 | from Vanessa's pamflet | Apr 11, 2013 8:56 AM |
| 10 | just want and need cleaner AIR | Apr 9, 2013 9:18 AM |
| 11 | Pellets are more easier to handle than chopping wood with arthritis. Heat / temperature is more constant throughout the house... | Apr 8, 2013 9:43 PM |
| 12 | housing programs - repairs & maintenance | Apr 8, 2013 4:31 PM |
| 13 | it is safer to use the base board heaters as there is no smoke coming from them. Plus we use an air purifier in our home along with a humidifier. | Apr 8, 2013 4:18 PM |
| 14 | Save money and keep warm and cozy during cold months | Apr 8, 2013 3:42 PM |
| 15 | information, awareness. | Apr 8, 2013 2:55 PM |

**Appendix 6:** *Lil'wat Bioenergy Economic Development Opportunities Review and Recommendations Report*

Creating the future **today**.

CENTRE *for*
SUSTAINABILITY
WHISTLER

# Lil'wat Bioenergy Economic Development Opportunities Review and Recommendations

Lil'wat Nation

Centre for Sustainability – Whistler 4325 Blackcomb Way, Whistler, BC V0N 1B4
whistlercentre.ca ph: (604) 935.8127

# Table of contents

Contents

## About the Whistler Centre for Sustainability

The Whistler Centre for Sustainability is a mission-based non-profit organization that provides support and assistance to local governments with community sustainability planning and implementation. We have assisted over a dozen communities (in B.C., AB, YK) with the development of integrated community sustainability plans, and have worked/are working with four communities on their OCP updates/alignments. We are also working in the area of energy and GHG emissions, having lead energy and GHG planning for a host of small communities in BC while integrating these plans with community sustainability plans and OCPs.

Our area of expertise is working with small and rural communities, in particular those with a tourism economy, and supporting the fourteen BC Resort communities with annual tourism development monitoring and meeting facilitation.

Public engagement is at the foundation of all of our community planning processes, and we utilize many innovative engagement techniques to ensure we involve community members, gather useful input and carefully incorporate it into the content of a community plan.

Our unique on the ground pragmatic perspective comes from our work embedded with local governments though past work experiences and our current office location in Whistler, BC. We work to implement plans as much as we create them with you.

## Project Funding

The British Columbia Ministry of Environment provided support for this project through the BC CLEAR fund as administered by the Fraser Basin Council

# Executive Summary

Combining the energy industry with local economic development in rural areas is natural fit due to the abundance of natural energy resources often found in these places. Of the various energy resources, biomass makes sense when looking at economic development because spending on biomass leads to more jobs than any other renewable or fossil fuel energy source. For example, spending $1,000,000 in the biomass sector leads to 17 jobs, whereas a similar amount spent in oil and gas only generates 5 jobs.[1] One of the reasons biomass energy projects lead to so many more jobs is the labour intensity of the gathering, transport, processing and extracting processes.

***For the purpose of this report, biomass is '...any wood or plant based organic matter that can be used as an energy source'.***

The main objective of this study is to evaluate at a very high level the feasibility of various biomass energy economic development opportunities for the Lil'wat Nation. In doing so, this study provides a brief introduction to biomass energy and the associated options for local economic development, a description of typical biomass energy opportunities, a high level assessment of the local economic development biomass energy opportunities and a discussion of 'next steps'.

After reviewing the various biomass opportunities for local economic development it is clear that the majority of opportunities depend on securing Lil'wat Nation access to biomass in the region. Therefore the most pressing short-term recommendations in the action table below relate to securing access to biomass and promoting biomass opportunities to current and potential biomass purchasers. Other short-term recommendations include generating economic activity through using biomass energy more efficiently in on-reserve buildings, which has the co-benefit of reducing local costs and increasing the supply of biomass for other valuable revenue generating activities.

Beyond securing access to biomass and other short-term actions, medium-term opportunities include investigating on-reserve biomass heating technology for larger buildings, reviewing the potential for growing bioenergy crops, exploring the possibilities to generate small to large sources of power and heat to use on reserve or to sell to larger customers such as BC Hydro.

We recommend that the Lands and Resources, the Lil'wat Economic Development Officer, and Lil'wat Forester lead most of the tasks in the table while bringing in consultants where needed. In addition to recommended actions, at the end of the document we have included a list of a few resources that we came across when researching this project.

[1] http://www.sightline.org/wp-content/uploads/downloads/2012/02/green-jobs-primer-pdf.pdf

| Recommended Action - Implementation Timeline | Short term - 1 year | Med term-2-3 year |
|---|---|---|
| Recommendation 1: Upgrade the Lil'wat Community Land Use Plan to incorporate a Community Forest Plan that ensures a sustainable supply of wood for community residential heating purposes. | | |
| Recommendation 2: Develop Memoranda of Understanding (MOUs) with local and regional forestry, mill, farms and composting operations for access to waste residuals for biomass. | | |
| Recommendation 3: Lil'wat Nation to secure access to unlogged timber from other forest licenses, beetle kill, and fire damaged timber. | | |
| Recommendation 7: Conduct residential building energy efficiency upgrades identified in the building opportunity assessment. | | |
| Recommendation 8: Require a minimum building standard for energy efficiency of Energuide 80 in new residential building construction. | | |
| Recommendation 9: Conduct a commercial and institutional building energy efficiency upgrade identified in the building opportunity assessment. | | |
| Recommendation 10: Conduct a comprehensive study of the community school complex to identify both energy efficiency measures and energy sources, including the potential for alternative sources such as biomass, geo-exchange and passive solar space heating and hot water heating. | | |
| Recommendation 11: Ensure adequate wood prep and proper stove maintenance to increase burning efficiencies. | | |
| Recommendation 12: Consider the economic feasibility of a central log yard for storing, splitting and seasoning firewood for on-reserve purposes. | | |
| Recommendation 13: Promote burning clean dry wood as a way to heat homes/buildings and to support the local economy. | | |
| Recommendation 15: Prioritize Lil'wat Nation sourced and semi-processed biomass for all onsite energy applications (recognizing that short term supplies from outside the Nation may initially be required ). | | |
| Recommendation 16: Further assess the commercial viability of regional commercial wood sales for wood stoves. | | |
| Recommendation 17: Initiate early conversations with the RMOW with respect to supplying the district energy system and support efforts to launch this system in Whistler. | | |
| Recommendation 19: Support and stay abreast of the Lillooet Biomass Energy Corporation opportunity and seek out opportunities as the commercial viability becomes more likely. | | |

| Recommended Action - Implementation Timeline | Short term - 1 year | Med term-2-3 year |
|---|---|---|
| Recommendation 4: Further explore the potential opportunities for growing, harvesting and processing energy crops on Lil'wat land in proximity to the waste water lagoons in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). | | |
| Recommendation 5: Lilwat Nation to explore delivered costs of pellets in conjunction with reviews of appropriate onsite bioenergy technology. | | |
| Recommendation 6: Consider the economic feasibility of a small-scale biomass waste processing systems (e.g. smaller remote pellet mill system, small-scale chipper) in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). | | |
| Recommendation 14: Assess the specific potential to retrofit the larger community facilities with individual biomass heat or combined heat and power systems and/or district systems if the facilities are proximal to each other. | | |
| Recommendation 18: Assess other potential institutional heat users in the region such as schools, universities and local governments. Prioritize Pemberton and Whistler, due to the proximity and the higher cost of natural gas/propane. | | |
| Recommendation 20: If a significant heat load is required for the community (more facilities, manufacturing, requirement to dry sewage sludge, district heating etc.) review the feasibility of systems to provide power to the community and BC Hydro power grid. | | |

# 1 Introduction

## 1.1 Background

The Lil'wat First Nation[2] has been proactive in introducing alternative energy for its new public facilities to promote energy resiliency and to reduce the long term costs and Greenhouse Gas (GHG) emissions. Existing Community Plan policies support reducing energy use and promote the use of clean, low-impact energy sources.

In 2011, the Band commissioned the Whistler Centre for Sustainability to complete a community energy baseline study to review the potential for moving to an energy future that maximizes economic, health and environmental benefits for the community. Recognizing the importance of wood heating systems in the community and their potential impacts, the Band received Fraser Basin Council CLEAR program funding[3] to raise the awareness of wood smoke and health issues while also exploring wood-based biomass energy economic development opportunities. Biomass makes sense when looking at economic development because spending on biomass leads to more jobs than any other renewable or fossil fuel energy source. For example, spending $1,000,000 in the biomass sector leads to 17 jobs, whereas a similar amount spent in oil and gas only generates 5 jobs.[4]

**Lil'wat Energy Values and Vision**

1. **Social.** Provide equitable access to clean, low cost energy that supports a high quality of life, including health promotion.
2. **Economic.** Reduce energy costs and protect the community from potential future energy supply or price shocks. An additional benefit of exploring a sustainable energy future is to increase capacity and expertise within the community to support new energy-related businesses.
3. **Environmental.** Reduce harmful emissions while ensuring that all proposed energy sources are reviewed for other environment impacts, including land, air, water, and habitat impacts.

**Figure 1-1 Lil'wat Energy Vision and Values**
**Source: Lil'wat Community Energy Baseline (CEB)**

Biomass often includes any organic material that can be used to produce energy[5], and includes both solid waste and liquid wastes. For the purpose of this report, biomass is '…any **wood or plant based** organic matter that can be used as an energy source'. More specifically, this study looks at the use of biomass for heating and/or electricity generation only.

Local economic development is any activity that helps to circulate wealth in the community or that helps to bring new wealth to the community.

---

[2] The Lil'wat Nation is governed by a Chief and Council, supported by staff. In this report, the terms "Band" and the "Administration" both refer to Lil'wat governance, while the "Community" or "members" refer to all members of the Lil'wat Nation.

3 "The British Columbia Ministry of Environment provided support for this project through the BC CLEAR fund as administered by the Fraser Basin Council"

[4] http://www.sightline.org/wp-content/uploads/downloads/2012/02/green-jobs-primer-pdf.pdf

[5] http://www.bcbioenergy.ca/resources/glossary/

## 1.2 Objective

The main objective of this study is to evaluate, at a very high level, the feasibility of various biomass energy economic development opportunities for the Lil'wat Nation and community. The core goals of such activity would be to support the Lil'wat energy vision as outlined in the Lil'wat Community Energy Baseline (CEB).

## 1.3 Scope

The scope of this study includes:

1. Providing a brief introduction to biomass energy and the associated options for local economic development;
2. Describing typical biomass energy opportunities;
3. Assessing the typical biomass energy opportunities at a high level for local economic development based on the Lil'wat energy vision and criteria for successful biomass energy projects;
4. A discussion of next steps.

## 1.4 Limitations

This analysis provides an initial high-level assessment of various biomass energy economic development opportunities. Results are very preliminary and based on readily accessible information at the time.

One significant data gap to this study is a deep assessment of biomass availability and analysis of specific biomass technologies. Very high-level considerations are used when looking at the various opportunities and further studies should most certainly include a thorough quantification of biomass resources and appropriate energy conversion technology and infrastructure for each economic opportunity.

# 2 Biomass and Economic Development

## 2.1 Biomass as Heat and Electricity

Using biomass as an energy source can potentially meet a number of the criteria outlined in the Lil'wat CEB study.

- Biomass is generally considered a 'carbon/GHG neutral' energy source because the carbon embedded in the biomass recently came from the atmosphere. Burning it is just replacing the carbon to the atmosphere. However, there are a few nuances to this characteristic. It would take decades to reabsorb the carbon released from cutting and burning a natural forest and during this time there would be a carbon dioxide addition to the atmosphere.

However, if biomass for energy comes from waste woods that would otherwise be burned openly or decay, and from an area with well-managed re-growing practices, the carbon result is essentially balanced with current practices. On the other hand, other non-wood waste sources ,such as grasses and short rotation crops/trees such as willow, can also offer a very low carbon source of energy as long as the land is sustainably managed and regrowth occurs quickly.

- British Columbia's carbon tax of $30/tonne of CO2e furthers the financial benefit of 'carbon neutral' fuels. However, biomass prices can be cost competitive with other energy forms used for heating even without the carbon tax.
- Biomass energy also has the potential to generate local economic activity because the economics require that it is sourced from the regional area where is it used. This results in regional jobs as opposed to jobs being created elsewhere, as would occur with using other fuels like propane or oil.

Currently, the most common traditional example of biomass energy in the region is home wood stove heating applications, but semi-processed biomass is also increasingly used in other locations in more modern ways. This semi-processed biomass is used for heat on a large scale for commercial applications as well as electricity for connection to local sites or the provincial power grid. Biomass can also be further processed into more valuable energy forms such as pellets for pellet stove and boiler applications.

**Figure 2-1 Biomass wood types, source: Whistler District Energy Prefeasibility Study 2012**

Chopped Wood Hogfuel Chipped Wood Wood Pellets

Favourable developments supporting biomass expansion include; British Columbia's Bioenergy Strategy, funds like BC's Innovative Clean Energy Fund, and the BC Bioenergy network[6] . BC Hydro also has a standing offer to purchase electricity from highly efficient combined biomass heat and electricity generation projects[7].

[6] http://www.bcbioenergy.ca/wp-content/uploads/2011/07/Bioenergy-Guide-2010-final-updated-May-2011.pdf

[7] http://www.bchydro.com/energy_in_bc/acquiring_power/current_offerings/standing_offer_program.html

One additional opportunity available to First Nations is the Clean Energy Business Fund. The fund is meant to promote First Nations participation in the clean energy sector within their traditional territories,provide capacity development funding for feasibility studies and to undertake their own clean energy projects.[8]

While the opportunities for using biomass for energy abound, some careful considerations of supplies and technologies is needed to ensure minimal environmental and health impacts, long term cost competitiveness and operational simplicity.

## 2.2 Biomass Technology

Technologies for converting biomass to energy range from woodstoves to highly technical gasification systems. The energy systems can simply provide air heating or water heating that is in turn distributed through a building or group of buildings, but more advanced systems provide combined heat and electricity. In the latter case, the heat is typically used nearby with the electricity often tied into an electrical grid for use locally and elsewhere.

## 2.3 Local Economic Development

Local economic development is any activity that helps to re-circulate wealth in the community or that helps to bring new wealth to the community. Using biomass as an energy source can potentially help generate local economic activity in both instances.

### 2.3.1 Biomass to keep local dollars in the community

The Lil'wat community spends a sizable amount of money on energy each year. Including estimated fuel costs, the annual energy spend per person is $2,000 for a total of $3.15 million. Looking at just stationary energy applications like buildings, the community spends $917,000 with only $84,000 of it spent on biomass wood energy. The bulk of the energy spend is on propane and electricity, which are the primary energy sources in institutional, residential and commercial buildings in Mt. Currie. Virtually all of the energy spent on electricity and propane leaves the community whereas the energy from biomass use, though limited, is likely generating the highest amount of local economic activity for each energy dollar spent due to the local and regional nature of the wood sources. Biomass is also a traditional energy source with 75% of local homes using wood stoves as their primary or secondary source of heating.

Increasing the amount of local/regional based biomass energy used for heating and electrical systems could help to keep more energy dollars in the community, generating jobs and reducing energy costs.

[8] http://www.gov.bc.ca/arr/economic/fncebf.html

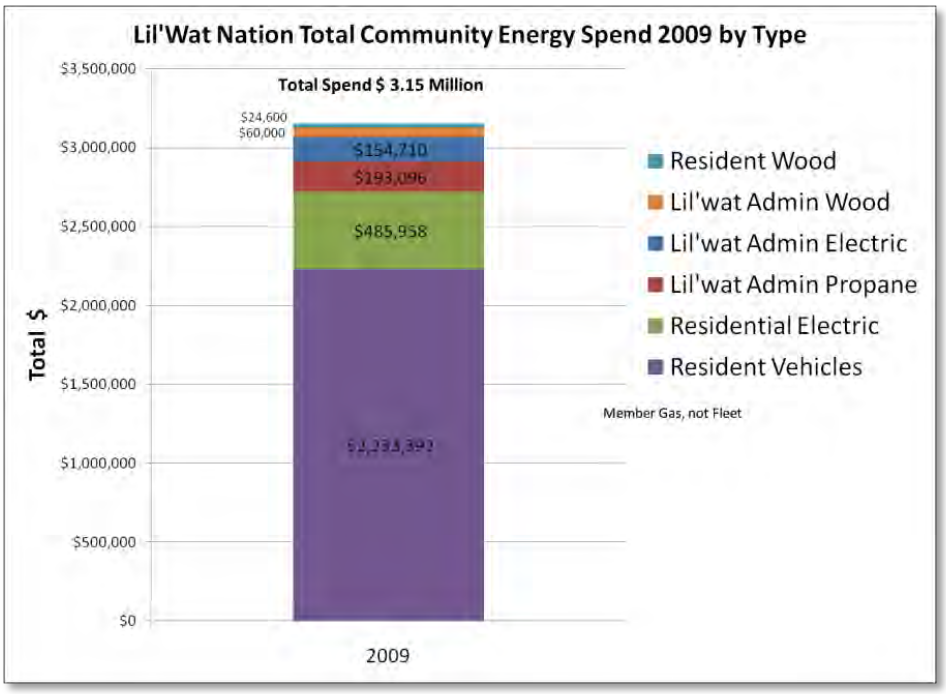



**Figure 2-2 Lil'wat Nation Energy Spend, 2009 Source: Lil'wat CEB**

### 2.3.2 Biomass for bringing new wealth into the community

Another potential economic development opportunity involves exporting biomass to other regions and in return bringing new wealth into the community. Examples might range from commercial gathering of wood for wood stove heating use in the greater region, to onsite manufacturing of wood energy products such as wood pellets or wood chips from waste wood. These opportunities to generate energy exports are highly dependent on a relatively large and easy to access source of low impact biomass.

### 2.3.3 Regional markets

Regional markets for locally gathered or processed biomass could include Whistler, Squamish, Pemberton, and possibly Vancouver. All of these markets have a requirement for wood stove fuel and Whistler may have a demand for semi processed biomass like wood chips if the community develops a wood heated district energy system. The retail rate used in the Lil'wat CEB for chopped wood is $150-$200 per cord and the Whistler District Energy System is economical at about $40/tonne of relatively wet wood waste, if it goes ahead.

In addition to the regional market, BC Hydro has a standing offer to accept electricity from highly efficient and low carbon generation stations. Recent power purchase agreements for biomass energy paid $0.10/kwh or about $27/GJ or more to proponents. This power would connect and feed into the larger power grid as opposed to servicing local markets.

### 2.3.4 International

Current export markets for wood include Asia and Europe where the demand for wood pellets is highest for community energy systems or to be used in combination with coal burning. The idea of making pellets, pucks or briquettes for an international market is to increase the density of the energy from loose wood bits to compressed wood products, which makes transportation less expensive and makes for a more consistent fuel. Year end 2012 bulk prices for pellets were $167/tonne.

## 2.4 Biomass Opportunities

There is a broad spectrum of biomass energy opportunities for communities, but the specific type is primarily dependent on the amount and type of biomass resources available within the surrounding area. While biomass often includes any organic material that can be used to produce energy[9], including both solid waste and liquid wastes, this report focuses on **wood or plant based** organic matter that can be used to produce energy. There are a few reasons for this. One, the resources directed at this study are quite limited so it was important to narrow the focus somewhat to ensure an adequate level of analysis. Two, the controversies surrounding the use of solid/liquid wastes for energy and the significant investments in technology are likely to make these options incompatible with the values the Lil'wat Nation has with respect to energy sources.

### 2.4.1 Methodology

The opportunity discussion and assessment of biomass energy draws information and assessment tools from the recently published report by the BC Bioenergy Network and Province titled "An information guide on pursuing biomass energy opportunities and technologies in British Columbia". The purpose of the guide is to assist stakeholders in small communities, aboriginal groups, municipalities and industry in developing and pursuing bioenergy options in BC. Other relevant documents used for this report include Whistler's District Energy Pre-Feasibility Study Report, numerous industry/community websites, and interviews with some stakeholders.

### 2.4.2 Biomass types and sources

As noted earlier, economic opportunities for biomass depend on having an adequate source of biomass and enough demand at the right price for that energy. Many biomass technologies can use a variety of biomass sources, making mixing and matching quite common.

The bioenergy potential of BC is quite large, with enough biomass from agriculture residue, enhanced forestry and pine beetle kill to offset over 50% of the fossil fuel used in the province[10]. All of these energy sources may be available within the local/regional area surrounding the Lil'wat Nation, though potentially not in enough volume for expanding local use or exporting.

Most notable biomass sources available to the Lil'wat Nation in the local/regional include:

[9] http://www.bcbioenergy.ca/resources/glossary/

[10] Biomass Availability Study For District Heating Systems, BC Bioenergy Network, 2012

**Waste wood resources**

Wood resources typically include forestry residues from nearby mill operations or roadside accumulations related to forestry operations. Mill residues include barks and damaged pieces of wood called hog fuel, chips that are often sold to pulp and paper mills, and sawdust savings. Roadside accumulations are often left behind from forestry operations due to the low demand for low quality wood. Access to these piles is typically arranged with forest tenure holders in the region. One of the regional tenure holders is the Cheakamus Community Forest, and the Lil'wat Nation is one of three partners in the 30,280 ha forest tenure[11]. The Lil'wat Nation also has allowable annual cuts and likely access to residuals in areas closer to Mt. Currie and in the Lil'wat traditional territory. Using some recent results from wood fibre studies[12] and based on their estimated 67,000 m3 annual cut[13], the Lil'wat Nation might have direct access to about 10,000-15,000 wet tonnes/year, or 5,000-7,000 bone dry tonnes/year.

It is beyond the scope of this study to detail the amount of waste wood resources, but the recent Whistler District Energy study noted that waste wood biomass availability in the region may decrease in coming years, due to a decrease in forestry activity coupled with an increase in demand for the biomass. While the supply may be getting smaller, waste wood from the region is still a possibility. Recent back of the envelope regional estimates by the Lil'wat Nation staff calculated between 19,500 and 39,500 tonnes of wood waste potential, though accessing and using the wood was not without its challenges, such as:

1. Lack of large industrial operations means that many small suppliers, instead of fewer, larger ones will be needed.
2. Coast wood is high in moisture content.
3. Distance from operating areas.

Waste wood sources could be used directly in a relatively raw form as a heat source, or indirectly as an input into creating electricity and into wood heating products like pellets. Based on the Lil'wat CEB, wood salvaged by the Lil'wat Nation and sold as firewood to customers in the region could fetch approximately $150-$200 per cord.

**Timber**

While the Lil'wat Nation has forest tenure rights in some regional areas, in most cases it is not as economical or environmentally sensitive to the land and climate to use living trees for more advanced biomass energy systems. On the other hand, standing dead trees and deadfall could be (and is) used for certain wood stoves and larger energy systems that can use this type of wood.

[11] http://www.cheakamuscommunityforest.com/why-a-community-forest/

[12] City of Cranbrook Biomass Thermal Energy Feasibility

[13] Phone call with Klay Tindall, Lil'wat Nation Forester

Like waste wood, dead sources could be used directly as a heat source for Lil'wat homes or community energy applications, but they could also be sold as firewood to customers in the region.

Accessing the dead trees and deadfall over and beyond the areas where the Lil'wat Nation currently has access to timber is possible with a commercial small-scale salvage license from the Ministry of Forests. There is also an amendment to the Forest Act allowing the Minister of Forests to invite First Nations to apply for forest licenses without competition. The timber volume for these licenses comes from beetle-kill and fire-damaged timber as well as from unlogged timber from other forest licenses.[14]

**Compost material**

Recent research being conducted by the Engineering Department at the Resort Municipality of Whistler is beginning to highlight the possibility of converting the output material from the community composting facility into an extremely dry biomass source. This dry, almost powder-like biomass could be used with minimal conversion costs in current propane/natural gas fossil fuel boiler systems. The process, called pulverized combustion, introduces the fuel with an airstream and then rapidly combusts it to create heat. Annual volumes of compost could be quite a significant and stable source of biomass into the future.

This biomass source could potentially be used directly as a heat source, or indirectly as an input into electricity generation systems and compressed biomass heating products like pellets.

**Bioenergy crops**

In addition to using wood waste or timber, it is possible to grow trees that can be used in biomass energy systems. Typically, this is done with fast-growing trees like poplar or willow. Willow is an ideal species for energy crops because it provides high yields in only a few years and can easily re-sprout after a harvest. The BC bioenergy information guide points out that, as long as there is an adequate land base, the economics can be made favourable if locals are hired to reduce harvesting costs.

The land base needed for producing wood for combined electric and heat applications is quite large at 250 -400 ha of land per MW of electrical generation, but heating only systems require far less land base at 15 ha per MW capacity of heat.[15] With that in mind, the Lil'wat Nation zoned agricultural land amounts to 200 ha with another 160 ha suitable for agriculture, but encumbered with property right issues. There is approximately 50 ha of Lil'wat land adjacent to the waste water lagoons that could benefit from sewage nutrients and in turn grow willow and produce about 750-1,000 tonnes (15-20/ha) of wet biomass, 5,250 GJ-7,000 GJ (7GJ/wet tonne), or about $30,000-

[14] http://www.for.gov.bc.ca/haa/fn_agreements.htm

[15] BC Bioenergy Information Report

$40,000 ($40/wet tonne[16]) worth of energy per year. This amount of biomass would be adequate for heating at least one or two Lil'wat buildings. Given the approximately 360 ha of land it would be possible to produce about 5,400-7,200 tonnes (15-20/ha) of wet biomass, 37,800-50,400 GJ (7GJ/wet tonne), or about $216,000 to $290,000 ($40/wet tonne) worth of energy per year.

Energy crops are typically planted on marginal or underutilized agricultural land to ensure the crops don't displace food growing or more economically attractive activities.

Biomass energy crops could potentially be used directly as a heat source on the reserve or indirectly as an input into on-reserve electricity systems and other biomass energy systems that may spring up in the region, such as in Whistler.

**Agricultural waste**

Agricultural waste includes such things as crop residues, and liquid and solid animal wastes that can be used for energy purposes. Dry crop residues, straw, etc., can be burned (or gasified) to drive a steam turbine or other process. These resources can also be compressed and pelletized like wood.he closest locations for large amounts of agricultural waste are Kamloops and the Lower Fraser Valley, but there may be some sources of hay in the local vicinity.

**Camrose, AB Sewage and Willow Bioenergy Crop**

The community purchased 10 acres of the land nearby the County's open lagoon and, with the Canadian Forest Service Initiative, planted 18,400 willows.

The goal is for the willows to be harvested by the County every three years to be used as biofuel to heat the County administration office.

The project utilizes other biomass in addition to the willow and has recognized long-term benefits including reducing the heating cost, self-sustainable energy supply, environmental benefits, and supporting the local economy by purchasing various equipment and services.


More Information: Albert Rural Development Network: http://www.ardn.ca/projects/poster-%20toso.pdf , http://www.youtube.com/watch?v=c7USD9bzlvw

**Wood products**

Waste wood and other biomass can and is converted into a number of processed wood products such as wood pellets. These pellets can be made or purchased and used as an energy source for the community and/or manufactured in the community for export markets. Current export markets are primarily overseas in Asia and Europe where the demand for wood pellets is highest for community energy systems; or, there is also a potential to be used in combination with coal burning. The idea of making pellets, pucks or briquettes is to increase the density of the energy from loose wood bits to compressed wood products, which makes transportation less expensive

[16] Whistler Pre-feasibility Study costs used for wet biomass

and makes for a more consistent fuel. Year end 2012 bulk prices for pellets were $167/tonne. Pellets come in many forms and compositions. White pellets made from sawdust and inner wood burn the most cleanly and have the highest market value. These white pellets are used for residential use and small commercial heating. The other type of pellet is an industrial based pellet that contains more bark and therefore burns a little dirtier, at times requiring emission cleaning systems.

Making pellets out of wood waste is a well-developed export industry in BC in locations where there are significant amounts of wood waste;however, there are also local opportunities for locations with more restricted access to wood waste. These local opportunities are based around using small portable pellet mills. These mills can be set up close to where the fuel is being used, or at remote sites near logging operations. A general rule of thumb is that a tonne of dry pellets is equal to two tonnes of wetter wood chips.

Given the access to wood sources in the region, the following are recommendations for ensuring access to the sources required for delivering economic opportunities:

***Recommendation 1: Upgrade the Lil'wat Community Land Use Plan to incorporate a Community Forest Plan that ensures a sustainable supply of wood for community residential heating purposes.***

***Recommendation 2: Develop Memoranda of Understanding (MOUs) with local and regional forestry, mill, farms and composting operations for access to waste residuals for biomass.***

***Recommendation 3: Lil'wat Nation to secure access to unlogged timber from other forest licenses, beetle kill, and fire damaged timber.***

***Recommendation 4: Further explore the potential opportunities for growing, harvesting and processing energy crops on Lil'wat land in proximity to the waste water lagoons in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler).***

***Recommendation 5: The Lilwat Nation should explore delivered costs of pellets in conjunction with reviews of appropriate onsite bioenergy technology.***

***Recommendation 6: Consider the economic feasibility of a small-scale biomass waste processing systems (e.g. smaller remote pellet mill system, small-scale chipper) in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler).***

## 2.5 Keeping local dollars in the community

Based on the potentially available biomass sources, energy use patterns and possible market demand, opportunities for growing the local economy include:

- More efficient homes and buildings;
- More economical wood sourcing and efficient use of wood ;
- Offsetting propane/electric use for heating;
- Utilizing local sources of biomass.

### 2.5.1 More efficient homes

Energy efficiency promotes job creation for two major reasons: 1) The investment in efficiency leads to local construction style jobs that tend to be more labour intensive than capital intensive energy jobs that are often based outside the community; and, 2) The annual savings by the homeowner are spent on more labour intensive industries than energy production.[17]

The Lil'wat CEB provided some detailed assessments on Lil'wat band members' homes. These assessments showed that, on average, each home paid approximately $1,300 in electricity costs each year. On top of this charge, most homes would pay for some wood heating. General findings revealed that there were some considerable opportunities for energy savings, including many with short to medium term paybacks. An investment of $300 per home and the additional labour for upgrades could be paid back in a few years. Applying stronger building standards at the outset would also lead to higher efficiencies in new buildings, more jobs upfront, and more non-energy related expenditures and jobs. The two recommendations come directly from the community energy baseline.

***Recommendation 7: Conduct residential building energy efficiency upgrades identified in the building opportunity assessment.***

***Recommendation 8: Require a minimum building standard for energy efficiency of Energuide 80 in new residential building construction.***

**Figure 2-3 Assessment of residential energy efficiency upgrades**

| Capital Costs (375 accounts) | Local Skill Match | Direct Labour Total | Operations Annual Savings Estimate | Payback | Extra money over 5 Years |
|---|---|---|---|---|---|
| $75,000 | High | .5-1 FTE (3 hours per unit etc.) | $37,500 | 2-3 years | $112,500 |

[17] http://aceee.org/ files/pdf/fact-sheet/ee-job-creation.pdf

The Lil'wat CEB also looked at the four largest energy uses from the suite of Lil'wat administration buildings (Community School, Health/Daycare, Firehall, Grocery Store). Combined, the buildings' energy spend was approximately $145,000 per year. Simple upgrades were estimated to cost about $445,000 and result in $37,500 in annual energy savings. Two recommendations from the energy study in this area include:

***Recommendation 9: Conduct a commercial and institutional building energy efficiency upgrade identified in the building opportunity assessment.***

***Recommendation 10: Conduct a comprehensive study of the community school complex to identify both energy efficiency measures and energy sources, including the potential for alternative sources such as biomass, geo-exchange and passive solar space heating and hot water heating.***

**Figure 2-4 Assessment of institutional building energy efficiency opportunities**

| Costs | Local Skill Match | Direct Labour Total | Operations Annual Savings Estimate | Payback | Extra money over 20 Years |
|---|---|---|---|---|---|
| $445,000 | Medium | 3-5 FTE | $37,500 | 12 years | $320,000 |

### 2.5.2 More efficient use of current wood

Homes that are more efficient will reduce the amount of wood needed for heating, but there are also efficiency opportunities in the way wood is prepped for burning and in the choice of wood stove technology. Good wood stoves can have a manufacture efficiency rating 10-20% higher than lower quality stoves, but maintenance of the unit and prepping wood can have just as large an impact on efficiencies.[18] Demand for wood can drop by using a good burning stove, performing proper care and maintenance and the correct prepping of firewood so that wood has 20% or lower moisture content. Using pellet stoves and pellets may be more efficient than wood stoves.

In addition to securing sources of biomass consider the following:

***Recommendation 11: Ensure adequate wood prep and proper stove maintenance to increase burning efficiencies.***

***Recommendation 12: Consider the economic feasibility of a central log yard for storing, splitting and seasoning firewood for on-reserve purposes.***

[18] http://energy.gov/energysaver/articles/wood-and-pellet-heating

Figure 2-5 Assessment of opportunities to increase the efficiency of current wood use

| Capital Costs | Local Skill Match | Direct Labour Total | Annual Community Savings Estimate | Payback | Extra money over 20 Years | Lil'wat Values |
|---|---|---|---|---|---|---|
| Minimal for wood prep and maintenance | High | One person, but could make wood available for commercial sales and more jobs. | $20,000-$40,000 | 1 year or less | $20,000-$40,000 and opportunity to sell wood to the region | more efficient, better air quality. |

### 2.5.3 Biomass for heating and power

Using biomass to offset local propane and electricity use is another potential strategy for reducing energy costs and creating new, local jobs. While 75% of the Nation's homes have wood stoves, they all might not use them as frequently as they could to offset electric heating. Newer wood stoves can also be connected into water systems to provide for domestic hotwater in heating season.

Increasing the use of wood heating could lead to more demand for wood, but also more local energy spending and, potentially, jobs.

In addition to residential heating, there may be some opportunities for heating the Community School, Health/Daycare Centre, Learning Centre and, Seniors Complex with biomass. These facilities could be equipped with wood furnaces and boilers that run on a mixture of biomass fuel types from chopped wood, to pellets and wood chips. These types of heating systems are very common in Europe and are becoming more common in Canada. If buildings are close in proximity--like the Lil'wat school and Health Centre--there may be opportunities to use one heating system to heat both.

Another opportunity that might work for the Lil'wat Nation is a biomass plant that produces both heating and electricity. Due to the heat demand in the Nation's Xet'olacw Village site, it would likely make sense for assessing the potential for a system in this location so that the heat and electricity can be used locally.

**District of Lillooet – Biomass Boiler for Recreation Centre**

**Capital investment after funding:** $140,000

**Technology:** .5MW KOB pellet boiler, 45 tonne pellet storage silo. Delivery 4-5 deliveries a year, 30 tonnes each from Williams Lake or Armstrong BC.

**Output:** 80-85% of heating demand
**Annual Savings** $26,000
**Simple Payback:** 5.4 years
**ROI:** 17%
**Staffing:** No additional required

The Lil'wat Nation's buildings with the greatest demand for heating in 2009 are listed in Figure 2-6 below along with the approximate costs based on recent energy usage and the costs based on using biomass energy as opposed to propane. The case study from Lillooet, BC was used to estimate some rough investments and returns for retrofits.

**Figure 2-6 High level assessment of Lil'wat buildings for biomass heating investments.**

| Lil'wat Facility | Annual Propane GJ Demand | Current Cost $25/GJ | BDT/Yr | Biomass Cost $100 | Biomass Cost $150 | Approx. Capital Cost | Approx. Pay back | Approx. ROI |
|---|---|---|---|---|---|---|---|---|
| MT. CURRIE COM. SCHOOL | 3,059 | $76,475 | 170 | $ 16,994 | $25,492 | $ 300,000 | 5-10 years no grants | 10%-17% |
| MT. CURRIE CREEKSIDE RES | 2,622 | $65,550 | 146 | $14,567 | $ 21,850 | Similar | Similar | Similar |
| MT. CURRIE HEALTH CENTRE | 531 | $13,275 | 30 | $2,950 | $ 4,425 | Lower | Longer | Lower |
| MT. CURRIE LEARNING CENTRE | 413 | $ 10,325 | 23 | $2,294 | $ 3,442 | Lower | Longer | Lower |

In addition to securing sources of biomass, consider the following:

***Recommendation 14: Assess the specific potential to retrofit the larger community facilities with individual biomass heat or combined heat and power systems and/or district systems if the facilities are proximal to each other.***

**Figure 2-7 Assessment of using Biomass for heating and or electricity**

| Capital Costs | Local Skill Match | Direct Labour Total | Savings Estimates | Payback | Lil'wat Energy Values | Local Biomass Availability |
|---|---|---|---|---|---|---|
| $100,000-$500,000 | Moderate | Depends on Feedstock | Depends | 5-15 years | Compatible, though air emissions might increase slightly | Biomass available as long as it is secured. |

### 2.5.4 Utilizing local sources of biomass

Using biomass heating and electric generation technology can lead to energy cost savings and additional local employment. Combining these technologies with local sources of biomass from Lil'wat Nation operations, however, is the best way to ensure local economic development. Like efficiency retrofits, biomass spending leads to more jobs than any other energy source. For example, spending $1,000,000 in the biomass sector leads to 17 jobs, whereas a similar amount

spent in oil and gas only generates 5 jobs.[19] Since a high proportion of the biomass energy jobs are related to the production or gathering of biomass and the basic processing (chipping and feeding) it is important to ensuring Lil'wat Nation access to regional biomass resources.

In addition to securing access to biomass resources, we recommend:

> ***Recommendation 15: Prioritize Lil'wat Nation sourced and semi-processed biomass for all onsite energy applications (recognizing that short term supplies from outside the nation may initially be required ).***

## 2.6 Bringing new wealth into the community

Based on the potentially available biomass sources described in Section 2.4.2, as well as possible market demand, economic export opportunities include:

- Exporting minimally processed biomass;
- Exporting wood products;
- Exporting electricity through heat/electric cogeneration.

### 2.6.1 Exporting minimally processed biomass

Exporting minimally processed biomass includes harvesting and preparing everything from wood rounds and wood waste from forestry operations, to growing, harvesting and chipping energy crops for export to local or regional customers.

**Wood Log Biomass and Heating**

The BC community energy and emissions inventories estimates Squamish Lillooet Regional District community wood fuel demand for 2010 at just under 500,000 GJ (or 27,000) cords valued at almost $5 million dollars. The largest market, but also the most geographically distributed, is the unincorporated areas in the SLRD, valued at $2.7 million with the more proximal communities of Whistler and Pemberton as the smallest markets at about $800,000 annually(See Figure 2.8). It should be noted that much of the wood used for home heating applications might not be purchased from wood suppliers but rather harvested directly by households at a minimal cost.

[19] http://www.sightline.org/wp-content/uploads/downloads/2012/02/green-jobs-primer-pdf.pdf

**Figure 2-8 Energy demand and $ value of wood heating in the SLRD, Source: BC Community Energy and Emissions Profiles**

| Community | Demand (GJ) | Cords ($180) | Revenue Value[20] |
|---|---|---|---|
| SLRD Unincorporated (2007 data) | 270,132 | 15,007 | $ 2,701,320 |
| Whistler | 32,456 | 1,803 | $ 324,560 |
| Pemberton | 47,339 | 2,630 | $ 473,390 |
| Lillooet | 96,011 | 5,334 | $ 960,110 |
| Squamish | 48,628 | 2,702 | $ 486,280 |
| SLRD Total | 494,566 | 27,476 | $ 4,945,660 |

While the wood demand for the wood stove market may be sizable, it is also the market with the most competition. Barriers to entry are quite small and anyone with a truck, chain saw and permit can access wood for personal use, free of charge. With a special salvage permit and minor stumpage fees, proprietors can also harvest firewood and sell it commercially.

One advantage that the Lil'wat Nation might have over individual harvesters or commercial operations is their potential ability to secure forest residuals or tenures in non-reserve areas where they (or others) are involved with forestry.

In addition to securing sources of biomass consider the following:

***Recommendation 16: Further assess the commercial viability of regional commercial wood sales for wood stoves.***

**Figure 2-9 Assessment of commercial wood business**

| **Capital Costs** | **Local Skill Match** | **Direct Labour Total** | **Revenue Estimates** | **Payback** | **Lil'wat Energy Values** | **Local Biomass Availability** |
|---|---|---|---|---|---|---|
| $20,000-$50,000 | High | Mod | $500,000-$1,000,000 | Short term | Compatible | Biomass available as long as it is secured. |

**Semi Processed Wood**

At present, there is not a large-scale commercial market for biomass energy. The community of Whistler is exploring the potential for a large district heating application, though installation, if feasible, is still a few years away. Studies used to assess the feasibility of a large scale, minimal processed biomass heating facility in Whistler indicate that 50% of the heating load would need initial annual requirements of 10,700-13,788 tonnes/yr of biomass and require spends of $428,000

[20] Much of the wood used for home heating applications is harvested directly by households and so 'Revenue Value' does not represent real spending, but rather the market value worth of wood.

to $518,000 annually (biomass price: $40/tonne (at 40% moisture content). At 100% of the heating load, spends might be in the $800,000 to $1,000,000 range. While the size of this opportunity may not be as large as the home firewood market, a single customer this large may provide the financial stability required to operate other biomass investments. In addition to securing sources of biomass consider the following:

***Recommendation 17: Initiate early conversations with the RMOW with respect to supplying the district energy system and support efforts to launch this system in Whistler.***

**Figure 2-10 Assessment of collecting and providing semi-processed biomass**

| Capital Costs | Local Skill Match | Direct Labour Total | Revenue Estimates | Payback | Lil'wat Energy Values | Local Biomass Availability |
|---|---|---|---|---|---|---|
| $50,000-$100,000 | High | Mod | $300,000-$1 Million | Mid term | Compatible | Biomass available as long as it is secured. |

### 2.6.2 Exporting wood products

Making pellets out of wood waste is a well developed export industry in BC in locations where there are significant amounts of wood waste. While the Lil'wat Nation is well situated from a transport perspective, the amount of wood waste and quality available to the Lil'wat Nation today may not be economically viable for large exports to Europe or Asia. The minimum size of a pellet plant in BC is 20,000 metric tonnes per year in order to operate at the appropriate economies of scale, but most BC plants operate at 100,000 tonnes per year.[21] A recent study completed for the Lillooet Biomass Energy Corporation reveals a number of interesting results relevant in considering this option for the Lil'wat Nation.

1. The selling price of over $200 CDN/tonne was needed to provide an adequate return of 15% on the investment.[22] Year end 2012 bulk prices for pellets were $167/tonne. Exchange rates are going in the wrong direction to support pricing and the opportunity is not feasible as of 2013.
2. Investment required for a 100,000 tonne/year plant without land purchasing was estimated at $12 Million.
3. Jobs would result in 5 salaried employees and a number of hourly workers.

[21] BC Bioenergy Information Report

[22] Lillooet Biomass Energy Corporation Business Plan for a Wood Pellet Plant, 2010

4. There was currently inadequate waste fiber and the initial start up required using round logs.
5. Assuming 25% average moisture content in beetle-killed pine, a 100,000 tonne per year wood pellet plant will require some 180,000 $m^3$ of logs.
6. Lillooet is closer to shipping ports than any other pellet plant in BC.

Pursuing this opportunity onsite in Mt. Currie likely isn't a possibility, but there may be other ways in which the plant or harvesting operations can employ Lil'wat Nation members. In addition to securing sources of biomass consider the following:

***Recommendation 18: Assess other potential institutional heat users in the region such as schools, universities and local governments. Prioritize Pemberton and Whistler, due to the proximity and the higher cost of natural gas/propane.***

**Figure 2-11 Assessment of wood product plant opportunity**

| Capital Costs | Local Skill Match | Direct Labour Total | Revenue Estimates | Payback | Lil'wat Energy Values | Local Biomass Availability |
|---|---|---|---|---|---|---|
| $12 Million | Med-High | High | Year 2 $11-$17 Million, needs at least $13 Million or so to break even | 5-20 years, depending on prices, prices are too low now. | Compatible | Biomass limited, and would likely require imports |

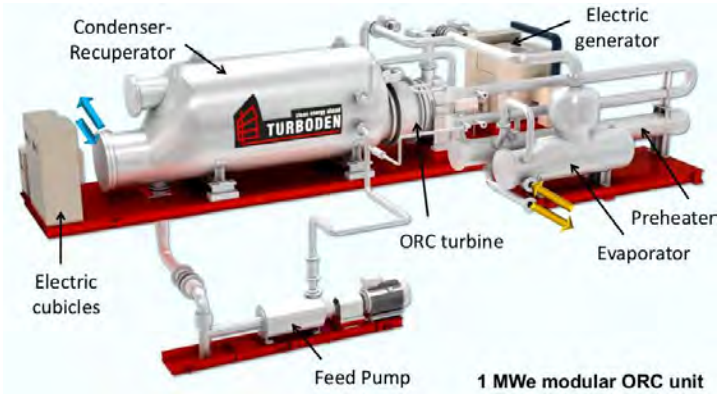
### 2.6.3 Exporting electricity through heat/electric cogeneration

BC Hydro currently has a standing offer to accept electricity from highly efficient and low carbon electrical generation stations. Recent power purchase agreements for biomass energy paid $0.10/kwh or about $27/GJ or more to proponents. This power would connect and feed into the larger power grid as opposed to servicing local markets. Hydro's standing offer is for generation stations of under 15MW. As the Lil'wat Nation has ready access to the provincial energy grid it would be relatively easy, given the economics of the system, to tie into the grid and sell power.

These power generation plants provide both heat and power, so they are ideally situated where the heat can also be used. Using the heat also has the benefit of increasing the power generation capacity and efficiency.

Given the amount of waste biomass currently available it might be difficult for the economics to work out for power plants, but electricity plants as low as 2 MW may be feasible as long as at least 30,000 tonnes of biomass are available. For example, the Whistler District Heating Study looked at the potential for a 1.3 MW electric/5.3MW heat and organic Rankine cycle heat and power plant.

**Figure 2-12 Heat/Electricity generation plant, Source: Whistler Pre-Feasibility Study**




In addition to securing sources of biomass, consider the following:

***Recommendation 20: If a significant heat load is required for the community (more facilities, manufacturing, requirement to dry sewage sludge, district heating etc.) review the feasibility of technology to provide both electricity and heating to the community and power grid.***

**Figure 2-13 Assessment of combined heat and electricity biomass plant**

| Capital Costs 1MW | Local Skill Match | Direct Labour Total | Revenue Estimate | Payback | Lil'wat Energy Values | Local Biomass Availability |
|---|---|---|---|---|---|---|
| $20 Million | Moderate | High | $4.8 Million, if the heat was sold as well, but there is not enough demand for heat right now. | 10-15 years, if the heat was sold. | Yes, though air emission might be slightly higher. | Yes, but it would use a significant amount of the annual wood residuals; compost from Whistler could be added. |

# 3 Conclusion and Next Steps

The main objective of this study was to evaluate, at a very high level, the feasibility of various biomass energy economic development opportunities for the Lil'wat Nation and community. The core goals of such activity would be to support the Lil'wat energy vision as outlined in the Lil'wat Community Energy Baseline (CEB). In doing so, this study provides a brief introduction to biomass energy and the associated options for local economic development, a description of typical biomass energy opportunities, a high level assessment of the local economic development biomass energy opportunities and this discussion of next steps.

After reviewing the various biomass opportunities for local economic development it is clear that the majority of opportunities depend on securing Lil'wat Nation access to biomass in the region. Therefore the most pressing recommendations in the action table below relate to securing access to biomass and promoting biomass opportunities to current and potential biomass purchasers. Other short-term recommendations include generating economic activity through using biomass energy more efficiently in on-reserve buildings, which has the co-benefit of reducing local costs and increasing the supply of biomass for other valuable revenue generating activities.

Medium-term opportunities include investigating on-reserve biomass heating technology, reviewing the potential for growing bioenergy crops and exploring the possibilities to generate power and heat from biomass, using both on-reserve techniques, or by selling electricity to BC Hydro while using the heat more locally.

We recommend that the Lands and Resources Department, the Lil'wat Economic Development Officer, and Lil'wat Forester lead most of the tasks in the table while bringing in consultants where needed.

| **Recommended Action - Implementation Timeline** | **Short term - 1 year** | **Med term-2-3 year** |
|---|---|---|
| Recommendation 1: Upgrade the Lil'wat Land Use Plan to incorporate a Community Forest Plan that ensures a sustainable supply of wood for community residential heating purposes. | | |
| Recommendation 2: Develop Memoranda of Understanding (MOUs) with local and regional forestry, mill, farms and composting operations for access to waste residuals for biomass. | | |
| Recommendation 3: Lil'wat Nation to secure access to unlogged timber from other forest licenses, beetle kill, and fire damaged timber. | | |
| Recommendation 7: Conduct residential building energy efficiency upgrades identified in the building opportunity assessment. | | |
| Recommendation 8: Require a minimum building standard for energy efficiency of Energuide 80 in new residential building construction. | | |

| Recommended Action - Implementation Timeline | Short term - 1 year | Med term-2-3 year |
|---|---|---|
| Recommendation 9: Conduct a commercial and institutional building energy efficiency upgrade identified in the building opportunity assessment. | | |
| Recommendation 10: Conduct a comprehensive study of the community school complex to identify both energy efficiency measures and energy sources, including the potential for alternative sources such as biomass, geo-exchange and passive solar space heating and hot water heating. | | |
| Recommendation 11: Ensure adequate wood prep and proper stove maintenance to increase burning efficiencies. | | |
| Recommendation 12: Consider the economic feasibility of a central log yard for storing, splitting and seasoning firewood for on-reserve purposes. | | |
| Recommendation 13: Promote burning clean dry wood as a way to heat homes/buildings and to support the local economy. | | |
| Recommendation 15: Prioritize Lil'wat Nation sourced and semi-processed biomass for all onsite energy applications (recognizing that short term supplies from outside the Nation may initially be required ). | | |
| Recommendation 16: Further assess the commercial viability of regional commercial wood sales for wood stoves. | | |
| Recommendation 17: Initiate early conversations with the RMOW with respect to supplying the district energy system and support efforts to launch this system in Whistler. | | |
| Recommendation 19: Support and stay abreast of the Lillooet Biomass Energy Corporation opportunity and seek out opportunities as the commercial viability becomes more likely. | | |
| **Recommended Action - Implementation Timeline** | **Short term - 1 year** | **Med term-2-3 year** |
| Recommendation 4: Further explore the potential opportunities for growing, harvesting and processing energy crops on Lil'wat land in proximity to the waste water lagoons in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). | | |
| Recommendation 5: Lilwat Nation to explore delivered costs of pellets in conjunction with reviews of appropriate onsite bioenergy technology. | | |
| Recommendation 6: Consider the economic feasibility of a small-scale biomass waste processing systems (e.g. smaller remote pellet mill system, small-scale chipper) in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). | | |

| Recommended Action - Implementation Timeline | Short term - 1 year | Med term-2-3 year |
|---|---|---|
| Recommendation 14: Assess the specific potential to retrofit the larger community facilities with individual biomass heat or combined heat and power systems and/or district systems if the facilities are proximal to each other. | | |
| Recommendation 18: Assess other potential institutional heat users in the region such as schools, universities and local governments. Prioritize Pemberton and Whistler, due to the proximity and the higher cost of natural gas/propane. | | |
| Recommendation 20: If a significant heat load is required for the community (more facilities, manufacturing, requirement to dry sewage sludge, district heating etc.) review the feasibility of systems to provide power to the community and BC Hydro power grid. | | |

| |
|---|
| Recommendation 13: Promote burning clean dry wood as a way to heat homes/buildings and to support the local economy. |
| Recommendation 15: Prioritize Lil'wat Nation sourced and semi-processed biomass for all onsite energy applications (recognizing that short term supplies from outside the Nation may initially be required ). |
| Recommendation 16: Further assess the commercial viability of regional commercial wood sales for wood stoves. |
| Recommendation 17: Initiate early conversations with the RMOW with respect to supplying the district energy system and support efforts to launch this system in Whistler. |
| Recommendation 19: Support and stay abreast of the Lillooet Biomass Energy Corporation opportunity and seek out opportunities as the commercial viability becomes more likely. |
| Recommendation 4: Further explore the potential opportunities for growing, harvesting and processing energy crops on Lil'wat land in proximity to the waste water lagoons in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). |
| Recommendation 5: Lilwat Nation to explore delivered costs of pellets in conjunction with reviews of appropriate onsite bioenergy technology. |
| Recommendation 6: Consider the economic feasibility of a small-scale biomass waste processing systems (e.g. smaller remote pellet mill system, small-scale chipper) in combination with the wood sources and appropriate on-reserve/corridor bioenergy technology (e.g. Whistler). |

| |
|---|
| Recommendation 14: Assess the specific potential to retrofit the larger community facilities with individual biomass heat or combined heat and power systems and/or district systems if the facilities are proximal to each other. |
| Recommendation 18: Assess other potential institutional heat users in the region such as schools, universities and local governments. Prioritize Pemberton and Whistler, due to the proximity and the higher cost of natural gas/propane. |
| Recommendation 20: If a significant heat load is required for the community (more facilities, manufacturing, requirement to dry sewage sludge, district heating etc.) review the feasibility of systems to provide power to the community and BC Hydro power grid. |

# 4 Resources

The following is a list of resources we came across while developing this report:

## 4.1 Energy Development

**Green Energy as Rural Economic Development Project, BC:**
http://www.ruralbcgreenenergy.com/
The purpose of this project is to increase rural knowledge of green energy opportunities and to develop new tools that will facilitate increased rural benefits from green energy development in the MPB epidemic zone of BC. Resources translate to other regions, however.

**BC Bioenergy Network**
http://www.bcbioenergy.ca/

Established in April 2008 with a $25 million grant from the BC government, BC Bioenergy Network is an industry-led initiative that is the catalyst for deploying near-term bioenergy technologies and supporting mission-driven research to build a world class bioenergy capability in BC.

## 4.2 Funding

**First Nations Clean Energy Business Fund**
http://www.gov.bc.ca/arr/economic/fncebf.html
The FNCEBF aims to promote increased First Nation participation in the clean energy sector within their asserted traditional territories and treaty areas through agreements between the BC Government and the eligible First Nations to:

- Provide capacity development funding to support First Nations to undertake activities such as feasibility studies or to engage with proponents of clean energy projects (Capacity Funding);
- Provide equity funding to qualifying First Nations to help acquire equity positions in clean energy projects or assist in the undertaking of their own community clean energy project (Equity Funding); and
- Share in the revenues from clean energy projects based on new, net, incremental revenues to government derived from water rentals, land rents and eventually wind participation rents (Revenue Sharing).

# CENTRE *for* SUSTAINABILITY
WHISTLER

*Creating the future **today**.*

*Centre for Sustainability – Whistler* *4325 Blackcomb Way, Whistler, BC V0N 1B4*
*whistlercentre.ca ph: (604) 935.8127*