The selection of the location of the demonstration stoves was based on the following parameters:

- Easy access of other villagers to the demonstration house for viewing the stove.
- The ability of the house owner to understand the improvements and explain the functioning of the stove to the neighbours and other interested parties.
- The ability of the house owner to monitor the performance of the stove in firewood consumption and its efficiency as compared to the former situation, and fill out the monitoring forms.
- The ability of the house owner to communicate his/her observations to the implementing agency, through the local coordinator or service centre.
- The willingness to participate in the installation and allow modifications to the kitchen and/or chimney arrangements if necessary for the proper functioning of the stove.
- The willingness to pay for the stove after the demonstration period.
- The signing of a contract agreement in which the above points are mentioned.

In the above house, the fireplace needs to be adapted. Eventually the large hood over the fireplace needs to be closed (removed). In addition a signboard needs to be installed along the main road, pointing to the demonstration house, so other villagers can easily find the location.[1]

On the same day we briefed the field staff of SCAFP and Mr. Lakpa Sherpa on the various aspects of using the improved metal cooking stove, including the assembling and its operation. It was explained to Mr. Lakpa how to fill out the questionnaire and survey forms prepared by STARIC-N and the techniques of monitoring the stoves during the winter.

The SCAFP staff agreed to instruct the villagers (new stove owners) on the monitoring methods and issue them with a scale to measure the amount of firewood used on a weekly basis. They need to submit all the stove monitoring reports, along with the comments of the villagers, to STARIC-N on a monthly basis. For the time being Mr. Lakpha will serve as service centre.

In addition to monitoring the stoves and their use, the service provider needs to develop a marketing system. This implies that there needs to be a viable credit system for low-income villagers so all villagers may eventually be able to buy an improved cooking stove. This can be developed with WWF-NP; planning has started on this topic.

Comment: For the time being Mr. Lhakpa of WWF will act as the service personnel from the service center. He wants to formally be associated with STARIC for stove dissemination.

[1] The painted metal signboards need to be brought from Kathmandu and written in English and Nepali.

STARIC staff briefing the field staff in a teahouse about the methods and procedures of monitoring the performance of the stoves.

18 November – Day Three

After installing the stove and briefing the new stove user in Lukla, we headed towards Ghat, a two-hour walk, where a hotel owner was anxiously waiting for our arrival. After installing the stove, the hotel owner was given a manual and questionnaires. In addition she was briefed on the installation and operation of the new metal stove.

The demonstration consisted of installing the stove in the user's place. First, the staff members from STARIC-N showed and described all 12 different parts of the stove. Then the various parts were assembled before the user so that the user would be capable of assembling the stoves if their neighbours also wanted the same stove. A cooking demonstration was given to convince the new users about the efficiency of the stove and to show in a practical way that the new stove consumed a lot less firewood than the older stoves, as well as taking much less time to cook the same food.

New stove installed on top of the existing mud stove. The chimney goes into the large hood. Both the mud stove and the new stove are burning. The two vertical pipes in the rear are from the smoke-water heater built into the mud stove. The metal slide on the fire opening is lowered on top of the wood.

Because the teahouse owner knew precisely how much wood and time would be required to boil water, she immediately noticed the efficiency of the new stove. One of her observations was that she also needed a water heating facility, currently built into the existing mud stove. By not having this feature, she would probably maintain her old stove for water heating, partly defeating the efficiency of the newly installed stove.

In the mountain areas the cook has no objections to cooking while standing. Placing the metal stove on top of the existing stove, however, raises the cooking height too much. The stove service provider will need to discuss with each individual house owner on how to improved the

kitchen set-up and/or demolish the existing mud stove. Demolishing the mud stove, however, will only be done if the water heating facility is fully incorporated into the new metal stove.

The short (temporary) chimney pipe (three lengths = three meters) ends inside the wide hood. The effect will be that warm air from the kitchen will also be sucked into the hood and the stove will hardly contribute to warming the kitchen. A chimney passage going through the upper floor should be installed as this will only marginally ventilate the kitchen (along the chimney pipe) while drawing out the excess smoke. The construction of a special floor/roof passage prevents the wooden floor from easily catching fire in the event of a chimney fire.

The galvanised sheet metal chimney pipe is only a temporary measurement.[2] The GI sheet pipes should not be used inside the house, but replaced by plain metal sheet pipes.

After installing the stove in Ghat, we moved on to Phakding, about an hour's walk further. There Mr. and Mrs. Rai were waiting for our arrival. We then installed the stove in Phakding and gave them the manual and questionnaires. We also explained the manual, page by page, and briefed them on the installation and operation of the new metal stove.

Comments of Mrs. Rai on Her New Stove

Once the stove was installed and operated, Mrs. Rai told us that the new stove was much more efficient than her older stove and consumed a lot less firewood and time than she would have expected. In the beginning she was wondering, by looking at the mouthpiece of the stove, if the stove would burn at all, but later she seemed to be surprised by the performance of the stove.

[2] When the flue gasses are hot, the galvanisation will evaporate, causing very poisonous gasses. Only the floor/roof passage, the top piece outside the roof and the wind vane can be made from galvanised sheet metal.

She also told us that she used the older stove for heating the water via the back-boiler, but now it seems to be more economical to boil the water on the new stove and pour it in the tank, rather than using the old stove just for the purpose of heating the water.

She was astonished by the short time it took to prepare dinner for seven persons, including the staff members of STARIC-N, WWF-NP and SCAFP. She told us that in the beginning she did not believe the new stove could be used to prepare dinner for more than 4 persons, but she was proven wrong.

As with the stove installed in Lukla, also in this case the incorporation of the back-boiler would be needed for even more efficient water heating. The project staff decided to allocate additional funding for developing the back-boiler as a feature that can be easily attached to the existing stove.

The heat pipe of the back-boiler can be installed, together with a new skirt, by removing the existing skirt. The skirt without the heat pipe is closer to the pot than the skirt with a heat pipe and therefore needs to be replaced. The removed skirt can be returned to the service provider for fitting on another stove having no back-boiler.

With regard to the angled position of the water kettle, the bottom support over the fire chamber needs to be adjusted in such a way so that the largest kettle (fitting into the opening) remains in a fairly horizontal position and flue gasses are optimally heating the kettle.

19 November – Day Four

In the early morning we walked to Monju, a small village about two hours walk from Phakding. The stove owner was in her house when we reached there. She was waiting for us with a sack full of dry ash which was later used to insulate the body of the stove. We installed the stove and gave her the manual and questionnaires. She was briefed about installation and operation of the new metal stove. There, too, we had to wait until a meal was prepared using the new stove in order to convince the user of its effectiveness.

The above process illustrates the need for on-the-spot demonstration in the villages. Seeing is believing. Other villagers can now view the stove and discuss the results with peers.

Stove with sunken water kettle and pressure cooker.
The dimension of the two holes will accommodate most medium-sized pots,
leaving only a minimal gap around the pot.
On the left are the two vertical pipes of the back-boiler from the existing mud stove.

Ashes from the old fireplace are used to insulate the body of the stove. The inner vertical burning chamber can be seen, with holes in the side, allowing the hot flue gasses to lead to the second cooking hole. This inside design will be modified for the next series of stoves.

20 November – Day Five

In the morning we moved to Namche Bazaar, about a four-hour walk from Monju and a very steep climb. When we reached Namche, we were pleasantly surprised to see that the stove owner was already using the new metal stove without us having to install it. He seemed to be really pleased with its performance and he had invited a lot of other villagers to have a look at his new stove.

The top of the stove had to removed because he had not put any insulation (ash) inside the stove, but this was easily resolved.[3] After filling with the insulating ashes, the owner prepared tea for us and the other spectators who had come to look at the stove's performance. In practice the owner of the demonstration stove will need to serve a lot of tea to the visitors who come to have a look at the new stove's performance. After observing the performance of the new stove, the owner told us that he would stop using his old metal stove because it consumed a lot of firewood and was time consuming.

The large and heavy metal stoves were manufactured in Kathmandu in a period (20 years ago) when firewood was readily available and no consideration was given to the deteriorating environment. Because stove manufacturers do not know any technical details on how to make firewood efficient stoves, the villagers kept on buying the only (old) model available in the

[3] Test will be conducted to assess the difference of efficiency between air-filled and ash-filled stoves.

market. Many teahouse owners, however, were obliged (by WWF-NP and the park management) to change to kerosene for cooking for the tourists in order to reduce the progressing deforestation and accompanied soil erosion that causes the destruction of the fragile mountain ecosystem.

The old metal stove on the bottom weighs about 115 kg
and consumes about a Bhari (35 kg) of firewood in one cooking cycle.
The new stove (on top) weighs about 20 kg and uses less than 5 kg in one cycle.
A plastic barrel on a stand with water heating pipes is on the right-hand side.

21 November – Day Six

In the morning we travelled to Khumjung, about a two hour's walk. There, too, we installed the stove in a teahouse. The owner had already collected some dry ash because the field staff from WWF-NP had advised her to do so. We used this dry ash for the insulation. As soon as the stove was installed, the owner started using the stove.

The demonstration stove design is made with a thin sheet metal inner burning chamber to reduce the heating-up time, thus conserving firewood. To avoid burning through in a few months, the inner chamber will be made from stainless steel.

After having some tea and lunch cooked on the new stove, we moved from Khumjung to Tengboche and subsequently to Debuche. The trek is about five hours from Khumjung. We reached Debuche at night.

The new stove placed on top of the old mud stove and already in use.

22 November – Day Seven

Mr. Lakpa Shrepa from WWF-NP had invited the potential users of the new stoves from Pangboche and Dingboche to Debuche. The stove owners of the other two villages reached there at 10:00 AM and we started briefing them about the installation and operation of the metal stove. This time we let them install the stoves themselves. We even made them cook lunch on the new metal stove so that it would boost their confidence.

The existing mud stove with ash receptacle covered with thin metal sheeting. On the left side of the ashtray is a hand blower. These stoves often have only one cooking hole.

Debuche, Pangboche and Dingboche are three villages situated at high altitude and are regarded as semi-alpine regions where firewood is really scarce.[4] All that is available is twigs and small branches of herbs and shrubs. The teahouse owner from Debuche was able to cook on the new stove just by using these small sticks. This made them very happy.

The elbow opening of the new stove is stuffed with small twigs and branches. The metal slide is not inserted here.

23 November – Day Eight

After briefing the villagers in Debuche, we returned the next day back to Namche Bazaar.

It had been planned in an earlier phase of the project to give people the option of ordering the stove with pot rings exactly fitting their most favourite cooking pots. A preliminary cooking pot and kettle survey showed, however, that the sizes of the cooking pots were rather similar and less attention was paid to well closing pot rings. This matter needs to be further reviewed. Reasonably lightweight and sturdy pot rings need to be manufactured (cast iron is heavy and breaks easily).

The cooking demonstration proved the chimney had sufficient draft. However, in this case, pot rings would be required to avoid air from being sucked into the stove alongside the pot, causing quenching of the fire and with that reducing the heat intensity in the second cooking hole. The current rings need to be exchanged for better closing rings that will allow only minimal flue gases (and smoke) to escape through the top plate or air to enter.

[4] Although the conservation and park management people oblige the teahouses to use kerosene to cater for the cooking needs of trekkers (tourists), they are still allowed to use deadwood from shrubs for their own firewood needs.

The valve in the chimney needs to be improved so it remains in the selected position to precisely control draft. This is important with long chimneys and in windy periods.