



EIE-06-256 REEPRO



Promotion of the Efficient Use of Renewable Energies in Developing Countries

Show Case documentation

**Show Case No.: 4
Saravanh Province
Authors**

December 2009

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1 Show case documentation

Type of Equipment: (tick off the type)	PV	Solar Thermal	Biomass to Energy	
			✓	
Name:	Multy purpose Brick mold for Rocket stoves production			
Location of the equipment:	Ban Nakhong Village, Meangg Saravanh, Saravanh province. Lao PDR			
Year of purchasing:	July 2009			
Operator: (Name and address)	Mr. Khamlae Chanthaboune, Chairman of Village group Nakhong. Saravanh District, Saravanh province. Lao PDR			
Planner: (Name and address)	Thongxay Bounthisavath, Deputy Director. Department of Energy and Mines, Saravanh province.			
Detailed description of the installation: (technology, function, benefit for training, etc. max 150 words)	<p>Two sets of brick moulds (one -metallic and another -wooden) were handed to village group for promoting production of rocket stoves in this area.</p> <p>The multipurpose mould was designed and fabricated by a group of students of ME/FE/NUOL. The mould is used for making bricks of different shapes and sizes, and therefore, can help production of different modification of rocket stoves. The mould is characterised by simplicity and flexibility in use. Besides, the mould can also be reproduced by anyone who is willing to deal with rocket stove making, by either metal or wooden materials.</p>			
Generated Energy service: (tick off the energy type)	electricity	heat	Gas	Light
		✓		
Power output of installation: (kWel, m³ biogas, kW th, etc.)				
Financing* (tick off the financing type)	private investment	loan	donation	grant
			✓	
Investment costs in US\$*	30 US\$ for metallic mould and 10 US\$ for wooden one			
Maintanance costs in US\$*	None			
Savings US\$ per month				
Energy sale income in US\$*				
Comments				

Pictures	
	
For making long brick	Medium length brick
	
Short brick	Right Trapezium shape brick
	
Rectangular-trapezium brick	Villager is learning how to use the mould



Level 1 trainer is introducing brick mold to level 2-3 trainees



Level 2 trainer showing villager (level 3) how to assembly the rocket stove

2 Show case development and operation

2.1 Project side survey

The REEPRO team contacted department of energy and mines for selection of the right location for promotion of rocket stoves production and use. The Nakhong villages' group, which is located about 6 km from the Saravanh provincial centre. The main occupation and also the main source of income is brick production. The village is located in the buffer zone between the city and the rural area, and is facing some shortage in wood supply, because a lot of wood is used for bricks burning. Thus the village was chosen as appropriate site for promoting use and production of efficient stoves, such rocket stoves.

2.2 Show case definition workshop

Saravane is a Centre of Southern provinces and still among the poor provinces of Lao PDR. Province is facing problems in achieving 90% electrification rate and poverty eradication by 2020, as planned by GoL. Rocket stoves were chosen for promotion in the target area because of its simple construction but rather high efficiency (up to 33%). In Lao PDR there is still high share of wooden fuel use in domestic energy balance. The rocket stoves were proved for use in many developing countries in Africa.

Partners were PDEM¹ of Saravanh and other southern provinces of Lao PDR and Nakhong Brick production Group² and other village groups in the province

2.3 Showcase planning

The brick mould will be used by group of villagers of Nakhong group for demonstration of rocket stoves use and production. They will reproduce the mould for wider application in other villages. Saravanh PDEM will supervise the use of handled brick mould for benefits of local people. The PDEM will report on mould use to FE team once a year.

¹ PDEM: provincial department of energy and mines

² Comprised of members in a village cluster

2.4 MOU on showcase project

Actually a MOU is not developed, because there is no action in this area.

2.5 Show case implementation

The first training on use of brick mould was held 25 July 2009 Nakhong village, Saravanh district, Saravanh province.

2.6 Show case operation

A group of villages of Nakhong villages' group, Saravanh district, Saravanh province was assigned to use the mould for trial production of rocket stoves.

2.7 Show case supervision

Actually there were no supervisions taken after the training, and also no MOU signed. The REEPRO team talked with the PDEM about the idea to promote rocket stoves in the province. The PDEM is interested but no were actions taken. It is probably because of no financial incentives in Lao PDR available.

Appendix 1: Show case implementation

Training Report



EIE-06-256 REEPRO



Promotion of the Efficient Use of Renewable Energies in Developing Countries

**Training of Trainers level 2
Solar PV systems, Rocket stove construction
and Project development**

level 2 course 6 and 7 in Saravanh

Report

Author

CDEA

Revised by

Khamphone NANTHAVONG, Faculty of Engineering (NUOL)

September 2009

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List of Acronyms

NUOL	National University of Laos
CDEA	Community Development and Environment Association
PDEM	Provincial Department of Energy and Mines
DOEM	District Office of Energy and Mines
EDL	Electricite du Laos

Documentation of REEPRO level 1 Training by Trainers

1. Summary Sheet

Event:	Training on low cost gasifier construction and modification
Task number	04.02.05 and 04.02.06
Date, Location, Time:	July 21 to 23, 2009, 8:00 - 16.30 EDL Saravanh Branch's meeting room. Saravanh district, Saravanh Province, Lao PDR
Theme:	Solar PV systems, Rocket stove construction and Project development
Target group:	<input type="checkbox"/> Level 1 <input checked="" type="checkbox"/> Level 2 <input type="checkbox"/> Level 3
Performance:	Three full days training comprised of theoretical presentation, video shows, practical exercises and field trip
Participants:	20 participants,
Success:	<p>Deputy Director of Saravanh provincial Department of Energy and Mines in his opening remarks has mentioned importance of such kind of training, which as he stated, was the first one in province, and he also pointed on the right approach for efficiently promoting renewable energy to local users, particularly regarding process of poverty reduction by means of sustainable access to modern energy service.</p> <p>This point was also shown through very active involvement and support by the Department's staffs to the training.</p> <p>During the three days training three courses namely Solar PV systems, Rocket stove construction and Project management were given to trainees, who come from Departments of Southern provinces (Saravanh, Attapeu and Sekong), 4 Districts offices of Energy and Mines of Saravanh province and also some villages' group representatives.</p> <p>One day field trip also organized to brick making villages group. During the training, there was always kept dual communication between trainers and trainees, in particular discussion on such issues as what local energy resources they have, solar PV systems use and installation, stoves' efficiency and use, project initiation and management, etc. At the end of each topic, the reviewed questions were also given and the correct answers were awarded with REEPRO promotional materials. All these measures helped creating good environment in the training room.</p>

2. Workshop Preparation

- The workshop preparation was assisted by NUOL REEPRO team in close cooperation with CDEA and Saravanh province Department of Energy and Mines in the following matters:
 - Participants contact
 - Training venue arrangement
 - Field trip arrangement

3. Workshop Performance

REEPRO Team for Saravanh training was comprised of 4 people: Mr. Khampha Keomanichanh, Mr. Bounpon Luangphimmajak (CDEA); Dr. Khamphone Nanthavong and Mr. Sengratry Kythavone (NUOL). The team arrived by rented van to Saravanh on late Monday, 20 July 2009 and participated into training from 21-24 July 2009. The team returned to Vientiane on 25 July 2009.

Day 1: 21 July 2009

- The first training session started by brief introduction on REEPRO trainings by Dr. Khamphone Nanthavong, and opening remarks by Mr. Thonxay Bounthisavath, Deputy Director of Department of Energy and Mines of Saravan province.
- The opening session ended with group photo and coffee break. During the break, short trilateral meeting between REEPRO team-Deputy Director of Department of Energy and Mines of Saravan province-Deputy Head of EDL Saravanh Branch, concerning current energy development situation and future plan in Saravanh province.
- After the break, the training was continued, on PV system: Introduction to Solar energy, PV system and its applications, PV system components, Solar home system sizing. Fundamental of electricity and energy consumption were also shortly reviewed and exercised;
- Afternoon session continued with PV systems: PV system installation, experiences on PV (home) systems use.
- Some short promotional materials (video scrip, pictures) time to times were shown during the training.

Day 2: 22 July 2009

- Mr. Sengratry Kythavone took over the training in the second day. The second day training was going on biomass and its conversion into energy by rocket stove.
- Training on rocket stove construction included such materials as (1) principle of rocket stoves and its specific features compared to common wood stoves; (2) construction of rocket stoves; (3) rocket stove modifications for adaptation to real Lao conditions.
- The level 2 and 3 performed practical exercise on rocket stove assembling and brick making at the field trip spot
- Shown Video on rocket stove production

Day 3: 23 July 2009

- Day 3 was about Project development and management, conducted by Mr. Khampha Keommanichanh from CDEA.
- Mr. Khampha told trainees how to initiate a certain project, what steps and information required for this process,
- Parallel to theoretical knowledge, the trainer also provided a lot of practical experiences from carried out by CDEA or others projects
- There were given some basic tools in project planning and management (project cycle and its steps' management, SWOT analysis, etc)
- Trainer-Trainees dual conversation was always kept during the training in order to achieve more understanding of the audience.

Day 4: Field trip to a village cluster

- The visited village was belong to a so-called villages cluster, which usually grouped several nearby located villages with overall steering committee.
- The main income generating activities in the cluster include irrigated rice plantation, brick making cottage, husbandry and traditional handicraft.
- The visited spot was about 6 km from the Saravan provincial centre.
- Training session at the spot included such as activities as demonstration on rocket stove assembling, rocket stove production video and then practical exercises on brick making, firstly by trainees level 2 and then by level 3 trainees (village craftsmen and women)
- In the afternoon session, question-answer games were conducted: the asked questions mainly were about wood fuel use issues, stove efficiency, fuel saving, wood collecting, gender issues of wood use, etc. The right answers or the active villagers were awarded with REEPRO shirts or caps.

Presentation and discussion results

- PV systems' presentations:
 - What is PV system?
 - Fundamental of electricity and energy consumption review;
 - PV system components;
 - PV system installation design;
 - PV system maintenance and troubleshooting;
 - Experiences
- Rocket systems:
 - Biomass and its conversion technologies
 - Rocket stove principle
 - Rocket stove construction (video)
- Project management:
 - What is project management?

- Project development process and cycle
- Experiences Project development

4. Discussion

- Lacking of clear policy to support local energy service providers would be a big concern for local technician or entrepreneurs to run energy service business in Lao rural areas
- Production of rocket stove for sale would be a good profitable business because less imported materials are used and relatively easy production process, and therefore unskilled craftsmen can do that;
- Mostly participants have had experiences on project development and management, in particular project development cycle, problems analysis (e.g., SWOT analysis)

5. Conclusion

The participants have come to conclusion that this training was a good opportunity for local craftsmen and officers to obtain knowledge on some renewable energy technologies as well as experiences in project development and management.

Although due to very short training duration and therefore limited knowledge transferred, but, participants have expressed that obtained knowledge will reserve as a basis for level 2 trainers to promote renewable energy technologies and their application in their localities, and in the future they may require further deeper trainings to make their knowledge repositories sustainable.

6. Participants' evaluation

Trainees comprised mostly males (figure 1).

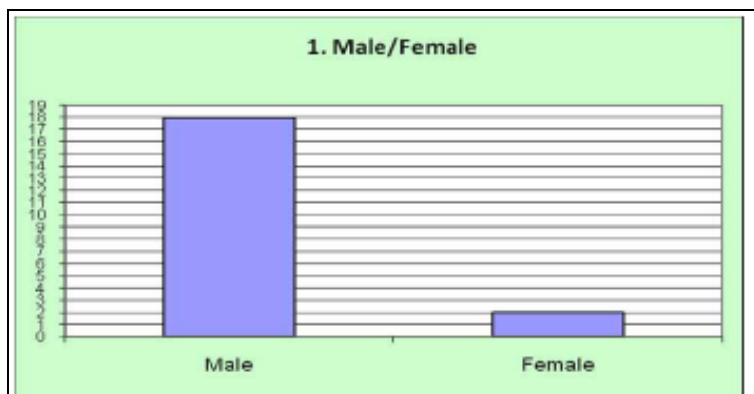


Figure 1: Participants' profile

Mostly participants have known about the training through REEPRO project news letter and personal contact (figure **Fehler! Verweisquelle konnte nicht gefunden werden.**). The REEPRO brochures have been sent to Saravanh Department of Energy and Mines several months earlier, which then in turn have sent together with official letter from REEPRO team, to other PDEM and to Districts' offices of Energy and Mines of Saravanh province.

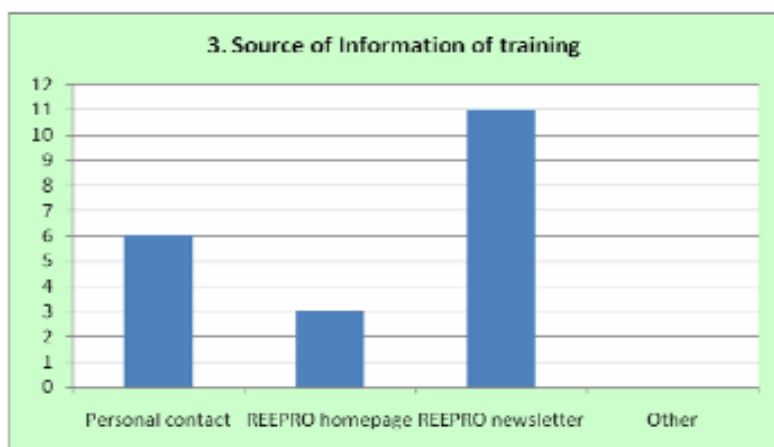


Figure 2: Information on the training

About 70% of participants have had engineering-technical background and almost of them are working in this field also (figures 3-4). This point is also supported by their satisfied expectations with the training topics and materials (figure 5).

Mostly participants expressed that obtained materials and knowledge will serve as a good basis for their future work plan in renewable energy promotion in their localities (figure 6)

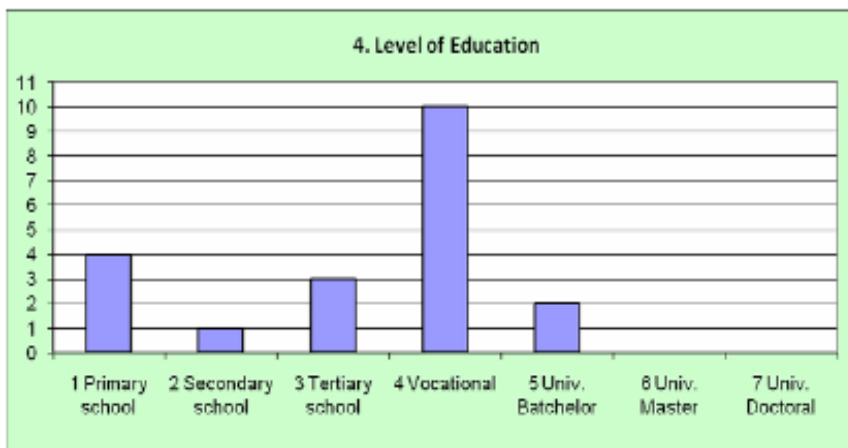


Figure 3: Education levels of trainees

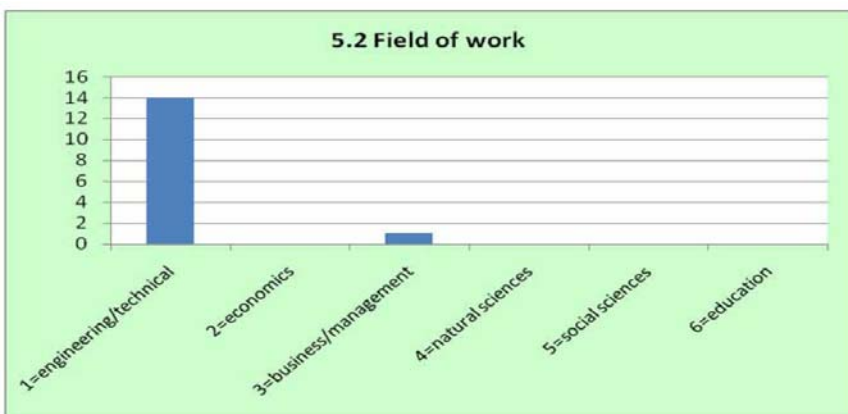


Figure 4: Field of works



Figure 5: Expectations of participants



Figure 6: Relevance to future work plan

The trainees agreed that they have got better understanding on the renewable energy devices, how they work and how to do their installation or construction (figures 7-8).

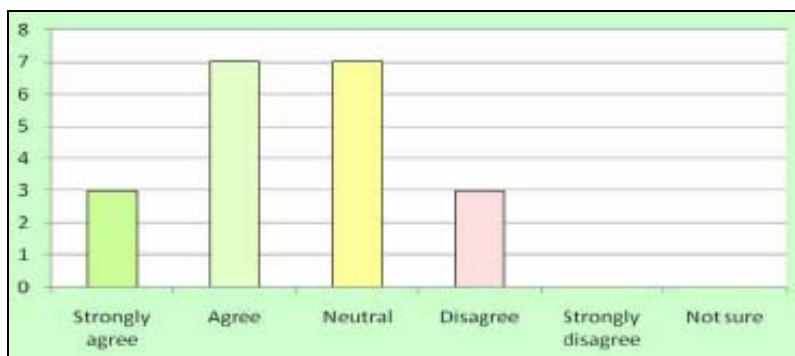


Figure 7: Device installation ability

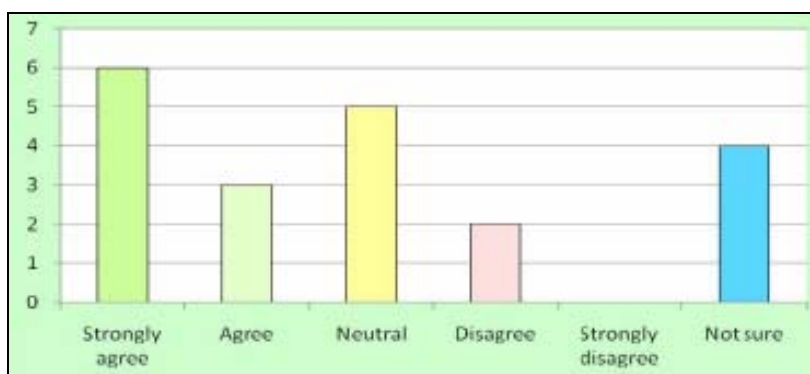


Figure 8: Understanding on device work

Interests of the participants to this REEPRO training can also be seen through their willingness to get further training on the given topics and materials, particularly in rocket stove construction and project management (figures 9-10).

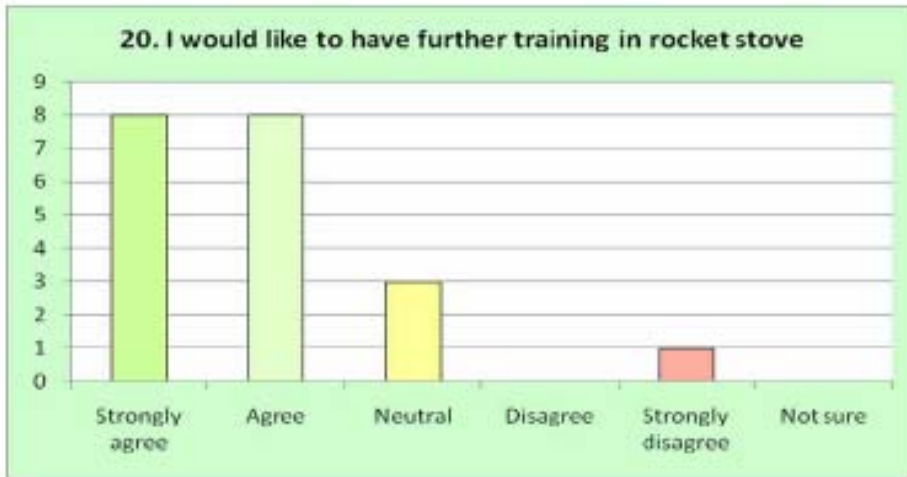


Figure 9: Needs for further training on rocket stoves



Figure 10: Need for Further training on Project management.

7. Programme

REEPRO-Saravan Provincial department of Energy and Mines Joint Training

Tentative Schedule for Level 2 and 3 Training

Subject: Solar PV system and Rocket stove

- Dates: 21-25 /7/2009
- Venue: Saravan Provincial Centre
- Tentative schedule

Date	Times	Training contents	Person in charge
21/7	8:30-9:00	Registration	Bounpone
	9:00-9:30	Introduction on REEPRO	Khamphone
	9:30-9:45	Opening remarks by Deputy director, Department of Energy and Mines, Sa- ravanh province	Mr. Thongxai Bounthisavath
	9:45-10:00	Photo session, and coffee break	
	10:00-12:00	Introduction on Solar energy and its application Solar PV system Fundamental of Electricity	Khamphone
	12:00-13:00	Lunch break	
	13:00-14:45	Solar Home PV system sizing	Khamphone
	14:45-15:00	Coffee Break	
	15:00-16:30	Solar Home PV system sizing	Khamphone
22/7	9:00-10:15	Introduction on principle and construc- tion of Rocket stove (Video show)	Sengratry
	10:15-10:30	Coffee Break	
	10:30-12:00	Rocket stove construction	Sengratry
	12:00-13:00	Lunch break	

Date	Times	Training contents	Person in charge
	13:00-14:45	Bricks making	Sengratry
	14:45-15:00	Coffee break	
	15:00-16:30	Rocket stove Assembling	Sengratry
23/7	9:00-10:15	Project development	Khampha
	10:15-10:30	Coffee break	
	10:30-12:00	Business Administration	Khampha
	12:00-13:00	Lunch break	
	13:00-14:45	Business Administration	Khampha
	14:45-15:00	Coffee break	
	15:00-16:30	Business adminsitraion	Khampha
24/7	8:30-16:30	Field trip to Solar PV spot (VOPS)	all trainers and level 2's trainees
25/7	8:30-16:30	Field trip to Brick making community to demonstrate rocket stove production and use	all trainers and level 2's trainees
26/7	8:00	Travel back to Vientiane	Trainers

8. List of Participants

No	Title	First Name	Last Name
1	Mr.	Sangthong	Inthaparkdee
2	Mr.	Khambone	Dokfangdeang
3	Mr.	Bounleud	Vangvichith
4	Mr.	Khongchai	Dadivong
5	Mr.	Khamsay	Luangkhamxay
6	Mr.	Xayadeth	Duangkhamchanh
7	Mr.	Souksamlee	Singsavanh
8	Mr.	Somsong	Phuangaphay
9	Mr.	Phimmavong	Xuangmanee
10	Mr.	Vanxay	Keokhampha
11	Mr.	Soukanya	Sihavong
12	Mr.	Khammanee	Vanthasouk
13	Mr.	Bounthavee	Sisomphone
14	Mr.	Khamponh	Souliyachak
15	Mr.	Thanousin	Maniboth
16	Mr.	Bouaphanh	Bounthisavat
17	Mr.	Khamlae	Chanthaboune
18	Mr.	Keoaudone	Aoupasith
19	Mrs.	Soudthaphasouk	Photjaleun
20	Mrs.	Khanthavixay	Phetsisomphou

9. Signed List

ລາຍຊື່ຜູ້ເຂົ້າຮ່ວມການຝຶກອົບຮົມກ່ຽວກັບແຫຼ່ງພະລັງງານສົດແນວລະດັບ 2 (ສຳລັບເມັດຊາຕານ) ທີ່ເຂດວຽກສາລາວັນ

List of participants of renewable energy sources training programmes level 2 in Saravan Province

№	ຊື່ ແລະ ນາມສະກຸນ	ຕຳແໜ່ງ	ບັນດາອົງການ	21/7/2009	22/7/2009	23/7/2009
No	Name and Surname	Position	organization	Signature	Signature	Signature
1	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
2	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
3	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
4	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
5	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
6	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
7	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
8	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
9	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
10	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
11	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
12	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
13	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
14	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
15	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
16	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
17	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
18	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
19	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]
20	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	[Signature]	[Signature]	[Signature]

ຜູ້ປຶກສາ/Trainer:

ຜູ້ຝຶກ/Trainer:

ລາຍຊື່ຜູ້ເຂົ້າຮ່ວມການຝຶກອົບຮົມກ່ຽວກັບແຫຼ່ງພະລັງງານສົດແນວລະດັບ 2 (ສຳລັບເມັດຊາຕານ) ທີ່ເຂດວຽກສາລາວັນ

List of participants of renewable energy sources training programmes level 2 in Saravan Province

№	ຊື່ ແລະ ນາມສະກຸນ	ຕຳແໜ່ງ	ບັນດາອົງການ	ເບີໂທລະສັບ	ສະເໜີ
No	Name and Surname	Position	organization	Telephone No.	Signature
1	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	0800000000	[Signature]
2	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	90000000	[Signature]
3	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	155 8150	[Signature]
4	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	6855 5468	[Signature]
5	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	6000 0000	[Signature]
6	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
7	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
8	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
9	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
10	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
11	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
12	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
13	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
14	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
15	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
16	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
17	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
18	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
19	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]
20	ທ່ານ ສິມສິມ	ຊ່າງ	ບັນດາອົງການ	8000 0000	[Signature]

ຜູ້ປຶກສາ/Trainer:

ຜູ້ຝຶກ/Trainer:

10. Photo



Figure 11: Group photo and Training room



Figure 12: Trainers level 2 doing exercise on rocket stove assembling and brick making



Figure 13: Level 1 and 2 Trainers on Level 3 training



Figure 14: Villagers learning how to use brick mould and how to prepare clay-sawdust mixture (level 3 training)

Video on trainings Level 2 and 3

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Posters on Benefits of Rocket Stove

Benefit of Rocket Stove

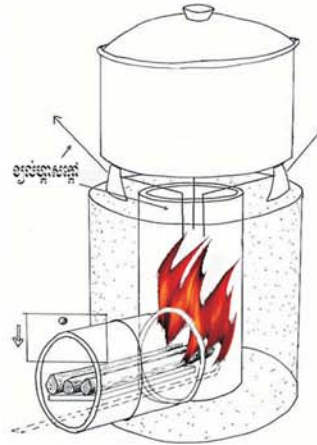


1. Disadvantage of 3 stone stove



- Bad atmosphere, full of smoke and dust
- Cause respiratory problem
- Consume lot of fuelwood

2. Advantage of using rocket stove



- Good environment and less smoke
- Clean pots
- Need less wood for cooking
- Reduce deforestation
- Reduce time spending for fuelwood collection for ladies and children



- Deforestation causes climate change
- Need to invest time for fuelwood collection
- Lost time for earning
- Children goes to school irregularly



- Women has time to do other business
- Children goes to school regularly
- Family members are healthy

Rocket stoves We can make Rocket Stoves by ourselves by following the instruction.

ຜົນປະໂຫຍດໃນການນຳໃຊ້ເຕົາຮອກແກ້ດ



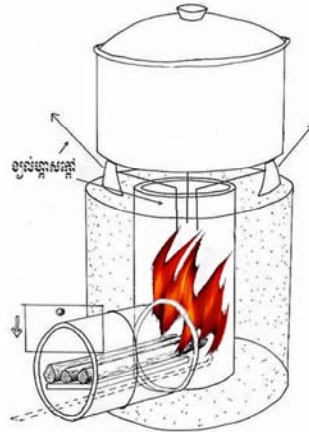
Intelligent Energy Europe

ຈຸດອ່ອນຂອງເຕົາຄຽງສາມຂາ



ການໃຊ້ຄຽງສາມຂາທັງບໍ່ປະຢັດພື້ນ ທັງມີຄວນ ຫຼາຍ ເປັນຜົນສະທ້ອນຕໍ່ສຸຂະພາບຜູ້ໃຊ້

ຈຸດດີໃນການໃຊ້ເຕົາຮອກແກ້ດ



- ເຕົາຮອກແກ້ດບໍ່ມີຄວນ, ໃຫ້ຄວາມຮ້ອນສູງ
- ໜ້າສະອາດ
- ໃຊ້ພື້ນໜ້ອຍ
- ຫຼຸດຜ່ອນການຕັດໄມ້
- ຫຼຸດຜ່ອນເວລາໄປເອົາພື້ນ ຊຶ່ງມັກຈະເປັນພາລະຂອງເດັກນ້ອຍແລະແມ່ຍິງ



- ໃຊ້ພື້ນຫຼາຍ ກໍ່ຕັດໄມ້ທຳລາຍປ່າຫຼາຍ
- ສິ່ງຜົນສ້ອນທ້ອນທາງລົບຕໍ່ສິ່ງແວດລ້ອມ



ແມ່ຍິງແລະເດັກນ້ອຍຈຶ່ງມີເວລາເຫຼືອ ສຳລັບການທຳມາຫາກິນ, ຮຽນໜັງສື ແລະ ອື່ນໆ

ເຕົາຮອກແກ້ດ:

ຜະລິດງ່າຍ, ໃຜຮຸ່ນສາມາດເຮັດເອງໄດ້

Booklets of Rocket Stove

Benefits

Rocket stoves are simple cooking stoves that can be assembled from a few basic components found in many households.

- Rocket stoves consume less wood, because heat utilization efficiency is around 33-36% compared to 10-12% of open fire
- Collecting less firewood lightens the works and saves the time of women and children who traditionally gather the firewood
- Less hazardous smokes due to complete combustion
- Less deforestation
- Cleaner kitchen and pots

Simplified stove theory

- Rocket stoves are considered to be efficient and relatively inexpensive to operate. The stove derives its name from the appearance of the piping that extends horizontally from the main portion of the unit (like a rocket).
- The principle is in maximizing combustion and heat transfer efficiency.
- Wood doesn't burn, wood gets hot and releases volatile gases that then combust.
- If wood is heated to 650 degrees Celsius (and sufficient oxygen is mixed with the volatile gases) the result is complete combustion. The products of clean combustion are CO₂, water vapour and heat (smoke is wasted energy).

Functional principles

Dr Winiarski rocket stove: The ordinary rocket stove

- Insulated low mass combustion chamber

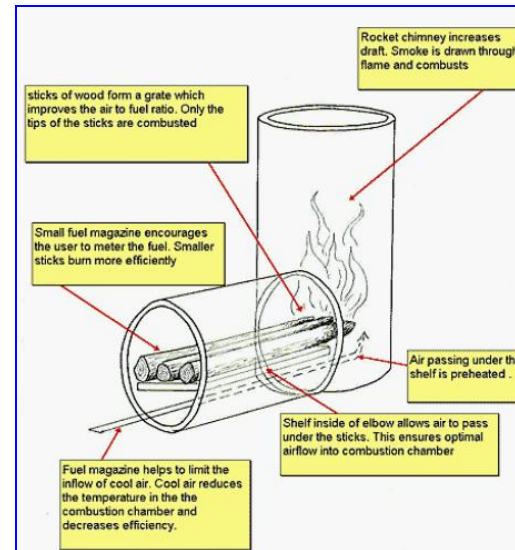


Figure 1 Rocket stove principle

- Stove power is controlled by regulating the fuel supply not the air intake
- Internal shelf allows sticks to form a grate. Stick/air/stick/air
- Small amount of high velocity air is drawn under the coals and the wood 'grate' which improves air to fuel mixture
- Horizontal feed chamber is convenient
- Since its invention in 1984 over 15,000 rocket stoves have been built

- Optimising heat transfer by forcing hot flue gases around pot due to additional heat exchanger/skirt (see figure 2). In this case, stove efficiency can reach more than 50%.

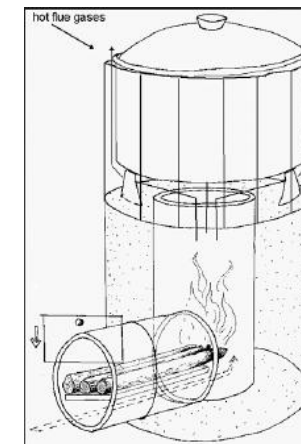


Figure 2 Rocket stove with heat exchanger/skirt

- Make it as tall as feasibly possible
- The stove's bricks can be made of Clay + an organic material, such as fine sawdust or ground coffee husks

REEPRO Modifications

- Adaptive research of Faculty of Engineering's students shows possibility to use rice husk as organic materials for making stove bricks.
- The brick mixture proportion is:
 - 1200 g water + 900 g clay + 500 g saw dust
 - 700 g water + 900 g clay + 200 g rice husk
- Multipurpose brick's mold has been designed (figure 3) so that bricks of different shape, and therefore, different stove modifications can be constructed (table 1)



Figure 3 Multipurpose brick mold

Stove modifications in table 1:

- 1) APROVECHO rocket stove: stove assembled of 5 short and 6 long bricks

Table 1 Rocket Stove modifications

Modification	Bricks	Stove assembling
1)	5 6	
2)	11	
3)	2 9	

- 2) REEPRO modification 1: stove is made of 11 rectangular bricks of one size
 - 3) REEPRO modification 2: stove is made of 2 rectangular-trapezium and 9 trapezium bricks
- Fuel grade can be made of thin metal sheet (fig. 4)

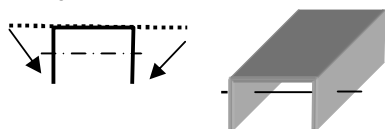


Figure 4 Fuel grade

- The bricks can be assembled in a metal body or mud covers (figure 4)

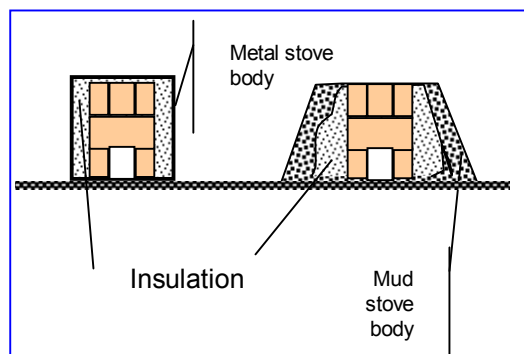


Figure 5 Placement of bricks

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Promotion of the Efficient Use of Renewable Energies in Developing Countries (REEPRO)

www.reepro.info



Rocket stoves

ສະເໜີຄວາມເປັນມາ

ເຕົາຮອກແກັດ (Rocket stove) ເປັນເຕົາທຸງ ຕື່ມງ່າຍ ດາຍ ຊຶ່ງປະກອບດ້ວຍໜ້ອຍສິນສ່ວນເທົ່ານັ້ນ. ໃນເວລາ ດຽວກັນນັ້ນ ເຕົາຮອກແກັດມີປະສິດທະພາບຂ້ອນ ຂ້າງ ສູງ. ເຕົາຮອກແກັດໄດ້ຊື່ມາຈາກໂຄງສ້າງພິເສດ ທີ່ເປັນ ລັກ ສະນະທີ່ຍືດຍາວອອກມາຈາກຕົວເຕົາຕາມລວງ ນອນ. ເຕົາຮອກແກັດຖືກພັດທະນາຂຶ້ນ ໂດຍສູນຄົ້ນຄ້ວາ APROVECHO (Oregon, USA) ນັບແຕ່ປີ 1976.

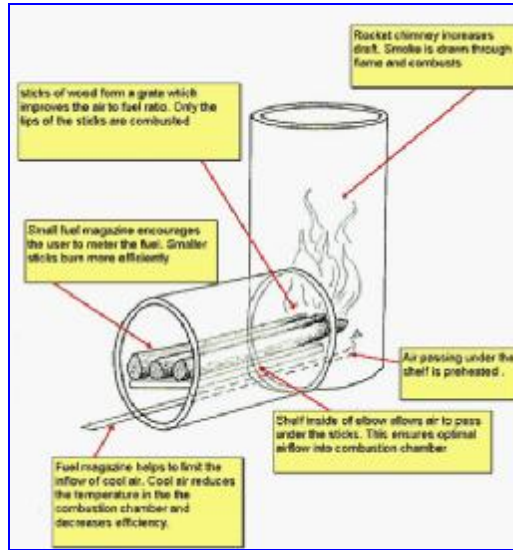
ທິດສະດີເຕົາແບບງ່າຍ

- ຫຼັກການຂອງເຕົາຮອກແກັດເພີ່ມໃສ່ປະສິດທິພາບ ການເຜົາໄໝ້ແລະການຖ່າຍເທຄວາມຮ້ອນສູງສຸດ
- ພື້ນບໍ່ຖືກເຜົາໄໝ້ໂດຍກົງ
- ເມື່ອໄມ້ພື້ນໄດ້ຮັບຄວາມຮ້ອນ, ຈະບົດປ່ອຍກ້າຊ ລະ ເຫີຍອອກໄວ້ໄພມາແລ້ວຖືກເຜົາໄໝ້
- ເພື່ອໃຫ້ໄດ້ດັ່ງນັ້ນ ອຸນຫະພູມຕ້ອງສູງສົມຄວນ
- ຖ້າໄມ້ຖືກເຜົາໃຫ້ຮ້ອນຂຶ້ນເຖິງ 650 °C (ແລະມີອີກ ຊິພຽງພໍໃນສ່ວນປະສົມຂອງກ້າຊລະເຫີຍ, ສຸດທ້າຍ ກໍ່ເກີດມີການເຜົາໄໝ້ແບບສົມບູນ. ຜົນການເຜົາໄໝ້ ແມ່ນກ້າຊ CO₂, ອາຍນໍ້າ ແລະຄວາມຮ້ອນ
- ໃນເຕົາພື້ນທົ່ວໄປ ພະລັງງານຄວາມຮ້ອນບໍ່ຖືກນຳ ໃຊ້ ຢ່າງເຕັມສ່ວນ
- ພະລັງງານທີ່ມີປະໂຫຍດອອກໄປນຳຄວນໄປ

Construction

ເຕົາຮອກແກັດຂອງ ດຣ ວີນີຢາສະກີ (Dr Winiarski):

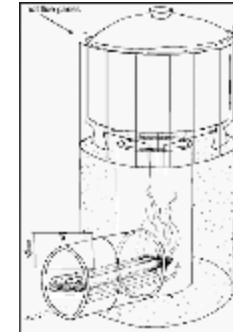
- ທ້ອງເຜົາໄໝ້ມີສະໜວນຫຸ້ມ
- ກຳລັງການເຜົາໄໝ້ຂອງເຕົາຖືກຄວບຄຸມໂດຍປະລິ ມານເຊື້ອໄຟທີ່ບ້ອນ ແຕ່ບໍ່ແມ່ນອາກາດທີ່ເຂົ້າໄປ



ຮູບ 1 ຫຼັກການຂອງເຕົາຮອກແກັດ

- ຖ້ານຢອງພື້ນເປັນຕົວແຍກຊ່ອງອາກາດເຂົ້າດ້ານລຸ່ມ ແລະໃສ່ພື້ນຢູ່ດ້ານເທິງ.
- ປະລິມານອາກາດໜ້ອຍແຕ່ໄຫຼໄວຖືກດູດເຂົ້າຜ່ານ ຖ້ານໄຟດ້ານລຸ່ມແລະຊ່ອງຕື່ມພື້ນຈະເຮັດໃຫ້ອາ ກາດ ປະລິມເຂົ້າກັນໄດ້ດີກັບເຊື້ອໄຟ
- ຊ່ອງຕື່ມພື້ນລວງນອນມີຄວາມສະດວກກວ່າ

- ນັບແຕ່ປີ 1984 ເຖິງປະຈຸບັນ, ໄດ້ມີການສ້າງເຕົາ ຮອກແກັດ ຈຳນວນ 15,000 ໜ່ວຍມາໃຊ້ແລ້ວ
- ສາມາດເພີ່ມທະວີການແລກປ່ຽນຄວາມຮ້ອນໂດຍບັງ ຄັງໃຫ້ອາຍເສຍຮ້ອນໝູນອ້ອມຮອບໝໍ້



ຮູບ 2 ເຕົາຮອກແກັດທີ່ມີເປືອກແລກປ່ຽນຄວາມຮ້ອນຫຸ້ມຫໍ່

- ຊັ້ນເປືອກຫຸ້ມຫໍ່ສາມາດເຮັດໃຫ້ຊ່ອງຫວ່າງແຄບລົງ ແຕ່ຍັງຮັກສາໜ້າຕັກຂອງທ້ອງເຜົາໄໝ້ໄວ້ເໝືອນເດີ ມ (ໂດຍສະເລ່ຍໃຫ້ຍັງປະມານ 1 cm ສຳລັບໝໍ້ ປານ ກາງ)
- ເມື່ອມີຕົວແລກປ່ຽນຄວາມຮ້ອນ ປະສິດທິພາບ ລວມ ຂອງ ເຕົາອາດເພີ່ມຂຶ້ນອີກ 50% ຫຼືກວ່າ ນັ້ນ
- ເປືອກຫຸ້ມໝໍ້ຕ້ອງເຮັດໃຫ້ສາມາດປັບໄດ້ໃຫ້ເຂົ້າກັບ ໝໍ້ຂະໜາດຕ່າງກັນ
- ເຮັດໃຫ້ສູງເທົ່າທີ່ເປັນໄປໄດ້
- ດິນຈີ່ກໍ່ເຕົາສາມາດຜະລິດຂຶ້ນມາຈາກວັດຖຸປະສົມ "ດິນໜຽວ+ຂີ້ເລື້ອຍ+ນໍ້າ" ໃນອັດຕາສ່ວນ 500+900+1500(ເປັນກຸາມ). ຊັດສ່ວນນໍ້າອາດແ

ຕກຕ່າງໄປ ໂດຍຂຶ້ນກັບຄວາມຊື່ນທີ່ມີຢູ່ ໃນດິນກ່ອນແລ້ວ

- ນອກນັ້ນຍັງສາມາດນຳໃຊ້ວັດສະດຸຊິວະມວນອື່ນໆ ທີ່ໝຸ່ນລະອຽດ ເຊັ່ນ ແກ້ບ, ເປືອກເມັດກາເຟ, ອື່ນໆ

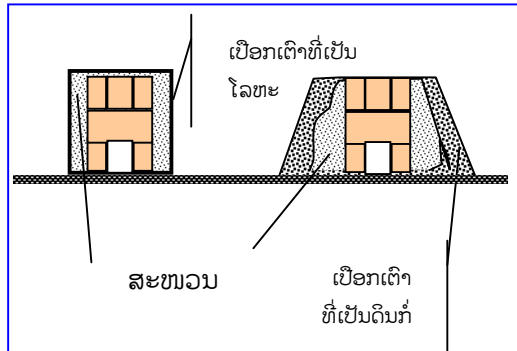
ການດັດແກ້ໂດຍໂຄງການ REEPRO

- ການຄົ້ນຄ້ວາດັດແກ້ໃນການນຳໃຊ້ແກບແລະຂີ້ເລື່ອຍ ເປັນສ່ວນປະກອບອື່ນຊື່

ຕາຕະລາງ 1 ການດັດແກ້ເຕົາຮ້ອກແກ້ດ

ແບບຫຼໍ່ດິນຈີ່	ດິນຈີ່	ວິທີປະກອບເຕົາ
	5 6	
	11	
	2 9	

- ແກບເຂົ້າມີຢູ່ທຸກແຫ່ງໃນ ສປປ ລາວແລະກຳປູເຈຍ
- ເປືອກເຕົາຮ້ອກແກ້ດສາມາດ ເປັນໂລຫະ ຫຼື ກໍ່ດ້ວຍດິນຈີ່/ດິນປຼ້ອກ (ຮູບ 3)
- ທີມງານໂຄງການ REEPRO ຂອງຄະນະວິສະວະກຳສາດໄດ້ອອກແບບຫຼໍ່ດິນຈີ່ອະເນກປະສົງ



ຮູບ 3 ວິທີກໍ່ເຕົາຮ້ອກແກ້ດ

ຜົນປະໂຫຍດ

- ປະສິດທິພາບໃນການນຳໃຊ້ຄວາມຮ້ອນຂອງເຕົາຮ້ອກແກ້ດປະມານ 33-36%, ເຕົາຄຽງ (10-12%).
- ເຕົາຮ້ອກແກ້ດຊ່ວຍປະຢັດພື້ນ
- ຕາມປະເພນີແລ້ວ, ຢູ່ປະເທດພວມພັດທະນາການຫາພື້ນເປັນພາລະໜັກໜ່ວງຂອງແມ່ຍິງແລະເດັກນ້ອຍ, ສະນັ້ນການນຳໃຊ້ເຕົາຮ້ອກແກ້ດຈະຊ່ວຍ ປະຢັດເວລາແລະແຮງງານເດັກນ້ອຍແລະຜູ້ຍິງ
- ຫຼຸດຜ່ອນມົນລະພິດໃນເຮືອນຄົວຍ້ອນການເຜົາໄໝ້ທີ່ສົມບູນກ່ວາ, ເຮັດໃຫ້ເຕົາໄຟແລະໝໍ້ສະ ອາດ

ຕິດຕໍ່

ຄະນະວິສະວະກຳສາດ, ມະຫາວິທະຍາໄລແຫ່ງຊາດ
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ໂຄງການສົ່ງເສີມການນຳໃຊ້ພະລັງງານທົດແທນ ຢ່າງມີປະສິດທິຜົນໃນບັນດາປະເທດພວມພັດທະນາ

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