



EIE-06-256 REEPRO



Promotion of the Efficient Use of Renewable Energies in Developing Countries

Show Case documentation

**Show Case No.: 7
Prek Chrey**

Authors

December 2009

1 Show case documentation

Type of Equipment: (tick off the type)	PV	Solar Thermal	Biomass to Energy		
	✓				
Name:	Interethnic Peace Centre (Solar Battery Charging Station)				
Location of the equipment:	Prek Chrey Community, Koh Thom district, Kandal Province, Cambodia				
Year of purchasing:	2009				
Operator: (Name and address)	- currently no operator				
Planner: (Name and address)	ITC, Pochentong Blvd, Toul kok district, Phnom Penh COMPED, Dangkor district, Phnom Penh Khmer Community Development (KCD)				
Detailed description of the installation: (technology, function, benefit for training, etc. max 150 words)	- until now no components were installed				
Generated Energy service: (tick off the energy type)	electricity	heat	gas	light	
	✓				
Power output of installation: (kW_{el}, m³ biogas, kW_{th}, etc.)	- no data available				
Financing* (tick off the financing type)	private investment	loan	donation	grant	
Investment costs in US\$*					
Maintenance costs in US\$*					
Savings US\$ per month					
Energy sale income in US\$*					
Comments	- until now the show case has no financial support				

2 Show case development and operation

2.1 Project side survey

The REEPRO team visited three areas in Prek Chrey to look for the pilot community and project community for the REEPRO project. Relevant data on the battery charging station were collected for the feasibility study of using Solar PV for charging the batteries. The health centre is located about 1 km from the charging station. The study was done by ITC for the capacity needed.

In Khnar Taing Yu Village, there is a charging battery station which uses small generator of capacity of 5.5 kW. This small Genset is operates almost everyday for charging battery with 10 hours a day. This station is located Kandal Province along the Bassac River nearby Cambodia-Vietnam border. The road is in good condition from Phnom Penh to Check point and about 3km by board from the check point. The centre is in the remote area there is no electricity grid for providing the consumption of the population who live in that area. In the centre, they use small generator for light or charging battery which very difficult to keep the medical in cool condition.

Health Centre (in Khmer, Mondul Sokhakupheab) is located Kandal Province along the Bassac River nearby Cambodia-Vietnam border. The road is in good condition from Phnom Penh to Check point and about 3km by board from the check point. The centre is in the remote area there is no electricity grid for providing the consumption of the population who live in that area. In the centre, they use small generator for light or charging battery which very difficult to keep the medical in cool condition.

Prek Chrey primary/secondary school is located in Kandal Province along the Bassac River nearby Cambodia-Vietnam border. The road is in good condition from Phnom Penh to Check point and about 3km by board from the check point. The centre is in the remote area, there is no electricity grid for providing the consumption of the population who live in that area. In school, there is no electricity for lighting or using they use small generator for light or charging battery which very difficult to keep the medical in cool condition.



Figure 1: Battery Charging Station in Prek Chrey



Figure 2: Prek Chrey Health centre



Figure 3: Library of a primary school in Prek Chrey

2.2 Show case definition

The decision for the charging battery station Khnar Taing Yu Village was made because of

- The large amount of charging batteries every day (60 batteries).
- It can reduce unfriendly toxic particles in the air
- It is independent from oil price increase

The benefits of health centre were:

- Provide the lighting application in the center
- Improve the quality of health centre (keep vaccination)
- Help Doctor or Nurse to do their work during night time

Also the Primary School Prek Chrey as a Pilot Community was selected because of:

- Free energy for using computer (Laptop)
- Lighting application for English course at evening
- Improve the education quality
- To make the gap education is smaller between rural area and city

2.3 Showcase planning

In a first step for all 3 show cases were concepts for the implementation developed:

2.3.1 Hybrid system – PV + Diesel Genset for charging battery station

The electricity will be produced by the combination of PV and diesel genset. The diesel genset can be set to run permanently during the evening time or when there is not enough energy from the PV or during peak load for instance. The scheme may vary depending on the nature of load, solar resource and desire of consumers.

System components

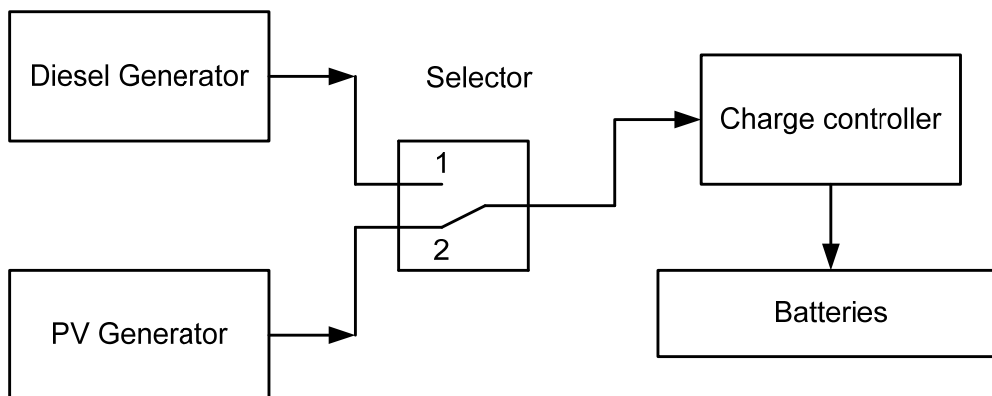


Figure 4: Layout of the PV system

System sizing

- PV Generator (P_{PV}):

$$P_{PV} = \frac{W}{\eta_{system} \times LDSR}$$

Where P_{PV} : Peak Power of PV generator (W)
 W : Daily energy consumption (Wh)

LDSR : Least Daily Solar Radiation = 4.3 KWh/day.m²

η_{system} : System efficiency = 75%

Hence

$$P_{PV} = \frac{18720}{0.7 \times 4.3} = 6219.26 \text{ Wp}$$

By using Sharp Module of different capacity with nominal voltage of 12 V, the number of modules are needed and connected in parallel shown in table below:

Module capacity (Wp)	Nb of module	Voltage (V)	Total Capacity
195	32	12	6240
185	34	12	6290
175	36	12	6300
170	37	12	6290

- Charge controller :

$$C = \frac{P_{PV}}{U}$$

Where P_{PV} : Peak Power of PV generator (W)
 C : Capacity of the charge controller (A)
 U : System voltage (V)

Hence, the capacity of charge controllers is list in the table below

PV module	Charge controller (A) @12V	Charge controller (A) @ 24V	Charge controller (A) @ 48V	Charge controller (A) @ 180V
module 195	520	260	130	34.66667
module 185	524.1667	262.0833	131.0417	34.94444
module 175	525	262.5	131.25	35
module 170	524.1667	262.0833	131.0417	34.94444

From the above result, the owner can select any configuration which is cheaper for the investment cost.

2.3.2 Individual Solar system for Health centre

This health center will be equipped with one solar home system. Electricity consumption will be independent from other energy resources.

System Components

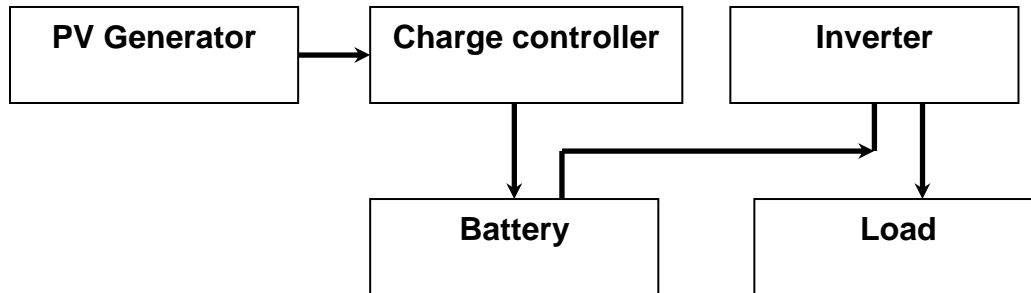


Figure 5: Layout of the PV system

Systems sizing

- PV Generator (P_{PV}) :

$$P_{PV} = \frac{W}{\eta_{system} \times LDSR}$$

Where P_{PV} : Peak Power of PV generator (W)
 W : Daily energy consumption (Wh)
 $LDSR$: Least Daily Solar Radiation = 4.3 KWh/day.m²
 η_{system} : System efficiency = 75%

Hence

$$P_{PV} = \frac{4428}{0.75 \times 4.3} = 1373.023 \text{ Wp}$$

By using Sharp Module with the capacity of 195 Wp each and nominal voltage of 24 V, 8 modules are needed and connected in parallel.

- Charge controller :

$$C = \frac{P_{PV}}{U}$$

Where P_{PV} : Peak Power of PV generator (W)
 C : Capacity of the charge controller (A)
 U : System voltage (V)

Hence

$$C = \frac{195 \times 8}{24} = 65 \text{ A}$$

- Inverter :

$$P_{Inverter} = P_{load} \times 1.3$$

Where $P_{inverter}$: Nominal power of the inverter (W)
 P_{load} : Total load power (A)
 1.3 : Allow 30% additional power or during starting

Hence

$$P_{Inverter} = 328 \times 1.3 = 426.4 \text{ W}$$

- **Battery :**

$$Ah = \frac{W \times N_d}{DOD_{max} \times U}$$

- Where
- Ah : Battery capacity (Ah)
 - W : Daily energy consumption (Wh)
 - DOD_{max} : Maximum Depth of Discharge of the battery, usually 50%
 - N_d : Number of autonomy day, usually 3 days for tropical region
 - U : System voltage (V)

Hence

$$Ah = \frac{4428 \times 3}{0.5 \times 24} = 1107 \text{ Ah}$$

Using battery with capacity of 200 Ah with nominal voltage 24 V, 6 batteries are connected in parallel.

2.3.3 Hybrid system – PV and Diesel Genset for Prek Chrey School

The electricity will be produced by the combination of PV and diesel genset. The diesel genset can be set to run permanently during the evening time or when there is not enough energy from the PV or during peak load for instance. The scheme may vary depending on the nature of load, solar resource and desire of consumers.

2.3.3.1 System Components

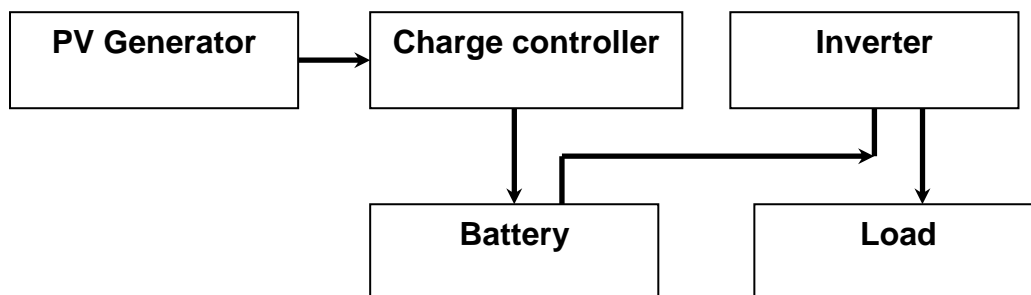


Figure 6: Layout of the PV system

Systems sizing

- PV Generator (P_{PV}) :

$$P_{PV} = \frac{W}{\eta_{system} \times LDSR}$$

Where P_{PV} : Peak Power of PV generator (W)
 W : Daily energy consumption (Wh)
LDSR : Least Daily Solar Radiation = 4.3 KWh/day.m²
 η_{system} : System efficiency = 75%

Hence

$$P_{PV} = \frac{4500}{0.75 \times 4.3} = 1395.35 \text{ Wp}$$

By using Sharp Module with the capacity of 175 Wp each and nominal voltage of 24V, 8 modules are needed and connected in parallel.

- **Charge controller :**

$$C = \frac{P_{PV}}{U}$$

Where P_{PV} : Peak Power of PV generator (W)
 C : Capacity of the charge controller (A)
 U : System voltage (V)

Hence

$$C = \frac{175 \times 8}{24} = 58.33 \text{ A}$$

- **Inverter :**

$$P_{Inverter} = P_{load} \times 1.3$$

Where $P_{inverter}$: Nominal power of the inverter (W)
 P_{load} : Total load power (A)
1.3 : Allow 30% additional power or during starting

Hence

$$P_{Inverter} = 800 \times 1.3 = 1040 \text{ W}$$

- **Battery :**

$$Ah = \frac{W \times N_d}{DOD_{max} \times U}$$

Where Ah : Battery capacity (Ah)
 W : Daily energy consumption (Wh)
 DOD_{max} : Maximum Depth of Discharge of the battery, usually 50%
 N_d : Number of autonomy day, usually 3 days for tropical region
 U : System voltage (V)

Hence

$$Ah = \frac{4500 \times 3}{0.5 \times 24} = 1125 \text{ Ah}$$

Therefore, the battery with capacity of 1200 Ah with nominal voltage 24 is used.

2.4 MOU on showcase project

The REEPRO team and Alain (KCD) signed a MOU on their cooperation on 19th of September 2009, which is attached as Appendix .

2.5 Show case implementation and operation

The project partners preferred the implementation of Solar system for Health centre at first. Thus an application was written for financial support for buying computers, work stations, tables, chairs and a solar home system.

Until now it was not possible to implement the show case because of the lack of necessary components and materials. The REEPRO team in cooperation with KCD requested financial support from Schmitz-Hille-Foundation. Due the current economic crisis the foundation can not support the project (see Appendix 1). Thus the project partners agreed to search for other financing options.

Appendix 1: MOU on showcase project

CO-OPERATION AGREEMENT

Between

Khmer Community Development

12C, Str. 408, Toul Tompong II, Phnom Penh

Represented by Mr. Alain Fressanges, Advisor

CAMBODIA

and

Deutsche Gesellschaft für Sonnenenergie e.V.

International Solar Energy Society / German Section

Emmy-Noether-Str. 2

80992 Munich

GERMANY

The Deutsche Gesellschaft für Sonnenenergie e.V., short DGS, and the Khmer Community Development, short KCD, agree to collaborate in working on the project “REEPRO - Promotion of the Efficient Use of Renewable Energies in Developing Countries” as detailed in this co-operation agreement. The objective of the collaboration of the REEPRO team and KCD is to develop and implement sustainable renewable energy concepts for Preak Chrey.

A Background

The project “REEPRO - Promotion of the Efficient Use of Renewable Energies in Developing Countries” hereinafter called REEPRO consist of the development and performance of an extensive training programme on renewable energies for all stakeholders from energy experts to villagers. The REEPRO training programme shall upscale the knowledge of the stakeholders and improve the quality renewable energy installations and their maintenance and promote the use of renewable energy in Laos and Cambodia.

The training of domestic experts (Level 1), technicians (Level 2), and customers / end users (Level 3) in a three-stage training programme is the main objective of the REEPRO project. The first stage of the education, the “Level 1” courses approaches local planners and engineers with a certain technical background. The participants of the “Level 1” courses will instruct their selves technicians “Level 2” in selected pilot villages in a second stage. The technicians are the source of information for the end users “Level 3”, i.e. the inhabitants of the rural pilot villages. The courses, designed in three levels, will not only transfer target-adopted technical knowledge but also basic knowledge of financing, project management, and entrepreneurship.

The project team will select minimum 6 communities for the implementation of the level 2 and 3 training programmes. Those communities will be encouraged to develop and implement RES show cases – pilot applications of renewable energy technologies.

The Prek Chrey community will be one REEPRO project community in Cambodia. Thus, it will be a location for REEPRO trainings and the REEPRO project team will support Preak Chrey by the installation of renewable energy show cases.

The Cambodian REEPRO project team consists of the International Solar Energy Society e.V., the Finland Future Research Centre at the Turku School of Economics (FFRC), the European Forum for Economic Co-operation (EFEC), the Institute of Technology of Cambodia (ITC) and COMPED. The trainings and the show case installations should be financed by the REEPRO project, which is funded by the European Commission in the frame of the Intelligent Energy Europe COOPENER programme. The Khmer Community Development will support the project with resources as described below.

B Duration

1. This agreement will operate from the date of signing until the end of the REEPRO project, December 31st 2009 and may be subject to revision or modification by mutual agreement.
2. This agreement can be renewed after the project phase in order to further promote the idea of REEPRO and to further support the Prek Chrey community.

C REEPRO Team

1. COMPED is the co-ordinator of the REEPRO project in Cambodia.
2. The REEPRO team supports KCD in developing renewable energy based electrification concepts for Preak Chrey.
3. The Cambodian REEPRO team will develop and perform training courses for each before mentioned target group (level 2 and 3) in Prek Chrey.
4. The Cambodian REEPRO team will inform the Khmer Community Development about any upcoming training in advance.
5. The REEPRO team will support KCD by the identification of financing tools suitable for the implementation of the developed energy concepts.

D Khmer Community Development

1. KCD will support the REEPRO trainings at Preak Chrey by providing training facilities.
2. KCD will support the REEPRO team with resource person for organising training courses in administration, selection and invitation of stakeholders and users in the area of project communities of KCD.
3. KCD will provide any necessary information for the development or renewable energy based electrification concepts for Preak Chrey.

4. KCD will provide full access for the Cambodian REEPRO team (DGS, FFRC, EFEC, COMPED, ITC) to any renewable energy system installed at the Prek Chrey community for training and documentation purposes.
5. KCDt will look for financing tools suitable for the implementation of the developed energy concepts in Preak Chrey.

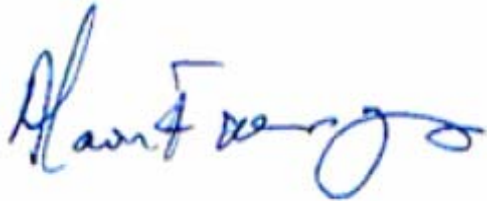
E SUPPORT OF AGREEMENT

It is understood that both parties shall support and promote the spirit of this agreement to encourage the success of the REEPRO project.

Executed for
Khmer Community Development

Executed for
Deutsche Gesellschaft für Sonnenenergie e.V.

Mr. Alain Fressanges
Advisor



Date: 19.9.2008

Mrs. Antje Klauss-Vorreiter
REEPRO Project Manager
DGS Vize-President



Date: 19.9.2008

Appendix 2: Application Schmitz-Hille- Foundation

Projektübersicht:

Interethnic Peace Centre Prek Chrey

Die Prek Chrey Gemeinde liegt im Südosten von Kambodscha an der vietnamesischen Grenze in der Kandal Province. Aufgrund der Insellage zwischen dem Bassac River und dem Mekong River ist die Gemeinde bisher unberührt vom infrastrukturellen Ausbau, was sowohl Verkehrswege als auch Strom- und Wasserversorgung betrifft. Die Prek Chrey Gemeinde besteht aus 4 Dörfern, welche entweder durch Vietnamesen oder Khmer bewohnt sind. Nach dem Rückzug der Vietnamesen aus Kambodscha (nach der Befreiung) haben sich viele Vietnamesen nahe der vietnamesischen Grenze in Kambodscha angesiedelt. In der Gemeinde Prek Chrey leben 13.000 Menschen, davon über 10.000 Vietnamesen ohne Khmer-Sprachkenntnisse. Khmer und Khmer-Vietnamesen zählen nur ein Fünftel der Bevölkerung.

Auch wenn die Khmer und die Vietnamesen direkt nebeneinander wohnen, vermischen sie sich nicht untereinander. Die Khmer fühlen sich als Minderheit in ihrem eigenen Land und akzeptieren die Anwesenheit der Vietnamesen zu großen Teilen nicht, da diese auch auf ihrem Land ihre Häuser gebaut haben. Auf beiden Seiten besteht große Unklarheit über die Kultur des Anderen und die daraus entstehenden Missverständnisse führen zu einer Verschärfung der Probleme.

KCD arbeitet seit 2006 in der Gemeinde Prek Chrey und konzentriert sich seitdem vollkommen auf diese Arbeit. Obwohl die Bevölkerung sehr aufgeschlossen gegenüber Neuem ist, braucht es viel Zeit um sie von der gewohnten Losergebenheit (Ohnmacht, nichts ändern zu können) abzubringen. Zurzeit arbeitet KCD an einem großen Programm "Programme for Communal Development and Democratisation project", das sich in 3 Bereiche gliedert: Kinderrechte, Förderung des Friedens und Förderung der Demokratie. In diesem langzeitlichen Programm werden Barrieren abgebaut, Hilfe zur Selbsthilfe geleistet und viel mit Kinder gearbeitet, über die eine Öffnung zu den Vietnamesen am leichtesten möglich ist.

Das Interethnic Peace Centre bietet die Chance den Kontakt zwischen Khmer und Vietnamesen weiter zu verstärken, vor allem über die Kinder. Das Herz des Zentrums bilden 20 Kinder, je 10 Khmer und Vietnamesen. Das Centre soll aber auch den anderen Kindern der Gemeinde zur Verfügung stehen. In ihrer Freizeit lernen sich die Kinder z.B. gegenseitig die andere Sprache, machen Hausaufgaben oder spielen zusammen. Um die Bildungssituation weiterhin zu verbessern und das Level der Städte zu erreichen, sind Computer für die Zukunft unabdingbar. Ziel des Projektes ist, dass täglich möglichst viele Kinder die Chance haben, am Computer zu arbeiten.

Das Interethnic Peace Centre stellt eine Begegnungsstätte, Unterrichtsort, Bildungszentrum, Bibliothek und Spielstätte zugleich dar. KCD fördert den Ausbau des Centre weiterhin, jedoch fehlen bislang noch ganz einfache Sachen, wie zum Beispiel Tische und Stühle und natürlich Licht, damit das Centre auch am späten Nachmittag und frühen Abend genutzt werden kann. Mit Hilfe der Photovoltaikanlage kann die Stromversorgung nachhaltig sichergestellt werden, da auf den Kauf von immer teurer werdendem Diesel verzichtet werden kann. Betreut werden das Interethnic Peace Centre und die Kinder von den von KCD teilstellten Lehrern, die den Kindern auch Nachhilfestunden nachmittags geben.

Antrag auf Förderung:

- 10 Computer
- 10 Arbeitsplätze, 10 Tische mit je 3 Stühlen
- Photovoltaikanlage zur Erzeugung von Strom

Projektbeschreibung
(Kurzübersicht)

Projektstandort	Prek Chrey Gemeinde, Kandal Province, Kambodscha		Az: *1) KST:
Projektbezeichnung	Interethnic Peace Centre		
Projektlaufzeit	Beginn:		Laufzeit:
Projektpartner im EL	KCD (Khmer Community Development) COMPED (Cambodian Education and Waste Management Organisation)		
Antrag an die Schmitz-Stiftungen	x.x.2009	eingereicht durch: DGS e.V. International Solar Energy Society / German Section	
Zielgruppe	<u>Direkt Begünstigte:</u> etwa 600 Kinder und Jugendliche der Prek Chrey Gemeinde <u>Mittelbar Begünstigte:</u> etwa 13.000 Einwohner der Prek Chrey Gemeinde		
Projekthintergrund	Die Prek Chrey Gemeinde liegt direkt an der Grenze zu Vietnam. In der Kommune selber leben zu über 80 % Vietnamesen und etwa 20 % Khmer. Das Verhältnis zwischen diesen ethnischen Gruppen ist angespannt, begründet in den kulturellen Missverständnissen und der Abneigung der Khmer gegenüber den Vietnamesen. KCD versucht mit einem langzeitlichen Programm diese Missstände zu beseitigen und beide Gruppen gegenseitig anzunähern. Da diese Situation sehr tief in der Gesellschaft verankert ist, kann eine Öffnung gegenüber der anderen Kultur leichter über die Kinder erfolgen.		
Ziele des Projektes sowie erwartete Ergebnisse	<u>mittelbar (Vision, ideelle und langfristige Ziele, „goals“):</u> - Annäherung, Kontakt und Verständnis der beiden Bevölkerungsgruppen jeweils für den Anderen - erweiterte Bildung der Jugendlichen aus beiden Bevölkerungsgruppen in Prek Chrey mit Hilfe von Computern <u>unmittelbar (konkrete Ziele, realistisch, kurzfristig, messbar, „objectives“):</u> - PV-Anlage erzeugt genug Strom um die Computer durchschnittlich 8 Stunden täglich zu betreiben - etwa 80 Kinder können täglich am Computer arbeiten		
Beantragte, zu finanzierende Maßnahmen	- PV-Anlage mit Batteriestation - 10 Computer - 10 Arbeitsplätze mit jeweils 1 Tisch und 3 Stühlen		
Beantragte Summe SHS	12.000	EUR	
Eigenanteil Partner im EL		EUR	
Konfinanzierungsanteil		EUR	
Öffentliche Mittel		EUR	
Gesamtprojektsumme		EUR	
Folgekosten-Finanzierung	Folgekosten werden durch das KCD-Programm abgedeckt. Das KCD-Team vor Ort besteht aus teilangestellten Lehrern, die sich auch in Zukunft mit den Kindern die Verantwortung der Projektfortsetzung übernehmen.		

*1) bitte nicht ausfüllen

Appendix 3: Refusal Schmitz-Hille- Foundation

Subject: AW: Projektvorschläge REEPRO
Date: Tue, 16 Jun 2009 15:33:55 +0200
X-MS-Has-Attach:
X-MS-TNEF-Correlator:
Thread-Topic: Projektvorschläge REEPRO
thread-index: AcnuZzg2XN7JZaMXQqujc9LppnHgKgAGwtcQ
From: "Ralf Kresal" <rkresal@schmitz-hille-stiftung.org>
To: "Antje Klauss-Vorreiter" <vorreiter@dgs.de>
X-HE-Spam-Level: /
X-HE-Spam-Score: 0.5
X-HE-Spam-Report: Content analysis details: (0.5 points)

pts	rule name	description
0.2	TW_BZ	BODY: Odd Letter Triples with BZ
0.2	TW_KT	BODY: Odd Letter Triples with KT
0.1	HTML_MESSAGE	BODY: HTML included in message
0.0	RDNS_NONE	Delivered to trusted network by a host with no rDNS

Envelope-to: vorreiter@dgs.de

Liebe Frau Anje Vorreiter,

danke vielmals für Ihre E-Mail und Ihre Entwürfe für die Projekte in Laos und Kambodscha.

Auf Ihre Frage, ob es prinzipiell so passt, kann ich Ihnen momentan leider nur eine generellen Antwort geben.

Die Situation hat sich für unsere Stiftung aufgrund der Finanzkrise momentan derart geändert, dass wir keine neuen Projekt, Partner und Standorte aufnehmen können. Wir verfügen momentan nur über einen sehr eingeschränkten Jahreshaushalt und können nicht mehr all das fördern, was an uns herangetragen wird. Sämtliche Projekte stehen bei uns erstmalig in einer Art „Wettbewerb“ wie wir das vorher noch nie hatten. Unser Board hat daher entschieden, dass wir zunächst nur laufende Projekte bzw. Partner, mit denen wir schon lange zusammengearbeitet haben, helfen, Projekte im Sinne der Nachhaltigkeit zu konsolidieren.

Die Regelung ist strikt einzuhalten. Wir können derzeit keine neuen Partner und völlig neue Projekte aufnehmen. Ich werde Ihre Entwürfe gern auf Wiedervorlage bei uns halten. Sobald sich die Situation für uns alle entspannt und wie wieder mehr Projekte fördern können, würde ich Ihnen Bescheid geben.

Herzliche Grüße
Ralf Kresal

Von: Antje Klauss-Vorreiter [mailto:vorreiter@dgs.de]

Gesendet: Dienstag, 16. Juni 2009 11:46

An: Ralf Kresal

Betreff: Projektvorschläge REEPRO

Hallo Herr Kresal,

anbei 2 erste Skizzen für kleine Projekte in Laos und Kambodscha im Rahmen von REEPRO. Wir würden diese gerne, wie bereits besprochen, in einem Antrag zusammenführen und bei Ihnen zur Förderung einreichen. Lassen Sie mich doch kurz wissen, ob das so prinzipiell passt.

Mit freundlichen Grüßen/Regards,

Antje Klauss-Vorreiter

Dipl.-Ing. Antje Klauss-Vorreiter
Vice-President (Treasurer)

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