

# Project submission

The ENERGY GLOBE Award is presented in the [Categories](#) Earth, Water, Fire, Air and Youth and distinguishes particularly sustainable projects. The Award is presented at the national and international level ([more information on Award](#)).

Anyone wishing to apply for the ENERGY GLOBE Award 2009 must complete an application form. You can either fill in the [online application form](#) or download the PDF below and send your project documentation and supporting materials in digital form to: [contact@energyglobe.info](mailto:contact@energyglobe.info) or a hardcopy of it to:

ENERGY GLOBE  
Mühlbach 7  
4801 Traunkirchen  
Austria, Europe

**Deadline for project submission: June 30th, 2009**

**Please send the following documentation along with the filled-out application form:** (documents A-C in English ) A short summary of the project (should not exceed 100 words) and a minimum of two (digital) project pictures in good quality. All of these will be used for the ENERGY GLOBE project database.

## **Project title: “LIMBS for LIFE & LIBERATION!”**



*...accidents*



*...kitchen burns*

- All people who have lost arms and legs are challenged, each and every day, to live independently, with dignity and without disadvantage.
- In 2006 MEND NZ set out to produce very tough, comfortable and lightweight artificial limbs that can be made locally in any developing country and be affordable to the poorest of amputees.
- That goal has now been almost achieved with a low-cost system developed for mass production of plastic components that reduces the wastage of technicians' time, speeds up the fitting of limbs and so reduces the costs to the amputee in need.
- Aluminium drink cans are recycled and smelted down to cast the molds and up to 80% scrap plastic can be used to manufacture the limbs.



### **MEND's plastic limbs and tools for daily living get field testing in Nepal**

A) A detailed description (approx. 2 pages): Description of the project, including a time schedule and exact details concerning the level of implementation. Please add specific facts and figures that document the effect of your project.

#### **Background to project**

- **MEND was set up as a non-profit organisation in New Zealand in 1991 by its Director to assist disabled people become mobile and independent.**
- **Please visit [www.mendnz.com](http://www.mendnz.com) and [www.mend.org.nz](http://www.mend.org.nz)**
- **In 2006 a small, isolated Nepali disability-support organisation, Hope Disability Centre requested MEND's technical help to develop a range of tough, low-cost artificial limbs, tools and mobility devices that would enable the poorest of amputees to become independent and employable.**
- **We were inspired by Hope's Chairwoman, Ganga Rayamajhi who lost both legs as a baby from a kitchen fire ( severe burns are common in rural Nepal) coupled with poverty and lack of awareness of her parents. With determination she crawled to school for the first 16 years of her life until at age 17, she was fitted with first prostheses. MEND sponsored her training as a community nurse and later as physioaide.**
- **In 2006, having experienced the neglect and uplift to her own life, Ganga then decided to set up her own organisation to help other disabled persons in that remote, mountainous and militant -affected region.**



*Double amputee Ganga Rayamajhi helping others now    Loss of limbs and fingers from fire*

- In Nepal, as in Ghana, Kashmir and Uganda, developing countries where MEND is helping small organisations implement projects, affordable, comfortable and robust artificial limbs and other practical mobility aids are often beyond the financial and logistical reach of many disabled people. Government social welfare funding support is often not available while health workers are without the resources and skills to change the status quo of disabled persons.
- MEND has learnt that self –help projects, managed by and for disabled people, such as Hope Centre and its Chairwoman can inspire life-changes that successfully empower their disabled members' own lives.
- Since 2006 Hope and MEND have been developing an innovative design and system for manufacturing quality, plastic artificial limbs and other items such as arm sockets and tool-kits for amputees, pit latrine toilets and wheelchairs. Metal molds are cast in a local foundry in Nepal from waste aluminium cans in which the limbs are cooked rotationally ( like roasting chicken in a rotisserie) using polyethylene plastic powder, 80% of which can be recycled if from same plastic formula.
- During “cooking” the melted plastic powder sticks to the INSIDE of the mold making the finished product hollow. The wall thickness of the final product is determined by the quantity of powder inserted and by varying the rotational speed and angle of mold, so that the parts nearest the knee joint can be thickened to advantage.
- The design that has evolved has a sliding foot to allow for the growth of children and for adjustment and realignment in remote areas to reduce the high cost, time and difficulty of travel for amputees. Locally bought low-cost sandals provide the rubber for cushioning the soles of these limbs
- The limbs can be cooked in a commercial plastic water-tank oven or made even from a used oil drum with the heat supplied from either a wood fire, gas or kerosene flame.
- All ingredients can be found in most developing countries reducing the material cost for a complete above-knee limb to less than \$10 US, if new polyethylene powder is used, or \$7 US, if a mixture of recycled and new powder is used.



*Rob with mold making process from original patterns to aluminium casts being machined*



A recycled oil drum adapts as an oven to “cook” the limbs.

Or even over a gas flame ...

- **Quality imported limbs can cost from \$200-\$1000.**
- **These sturdy limbs, available in bright colours too, weigh only 1 kg for children to 2 kg for adults. From powder to finished limb takes only 25 minutes of cooking time at 270 C and 25 minutes of cooling time with fan.**
- **The only metal used in these limbs is the locking mechanism and stainless steel axle tube at the knee joint which allows these limbs to be immersed in water without damage. This is important in rice growing areas and for bathing. Nylon bushes are inserted to house the axle pins.**
- **It takes no formal training for disabled staff to have the ability to make, distribute and sell their own affordable, quality plastic limbs using new technology that can be set up in any other country of the world.**

### Summary

- ***We have developed a system to smelt down waste aluminium cans in a fire to make the molds for artificial limbs.***
- ***These molds are filled with powdered plastic ( up to 80% recycled waste mixed with 20% virgin powder) and rotated in an oven or over a fire to create a range of artificial limbs, wheelchairs or village toilets.***
- ***This can become an income-generating business and employment for disabled persons in any country..***
- ***These plastic artificial limbs are possibly the lowest cost in the world yet very durable and easy to fit.***
- ***They completely transform the lives of amputees who previously had to crawl everywhere.***



Stump cast



Arm cast



*first steps with his limb...*

*Fitting is simple, fast and clean. No toxic resins are used in making rotolimbs.*



**Limb colours can be fun...and a fashion statement even for amputees?  
Particularly for children, as colour makes their limbs feel attractive and even desirable!**



**Interchangeable tools for daily living skills with ball joint cast from, aluminum and made from recycled cans. The arm sockets are also made from recycled plastic.**

C) A half page addressing each of the following evaluation criteria:

- Project aim taking into consideration the sustainability and efficiency of the project.

- **This project combines visual, emotional, practical, ecological and economic ingredients that have a life-changing effect on people who are not only the poorest of the poor, but live their whole lives with a challenging disability.**
- **The loss of a limb, as with any disability left untreated, has a profound effect on a person's psychology & ability to function, to be employed, to be a contributing member of a family and the community, to have dignity, to attract a spouse and have a family....and to have a little fun in one's life.**

- In fact survival in mountainous countries like Nepal where roads are scarce and labour-saving devices few, and power cuts normal, manual labour skills are essential and when summer months are short and all staple food must be grown before winter, loss of limbs or mobility is regarded as a curse and liability on a family.
- This project has many poignant elements that can profoundly inspire other people with disabilities around the world to achieve “self-help, not sympathy” as a “roadmap to independence and dignity.
- They include:
  - mobilising and empowering people with disabilities to start their own process of rehabilitation and inclusion...particularly disabled women.
  - using waste products to creatively produce high quality mobility aids that can be sold locally at affordable rates or even exported.
  - providing employment and training skills for disabled persons to make products that benefit themselves and others in need
  - creating awareness of the plight of disabled and disadvantaged people in Nepal and other developing countries

- Innovative aspects of the project, taking into account the technological standards and the circumstances in the region.

- In many countries such as Nepal it is expensive for amputees to travel to workshops to have limbs fitted or altered, which is normal for most amputees especially children who are growing and their limbs changing quickly.
- Having some adjustment in the feet height ( as the MEND limbs do) means some small adjustments can be made in the village . Also having a range of “off-the-shelf” parts means that “next sizes” larger can be fitted easily.
- The MEND foot can be rotated for alignment and also fitted with a variety of sole materials and shapes depending on the persons’ need for correction. Local rubber sandals that cost about \$1 to\$2 a pair can be used, saving the need for replacement with expensive feet or special rubber.
- Rehabilitation equipment must be sturdy to survive and be serviceable in rough mountain areas. It should also be repairable locally as many imported components can not be sourced, while exotic metals cannot be welded. In monsoon regions prostheses should be able to cope with rain and mud, as do these plastic limbs.
- Many prosthetics’ workshops are often short of staff yet it can take 1 or 2 days of full-time effort to make a complete AK ( above knee) limb by a skilled technician. With this molding system of “off the shelf” components that time can be reduced to just a few hours once the cast is taken of the stump, so allowing better use of technician’s time to attend to more amputees.



*This pink foot has nuts cast into plastic so that rubber soles can be fastened by bolts.*



*Earlier prototype of tools have limited flexibility being without ball joint.*

*Cost per set is about \$8 US using metal cups and utensils found in local shops. These can also be cast in one piece in aluminium from recycled cans.*

- Cost/benefit in terms of economic and social aspects.

- **Mobility is essential to enable all disabled persons to reduce their dependency on their caregivers and families whose energy and time can then be released to attend to other tasks.**
- **Enhanced mobility leads to independence, opportunity and choice, formerly out of the reach of most disabled persons. Marriage in Nepal is still allusive for those amputees who lack arms and simple manual skills, as community superstition and “karma” continue to disadvantage those with disabilities.**
- **Limbs must be comfortable and ensure normal gait when walking. They must also be affordable and cosmetically acceptable to the user. They must also be lightweight so that an amputee is encouraged to use their limbs. Many heavy AK ( Above Knee) limbs that weigh 6 & 7 kgs lie discarded and unused around the world wasting government funds when financial support to the poor is scarce.**
- **This project empowers those of the lowest community status, those with disabilities, by visually highlighting the innovative and potential “end-use” of common leftovers of industry and packaging currently tossed into landfills around the world.**

- Replication potential: suitability of the project for implementation elsewhere

- **This technology is perfect for setting up quickly, simply and at low cost in any country. MEND is happy to support that process on a non-profit basis so that any development funds raised by project partners can be focused on the beneficiaries and training costs.**
- **A set of aluminium molds to make 4 sizes of limbs will be required that are either made from MEND’s fibreglass patterns in each country, or initially exported from Nepal where a foundry can make a complete set in a day. Each set of three sections, ( upper, lower and foot) costs about \$100 US to make which includes materials and machining to be ready for manufacture of one limb per hour ( 30 minutes cooking and 30 minutes cooling)**

- Environmental compatibility: in particular regarding emissions and climate protection.

Environmentally this project magically turns waste drink cans, recycled plastic and an oil drum into quality, life-changing mobility tools which lead to independence, employment and dignity for those disabled by accidents, war, disease, electrocution, burns, birth effects, medical misadventure and leprosy.

About 40 kgs of waste aluminium cans makes 4 sets of molds that make 4 sizes of limbs.

D) If available: Documentation material such as publications, newspaper articles, photographs, videotapes, DVDs, brochures, website, etc.

- Check [www.mendnz.com](http://www.mendnz.com) and “Hot off the Press” and “Hope Centre Nepal” for links to newsletters and BBC World Challenge 2008 story of Kashmir.
- Check [www.mend.org.nz](http://www.mend.org.nz) for other designs and information.
- (2) Please view the BBC World Challenge 2007 story about our Nepal project (and technology) which was selected from 1000 entries from 152 countries as a finalist of 12. Click on.. <http://www.webbytalents.com/play.php?vid=528>
- (3) MEND designed and makes plastic wheelchairs with same technology e.g the Sealander. See other innovative designs of mobility aids at:
  - <http://www.zartaj.co.nz/mend/design.htm>

### The “SEALANDER”



*MEND's plastic molded wheelchair is tough, water-friendly and non-rusting.*

*Made from ultra-violet-resistant plastic with nylon wheel bushes, stainless steel axles and aluminium tube footrest, the Sealander can be immersed in salt water without damage.*

*This wheelchair suits bathing and use on beaches and can be fitted with a commode/toilet.*

*The Sealander is available in three models with seat width of 15".*



*The "Beach' model is fitted with 10" and 14" diameter plastic wheelbarrow wheels and wide 4" tyres for traction on sandy and bush terrain.*

*The front wheels are fixed.*

*The standard Sealander has 24" diameter plastic wheels and solid rubber tyres, eliminating punctures.*

*Castor wheels have 8" diameter solid tyres.*

*Axles are 0.5" stainless steel rod.*

*Note: Regular cleaning to remove sand will stop damage to axles*

### **The “WATERLOO”, a sanitary village pit latrine toilet**

Made from ultra-violet-resistant polyethylene plastic, this toilet can be used without water and bowl, as a "long drop", or with the waterseal bowl which is flushed with water by hand.

(Note that the water seal keeps odours locked below )

Lightweight for easy transport (at 7 kgs) it is easy to clean and install, and low cost: approximately \$180NZ or \$90US. The toilet is flushed with a litre scoop of water. A range of colours are available.

The molds, technology and license to make the Waterloo in any country are also available.

To install: simply dig a hole about 2 feet (0.6 m) in diameter and 2-3 m deep and stake the Waterloo to wooden bearers or to the earth using metal stakes.

NOTE: this toilet can be combined with a holding tank for making biogas



light, clean and suitable for elderly and disabled

### **“LO-CAL” ( low calorie!) a disabled-friendly wheelchair for two!**



*This pedal car can be propelled by hand or foot, solar -powered electric or hydrogen motor or both.*

*It enables two disabled persons to travel together or with their family or caregiver.*

*In effect, a glorified wheelchair, for two!  
Luggage and goods can be transported as well as passengers.*

*This design protects the cyclists from both sun and rain, and from other vehicles.*

*It is constructed of steel or aluminium tubing and standard bicycle parts and 20" diameter rickshaw wheels. Cost to make is about US\$150 in steel or US\$250 in aluminium.*

*Note: MEND is developing a similar plastic pedal car that will be suitable for urban use and also pedalled by hand or foot.*

**Thankyou from MEND!**

**Please be sure to fill out the application form completely. The back of the application form suggests keywords for possible project areas. Your project need not necessarily fit into these designations.**

**By participating in the ENERGY GLOBE you agree to accept a publication of your project. If deemed necessary by the organizer, the submitted project may be moved to another category. Submitted projects are also documented in the ENERGY GLOBE database.**

[application form \(en\)](#) (PDF, 1700 kB)