Technical Standards

For

Solar Dryer and solar Cooker

Alternative Energy Promotion Center

National Rural & Renewable Energy Programme

Jan 2013

List of Abbreviation

AEPC	Alternative Energy Promotion Center
NRREP	National Rural & Renewable Energy Programme
m/s	Meter per second
ft^2	Square feet
W/mK	Watt per meter Kelvin
Kg/s	kilograms per second
mm	Millimeter
UV	Ultra Violent
PC	Poly carbonate sheet
MS	Mild Steel
Km/hr	Kilometer per hour

Background

Alternative Energy Promotion Centre (AEPC) is an apex institution promoting Renewable Energy Technologies (RETs) in rural Nepal. Presently, AEPC has been implementing National Rural and Renewable Energy Programme (NRREP) supported by Danida, Norad, KfW, Renewable Energy for Livelihood (RERL – former Rural Energy Development Program) supported by World Bank and UNDP, Biogas Support Program (BSP) supported by SNV Nepal and KfW. AEPC works closely with various INGOs, NGOs, GOs and private sector in order to implement various programs and projects.

National Rural and Renewable Energy program has just been started from July 16, 2012. This program envisages installation of 7,500 solar thermal systems in next five years. Understanding the local needs, AEPC / NRREP is committed towards promotion of the solar thermal technology at domestic and industrial scale. To assure the quality and reliability of the products the organization is progressive in developing the technical standards. The technical standards will be paramount to benchmark the products which will be disseminated under the subsidy policy.

1 Definition

Solar thermal energy

Solar thermal energy is innovative technologies for harnessing solar energy for heat.

Solar Dryer

Solar Dryer is a device that facilitates the dehydration of the matter by passing hot air in direct contact or pre-heated air through natural or forced circulation. The air is heated by solar energy.

Domestic scale solar dryer

Is defined as with effective drying area of $3ft^2$ to $20ft^2$

Medium scale solar dryer

Is defined as with effective drying area of $21ft^2$ to $85ft^2$

Large scale solar dryer

Is defined as with effective drying area above $85ft^2$

Solar Cooker

Solar cooker is a device that converts sunlight into heat for cooking.

Parabolic solar cooker

A reflective mirror of polished glass, metal or metalized film is used to concentrate light and heat from the sun into a small cooking area, making the energy more concentrated and increasing its heating power.

2 Document Validity

The minimum technical standards will provide the benchmark criteria for solar cooking and dryer specified under the government subsidy policy. This document will be effective from Jan 2013 and will remain valid till a new version formally replaces it.

3 Minimum technical standards for solar dryer and solar cooker under the government subsidy Policy

3.1 Solar Dryer

a) Domestic scale

<table>
<tr><td>Dryer Chamber</td><td colspan="2">The outdoor body of the solar dryer must be resistant and low weathering to exposed environment</td></tr>
<tr><td>Insulation</td><td>Dryer Description</td><td>Suggested U[1] Value (W/m^2 K)</td></tr>
<tr><td></td><td>Transparent drying chamber with single layer glazing</td><td>9</td></tr>
<tr><td></td><td>Transparent drying chamber with 2 layers of glazing</td><td>6</td></tr>
<tr><td></td><td>Un-insulated opaque drying chamber eg.brick concrete or timber</td><td>4</td></tr>
<tr><td></td><td>Insulated opaque drying chamber</td><td>1</td></tr>
<tr><td></td><td colspan="2">Rust free food grade trays - wooden /stainless steel or relevant</td></tr>
<tr><td></td><td colspan="2">Appropriate sealant on the doors to avoid any air infiltration</td></tr>
<tr><td></td><td colspan="2">MS frames coated with anti rust and rigid enough to avoid any buckling during manual handling or under wind pressure of 170km/hr</td></tr>
<tr><td>Paint</td><td colspan="2">Low reflecting , black paint must be non toxic or relevant coating technology</td></tr>
<tr><td>Aperture</td><td colspan="2">3-4mm clear toughened glass with transitivity >80% / 2-3mm UV stabilized food grade polycarbonate (PC) sheet The glass or PC must be sealed with appropriate UV resistant sealant. UV mark and Food grade certificate from manufacture is mandatory.</td></tr>
<tr><td></td><td colspan="2">The air draught opening of the dryer must have steel mesh preferably air</td></tr>
</table>

[1] U is sum of losses from long wave radiation, convection and air leakage

	filter to restrict insect and minimize debris.
Others	
	All parts/components should be low weathering design specifications to withstand outdoors weather under local climatic conditions for a minimum period of 10 years (except for glass or PC which may require replacement 5 years).
Label	The dryer must be well labeled as – • Dryer Model • Total drying area m^2 • Effective drying area m^2 • Effective drying volume in m^3 • Manufactured Date • Manufacturer Name • Manufacturer Contact Phone number and address
Warranty Card	The supplier shall provide a guarantee card duly signed by the supplier with seal and date of supply.
Warranty	3 years

b) Medium Scale and Large Scale

<table>
<tr><td>Dryer Chamber</td><td>The outdoor body of the solar dryer must be resistant and low weathering to exposed environment</td></tr>
<tr><td></td><td>Insulated wall on sides top and bottom</td></tr>
<tr><td></td><td>Rust free food grade trays - wooden /stainless steel or relevant</td></tr>
<tr><td></td><td>Appropriate sealant on the doors to avoid any air infiltration</td></tr>
<tr><td></td><td>MS frames coated with anti rust and rigid enough to avoid any buckling during manual handling or under wind pressure.</td></tr>
<tr><td>Insulation</td><td>
<table>
<tr><td>Dryer Description</td><td>Suggested U^2 Value (W/m^2 K)</td></tr>
<tr><td>Transparent drying chamber with single layer glazing</td><td>9</td></tr>
<tr><td>Transparent drying chamber with 2 layers of glazing</td><td>6</td></tr>
<tr><td>Un-insulated opaque drying chamber eg.brick concrete or timber</td><td>4</td></tr>
<tr><td>Insulated opaque drying chamber</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Absorber</td><td>Absorber area should be in ratio of 4:7 minimum to the drying chamber</td></tr>
<tr><td>Paint</td><td>Low reflecting, black paint must be non toxic or relevant coating technology</td></tr>
<tr><td>Aperture</td><td>3-4mm clear glass[3] / 2-3mm UV stabilized food grade polycarbonate sheet The glass or PC must be sealed with appropriate UV resistant sealant. UV mark and Food grade certificate from manufacture is mandatory.</td></tr>
<tr><td></td><td>The air draught opening of the dryer must have steel mesh preferably air filter to restrict insect and minimize debris.</td></tr>
</table>

[2] U is sum of losses from long wave radiation, convection and air leakage
[3] Glass shall be preferably iron free and toughened

Others	
Forced convection	If PV used for forced convection must be certified by RETS.
	All parts/components should be low weathering design specifications to withstand outdoors weather under local climatic conditions for a minimum period of 10 years (except for glass or PC which may require replacement 5 years).
Label	The dryer must be well labeled as – • Dryer Model • Total drying area m^2 • Effective drying area m^2 • Effective drying volume in m^3 • Manufactured Date • Manufacturer Name • Manufacturer Contact Phone number and address
Warranty Card	The supplier shall provide a guarantee card duly signed by the supplier with seal and date of supply.
Warranty	3 years

Note – Solar drying technology not covered by the standards while valid within the government subsidy mechanism - would need to provide national or international recognized 3rd party certificate verification from RETS.

3.2 Domestic Solar Cooker

a) Parabolic Disc

Reflecting Disc	Parabolic dish made of single/multiple reflectors fixed firmly to a rigid frame. The size and shape of the reflectors will be such that when joined/fixed they automatically form a perfect parabolic dish which when exposed to the Sun in the normal direction a point focus is formed.
Dish diameter	Minimum 1sq m .It will be of a size such that all the reflected rays are exactly focused at the bottom of the vessel
Reflector Material	Bright anodized aluminum sheets of thickness <=0.4 mm or reflective glass mirror with protective back layer to protect weathering or Reflector film of similar quality.
Reflectivity	>80% with a maximum degradation of 10% in 5 years preferably 3rd party certificate
	The reflector fins should be pasted or tied with the supporting rings with a metallic cord (anti-rust) so that it tying cords does not wear out over a span of time
Concentration Ratio	Greater than 80%
Dish supporting frame	The outer frame of the dish should be made of powder coated aluminum channel of 24x24x10 mm or MS structure with epoxy/antirust coating.
	The supporting frame for the reflecting bowl will be made of a grid of at least three MS rings supported by MS strips or fiber glass material/thick MS wire-mesh structure. It will be rigid enough to avoid any deformation of the bowl shape during manual handling or under wind pressure.
Dish stand	

	The stand should be of mild steel, epoxy/power, anti rust coated. With arrangement to hold cooking vessels of different sizes (pot holder) from 4-12inch vessel diameter .With suitable provision for securing the cooker to the ground
Tracking System	
Manual	Designed to enable unrestricted 360-degree rotation of parabolic dish around its horizontal axis passing through its focal point and center of gravity and also around its vertical axis, for adjustment of the cooker in the direction of the sun i.e. from North - South and East - West.
Locking mechanism	With simple locking arrangement to hold/fix the bowl at a particular position.
Sun tracker	With vertical pointer arrangement to facilitate users positioning of the bowl exactly in the direction of the Sun.
Other Requirements	
	The entire structure should be able to withstand wind speed of 170 km/hr without any damage.
	All parts/components should be of weather resistant design specifications to withstand natural weathering outdoors under local climatic conditions for a minimum period of 10 years (except for reflecting mirrors which may require replacement every 5 years).
	The supplier shall provide a guarantee card duly signed by the supplier with seal and date of supply.
Warranty	3 years

Note – Solar drying technology not covered by the standards while valid within the government subsidy mechanism - would need to provide national or international recognized 3rd party certificate verification from RETS.