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برنامج الأمم المتحدة للبيئة • 联合国环境规划署

PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT • PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE
ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ

ATTACHMENTS

Indonesia Solar Energy Technology Loan Programme

Aceh, Indonesia

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Attachment 1

VENDOR QUALIFYING CRITERIA

1. The Vendor should have sold Dryers in Indonesia and/or other nations in Asia.
2. The Vendor should have sold at least 5 Dryers.
3. The Dryers should be suitable for use in drying cocoa beans, coffee beans, and/or seafood.
4. The Vendor should be a turnkey service provider and have capabilities to design, produce, supply, construct, install, commission, and maintain the Dryers, and train operating personnel.
5. The Service Center should be able to provide a high level of after-sales support to customers no longer than 48 hours after customer's request. Vendor should provide information on Service Centers established by them, the area covered by each, and the facilities available in each.
6. In the event that the Vendor proposes to use dealers, resellers, agents, contractors, or such other persons to provide any of the services, Vendor must assume responsibility of all acts of such persons.
7. Dryers should comply with the Technical Specifications detailed in **Attachment 2**.
8. The Vendor will be required, from time to time, by the UNEP and/or the Banks to subject its Dryers to testing, audit, and certification by independent agencies.
9. In the event that the Dryer does not conform to the Technical Specifications, Vendor should make adequate disclosure of such information to the customer and the Bank financing the purchase, stating the deviations therefrom, impact thereof, and quantifying the cost increase or reduction therefrom.
10. The Vendor should have the ability, resources, and infrastructure to provide after-sales services based on a pre-determined schedule. The maintenance schedule should be disclosed in product literature.
11. The Vendor should have ongoing programmes to train customers' personnel to use the Dryers.
12. After-sales service support should be made available to the customer for the full period of the Bank Loan.
13. After-sales service support should continue to be available for the original period of the Bank Loan if the Bank repossesses the Dryers from defaulters.
14. The Vendor should assist the Bank in restoring by repair or replacement the Dryers that are repossessed by the Bank from defaulters, and resold to other customers at a price to be mutually decided upon.



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15. The Vendor should circulate the common Price List for each of its products to the Banks and UNEP. The Price List should detail all common configurations in which the product is or proposed to be sold. Revisions to the aforesaid Price List should be indicated to the Banks.
16. The Vendor will be required to submit reports in stipulated formats to the Banks and/or UNEP. Reports will be submitted every 2 months for the first 6 months after Dryer installation and commissioning regarding: Dryer sales, installation, commissioning, and specifications; added value of the Dryer; after-sales service activity; and obstacles encountered in the Dryer's operation. Summary reports will then be submitted bi-annually covering the same material during the life of the Bank loan.
17. Facilities (i.e., offices of the Vendor and its dealers, resellers, agents, and contractors) and Dryers installed in premises of customers should be open to inspection by UNEP and/or Banks. Vendor should provide detailed information, including transaction documentation, in respect of its Dryers.



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Attachment 2

TECHNICAL SPECIFICATIONS OF SOLAR BIOMASS HYBRID DRYER

1 - DESCRIPTION

- 1.1 The solar biomass hybrid dryer ("Dryer") is intended to provide the user with an environmentally friendly and cost-effective alternative to drying crops and fish (currently, this is mostly done by sun-drying). The solar alternative offers a reliable drying mechanism that ensures drying continuity in Indonesia during the rainy season and during non-daylight hours, and accommodates larger input capacity requirements during peak harvest months. The Dryer is advantageous to kerosene and diesel-powered mechanical dryers in areas such as Aceh that have poor petroleum product distribution networks and unreliable grid power.
- 1.2 The Dryer will be applicable for drying crops like coffee and cocoa, as well as seafood. Seafood to be dried will be those relevant for Aceh, that is, anchovy and medium-sized fish.
- 1.3 The Dryer will run on a combination of solar and biomass power. During sunny daylight hours, the Dryer should rely on solar power. Biomass should be the back-up fuel source, and enable operation during non-daylight hours and cloudy periods such as the rainy season. Biomass burning capabilities shall include biomass waste relevant for coffee, cocoa, and fish crops, or waste easily obtainable in Aceh (e.g., cocoa pods, rice husks, coffee parchment). Non-solar and non-biomass energy consumption should be minimal.

2 - DESIGN AND COMPONENTS

- 2.1 Technical Specifications of the Dryer must meet or exceed the specifications and best practices recommendations stipulated herein or by Standard National Indonesia (SNI). Dryer technical specifications in a format similar to that provided in **Worksheet A – Technical Specifications**.
- 2.2 The Vendor shall provide the most appropriate system integration, components, assembly, and packaging that meet the component specifications and best practices recommendations. Any exceptions and variations to the specifications must be explicitly stated, and the scope and reasons for each listed exception and variation must be fully explained with supporting data.
- 2.3 The Vendor shall deliver the system to the user with as many components pre-assembled and pre-wired as is feasible prior to shipment, if this improves cost effectiveness.
- 2.4 All components, including spare parts, will undergo quality control testing of the highest standards at the Vendor's factory or the originating source factory, and proper documentation should be available detailing the procedures followed and results thereof.
- 2.5 Consistent with the needs in Aceh Province, the Dryer's input capacity shall be a minimum of 1 ton per day (of 24 hours). The design should be flexible to adjust to specific user needs and scalable, for example, expansion to a 1.5 ton/day input capacity.
- 2.6 Operating temperature should be variable with the end-user provided with temperature controls.



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- 2.7 Moisture content of the crops and fish should be approximately 1 to 1.5 degrees Celsius per hour. Coffee crops will be dried from approximately 25-30% moisture content (MC) to 12% MC, cocoa from 25 to 7% MC, and seafood either from 75-80 to 12% MC or from a partially wet state from 55 to 12% MC.
- 2.8 Solar collector technology could be either active solar or passive solar.
- 2.9 Dryers should be designed for ease of use and operation, with minimum manpower required (1 or 2 persons) for operation.
- 2.10 Ductwork and pipe systems for the heating medium (air or water) for the solar and biomass heating units shall be properly insulated wherever possible to minimize heat loss during transporting process.
- 2.11 The loading/unloading unit of the dryer should be designed for ease of loading/unloading and maintenance. The loading/unloading units should be designed in a way that it is free from clogging during normal operation, with mechanisms to easily remove clogging, if it shall occur.
- 2.12 The heating medium shall provide even distribution of heat to the drying crops. The heating surface, heating chamber, and heat distribution surfaces shall be designed to minimize under-heating, uneven heating, and overheating (e.g., avoidance of burned crops).
- 2.13 The Dryer shall be designed and built to withstand the environmental conditions found in the area of installation. For design purposes, consider that ambient outdoor temperatures in Aceh can range from 5 to 45 degrees Centigrade, and humidity levels as high as 95%.
- 2.14 All components, enclosures and fixtures must be resistant to high humidity conditions, corrosion, and insect and dust intrusion.
- 2.15 Details of construction materials and components shall be provided (including manufacturer and model name, and specifications for materials such as solar collectors, engines, motors, and frames), in addition to foundation requirements (e.g., concrete mix design requirements). Details regarding key design components such as status displays and protective devices should also be provided.

3 - INSTALLATION AND COMMISSIONING

- 3.1 The Dryer will be packaged and pre-wired to provide convenient installation in Aceh by a qualified technician. The Dryer should be constructed such that a user can perform routine maintenance such as removing ash, and so a technician can easily perform system diagnostics or replace components.
- 3.2 The Dryer must be designed and constructed so that it requires maintenance and inspection by a technician no more frequently than once every 6 months.
- 3.3 The main components shall be integrated in such a way as to allow replacement (in case of failure) with a similarly functioning component of a newer design or a different brand. This will allow for future component evolution or variability of future component availability.
- 3.4 Dryers shall be installed and tested to meet design specifications and weather and operation conditions based on user's operation requirements. Proper commissioning of the Dryers shall be performed prior to turning over for user's operation.



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- 3.5 Proper on-site, hands-on user training shall be provided to Dryer users to the extent that main operation personnel of the Dryer, as identified by the Dryer users, understand operational functions of each components, are able to operate at field conditions, and are familiar with regular maintenance procedures, trouble shooting procedures, and safety measures.
- 3.6 The minimum period for commissioning and on-site user training period is 1 week.
- 3.7 Warranty shall be provided on the entire Dryer system for a minimum of 12 months against manufacturer and installation defects. Warranties will start from the day the system is installed and commissioned at the premises of the customer.
- 3.8 Extended warranties shall be available on specific components for the period stipulated below:
- Solar heat collector unit - 10 years;
 - Fans – 2 years;
 - Motor – 2 years;
 - Engine - 2 years; and
 - List sources of suppliers of each of the above components and warrant cover provided to customer.
- Warranties will start from the day the system is installed in the premises of the customer. In the event that the manufacturer or supplier of the individual component(s) provides longer periods of warranty, such benefits should be passed on to the customer.
- 3.9 The Dryer, if necessary, should be certified by independent testing agencies.
- 3.10 The Dryer should comply with all relevant National Standards, including:
- SNI 02 – 1184 - 1989 National Standard of Bed Dryer Type for Cocoa Beans, Procedure for Testing and Performance;
 - SNI 02 – 0845 – 1989 National Standard of Rotary Drum Dryer Type for Coffee Beans, Procedure for Testing and Performance;
 - SNI 01 – 2323 – 2000 National Standard of Cocoa Beans;
 - SNI 01 – 2907 – 2008/ SNI 19 – 0428 – 1998 National Standard of Coffee Beans;
 - SNI 01 – 3462 – 1994 Half-dried small fish;
 - SNI 01 – 2725 – 1992 Dry salted fish; and
 - SNI 01 – 2709 – 1991 Dry-salted anchovies.

4 - DOCUMENTATION

Users Manual

- 4.1 The Vendor must provide a Users Manual intended for the users and that will be included with each of the Dryers. The Users Manual documentation must be in the Indonesian language and should be easy to understand. Use of sketches or graphics should be used to make the manual easier to use. The Users Manual is to include the following:
- How the Dryer works. The relationship between energy available on daily basis and sunlight conditions should be clearly and simply explained;
 - A block diagram showing the main components;
 - Break-up and description of components supplied, including user-interactive hardware such as switches and status indicators;



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- Standards complied with;
- Standard operation procedures (SOP);
- Maintenance procedures and recommended maintenance schedules, including ash removal and biomass loading;
- Troubleshooting guide;
- Contacts of service centers;
- Warranty information; and
- Price at which the Dryer is sold.

Technicians Manual

- 4.2 The Vendor must provide a Technician's Manual to be used by the service technicians. The Technician's Manual must be in the Indonesian language. The manual will include the specific details on installation, operation and maintenance, including:
- A detailed technical description of the Dryer;
 - A complete copy of the Users Manual;
 - A complete list of all components, with associated manufacturers literature, specifications, and warranties;
 - Complete installation instructions;
 - A recommended post-installation periodic maintenance schedule, with complete maintenance instructions;
 - A detailed troubleshooting guide referencing all the components. This shall include repairs and diagnostic procedures that can be done by the Vendor or a qualified third party;
 - Measurements and test results shall be maintained by technicians in the Installation Log and Repairs Log portion of the Technicians Manual; and
 - Electrical drawings.

5 - OPERATING CHARACTERISTICS & MAINTENANCE SCHEDULES

- 5.1 Dryer operating requirements should be indicated in a similar to that provided in **Worksheet B – Operating Characteristics**. Required Maintenance Schedules should follow the format provided in **Worksheet C – Maintenance Schedules**. Operating Characteristics and Maintenance Schedules of the Dryer should be indicated in respect of each crop and category of seafood.
- 5.2 Indicate the method of manufacture of the Dryer, and the extent to which the Vendor will manufacture and fabricate components on-site.
- 5.3 Diurnal and Seasonal variations may be explained, along with impact analyses. Provide graphical representations of each of the following:
- Diurnal Variations of Temperatures in the Dryer;
 - Diurnal Variations of Relative Humidity in the Dryer; and
 - The Drying Curve for each Crop.
- 5.4 Provide diagrammatic representations of the Dryer.

Worksheet A - Technical Specification

Parameter	Value	Unit	Condition/Notes
a) Model			Indicate if the Dryer type is cabinet, rotary, bed, etc.
- Approximate Dryer life span		Year	
b) Dimension¹			
- Whole equipment		cm	L x W x H
- Drying chamber		cm	L x W x H or L x D
- Blower		cm	L x W x H
- Solar thermal		cm	L x W
- Biomass burner		cm	L x W x H
- Convection type		cm	Forced/ Natural
- Mechanical power source		cm	Diesel Engine or Electric Motor, L x W x H
- Heat exchanger		cm	L x W x H
c) Mechanical Power Source			
- Power source option			Diesel Engine or DC Motor or AC Motor
- Type			Manufacturer specified type
- Model			Manufacturer specified model
- Manufacturer			Name of manufacturer and country of origin
- Effective power output		Hp	Horsepower
- Fuel (if combustion engine)		Liter/hour or Liter/hp	Type fuel and rate of consumption
- Electricity consumption		Kw and Kw/batch	Total electricity consumption
d) Heated Air Blower / Fan			
- Model			Axial, centrifugal, forward incline, backward incline, etc.
- Manufacturer			Name of manufacturer and country of origin
- Number of blades			Number of blades
- Diameter of fan		cm	Diameter
- Fan blade dimension		cm	Length
- Fan rotation		RPM	Number of rotation
- Static head		mmH ₂ O or ATM	Air pressure differential of ambient air and drying chamber
- Airflow rate		Cubic-meter per minute	Flow rate of heated air

¹ Mention range of standard dimensions, and sizes of largest and smallest Dryers manufactured.

Parameter	Value	Unit	Condition/Notes
e) Solar Collector			
- Type			Direct or Indirect, Passive or Active
- Model			
- Manufacturer			Name of manufacturer and country of origin
- Materials used			
- Life of coating			
- Collector size		m ²	Area of collector
- Thermal output		kJ/day	Average thermal output capacity during daylight
- Thermal efficiency		%	Heat produced from thermal collector compare to solar heat radiation
- Energy generated during solar operation during an 8-hour sunny day (without using biomass)		Kw	
- Heat transfer medium			Air or water
f) Biomass Burner			
- Type			Direct Burner or Gasifier
- Model			Manufacturer specified model
- Manufacturer			Name of manufacturer and country of origin
- Power input			Input rate
- Type of biomass			
- Biomass required to power the system (without solar)		kg/hr operation or kg/batch	
- Thermal output		kJ	Heat produced
- Thermal efficiency			Heat produced from burner compare to calorific value of biomass
- Ash Disposal			
g) Heat Exchanger			
- Type			Fin, shell and tube, etc.
- Heat exchange surface area		square-meter	
- Heat transfer medium			Air to Air, Water to Air, etc.
- Heat transfer efficiency		%	
h) Drying Chamber			
- Temperature range of Dryer		Degrees Celsius	
- Input capacity		kg	Specify for each type of crop and the moisture content
- Material			Type of material for Frame, Body,



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Parameter	Value	Unit	Condition/Notes
			etc
- Loading/Unloading			Manual/Mechanized
i) Indicator and Controller			
- Temperature indicator			
- Temperature controller			
- Moisture content meter			
- Fan speed controller			
- Air humidity indicator			
j) Anti-Rodent/Insect Protection			

Worksheet B - Operating Characteristics

Parameter	Value	Unit	Condition/Notes
a) Overall thermal efficiency		%	Total heat of heated air compare to total heat from thermal source
b) Drying rate		%MC/hour	%MC per hour
c) Input capacity		Kg or ton for certain MC	Initial mass of input with specified MC
d) Drying capacity		Kg/hour	Mass of dried product (with specified final MC from specified initial MC) per drying duration
e) Temperature range of drying air			45 - 60 degree Celsius, depends on crops type and variety
e) Operating lifetime			
- Solar collector		hours or years	
- Blower		hours or years	
- Engine		hours or years	
- Motor		hours or years	
- Fan belt		hours or years	
- Heat exchanger		hours or years	
- Biomass burner		hours or years	
- Drying chamber		hours or years	
g) Number of operator(s)			Number of operator per shift, for each activity (8-10 hours/shift)
h) Noise level		dB	
Coffee			
a) Maximum drying time		Hours	24 (from initial MC 52-54% to final MC 12%)
b) Odor contamination			Free from odors other than coffee bean itself
c) Maximum coffee bean MC variation		%	0.3
d) Burnt coffee beans		%	Maximum 3
e) Over dried beans		%	Maximum 3
f) Minimum drying capacity		Kg dried bean/kWh	4



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Parameter	Value	Unit	Condition/Notes
g) Final MC		%-w	Maximum 12
Cocoa			
a) Final MC		%-w	Maximum 7
b) Odor contamination			Free from odors other than coffee bean itself
c) Over dried/skin defect cocoa beans		%	Maximum 10
d) Thermal efficiency		%	50
Seafood			
a) Final MC		%-w	Maximum 12
b) Odor contamination			Free from odors other than seafood itself
c) Over dried seafood		%	
d) Thermal efficiency		%	



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Worksheet C - Maintenance Schedule

Parameter	Maintenance Activity	Frequency and Duration
a) Solar heat collector		
b) Heat exchanger		
c) Combustion engine		
d) Electric motor		
e) Fan / blower		
f) Fan belt		
g) Air duct		
h) Drying chamber		

Attachment 3

SAMPLE COST SHEET

BASIC ASSUMPTIONS

No.	Parameter	Unit	Value	Notes
1	General			
a.	Proposed Dryer's drying capacity	Ton/batch		Input basis per batch
b.	Dryer's lifetime	Years		
c.	Annual working day	days/year		Depends on commodity type & harvest season
d.	Input (wet beans/fish, MC x%)	kg/batch		Specify initial MC
e.	Output (dry beans/fish, MC y%)	kg/batch		Specify final MC in accordance to commodity type
2	Operating Unit Cost			
a.	Electricity cost	IDR/kwh		Specific to location
b.	Kerosene fuel cost	IDR/Liter		Specific to location
c.	Diesel fuel cost	IDR/Liter		Specific to location
d.	Labor cost	IDR/person/day		Specific to location
e.	Biomass fuel cost	IDR/kg		Specific to location
f.	Other operating cost, specify:			

OPERATING CHARACTERISTICS COMPARISON OF PROPOSED DRYERS TO OTHER DRYERS

No.	Parameter	Unit	Proposed Dryer	Other Dryer 1*	Other Dryer 2*	Sun Drying
1	General					
a.	Drying Terrace capacity	m2/ ton				
b.	Drying duration	hours/batch				
c.	Drying terrace requirement	m2/batch				
d.	Operating hours	Hours/day				
2	Energy requirement					
a.	Electricity load	kW				
b.	Electricity consumption	kWh/batch				
c.	Oil fuel consumption	L/batch				

d.	Biomass fuel consumption	kg/batch				
3	Labor requirement					
a.	Number of operators	man-days/batch				
b.	Training days for operator	days				
No.	Parameter	Unit	Proposed Dryer	Other Dryer 1*	Other Dryer 2*	Sun Drying
4	Other operating requirement					
a.	Specify for each requirement					

* = Other Dryers to be compared are other known mechanical dryers or other type of dryers that are suitable to dry coffee or cocoa or fish. If exact data for other dryers is not available, please use your best estimation.

INVESTMENT & OPERATING COST COMPARISON

No.	Parameter	Unit	Proposed Dryer	Other Dryer 1*	Other Dryer 2*	Sun Drying
1	Investment Cost					
	Dryer Cost	IDR/Unit				
	Shipping & Handling	IDR/Unit				
	Construction Material	IDR/Unit				
	Installation Labor	IDR/Unit				
	Other cost, specify:	IDR/Unit				
2	Operating Cost					
	Energy cost	IDR/batch				
	Labor cost	IDR/batch				
	Other operating cost	IDR/batch				
3	Maintenance Cost					
	Spare parts replacement	IDR/year				
	Consumables (lube oil, etc.)	IDR/year				
	Maintenance labor	IDR/year				
	Other maintenance cost	IDR/year				

* = Other Dryers to be compared are other known mechanical dryers or other type of dryers that are suitable to dry coffee or cocoa or fish. If exact data for other dryers is not available, please use your best estimation.