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**CHINA-GHANA SOUTH-SOUTH COOPERATION ON  
RENEWABLE ENERGY TECHNOLOGY TRANSFER  
FOR SOUTHERN GHANA  
(DOMESTIC COOKSTOVES AND MOBILE CHARCOAL KILNS)**

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## **Outline**

- Objectives
- Criteria of shortlisting project/site selection
- Shortlisted projects and their characteristics
- Financials – investment, operation and revenue
- Cost benefit analysis
- Business models- options





## Introduction

- Under the sponsorship of the Danish Government, the United Nations Development Program (UNDP) and Energy Commission are spearheading a cooperation between China and Ghana on Renewable Energy Technology Transfer (RETT) to expedite the transfer and diffusion of Renewable Energy Technologies (RET) from China to Ghana within the framework of the UN's Sustainable Energy for All (SE4ALL) initiative.



## Introduction

- The CSIR-IIR was commissioned to undertake research and review a catalogue of RET for adaptation in Southern Ghana (Improved Domestic Biomass Cookstoves for Greater Accra, Western, Central and Volta regions and Mobile Charcoal Production Kilns for Eastern region).





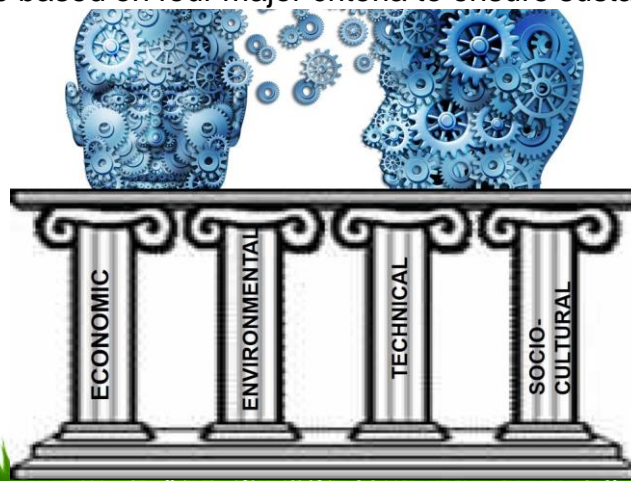
## Objectives

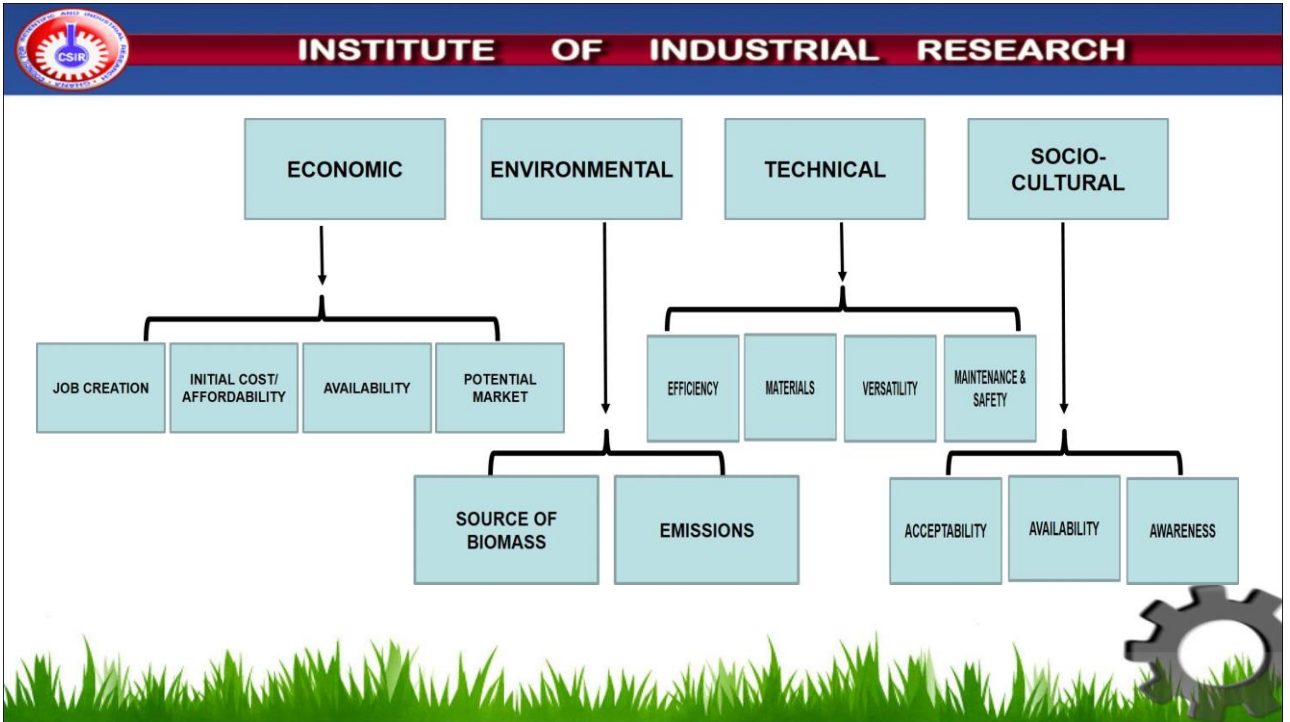
- Develop criteria and standards for selecting clean cookstoves/mobile charcoal kiln technologies that are appropriate for transfer.
- Conduct situational analysis of readily available clean cookstove/mobile charcoal kiln technologies in China potentially suitable for transfer to Ghana.
- Conduct prefeasibility study on proposed demonstration sites.



## Criteria for Selection

- The selection of the most appropriate technology suitable for the Ghanaian market was done based on four major criteria to ensure sustainability.







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- Technologies were ranked on the indicators on a scale of 0-5 by research scientists of the CSIR-IIR who have substantive years in research and development as well as the transfer of knowledge and technology derived from their research activities to both rural and urban stakeholders in Ghana.
- The cumulative score of the individual indicators was used to weight the different major criteria in order to finally select the most appropriate RET for sustainable transfer and adaptation.
- Five (5) technologies each for Biomass Domestic Cookstoves and Mobile Charcoal Kilns were sampled from a catalogue of Chinese RETs for review and selection.



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- Prioritising the major criteria for selection of a specific technology in the level of importance in decision making relative to choice by the average Ghanaian who are the targeted end users of the technology
- Economic considerations (41%) was the highest, followed by Technical (27%), Socio-Cultural (23%) and Environmental (9%) considerations in decreasing order of importance.







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**Domestic cookstove technologies**

**Biomass Stove with thermoelectric power generator**



**High Energy Cast iron wood stove**



**Stove Tech Greenfire Technology**



**Portable wood camping stove**



**Zoom Versa**



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**Shortlisted cookstove technologies and their characteristics**

**Domestic cooking RET for demonstration in the Greater Accra, Central, Western and Volta regions**

Cumulative score 64%

- Biomass Stove with thermoelectric power generator



Cumulative score 72.7%

- Zoom Versa





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# Charcoal production technologies

**High output wood charcoal carbonization kiln**



**Barrel kiln**



**Small Scale Retort Kiln**



**Air Controlled Dome**



**Liquid tar collection air flow furnace charcoal carbonization kiln**



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# Shortlisted mobile charcoal kiln technologies and their characteristics

Cumulative score 79.8%

Cumulative score 85.3%

**RET charcoal production technologies for demonstration in the Eastern Region**

**Barrel kiln**



**Small Scale Retort Kiln**





## Overview Of Charcoal Production In The Eastern Region

- The Eastern Region is one of the ten (10) administrative regions of Ghana. It shares boundaries with five other regions: Greater Accra and Central Regions to the south, Volta to the east, Ashanti Region to the West and the Brong Ahafo Region to the north. It lies between latitudes 6° and 7° N and longitude 1.30° W and 0.30° E.
- Geographically it is situated in the moist semi deciduous and guinea savannah vegetative region of Ghana. It therefore provides a fertile area for the production of biomass.



## Overview Of Charcoal Production In The Eastern Region



1. Kwahu North,
2. Afram Plains South,
3. Fanteakwa,
4. Upper Manya Krobo,
5. Lower Manya Krobo,
6. Akwapem North,
7. Birim Central
8. Atiwa,
9. Kwahu West







## Present Charcoal Production Technology



- A mound charcoal production kiln is a dug shallow trench of about 6 feet to 8 feet wide by between 4 feet to about 25 feet long.
- The woody materials are arranged in a pile to a height of about 2-4 feet which allows the trapped air to support the limited combustion needed for the charring process whilst also ensuring heat transfer by conduction through the pile in the mound.



## Sources Of Raw Materials

- In the Kwahu West, Birim Central and Atiwa Districts, charcoal production is a waste processing activity from the wood carving and timber processing industries.
- The tree species used are mainly *Milicia excels* (Odum), *Cola nitida* (Bese), *Albizia zygia* (Okoro) and *Piptadeniastrum africanum* (Dahoma).
- The Fanteakwa, Afram Plains, Kwahu North, Akwapim North and the Upper Manya districts raw materials is from harvested wood (pruning of species like Cassia and felling of other wood tree species in allotted farms)





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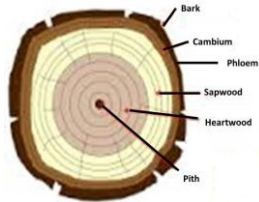
Neem



Cassia



Off cuts from wooden mortar carvings

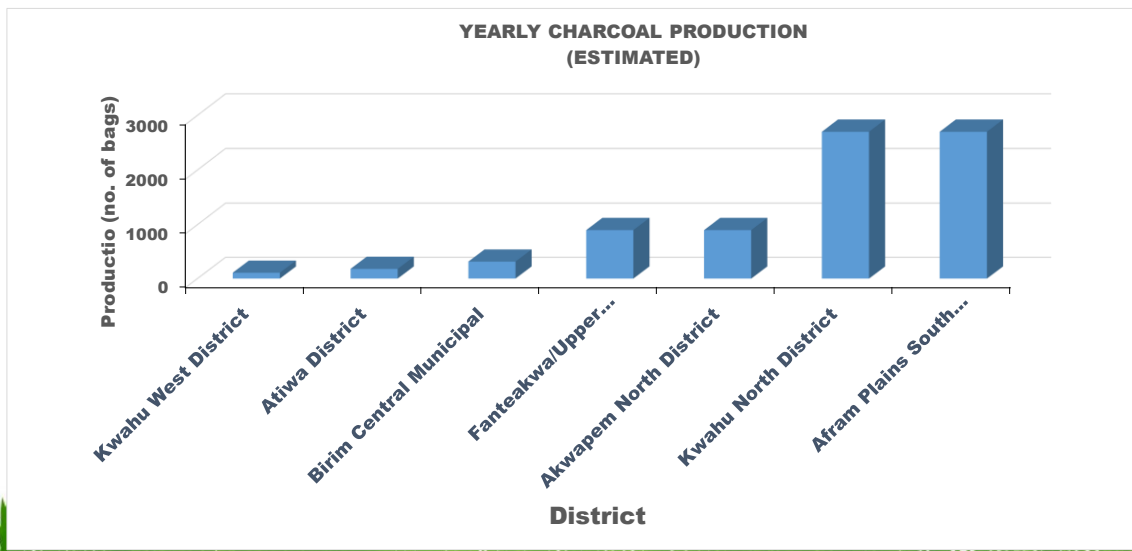


Off cuts from timber processing



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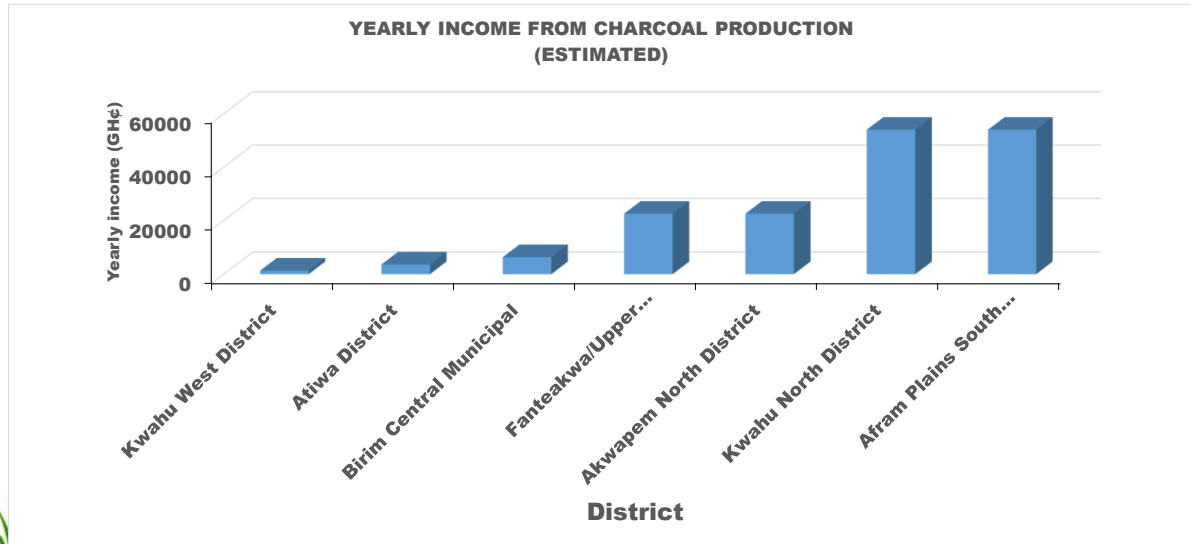
**Charcoal Production In The Nine Districts**





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### Revenue from charcoal producers/year



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### Financials (Assemble option) – investment in infrastructure and operation

DESCRIPTION	PROJECTED COST (\$)
• Investment	515,000.00
– Infrastructure (land, workshop and equipment)	
• Operation	206,000.00
– Capital for utilities	
– Maintenance	
– Labour	
– Materials	
Sub Total	<b>721,000.00</b>
• Interest Rate (35%) for 3 years	757,050.00
Grand Total	<b>1,478,050.00</b>



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### Financials (from scratch option) – investment in infrastructure and operation

DESCRIPTION	PROJECTED COST (\$)
<ul style="list-style-type: none"> <li>• Investment               <ul style="list-style-type: none"> <li>– Infrastructure (land, workshop and equipment)</li> </ul> </li> </ul>	2,415,000.00
<ul style="list-style-type: none"> <li>• Operation               <ul style="list-style-type: none"> <li>– Capital for utilities</li> <li>– Maintenance</li> <li>– Labour</li> <li>– Materials</li> </ul> </li> </ul>	1,156,000.00
Sub Total	<b>3,571,000.00</b>
<ul style="list-style-type: none"> <li>• Interest Rate (35%) for 3 years</li> </ul>	3,749,550.00
<b>Grand Total</b>	<b>7,320,550.00</b>



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### Revenue Projections

Type of Product		Unit Cost (\$)	Quantity Per Month	Revenue/month (US\$)	Revenue / 3yrs(US\$)	Pay Back Period /yrs
Biomass Stove with thermoelectric power generator		30.00	500	15,000.00	540,000.00	17
Zoom Versa		195.00	500	97,500.00	3,510,000.00	3
Small Scale Retort Kiln		4,000.00	25	100,000.00	3,600,000.00	3
Barrel kiln		200.00	50	10,000.00	360,000.00	25
<b>Total Revenue</b>				<b>222,500.00</b>	<b>8,010,000.00</b>	<b>1.2</b>





## Revenue Projections

Scenario	Investment (US\$)	Payback Period
Production from scratch	7,320,550.00	33 months
Assembling prefabricated parts	1,478,050.00	14 months ✓



## Business Model Options

1. Subsidiary
  - A private company is set-up as a subsidiary of the Chinese Company to produce for Ghana and the West Africa sub-region
2. Joint venture
  - Two or more private companies or a public private partnership pooling resources for the purpose of owning and operating the technology





## Conclusion

- Based on the cumulative score of the individual indicators weighted in accordance to predicted decision making judgements by the average Ghanaian, the four (4) RETs were selected as appropriate RET for sustainable transfer and adaptation.
- The business is economically viable with payback time of less than 3 years for the most expensive option.



Thank You

