



Towards Low Carbon Development: Scaling up Energy efficiency and fuel switch in the tea sector in Kenya

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Kenya National Cleaner Production Centre (KNCPC)

- ❑ Established under UNIDO/UNEP global framework - 2000
- ❑ Now a Non-profit Trust under MI&ED - 2006
- ❑ Building capacity in Resource Efficient & Cleaner Production (RECP) technologies & techniques
 - Energy productivity
 - Water productivity
 - Material productivity
 - Pollution intensity
- ❑ Information, training, projects, policy advise, consultancy)
- ❑ Training (RECP, EIA/EA, SEA, waste management, energy management, climate change, etc)
- ❑ Several demonstration projects implemented that need replication and up-scaling
- ❑ RECP industry awards (national & EAC)



On-going projects at KNCPC & partners



Lake Victoria Environmental Management Project (LVEMPII)...Resource Efficient & Cleaner Production..

World Bank
/EAC/SIDA/G
oK

Switch Africa Green (Project on Industrial symbiosis)

UNEP

Mainstreaming SCP policies for eco-innovation in Kenya

UNEP

Low carbon and climate resilient development of selected industrial facilities

UNIDO

Safe Chemicals handling, transportation and storage

ICCA/UNEP

Environmental compliance assistance for businesses in the Nairobi River Basin

NEMA



Some projects that have been identified

Identified through KNCPC in-plant assessments.....

- 1. Towards low carbon development: scaling up efficiency and renewable energy options in the tea industry**
2. Water footprinting: greening the supply side water management by water service boards
3. Demand site water management: reducing water footprint in the beverage industry
4. Up-scaling industrial pollution prevention in the Nairobi River Basin



1. The project on scaling up energy efficiency and renewable energy options in the tea industry in Kenya

- Responds to the need to transform towards low-carbon and climate resilient development pathway
- Directly contributes to Kenya's Vision 2030, Kenya's Industrial Transformation Programme (KITP), Green Economy Implementation Strategy, and National Climate Change and Response Strategy, Solar Energy Regulations, Energy Management Regulations...



The Kenyan tea sector

- More than 110,000 hectares of land devoted to tea
- About 20% of Kenya's total national exports
- Small-scale farmers grow more than 80%, rest (20%) by large-scale producers
- Large-scale producers: Brooke Bond, George Williamson, Eastern Produce, James Finlay and Sotik Tea
- 105 factories registered by the Tea Board of Kenya
- Marketing: KTDA (small scale producers)



Processing tea:

- ❑ Kenyan tea production almost exclusively CTC manufacture (cut, (tear) and curl).
- ❑ Produces strong-liquoring teas yielding a high number of cups per kilo, when brewed both loose and in teabags
- ❑ Tea processing is energy intensive process (30% cost of production)
- ❑ Energy audit data from various tea factories undertaken by KNCPC indicates that 0.5 – 2.0 KWh of electrical energy and 1.5 – 2.0 kg firewood is consumed to produce 1 kg of made tea
- ❑ **Reliance on unsustainably supplied firewood from the local communities and fossil fuel**



If Implemented the Project will Achieve:

Goal: to lower the carbon footprint of the tea industry by reducing energy intensity and deploying renewable energy options in 105 tea factories based on successful case studies.

Specific objectives:

1. Capacity building for the adoption of solar thermal energy in tea transportation, withering and drying
2. To promote and build capacity on use of bio-waste to generate biogas To build capacity in use of agricultural waste as boiler fuel feed
3. To enhance industry capacity in energy efficiency
4. To provide policy advice on greening the industry



Objective 1: Promote and build capacity for adoption of solar thermal; cleaner and renewable energy resource

- a) Transition from wood fuel/fossil fuel to solar tea withering and drying (Continuous Chemical & Physical Withering)
- b) Training industries on commercial solar application
- c) In-plant assessment to determine viability of solar option
- b) Designing and construction of solar systems

Solar drier panels

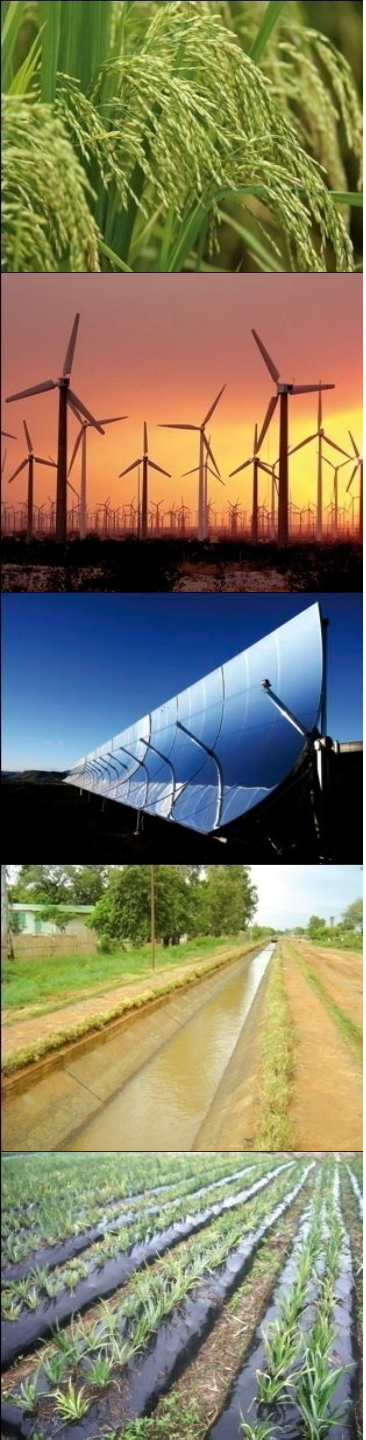
CCW

CPW





- ❑ *Benefits based on implemented case study in factory:*
- ❑ *Annual savings:* installation of a continuous chemical and physical withering (CCW & CPW) unit with a capacity of approx. 40 tons green leaf/day will result in a total annual savings of 21 million Kenya shillings.
- ❑ *Capital investment:* including the building is approx. Ksh. 73 million
- ❑ This gives a **simple payback period of 3.5 years**



Benefits at sector level:

- Average annual production of made tea of **361 million kg** consumes approx. **541.5 million kg of steam** from firewood (98%) and furnace oil or heavy fuel oil (2%).
- **Withering:** total industry savings by adoption of solar air heating for withering process alone translates to an equiv. of 20,801 tons of firewood which is worth Kshs. 178.3 million.
- This steam translates to about **640,402 tons** of firewood/per year equiv. to **12,198 hectares** of forestry land (150 cubic meter per ha) per year.
- This is equivalent to a preservation of forestry cover of approx. 396 ha



- **Drying:** the total industry savings from solar air heating for drying process alone translates to an equiv. of 150,622 tons of firewood which is worth Kshs. 1.3 billion.
- This is equivalent to a preservation of forestry cover of approximately 2,869 hectares.
- **Combined savings** of solar tea withering and drying process has a potential to save at least Kshs 1.5 billion per year and 3,265 ha per year forest cover.
- **Other benefits:** more wood available to farmers, carbon sequestration; accelerating attainment of 10% tree cover; more income to farmers, less GHG emission
- **Project stage:** Replication (KTDA tea factories; large-scale producers)



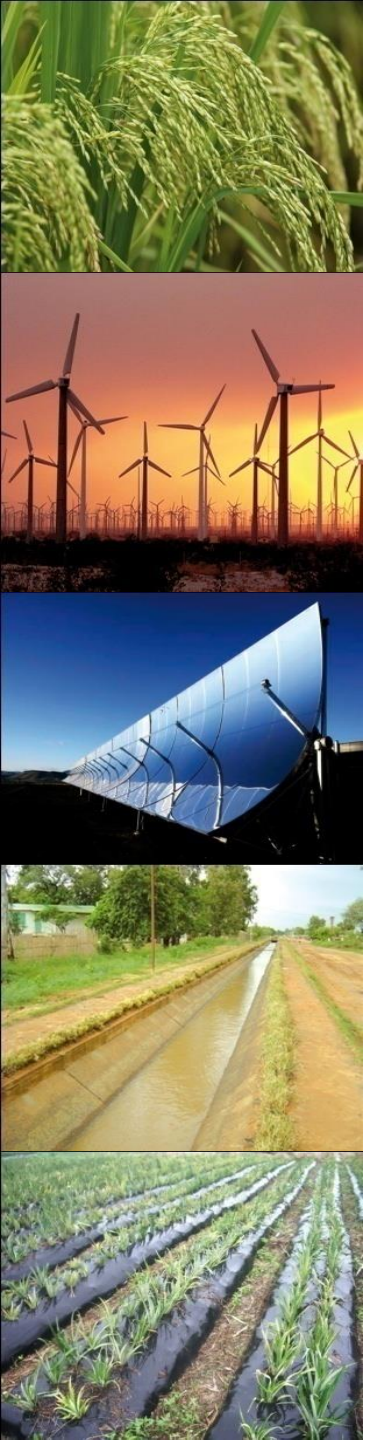


c) Aerial ropeway conveyance technology to transport green leaf from the field to the factory

The Ropeway is a new technological concept of transport of materials by means of conveying them using a cable anchored and running along towers.

Increased renewable energy content by installing solar energy-driven motors





Benefits

- ❑ Displacement of delivery trucks (reduced accidents, reduced GHG emissions, utilising air-space)
- ❑ Reduced production costs (high productivity e.g. queuing of vehicles to off-load/reduced spillages, reduced operating costs/reduced cost on road maintenance)
- ❑ Better product quality: from hidden benefit of reduced damage/stress of leaf by reduced handling)
- ❑ New green jobs (vehicle drivers now with new skills to operate ropeway)



Benefits based on a case study

- ❑ Reduced cost of transport- A cost benefit analysis of the project by KNCPC/industry between the months of December 2012 to April 2013 showed a net financial benefit of Ksh.14,689,982 (5 months!)
- ❑ Green jobs – Additional 40 technical and non-technical workers employed directly to operate the ropeway system.
- ❑ The carbon intensity reduced by 10% from the base year 2011 compared to 2012
- ❑ Technology been replicated in a 2nd tea estate



Objective 2: Promote and build capacity on the use of waste bio-waste to generate biogas

Involves the generation of biogas from anaerobic digestion of organic wastes.

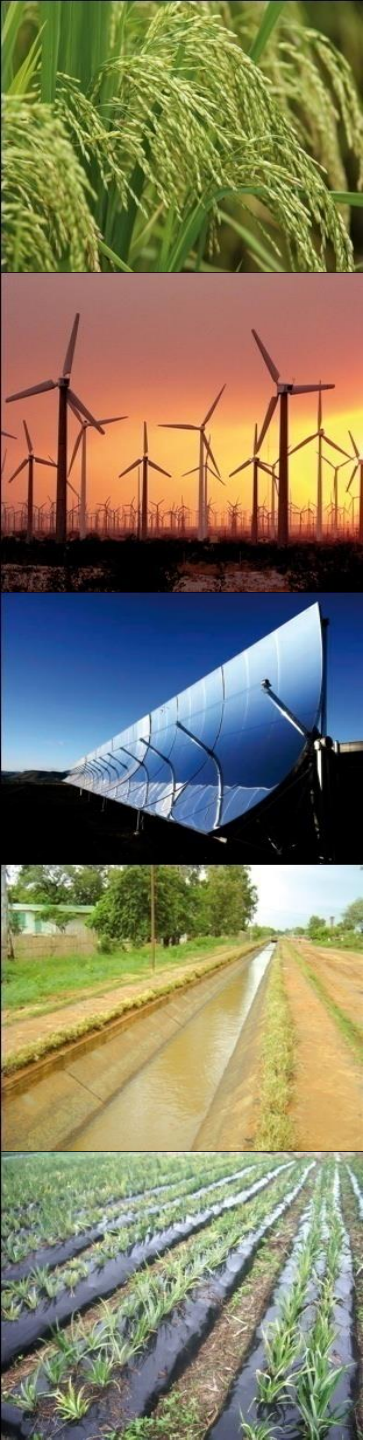
Biogas burned in a special CHPs gas engine generator to generate electricity and heat energy.

Waste streams utilised:

- Spent green and black tea
- Flower waste from flowers farms
- Septic tank waste from estates
- Slaughter house waste

Interventions: Information and awareness, training, in-plant assessment, design & installation



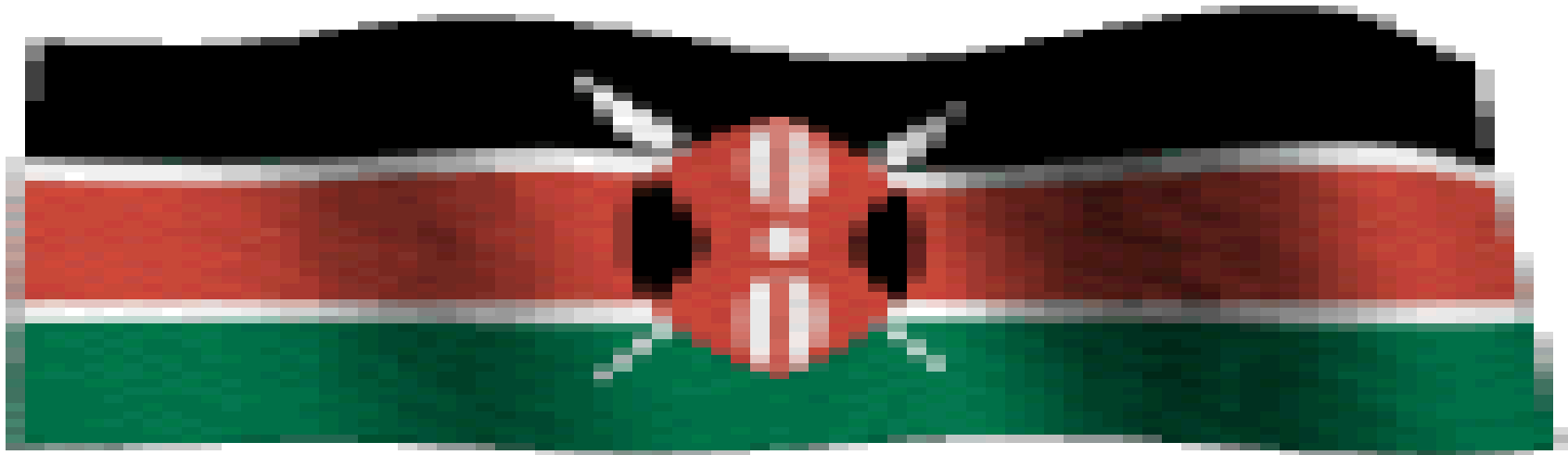


Benefits

1. Reduced greenhouse gas (GHG) emissions
2. Waste reduction into dumpsites
3. Improved sanitation
4. Green jobs creation (biogas operators & contractors for waste collection)
5. Electricity generated is fed into the main grid...income for industry
6. Savings from avoided waste transport and disposal costs
7. Based on a case study, a daily biogas production of 600 m³/day and this can go up to 1000 m³/day when the digester is full.
8. The electricity generated from the biogas is 160 kW with another 20 kW heat energy which is used to maintain the temperature of the digester.
9. Saving of over Ksh 55,000 per day on electricity
10. Stabilised organic manure for tea estates



End of Presentation



THANK YOU

