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Sugar industry — Code of practice

Part 2:

Cane harvesting, processing and trade

KS 2977-2: 2023

TECHNICAL COMMITTEE REPRESENTATION

The following organizations were represented on the Technical Committee:

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Ministry of Health – Food Safety Unit
Kenya Industrial Research and Development Institute
National Public Health Laboratories Services
Government Chemist's Department
Kenya Revenue Authority
University of Nairobi — Department of Food Science and Technology
Kenafric Industries Ltd.
Consumer Information Network
Trufoods Ltd.
Brookside Ltd.
Kenya Sweets Ltd.
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South Nyanza Sugar Company Ltd.
West Kenya Sugar Company Ltd.
Sukari Industries Limited
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Chemilil Sugar Company Ltd.
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KALRO- Sugar Research Institute
Kenya Bureau of Standards — Secretariat

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In order to keep abreast of progress in industry, Kenya Standards shall be regularly reviewed. Suggestions for improvements to published standards, addressed to the Managing Director, Kenya Bureau of Standards, are welcome.

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Sugar industry — Code of practice

Part 2:

Cane harvesting, processing and trade

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Foreword

This Kenya Standard was prepared by the Sugar and Sugar Products Technical Committee under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

The Kenyan sugar industry has over the years experienced numerous operational challenges in primary production, processing and marketing. This Part 2 of this standard provides a framework and guidance to industry players to embrace industry best practices, law and order, harmony, fair play, competitiveness, discipline and self-regulation among others in Cane harvesting, transportation and processing.

This Code of Practice is aimed at providing guidance to all stakeholders in the value chain to conduct all activities in a manner that ensures food safety and quality; personnel safety and welfare; environmental protection and sustainability. It also intends to enhance compliance with statutory and regulatory requirements in Kenya.

KS 2977 consists of the following parts, under the general title Sugar industry — Code of practice:

- Part 1: Primary production
- Part 2: Cane harvesting, Processing and trade
- Part 3: Environmental and socio-economic and sustainability

This second part of this standard provides guidelines and covers recommended best practices and requirements Cane harvesting, transportation and processing of sugarcane.

During the preparation of this standard, reference was made to the following document:

KALRO Sugarcane growers guide.

Acknowledgement is hereby made for the assistance derived from this source.

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Sugar industry — Code of practice

Part 2:

Cane harvesting, processing and trade

1 Scope

This Kenya Standard provides guidelines for achieving requirements for food safety and quality; worker health, and safety; by value chain actors during cane harvesting, transportation, processing and trade of sugar in Kenya.

This standard applies to all players in the cane harvesting, transportation and processing including but not limited harvesters, transporters, millers, county governments and relevant government agencies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CAC/RCP 1, *Recommended International Code of Practice General Principles of Food Hygiene*

KS EAS 38, *Labelling of pre-packaged foods— General requirements*

KS EAS 39, *Hygiene in the food and drink manufacturing industry — Code of practice*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 audit

systematic and functionally independent examination to determine whether quality and food safety activities and results comply with planned procedures and whether these procedures are implemented effectively and are suitable to achieve objectives.

3.2 certification

all those actions leading to the issuing an official document attesting to a status or level of achievement of requirements of a standard

3.3 documentation

collection, classification and dissemination of information relating to a process or procedure usually in written or electronic form

3.4 erosion

mechanical movement of the land surface by wind, rain, running water or moving ice resulting in the wearing away of land or soil

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3.5
food safety
assurance that food will not cause harm to the consumer when it is prepared and consumed according to its intended use

3.6
off-type
any seed or plant not a part of the variety in that it deviates in one or more characteristics from the variety as described

3.7
Integrated pest management (IPM)
consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep plant protection products and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment

3.8
field establishment
field planting, bringing into bearing and in filling of a sugar plantation

3.9
traceability
ability to follow the movement of a feed or food through specified stage(s) of production, processing and distribution

3.10
manure
decomposed or otherwise treated materials used to maintain or improve plant nutrition and soil properties.

3.11
seed cane
sections of the stalk of immature cane used for planting

3.12
value chain actors
individual producers of primary agricultural products including propagators and breeders; growers, associations and cooperatives; processors and packers; trading companies (including exporters), shippers, consolidators and cargo handlers

3.13
packaging
process of protecting the products by a wrapper, a container, box or other suitable device

3.14
pest
any injurious, noxious or troublesome insect, fungus, bacterial organism, virus, weed, rodent or other plant or animal

3.15
pest control products
product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, attracting or repelling any pest

3.16
potable water
water which meets the quality standards of drinking water as Specified in relevant Kenya standards

3.17**risk**

probability of a hazard occurring

3.18**waste**

All items that organization no longer have any use for, which they either intend to get rid of or have already discarded.

3.19**sett**

piece of cane stalk with 3-5 eye-buds used as planting material

3.20**bagasse**

final crushed sugar cane fibre remaining after milling. Cane residue leaving mills after extraction of juice.

3.21**brix**

measure of dissolved solids in sugar liquor or syrup using a refractometer, otherwise referred to as refractometric dry solids. For solutions containing only sugar and water, Brix = % sugar by mass. Spindle Brix is determined using a hydrometer but is now seldom used.

3.22**refractometer brix**

term used when a refractometer equipped with a scale, based on the relationship between refractive indices at 20°C and the percentage by mass of total soluble solids of a pure aqueous sucrose solution, is used instead of a hydrometer to test the solids concentration of a sucrose containing solution. The sugar industry is now standardized on refractometer brix

3.23**crystal content**

percentage by mass of crystalline sugar present in a massecuite, magma or similar material

3.24**dissolved solids**

all solute material which is in solution, including sucrose, monosaccharides, ash and other organic impurities

3.25**dry substance**

- material remaining after drying a product to constant mass, or for a specified period. The mass of dry substance can also be found by deducting from the mass of the product, the mass of moisture, as determined in a specified manner; or
- measure of total solids obtained from evaporating a solution or massecuite under vacuum to dryness

3.26**extraction**

- proportion of sugar taken out from cane in the extraction plant; equals mass of sugar in raw juice as a percentage of mass of sugar in cane; or
- percentage ratio of sucrose in mixed juice to sucrose in cane. If based on pol it is referred to as Pol

3.27**filter cake (scum or filter mud)**

residue removed from process by filtration including any added filter aid

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3.28

invert sugar

mixture of approximately equal parts of glucose and fructose (monosaccharides) resulting from the hydrolysis of sucrose (inversion)

3.29

massecuite

mixture of crystals and mother liquor resulting from the crystallization in a vacuum pan. Massecuites are classified according to purity as A, B, or C massecuites. The term is French for 'cooked mass'.

3.30

molasses

mother liquor separated from the crystals by centrifuging A, B, or C massecuites. Molasses is derived from the corresponding massecuites. C molasses is also referred to as final molasses

3.31

polarization (pol)

- relative rotation of plane polarised light as a measure of sucrose concentration; or
- apparent sucrose content of any substance expressed as a percentage by mass and determined by the single or direct polarisation method. The term is used as if it were a real substance; or
- The apparent sucrose content expressed as a mass percent measured by the optical rotation of polarized light passing through a sugar solution. This is accurate only for pure sucrose solutions.

3.32

purity

- true purity is the sucrose content as a percent of the dry substance or dissolved solids content. The solids consist of sugar plus non-sucrose components such as invert, ash, and colorants. Apparent purity is expressed as polarization divided by refractometer Brix, multiplied by 100.
- percentage ratio of sucrose (or pol) to the total soluble solids (or brix) in a sugar product. The following terms are in general use: Refractive apparent purity: The percentage ratio of pol to refractometer brix. G.C. sucrose refractometer brix purity: The percentage ratio of GC sucrose to refractometer brix.

3.33

R

reduced or parameters standardise at agreed conditions

3.34

raw juice

juice obtained from the cane extraction process. Also referred to as mixed juice (from mills) or draft juice (from diffusers).

3.35

refining

purification of sugar through chemical and physical methods generally including some or all of clarification, filtration, decolourization and recrystallization.

3.36

sucrose

pure disaccharide α -D-glucopyranosyl- β -D-fructofuranoside, known commonly as sugar.

3.37

sugarcane

botanically a tall grass of the genus *Saccharum* and agriculturally the crop produced from hybrids which are the progeny of a number of *Saccharum* species commonly referred to as cane. For determination and payment of sucrose in cane it is the raw material accepted at the mill for processing.

4 Symbols and abbreviated terms

For the purposes of this document, the following symbols and abbreviated terms apply.

RME - Reduced Mill Extraction

FIFO – First in First Out paragraph

5 General requirements

5.1 General

5.1.1 Stakeholders within the sugar value chain should undertake production, processing, distribution and trading of sugar in a manner that ensures high productivity and efficiency; food safety and quality; worker health, safety and welfare; environmental protection and sustainability.

5.1.2 Adequate measures should be taken, as appropriate throughout the value chain in accordance with relevant Kenya Standards to achieve the following:

- a) high productivity and efficiency by adopting industry best practices;
- b) safety by identifying practices, control measures, and monitoring hazards associated with the product at each step;
- c) quality by identifying factors that compromise sugar quality and implement measures to ensure conformity to product specifications;
- d) environmental protection by adopting sustainable practices; and
- e) Worker health, safety and welfare by adhering to relevant legislation.

5.2 Documentation and record keeping

5.2.1 An organized system of record keeping should be documented and implemented for all records pertinent to this code and should remain legible, readily identifiable and retrievable.

5.2.2 The value chain actor should keep copies of the list of relevant international and national policies, laws and regulations where applicable.

5.2.3 Records should be maintained for a period of at least two years or as required by law.

5.2.4 The value chain actors should ensure that employees charged with record keeping are trained to do so accurately and that they are adequately supervised.

5.2.5 Records should be clearly written, dated and signed (including the name) by a responsible person.

5.2.6 Recording of data showing non-conformity with standards should be followed up with a written corrective action to be taken.

5.2.7 All records should be available for inspection by authorized persons.

5.2.8 The value chain actors should undertake at least one self-assessment per year which should be documented.

5.2.9 All the non-conformities generated from the internal audit should be documented and corrective actions taken.

5.2.10 Documentation should include but not limited to the following:

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- a) policies and manuals for all activities along the value chain including for sugar quality and food safety, environmental protection, and worker welfare and health;
- b) procedure for management of non-conforming products;
- c) procedure for traceability, withdrawal and recall.
- d) records of personnel training;
- e) records of updated sugarcane growers ;
- f) records of soil and leaf-tissue analysis;
- g) records of prequalification of suppliers of materials, services and transport;
- h) records of stocked and applied fertilizer and crop protection products;
- i) programs and records for pests and disease incidences and control;
- j) records of pesticide residue monitoring;
- k) personnel hygiene policy;
- l) statutory certificates and licenses [food handlers health certificates and other relevant licences, certificates and permits];
- m) records for harvested cane quality;
- n) records of production, processing and distribution;
- o) procedures and programs for cleaning and disinfection;
- p) records of heavy metals monitoring; and
- q) records of plant machinery and equipment

5.3 Competence

5.3.1 A capacity development system should be established and maintained to ensure personnel at each stage of the value chain are equipped, through appropriate training, with knowledge and skills that ensure best practices.

5.3.2 The trainings should include; enterprise diversification, protection of environment, workers' health and safe handling of products.

5.4 Safety and security

Measures should be established and implemented to control access to the cane production and processing areas, storage and handling facilities.

6 Cane harvesting, transportation, weighment and quality checks

6.1 Cane Harvesting

6.1.1 Mature cane should be harvested at the age recommended by the cane variety catalogue.

6.1.2 A cane harvesting plan should be established by the miller or an out-grower institution on the basis of factory milling capacity, cane maturity and accessibility by transport machinery.

6.1.3 Cane should preferably be harvested green, cut at the base, appropriately topped, de-trashed and piled, heaped, stacked or windrowed.

6.1.4 Harvesting should be done in a manner that is hygienic and protects the quality of the cane. Measures should be taken to control cane contamination during harvesting and handling.

6.1.5 Appropriate personal hygiene practices should be maintained and the personnel should be sensitized on appropriate behaviours, handling of equipment and personal protection.

6.1.6 Harvesting personnel carriers should be clean, and free from contamination.

6.1.7 Where harvesting machines are used, they should be maintained in good hygienic condition and the lubricants used should be of food grade quality.

6.1.8 Burning of cane is highly discouraged however, in instances where it accidentally occurs, harvesting should be authorized by the miller after quality assessment based on parameters established by the authority.

6.1.9 Planned burning of cane should be authorized by the miller and may be carried out where the field is infested with snakes and/or pests, lodged, and has over-grown shrubs and weeds.

6.1.10 To minimize deterioration in quality of burnt cane, it should be given priority during harvesting, transport and weighing to reach the factory for milling within 24 h.

6.1.11 Records for harvested cane should be maintained by the miller and grower.

6.2 Cane transportation

6.2.1 Harvested cane should be transported to the factory for milling within 24 hours to avoid deterioration of quality.

6.2.2 Mode of transport, equipment and carriers used should be designed to maximize payload and safety and minimize cane spillage and transport cost.

6.2.3 Cane transport services should be adequate, reliable and affordable.

6.3 Cane quality assurance

6.3.1 Cane should conform to respective varietal attributes.

6.3.2 Cane quality should be assured at harvesting, loading, transportation and delivery.

6.3.3 Cane quality should be tested at independently managed accredited laboratories.

6.4 Cane weighing and off-loading

6.4.1 Cane weighing should be done at designated weighbridges.

6.4.2 Weighing equipment should be calibrated and maintained in accordance with the Weights and Measures Act Cap. 512.

6.4.3 Weight readings should be directly documented and feedback given to the grower in real-time.

6.4.4 Weighment records should be maintained by the miller and the grower.

6.4.5 Sugar cane off-loading in the yard should be safely done on the basis of First In, First Out (FIFO).

6.5 Cane pricing and payment

6.5.1 Cane pricing should be based on a formula conforming with the relevant law(s).

6.5.2 The Cane Pricing Committee may periodically review the formula based on industry dynamics.

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- 6.5.3 Millers shall comply with cane pricing formula.
- 6.5.4 Recoverable input and service charges should be as prescribed in the signed agreement.
- 6.5.5 The miller shall pay the grower within seven days of sugarcane delivery.

7 Processing

7.1 General processing provisions

To ensure cane products are wholesome, safe for human consumption and the worker is protected from occupational hazards, cane sugar processing location, premises and steps should conform to Good Manufacturing Practices (GMP) in accordance with KS EAS 39, and other relevant legislations, but not limited to Public Health Act; Environmental Management and Coordination Act (EMCA), 1999, and Occupational Safety and Health Act.

7.2 Location, design and layout

Sugar cane processing premises should be located, designed, and constructed to facilitate sustainable practices. The location should provide for access to adequate raw material and utilities. The design and layout should ensure:

- a) efficient process operations;
- b) sources of contamination, pollution, and threats to safety are identified and appropriately controlled;
- c) adequate maintenance including: cleaning, disinfection, monitoring of equipment, buildings and surfaces;
- d) materials in contact with sugar are of food grade quality and easy to maintain;
- e) wet and dry operations are adequately separated to reduce contamination;
- f) workers safety is assured and maintained by use of appropriate controls; and
- g) waste is managed effectively to prevent recontamination and infestation.

7.3 Hygiene facilities

- a) To ensure good hygiene throughout the plant, the following should be provided:
- b) foot baths, bathrooms, washrooms, changing rooms, and hand-washing facilities supplied with water, disinfectants liquid soap, sanitizer, disposable towels and/or hot air hand driers, as appropriate;
- c) potable water conforming to Kenya standards for potable water KS EAS 12;
- d) adequate lighting and glass and brittle plastics policy;
- e) clean compressed air for dry cleaning;
- f) appropriate storage facilities for packaging materials, finished products (unpackaged and packaged), lubricants, fumigants, etc.; and
- g) facilities for appropriate waste disposal.

7.4 Maintenance

Maintenance procedures and programmes should be established to cover all areas of the manufacturing premises and ensure:

- a) efficient operations for all plant, machinery and equipment with minimum downtime;
- b) effective cleaning and disinfection for all facilities and equipment are undertaken;

- c) use of approved solvents, oils, lubricants, detergents and disinfectants; and
- d) monitoring is done to establish effectiveness of maintenance, cleaning and sanitation program.

7.5 Personal Hygiene

A personal hygiene policy should be established and implemented to ensure:

- a) written instructions for acceptable personal hygiene should be visibly displayed at appropriate areas and enforced;
- b) visitors to manufacturing and storage areas should be sensitized on hygiene practices and wear protective clothing as appropriate; and
- c) a documented and effective training program will be in place to ensure employees, contractors and sub-contractors are competent and are conversant with hygiene, accidents and emergency procedures and any other issue critical to safety.

7.6 Process control

All process steps should be designed, implemented, monitored, documented and reviewed for effectiveness of controls and compliance with critical control limits to ensure:

- a) a systematic and effective control system which identifies potential hazards arising from process operations and relevant mitigation measures;
- b) incoming cane should be inspected for compliance with cane quality parameters;
- c) measures should be established to ensure spillages in the processing area are appropriately handled. Those intended for reuse should be collected in clean and clearly marked containers and immediately recycled;
- d) equipment and facilities used for process controls should be calibrated and maintained in good state of repair;
- e) appropriate flow, mass, temperature, pressure and time controls should be established to optimize quality of products; and
- f) monitoring should be undertaken at control points to identify non-conformities for appropriate corrective actions.

7.7 Product control

To minimize risks associated with damage of the final product and to allow for product traceability;

- a) products should be packaged, stored, dispatched and transported in a manner that maintains its wholesomeness and complies with relevant Kenya standards and customer requirements;
- b) a quality control system should be established to ensure compliance of finished products with specifications;
- c) consumer packages should be designed and labelled in accordance to KS EAS 38;
- d) containers and packages should be designed in a manner that prevent damage and contamination;
- e) a dispatch procedure and criteria should be established to ensure only clean vehicles capable of preserving safety and quality of the product are used;
- f) transport personnel should be sensitized on food safety requirements, appropriate vehicles and security conditions for transporting finished products; and
- g) vehicles and containerized transport should be locked with a security seal to be opened only by authorized personnel at the designated point of offloading and the seal identification number should be traceable.

7.8 Cane processing efficiency

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Cane processing should conform to the following limits:

Process	Parameter	Measure	Limit
Cane preparation	PI	%	Greater than 85
Mill extraction	RME	%	Greater than 95
	Bagasse moisture	%	Less than 50
Juice Clarification	Clarity	Transparent light yellow(indicator)	
Evaporation	Brix	%	65
Syrup Clarification	Clarity	Shining yellow	
Crystallization	Crystal content	%	
	Final Molasses purity	%	Below 32
Centrifugation			
Sugar Drying	Moisture content	%	Sugar std (0.2)
Screening of mixed juice**			
Energy consumption norms	Steam consumption on cane	%	Less than 50
	Power consumption on cane	KWh/Ton	Below 35

NOTE Automation and mechanization to be maximised as much as possible.

8 Sugar trade

8.1 Local trade — Marketing, distribution and sales

8.1.1 Distribution of sugar should discourage restrictive trade practices such as discrimination in supply, predatory, collusive and monopolistic trade practices. This may be achieved by independent distributors, wholesalers and retailers.

8.1.2 Local sugar distribution should be country wide.

8.1.3 Sugar stores and warehouses should conform to KS EAS 39.

8.1.4 Promotion of competitively priced local sugar should be done by producers.

8.1.5 All sales should be executed on the basis of legitimate contractual agreements.

8.2 International Trade — Imports, exports and transit

8.2.1 Sugar imports/exports should be facilitated as prescribed by relevant legislations and treaties.

8.2.2 Sugar imports should be controlled to ensure local market stability.

8.2.3 Local production should be enhanced for export.

8.2.4 Market surveillance and enforcement should be carried out to curb the following:

- a) smuggling and dumping of transit sugar;
- b) repackaging, rebranding and direct marketing of legally imported industrial sugar; and
- c) Counterfeiting of sugar products/brands.

8.3 Repackaging and rebranding

Sugar should be repackaged and rebranded in accordance to sugar regulations and packaging standards KS EAS 38.

8.4 Shipping of imports/exports

8.4.1 Sugar imports and exports shall be authorized prior to shipment.

8.4.2 Sugar shall be shipped in compliance with applicable sugar regulations and standards.

8.4.3 Sugar imports and exports records should include the following:

- a) consigner/exporter;
- b) consignee/importer;
- c) quantity;
- d) type or grade of sugar;
- e) port of departure;
- f) country of origin and destination;
- g) expiry date;
- h) unique consignment reference number;
- i) manufacturer; and
- j) value.

9 Traceability system

9.1 A sugar traceability, withdrawal and recall system should be established and maintained across the value chain;

9.2 Records maintained should include but not limited to the following where applicable:

- a) truck/trailer registration number;
- b) date and time of dispatch;
- c) name of manufacturer/importer/packer/distributor ;trade mark and grade;
- d) product invoice numbers;
- e) delivery note; and
- f) goods received note.

Annex A
(normative)

Relevant legislations

The following is a list of legislations that apply to the sugar industry:

- The Constitution of Kenya, 2010.
- The Agriculture, Fisheries and Food Authority Act (AFFA) 2013 (Revised, 2016).
- The Crops Act, 2013.
- Kenya Agricultural and Livestock Research Organization Act, 2013.
- The Employment Act, Cap. 226.
- The Environmental Management and Coordination Act, 1999.
- Occupational Safety and Health Act, 2007.
- Work Injury Benefits Act, 2007.
- The Food, Drugs and Chemical Substances Act, Cap. 254.
- The Public Health Act, Cap. 242.
- The Irrigation Act, Cap. 347.
- The Lakes and Rivers Act, Cap. 409.
- The National Hospital Insurance Fund Act, Cap. 255.
- The National Social Security Fund Act, Cap. 258.
- The Physical Planning Act, 1996.
- The Regulation of Wages and Conditions of Employment Act, (ROWA) Cap. 229.
- The Standards Act, Cap. 496.
- The Trade Disputes Act, Cap. 234.
- The Children's Act, 2001.
- The Sexual Offences Act.
- The Trade Union Act, Cap. 233.
- The Water Act, Cap. 372.
- Seeds and Plant Varieties Act, Cap. 326.
- The Pest Control Products Act, Cap. 346.
- The Plant Protection Act.
- Weights and Measures Act, Cap 513.
- Land Act No. 6 of 2012.
- The Fertilizers and Animal Foodstuffs Act, Cap 345.
- Factories and Other Places of Works Act, Cap 514.
- Co-operative Societies Act Cap 490.
- The Crops (Sugar) (General) Regulations, 2020.
- The Crops (Import, Export and By-products) Regulations, 2020.
- The Labour Institutions Act No. 12 of 2007.

- The Labour Relations Act No. 14 of 2007.
- Retirement Benefit Act No.3 1997.

AnnexB
(normative)

Product diversification

Millers should diversify their production to include the following:

- Brown/mill white sugar
- Refined white sugar
- Sugar cane jaggery
- Raw cane sugar
- Fortified sugar
- Icing sugar
- Molasses
- Bagasse
- Carbonized briquettes for household
- Non-carbonized briquettes for industrial
- Ethanol
- Co-generation
- Filter mud
- Fly ash
- Fibre boards
- Pulp and paper

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