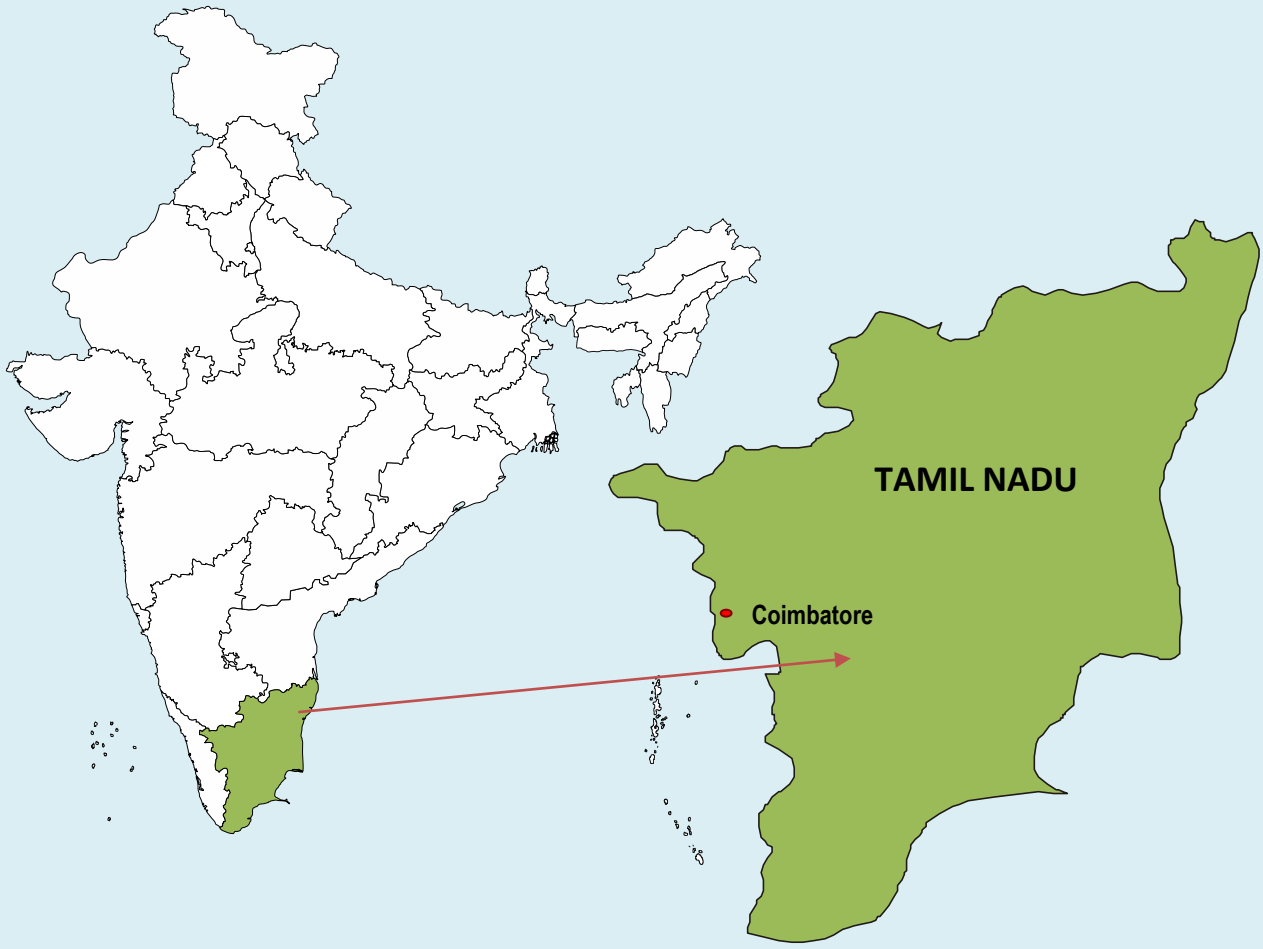
Cluster Profile
Coimbatore bakery industries



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SAMEEEKSHA

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Disclaimer

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Contents

ACKNOWLEDGEMENTS

Overview of cluster 1
Product types and production capacities 1
Raw material usage in the cluster 2
Production process 3
Technologies employed 4
Energy consumption 4
Energy saving opportunities and potential 5
Major stakeholders 8
Cluster development activities 8

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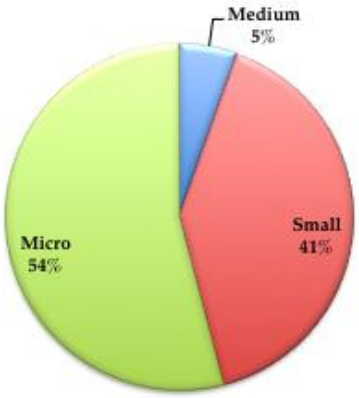
Last but not least, the interactions with MSME entrepreneurs and other key stakeholders in the cluster for providing valuable data and inputs that helped in cluster analysis.

Coimbatore bakery industries

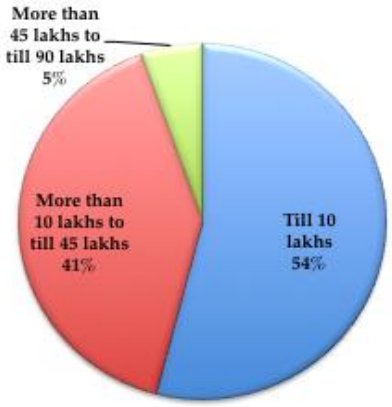
Overview of cluster

Coimbatore district is known as one of the densely populated bakery cluster with more than 700 bakeries. Of these about 370 bakeries are located in the city area and a few units in industrial area. The bakery units in Coimbatore cluster are known for their tasty, quality and variety of baked food items like bread, bun, biscuits, toasts, puffs and cakes. Coimbatore has mainly retail bakeries which "bakes in the back and sells in the front type". There are standalone units having production unit at a one place from where all the products are made and distributed to retail shops.

Micro and small bakeries contribute to about 95% of total number of units in the cluster. The industry mainly caters to the demands of various baked food items like breads, buns, biscuits etc. from local market. The bakery industry provides employment to more than 6000 people directly or indirectly. The estimated total turnover of bakery industries in Coimbatore is more than Rs 105 crores.



Distribution of bakery units based on category

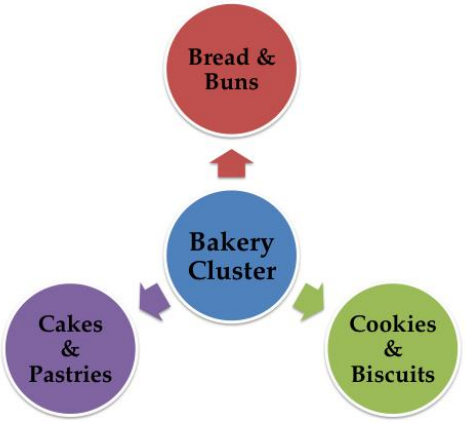


Distribution of bakery units based on annual turnover (Rs)

Product types and production capacities

Different products of bakery industries in Coimbatore cluster are consumed mainly in city area. Some of the primary products manufactured by bakery units are as follows:

- Bread and buns products
- Cookies and biscuits products
- Cakes and pastries (Macaroons) products



Primary products from Coimbatore bakery cluster

These products can be grouped primarily into three types of products such as (1) Breads and buns, (2) Cookies and biscuits and (3) Macaroons. These products have further categories based on their ingredients like there are cakes, which are made up of chocolate, strawberry, pineapple etc. Sometimes products like cakes are custom made to satisfy the

demands of consumers. The production levels of bakeries are quite varying based on consumers demands. The production and installed capacity of the similar industries in the cluster vary from one unit to another; even production of a unit is also not constant during the year. The production data is generally available only in terms of number of pieces produced for a particular product.

Raw material usage in the cluster

The bakery industries use different raw materials like maida, ghee, sugar, oils, sweeteners and colours. These major ingredients are used as base materials for preparation of many of the bakery products like cakes, breads and buns, etc. These ingredients are supplied by local market for the retails bakeries while standalone units make bulk procurement.

Basic ingredients for bakery products

Energy scenario in the cluster

Electricity, diesel oil, wood and LPG provide the main source of energy for most of the bakery units in the Coimbatore cluster. Almost all the units are depended on electricity from grid to meet their energy needs. The average connected loads per unit are depended on the kind of products and install capacity of the plant. All of the units have LT connection. The other forms of energy use in the cluster include diesel oil. Diesel is used for heating in oven. Wood fired ovens and electrical ovens are also used. The power situation is very good hence, the dependence on DG set is very low and its use is insignificant in term fuel consumption compared to electrical energy from connected grid supply.

Prices of major energy sources

Energy type	Source	Price (Rs)
Wood	Local market	6000 per tonne
Electricity	Tamil Nadu Generation and Distribution Corporation (TANGEDCO)	4.50 per kWh
Diesel	Local market	54 per litre
LPG	Local market	60 per kg

Production process

The major steps involved in bakery products are mixing of ingredients, shaping and sizing, baking, curing and then packing and dispatch. The generic process steps followed by the unit are briefed below:

Production process of a bakery unit

(i) Raw material procurement and weighing

Raw materials like sugar, flour, ghee and other ingredients are procured and weighed as per recipe requirement. Weighing is done carefully to avoid any changes in proportions of ingredients which otherwise may affect the product quality.

(ii) Raw materials mixing, dividing and shaping

Different ingredients are mixed in mixer machine and poured into the moulds as per required shapes. These are then cut into the various sizes.

(iii) Resting and baking

The moulds prepared are kept for fermentation by yeast during which process the mix of ingredients balloons up in case of buns and breads. After fermentation, the moulds are baked in ovens. The temperature requirement varies with type of product. Baking operation is done in batches.

(iv) Cooling and cutting

The baked products are taken out and kept for natural cooling. Cutting of the baked products in case of buns and breads is done manually and then sent for packing.

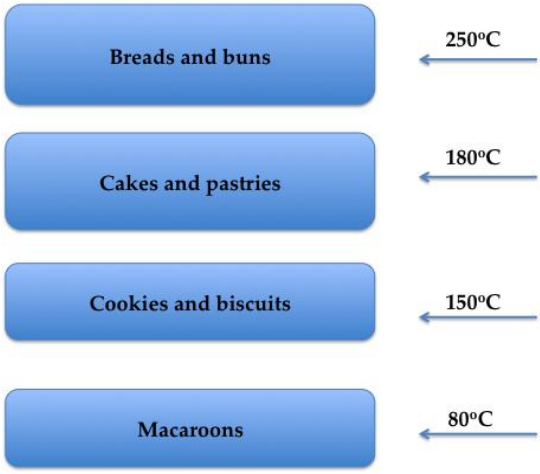
(v) Packing and despatch

The final products are packed in the plastics wraps and sent to retail shops.

The generic production steps for bakery products are shown in figure.

The production process for different bakery product is almost similar with difference being temperature and time required for baking. Depending on the product type, mixing time also varies. Many units now have started using machines for cutting and shaping purposes which reduce production time.

The temperature requirement in baking is shown in the chart Bread and buns require highest temperature of 250 ºC with longer soaking period in the oven while macaroons require lowest temperature of 80 ºC. Cakes and pastries are baked at about 180 ºC and cookies and biscuits are baked at 150 ºC.



Temperature requirements in baking

Technologies employed

The use of outdated and outmoded technologies for baking process is a major challenge in Coimbatore bakery cluster. At present, most of the standalone units use diesel fired ovens with single burner while retail bakeries use mainly wood fired ovens. A few bakery units are using electrical ovens. Some of the primary process technologies are explained below.

(i) Baking ovens

Most of the ovens in the standalone units are diesel fired while small retail shops have wood fired ovens; also some of the units are using electrical ovens. Diesel fired ovens have been equipped with mono-block burners. These burners are of 5-8 litre per hour firing rate. Wood fired ovens use dry wood and are built with refractory bricks.

Diesel fired oven **Electrical oven**

(ii) Mixers

Mixers are used for mixing ingredients of the recipe of the products. Presently there are plenary mixers available, which give better mixing than old conventional mixers. New mixers also require less mixing time. Motors used for these mixers are generally of rating 3hp or 5hp. Some mixers come with timer settings.

Mixer

Energy consumption

Baking accounts for major energy consumption in a bakery unit. Other energy consuming area is mixers, which use electricity.

(i) Unit level consumption

The energy consumptions of different types of units operating in the cluster are estimated to be about 15 toe for micro or smaller size bakery and 33 toe for a medium size unit as shown

in the table. The higher energy consumption of medium size unit may be attributed to higher level of production.

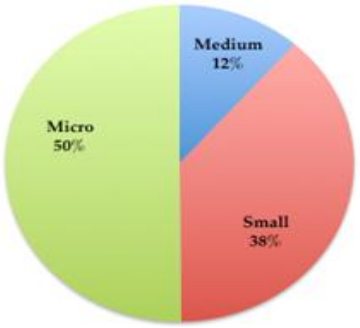
Energy consumption of bakery units in Coimbatore cluster

Type of Industry	Thermal Energy (toe/year)	Electricity (kWh/year)	Total energy (toe/year/unit)
Medium	582	83	33
Small	1917	310	15
Micro	2700	206	15

**Energy data collected from individual bakery units in Coimbatore*

(ii) Cluster level consumption

The total energy consumption of bakery cluster is estimated to be 5,798 toe per year. Wood represents close to half of energy consumption of the cluster as shown in the table. The bakeries in micro category account for about 50% of total energy consumption in the cluster followed by small bakeries (38%).



Energy consumption share by bakeries

Annual energy consumption of Coimbatore bakery cluster

Type	Unit	Quantity	Equivalent toe	Share (%)	GHG emissions (tonne CO_2/yr)	Annual energy bill (million INR)
Electricity	Million kWh	7.0	599	10%	682	31
HSD	kL	1140	1083	19%	2905	615.6
LPG	MT	1200	1416	24%	3582	720
Wood	MT	9000	2700	47%	-	540
	Total		5798	100%	7169	1907

Energy saving opportunities and potential

Some of the major energy saving opportunities in bakery units in the cluster are discussed below.

(i) Energy efficient burners for ovens

Presently diesel fired ovens have mono-block burners which require proper tuning. These burners also have limitation that they tend to reduce the temperature when diesel is cut off upon achieving required temperature as the blower keeps running. This increases the overall 'on-time' of the burner thereby increasing 'specific energy consumption' (SEC) of the furnace. Hence it recommended to use energy efficient recuperative type burners which will help in improving the SEC of the ovens.

(ii) Insulating ovens

The ovens are generally built with ceramic insulation in case of diesel fired and electrical ovens and refractory bricks in case of wood fired ovens. It is recommended to ensure proper

insulation by checking ovens for any heat loss from surface or hot spot formation which indicates worn out or damaged insulation. The outside surface temperature may be maintained close to a maximum of 20 ºC above ambient temperature. This will also reduce heat losses and improve workplace environment.

(iii) Residual heat utilisation in wood fired ovens

Wood fired ovens are built with refractory bricks, which stores heat for some time. As temperature requirement for different products is variable, product of highest temperature requirement i.e. bread can be baked in the oven at 250 ºC, after this residual heat in the oven can be utilized by keeping cakes in the oven which requires 180ºC temperature. After baking cakes, cookies or biscuits can be baked at 150 ºC and at last macaroons at 80 ºC can be baked. This gives the complete utilization of residual heat which will help in minimising fuel consumption. Residual heat can also be used for wood drying process at the time of night when oven is not operated and it will reduce further wood consumption for moisture removal. This is possible in small wood fired ovens used in small retail bakeries.

(iv) Thyristor control for electrical ovens

Electrical ovens used are of resistance heating type. Normally on-off controls are used to control heating cycle. Due to continuous switching, life of heating coil reduces due to thermal shocks and frequent failure occurs. Thyristor control can be used instead of on-off control, which can give around 7-15% energy savings and can increase coil life due to smooth switching with the precise temperature control. The investment requirement for thyristor control is about Rs 0.1-0.8 lakh.

(v) Replacement of rewound motors with energy efficient motors

The bakery units use rewounded motors quite exensively. Rewinding leads to drop in efficiency by about 3-5%. It is recommended to repalce all old motors which have undergone rewinding two times or more with EE motors (IE3 efficiency class). This would result in an energy saving of 3-7% result in saving in energy costs. The payback period for EE morots varies from 1.5 to 3 years.

(vi) Use of timer switches for mixers

The time requirement for mixing of ingredients varies from 15 to 20 minutes depending on the product. Mostly, the mixing time exceeds due to workers ignorance and motors keep running for more than the batch period ultimately consuming more energy. This can be avoided by using timer switches for mixer motors which will switch off the motor automatically after the set time period is over for the batch.

(vii) Use of solar energy for electricity and hot water

Generally, the bakery units have large area of roof tops which can be used to tap solar enregy. The solar energy can be utilized to replace existing coventional water heating arrangement and/ or to meet part of electrical loads such as lighting and lower range. Customised soultions can be developed for unit specific applications.

(viii) Optimum loading of ovens

Bakery production process is generally not planned and ovens are operated as per requirements. Many times this results in poor loading of ovens where production output

reduces consuming similar amount of energy. Hence it is recommended to do proper planning of production, which will ensure optimum loading of ovens.

(ix) Slurry preparation for reduction in mixing time

Mixing is the major step in preparation of bakery products. Normally all the ingredients are mixed at the time of mixing process in the mixer utensil and kept for 15 to 30 minutes depending on the type of product. This is quite time consuming and increases energy consumption of mixer motor. Hence it is recommended to prepare slurry of ingredients except flour and keep it ready before mixing it with flour. This slurry can be directly poured into the mixer along with the flour at the time of mixing process. This would help in improving product quality in case of bread and buns and also reduces mixing time by around 10 minutes per batch which is significant.

(x) Adoption of biomass gasification in wood based ovens

The efficiency of wood firing in wood based ovens is very low resulting in higher wood consumption and generation of higher GHG emissions. The wood can be better utilized through a gasification system instead of direct burning. The biomass gasification has following attributes.

- Wood is converted to producer gas, a clean form of fuel
- Easy to monitor and control operating parameters
- Higher efficiency of the system
- Less emission and better work place environment
- Improved product quality and higher productivity
- Potential wood saving upto 50%

(xi) Reduction of deadweight of baking racks

The products are baked by keeping them on fixtures with multiple shelfs which are fabricated locally using mild steel angles and plates. The MS rack accounts for around 90% of total weight of trolley structure. Both the products and fixtures are heated inside the oven upto about 180 ^{o}C. Since batch operation is followed, the fixutre (which provides only support to the product) is subjected to alternate heating and cooling. The weight of fixture can be reduced by introducing SS mesh trays to replace existing support plates which are kept in the middle. A potential weight redution to the extent of 20% is feasible without affecting performance. This would enhance the product to fixture ratio and hence would lead to reduction in fuel consumption. The potential energy saving with this arrangement is around 5-10%.

(xii) Lighting

T-12 tube lights (of 52W including choke) and CFL lamps (36W and 45W) are generally used by bakery units in the cluster. These inefficient lightings can be replaced with energy efficient LED lighting (LED tube lights of 10W and 20W) which would provide better illumination and energy savings. Since a large number of lamps are used in the units, the existing lighting may be replaced with EE lighting in a phased manner. The payback period is generally about 2 to 3.5 years.

Major stakeholders

The primary stakeholders in the cluster are the bakery units based in Coimbatore and the leading industry association of the region –Coimbatore District Bakery Owners' Welfare Association, District Industries Centre, (DIC), MSME-DI, SIDBI, various government agencies, regulatory bodies, research and academic institutions, testing and training institutes and Business Development Service (BDS) providers. These cluster actors provide various services to the cluster units, such as training of workers, testing facilities, financial services, technical know-how, regulatory and advisory services, raw materials supply, supply of technologies etc. Out of these stakeholders, the bakery owners' welfare association is the most proactive in the cluster. It has more than 300 members. The association address the issues related to the welfare and grievance redressed of their member industries.

Cluster development activities

There are no on-going activities in bakery industries in the cluster.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http:/ / www.sameeeksha.org