Electric Injera Mitad Energy Efficiency Standards & Labeling, challenges and prospects

Prepared by Ethiopian Energy Agency (EEA) presented by
Getahun Moges
Director General  EEA
I. Injera and the conventional electric Injera Mitad

**Injera**

Injera: Staple food for Ethiopians
350 – 450 Grams

**Conventional Electric Mitad**

Majority of producers -0.9 mm resistance
4 Kw starting & 3.8 Kw Avg. Steady power
Single or double clay plate
8 -12 Kgs Clay plate
Start up time: 15 to 20min

- Fixed position
- 4 Sq. mm Cable
- 25 A Switch (Kalki) and ACB
II. Analysis of problem

2.1 The Core problem

Problem tree Locally manufactured .pptx

- Very low energy efficiency – About 56-60%.
- Efficiency not improved over 50 years.

2.2 The causes of energy inefficiency

2.2.1 Heat losses.

- Bottom, Side, Lifting cover - 50% time closed.
Analysis of problem…..

❖ Make up and production of clay plate
  • Clay and Sand proportion – not known
  • Mixing clay and Sand - by hand and Leg
  • Clay plate thickness - non uniform
  • Clay plate firing - open air firing

❖ Over heat and under heat conditions

2.2.2 High heat load (mass to be heated up) – 14 Kgs
  ➢ Clay plate: 8-9Kgs
  ➢ Heat insulation: Gypsum, clay or soil, 3 Kgs
  ➢ Sealant material: Gypsum, 2 Kgs
2.2.3 Absence of Standard:

- Sizes - 40 to 60 cm,
- Thickness - 2.5 to 3 cm,
- Weight - 8Kg to 9 Kg.
- Heating element: 0.9 type. Resistance values: 22.9 ohm, 23.1 ohm, 26 ohm.

- Absence of Uniformity in placing resistance:
  - Groove spacing,
  - Groove Depth: Shallow, Deep
  - No of spiral circles 12-14

Analysis of problem.....
Analysis of problem.....

2.2.4 Lack of research & innovation
- Lack of Technical support
- Lack of Financial support

2.3 The effects of energy inefficiency

2.3.1 High power demand:
- Power supply infrastructure overloading
- Frequent Interruption (Holidays seasons)
- Outages, Voltage drop, Load shedding

2.3.2 High energy consumption
- Customer
- Impact during baking.
- Unwarranted energy consumption – National level
Analysis of problem.....

2.3.3 Mitad supplied with losses :
- 37.1% losses on power, 2014, EEPCO Master plan
- Generation = 3.8KW / (1 - 0.371) = 6.04KW
- 23.4% losses on energy, 2014.

2.3.4 Environmental degradation
2.3.5 Environmental pollution
2.3.6 Burden on women
III. Demand for improved product

INJERA ELECTRIC BAKING: ENERGY USE IMPACTS IN ADDIS ABABA ETHIOPIA
(A World Bank-funded Study)

Submitted To: Ethiopian Electric Power Company
Addis Ababa, Ethiopia; and
The World Bank
Africa Region
Washington DC 20433

Submitted By: Dave Sood
Consultant
Great Falls, Virginia 22066
USA
Email: davesood@aol.com

Date: May 10, 2010
3.1 Estimated demand

Estimated 500,000 Mitads in AA in 2012 GC

High resistance, inadequately sized electric wiring, and incorrectly adjusted combustion element;

Use of poor construction materials;

Poor insulation: dissipation of energy during the baking session is said to roughly range from 40 to 50 percent;

Lack of temperature control device, and Overall, sub-optimal/poor and inefficient design and workmanship.
Demand for improved product....

3.2 Ethiopians continue consuming Injera

- 2 million plus Injera for Addis Ababa per day
- Clay plate Mitad preferred. Quality, cost, convenience

3.3 Households % of national energy cons.

2006 – 34%
2007 - 43%
2008- 31.4%

More than Industrial consumption.
3.4 Number of Injera Mitads

- EEU domestic customers 2006 EFY: 2 million plus
- Hidar 2007 EFY, no. of EEU Domestic customers 100 KWh/month - 550,000.
- About 1 Million Mitads in Ethiopia.

3.5 Power and energy demand

60% of the residential power demand

Installed Power demand year 2007 EFY

Estimate = 3.8 KW/Mitad X 550,000 Mitad = 2090 MW.

- Including losses = 831 MW

Demand for improved product....
Demand for improved product....

3.6 Peak power demand

Holidays:

- Diversity of use, = 25%
- 25% x 2090 MW = 523 MW

Energy consumption estimate

3.8Kw x 2hrs/baking x 10 baking/month x
550,000 x 12 months = 502 GWh/year.
Including losses – 652 GWh/year.

3.7 The rate of production Injera Mitad.

Chid Tera no of producers thought the year.
Rate of clay plate arrival - Chid tera, Wednesday and Saturdays
Many electric Mitads will be installed at faster rate
Demand for improved product....

3.8 Migration from bio mass fuel Mitad to Electric Mitad due to:
   Huge rural electrification works underway.
   Scarcity and soaring price of wood

3.9 Cheaper electrical energy tariff.

3.10 Demand from Policy context
   The GTP
      ➢ Expansion of energy infrastructure
      ➢ Rural electrification access program.
      ➢ Government ensure energy efficiency and conservation
   The CRGE: re-establishing forests & Leapfrogging to energy-efficient technologies

3.11 Draught – Shortage of water in dams
IV. Mitad Technology Improvement efforts

4.1 Gashaw Getenet thesis for Masters Degree at Addis Ababa University, “Heat Transfer Analysis during the process of Injera baking by finite element method”, in Nov, 2011. Test made on a 20 CM thick, 60 CM diameter and 3.0 KW Mitad, the energy efficiency was found to be 53.11%

4.2 “Design and manufacture of laboratory model for solar powered injera baking oven” by Mekonen Meselu, Addis Ababa University, Department of Energy center, Nov. 2011, Ethiopia
Mitad technology Improvement efforts...

4.3 MDM Engineering, Addis Ababa produces the revolving double face electric Injera Mitad type which are currently in the market.

4.4 WASS electronic services, USA, has designed and produced non clay based Injera Mitad of 16” size named WASS Mitad grill
**Mitad technology Improvement efforts...**

4.5 ZELFIWU, Inc, patented, USA, Designed and manufactured non clay based ZelealemInjera Machine, an Automated Injera Machine

4.6 Yoseph Temesgen, patented, 2008, USA
Mitad technology Improvement efforts...
4.7 Mengisu Kndle, patented, 2003, USA, designed non clay based an automated Injra Mitad.

4.8 Emru Desalegn, patented, 2005, USA
Mitad technology Improvement efforts...

4.9 Sisay Shimelis, Injera machine, patented in 2012, USA

4.10 Renewable Energy Technology Directorate at Ministry of Water, Irrigation and Energy and the Ethiopian Energy Authority (EEA)

4.11 Lejo Aluminium, EELPA,
4.12 Injera and Dabo Mitad
4.13 Wall mounted (condominium) Mitad
4.14 Induction Mitad
4.15 Leg folded Mitad
4.16 Energy efficient Mitad
4.17 Automatic multiple circular baking machine, 9-12 Mitads
4.18 Ceramic Mitad, Korea
Project title: Supporting the local manufacturing

Project ID Number: 150409

Area/Location/Countries: Africa, Ethiopia

RBM code: EC3 Environment & Energy
Thematic code: EC32 RECP & LowCarbon

Planned Start - finish date: 01.12.2015 - 30.05.2017
Mitad technology Improvement efforts...
Development of energy efficient
new IH Mitad stoves; a cooperative project between:
UNIDO Korea Energy Agency (KEA) and Korea Testing Laboratory (KTL)
Mitad technology Improvement efforts...

Induction Coils & Temperature Sensor

Baking Plate

Basic development of new IH Mitad stove is completed but fine tuning to improve baking performance
V. Energy Efficiency (EE) standards and labels-

5.1 Labels:
   a. informative labels affixed to manufactured products (usually in the form of energy use, efficiency, or energy cost)
   b. give consumers the data necessary to make informed purchases.

Two types: endorsement labels and comparative labels.

5.2 Energy efficiency (EE) standards:
   a. procedures and regulations that prescribe the energy performance of manufactured products,
   b. sometimes prohibit the sale of products that are less efficient than a minimum level.

5.3 Rational for EE labels & standards:
   a. essential element in any government’s portfolio of EE policies and climate-change-mitigation programs.
      i. they can produce very large energy savings
      ii. limiting energy demand growth without limiting economic growth
      iii. require change in the behavior of a manageable number of manufacturers rather than the entire consuming public
      iv. they treat all manufacturers, distributors, and retailers equally
      v. the resulting energy savings are generally assured
Energy Efficiency (EE) standards and labels...

5.4 Steps in the process of developing energy-efficiency labels and standards

- a) Decide Whether and How to Implement Energy Efficiency Labels and Standards
- b) Develop a Testing Capability
- c) Design and Implement a Labeling Program
- d) Analyzing and setting standards
- e) Design and Implement a Communication Campaign
- f) Ensure Program Integrity
- g) Evaluating the impact of labeling and standards programs
VI  Mitad Labeling

6.1 Labeling

Draft Label design by EEA

<table>
<thead>
<tr>
<th>Label Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Efficient</td>
<td>1</td>
</tr>
<tr>
<td>Low Efficient</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Manufacturer Model No.</td>
<td></td>
</tr>
<tr>
<td>Nominal Power (kW)</td>
<td></td>
</tr>
<tr>
<td>Annual Energy Consumption (kWh)</td>
<td></td>
</tr>
<tr>
<td>CO2 Emission per Year</td>
<td></td>
</tr>
</tbody>
</table>

Figure - 33. Locally produced electric stove energy efficiency label
Mitad labelling...

6.2 Communication Campaign by EEA

6.3 Standard

Draft MEPS by EEA and ESA

6.4 Implementation Comparative labeling program

identify products with lower energy consumption and better efficiency in the market.

the first phase (first few years) an implementation of voluntary testing samples

Assign labels

6.5 Ensure Program Integrity

6.6 Evaluate the impact of labeling and standards
Mitad labelling ....

6.7 Types of producers
Body producers.
Clay plate whole sellers and retailers.
Assemblers
Clay plate producers

6.8 Assessment on producers
38.3% are body producers, 3.7% are clay plate whole sellers and retailers and 55.3% are Mitad assemblers, 2.7% Body producers and assemblers.
Estimated about 90% producers including those not identified are located in Addis Ababa.10 % are located in the regional states and Dire Dawa city administration.
Majority of Mitad body builders are located at Chid Tera, Addis Ababa
62 % of assemblers produce the single clay type 58 cm diameter Injera Mitad, 32% 59 cm and 6% based on customer interest.
Majority of Mitad assemblers use what they refer to as two pieces of 0.9 mm diameter electric heating element and 95% of them do not measure the resistance of the heating element and fix it directly to the clay plate.
6.9 The concerns, interests and challenges of the producers are:

a) Concerns & interests
Perceived fear of being registered and paying tax (VAT) for those working without trade licenses. Majority work at home and sell products through contacts. That production methods to continue as used to be. Change in production methods and introduction of new improved products may pull them out of the business. Cost to be incurred for the program. Better market opportunities for those having trade license. Patent rights issues on the efficient products they develop through innovations and researches. The decision on fixing the power rating of the products is in the hands of Producers. Contacts consumers.
b) Challenges

Lack of Production facility. Small work spaces, high rent, working for others
Lack of finance and Loans
Lack of testing and measuring instruments
- Lack of Training and skill development. Training the assemblers on electrical systems and EE, clay producers, and body producers is a precondition and mandatory requirement for the successfulness of the EE standard and labeling program
- Lack of incentive.
  - Government purchases. Military, universities
  - Tax reduction
  - Performance based purchases, per EE product.
- Depletion of raw material
- Lack of standard production materials
- Low voltage levels at consumer locations
- Products made by none experienced & non skilled
6.10  What is expected from the producer

a) Support the EE ST and L program: National interest

b) Actively participate:
   in the label design
   in the standard development
   in the comparative labeling

c) Improve its products: Energy efficiency, quality, workmanship

d) Cooperate, specialize, respect patent

e) Demand for support:
   Technical and Financial assistance
   Loan
   Land
   Raw material locations. Eth Min of Mines

f) Protect this indigenous & cultural product
e) Support to consumer by Gov/donors

- Providing rebates to reduce cost of Energy eff.
- Grants and incentives. eg. CFL
- Consumer credit facility
- Distribution to users in collaboration with the (EEU) Government
  ✓ Charging consumers the cost of improved Mitads with electric Bills.

f) Experience of NEMA - National Electrical Manufacturers Association, USA

- The authoritative representative of the collective interests of the electrical
• Expand market opportunities, remove business barriers and reduce manufacturing costs through development and delivery of consensus-based standards and other intellectual property

• Promote the safe and effective design, installation and use of electrical and medical imaging products.

• Support national regulations and voluntary standards that are technically sound, economically justified, and promote innovation, public safety, access to life saving and energy efficient products, and efficient resource allocation.

• Opposed to conduct which is likely to defraud or deceive the public or our customers about our industry’s capabilities, products and services.
Collaborate within NEMA to improve production and manufacturing
Opposed to conduct which is likely to defraud or deceive the public or our customers about our industry’s capabilities, products and services
- We have zero tolerance for those who traffic in or promote the sale of counterfeit and pirated products.
- Conduct our business responsibly & ethically and in compliance with all of the laws and regulations where we do business.
Collaborate within NEMA to improve production and manufacturing.

Opposed to conduct which is likely to defraud or deceive the public or our customers about our industry’s capabilities, products and services

- We have zero tolerance for those who traffic in or promote the sale of counterfeit and pirated products.
- Conduct our business responsibly & ethically and in compliance with all of the laws and regulations where we do business.
6.11 Other Benefits

- Saving on consumer power & energy demand
- Reduction in infrastructure overloading, outage, overloading, interruptions
- Reduced emission from clay plate firing
- Women and Girls. Reduced burden of collecting firewood and Health related problems.
Innovative technologies in Efficiency is a subject of dire importance & Should pursued as a separate sphere of regulation in order to develop market for energy services.

The end questions?