

Ethanol Cookstoves in India

Proposed Initiative for Government Of India

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Can India Diversify Its Cooking Fuel Mix?

*India's energy demand continues to grow, while the country remains **heavily dependent on imported LPG**, exposing the cooking energy system to price volatility, supply disruptions, and geopolitical risks.*

*At the same time, India is witnessing rapid expansion in domestic ethanol production capacity, with over **700+ crore litres of potential surplus ethanol** beyond current OMC requirements.*



India's Growing Cooking Energy Demand

10.33Cr

PMUY Connections

*LPG connections released under
Pradhan Mantri Ujjwala Yojana*

3,100Cr

Annual LPG Consumption

*Kilograms of LPG consumed in India
annually*

60%

Import Dependency

*Share of LPG demand met through
imports*

Despite significant progress, cooking energy demand continues to rise due to population growth, rising urbanisation, and expansion of clean cooking access. India's growing demand requires additional clean, scalable, and domestically sourced energy solutions.

Energy Vulnerability & LPG Import Dependency



Global Price Volatility

Fluctuations in international LPG prices impact domestic costs



Shipping Disruptions

Nearly 90% of shipments pass through Gulf/Hormuz route



Geopolitical Shocks

External supply chains vulnerable to global conflicts



Supply Shortages

Potential disruptions threaten cooking energy security



Case for Fuel Diversification

Long-term energy resilience requires multiple fuel pathways. Resilient energy systems rely on a diversified mix of complementary fuels such as LPG, electricity, biofuels, and natural gas.



Reduce Pressure

Lessen dependence on single fuel supply chain



Improve Flexibility

Better system response during disruptions



Domestic Resources

Utilise local energy production capacity



Energy Security

Strengthen long-term resilience

Surplus Ethanol Capacity

Ethanol Supply vs Demand (ESY 2025-26)

Category	Value (Crore Litres)
Capacity	2000
OMC Demand	1300
Surplus	700

India has strong policy support through Ethanol Blended Petrol Programme and National Policy on Biofuels, abundant agricultural feedstocks, and rapidly expanding distillery infrastructure.



Absorbing Surplus Ethanol Supply

01

Energy Equivalence

1 kg LPG $\approx$ 1.6 litres ethanol

02

Annual LPG Consumption

3,100-3,300 crore kg LPG consumed annually

03

Ethanol Equivalent

$\sim$ 5,000 crore litres ethanol equivalent

04

10% Substitution

$\sim$ 500 crore litres annual ethanol demand

Even limited substitution can create substantial new ethanol demand, absorbing a significant share of India's surplus biofuel production capacity.



Ethanol Cookstove Technology

Ethanol can be used as a clean liquid cooking fuel through modern ethanol cookstoves. Both LPG and ethanol fuels are recognised as clean cooking fuels by international standards at the point of use.



Clean Burning

Minimal smoke, low particulate matter, negligible indoor air pollution at point of use



High Efficiency

Around 58% thermal efficiency, comparable to or exceeding traditional LPG stove performance



User-Friendly

Simple operation, easy refuelling, and safe handling make ethanol cookstoves accessible for households



Safe & Portable

Easy to transport, store, and meter, with lower explosion risk than pressurised gas cylinders

Benefits of Ethanol Cookstove Adoption

Energy Security

- *Reduces dependence on imported LPG*
- *Diversifies India's household energy mix*
- *Strengthens resilience during global supply disruptions*

Rural Economy

- *Creates additional demand for agricultural biofuel feedstocks*
- *Supports farmers through ethanol supply chains*
- *Encourages investment in rural distillery infrastructure*

Environment

- *Reduces deforestation caused by firewood collection*
- *Lower greenhouse gas and particulate emissions*
- *Supports India's clean energy and climate goals*

Public Health

- *Significantly reduces indoor air pollution*
- *Decreases respiratory illnesses linked to biomass smoke*
- *Improves cooking conditions for women and children*

Proposed Implementation Strategy



Pilot Deployment

Pilot projects in select districts and institutional kitchens



Domestic Manufacturing

Promote Make-in-India ethanol cookstoves



Fuel Distribution

Leverage existing fuel distribution networks



Policy Support

Introduce pilot DBT subsidy (5–6 L per refill)



Safety & Standards

Develop technical and safety standards



Scale-up

Gradual expansion based on pilot outcomes



Case Study – KOKO Energy: Powering Kenya's Clean Cooking Revolution

*An innovative model that brought clean, affordable
bioethanol cooking to millions of Kenyan households*

The Challenge: Dirty Cooking Fuels in Kenya

Environmental Damage

Traditional charcoal and kerosene fuels drive deforestation and generate massive greenhouse gas emissions across urban and rural areas.

Health Crisis

Severe indoor air pollution causes respiratory diseases, particularly affecting women and children who spend hours near cooking fires daily.

Economic Burden

Polluting fuels remain the only affordable option for millions of low-income households, trapping families in a cycle of poor health and high costs.

KOKO's Vision: Clean, Affordable, Convenient

KOKO Networks set out to revolutionize cooking in Kenya by replacing polluting fuels with clean, liquid bioethanol—a renewable fuel made from agricultural waste. The company's mission was ambitious yet focused: make clean cooking accessible and affordable for low-income urban households, creating a sustainable alternative that improves health while reducing environmental impact.



The KOKO Distribution Model: A Tech-Enabled Ecosystem

KOKO created an integrated system that combined hardware, software, and local partnerships to deliver clean fuel at scale:



KOKOpoints

Cloud-connected "fuel ATMs" installed in local neighborhood shops (dukas and kiosks), enabling convenient refills in familiar community locations.



Smart Canisters

Customer-owned canisters that dock with KOKOpoints for refilling and connect to KOKO Cookers at home—each uniquely tracked through the platform.



KOKO Cookers

Affordable, modern bioethanol stoves designed for safety and efficiency, offering a direct replacement for charcoal and kerosene cooking methods.



KOKO Cloud

Software platform managing the entire network, enabling cashless payments, remote safety monitoring, and real-time supply chain visibility.

Strategic Partnerships: Scaling with Giants



Vivo Energy Kenya

A key strategic partner that leveraged Shell-branded fuel distribution infrastructure for storage and last-mile delivery.

This partnership enabled KOKO to integrate its technology platform with existing fuel logistics networks, dramatically accelerating deployment without building parallel infrastructure.

The Impact: Millions of Households Transformed

1.5M

Households Served

Over 1.5 million Kenyan households gained access to cleaner cooking alternatives, replacing charcoal and kerosene with bioethanol.

2.4M

Tonnes of CO2 Avoided

Estimated annual reduction of 2.4 million tonnes of greenhouse gas emissions in urban Kenya—equivalent to removing over 500,000 cars from roads.

\$100

Annual Savings

Households saved approximately \$100 annually on fuel costs while enjoying better health outcomes and convenience.

The transition led to significant cost savings for consumers and dramatically reduced environmental impact across Kenya's urban centers.

Affordable Clean Fuel at Your Fingertips

KOKO points transformed local dukas and kiosks into clean fuel stations, bringing modern energy access to familiar neighborhood locations.





KOKO Networks: Lessons from Kenya's Clean Cooking Ethanol Model

An analysis of why an ambitious last-mile distribution ecosystem failed and what it means for India's ethanol cooking fuel opportunity

Three Pillars of the Business Model



Ethanol Fuel Sales

Smart vending machines ("KOKO Points") sold ethanol at below-cost retail prices to drive rapid household adoption and displace traditional cooking fuels



Carbon Credit Engine

Core revenue relied on generating and monetizing carbon credits by demonstrating emissions reductions from fuel switching



Subsidized Hardware

Heavily discounted ethanol-compatible cookstoves accelerated customer acquisition, with losses expected to be recovered through future carbon revenues

The Fatal Flaw: Structural Financial Vulnerability

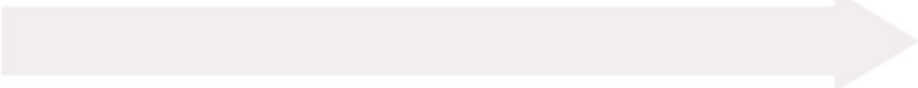


The Core Problem

Ethanol retail pricing was not cost-reflective and depended entirely on external carbon finance to bridge the viability gap.

Result: *Fuel sales alone could not sustain operations. Profitability required continuous, predictable carbon credit monetization.*

Why the Model Collapsed



Carbon Credit Approvals Stalled

Regulatory and policy constraints created uncertainty in carbon credit monetization mechanisms



Expected Cash Flows Failed to Materialize

Projected revenues from carbon markets did not arrive as forecasted, disrupting financial planning



Subsidy Recovery Impossible

Unable to recover embedded subsidies in both fuel pricing and stove distribution programs



Entire Structure Unsustainable

Financial foundation collapsed without carbon credit revenue stream



Key Insight: The Carbon Finance Trap

-  **Critical lesson:** While ethanol-based clean cooking has strong demand potential, a business model overly dependent on carbon credit revenues is inherently fragile and exposed to regulatory risks.

Requirements for Sustainable Models

1

Cost-Reflective Fuel Pricing

Retail pricing must cover operational costs without relying on external subsidies or volatile revenue streams

2

Carbon Credits as Supplementary Upside

Treat carbon revenues as bonus income, not core financial foundation. Build resilience against market volatility

3

Minimal External Subsidy Dependence

Operational viability must be achievable through core business economics, not contingent on policy support or carbon markets

India's Opportunity: A Different Foundation

India's Advantages

- *Strong domestic ethanol supply economics*
- *Established production infrastructure*
- *Large addressable market*

Policy Considerations

- *Pricing frameworks that ensure cost recovery*
- *Minimal dependence on volatile carbon markets*
- *Focus on operational sustainability*



Strategic Implications for India



High-Impact Opportunity

Ethanol retail for cooking remains a compelling solution with proven demand potential and environmental benefits



Supply Economics Matter

India's domestic supply advantages provide a stronger foundation than Kenya's import-dependent model

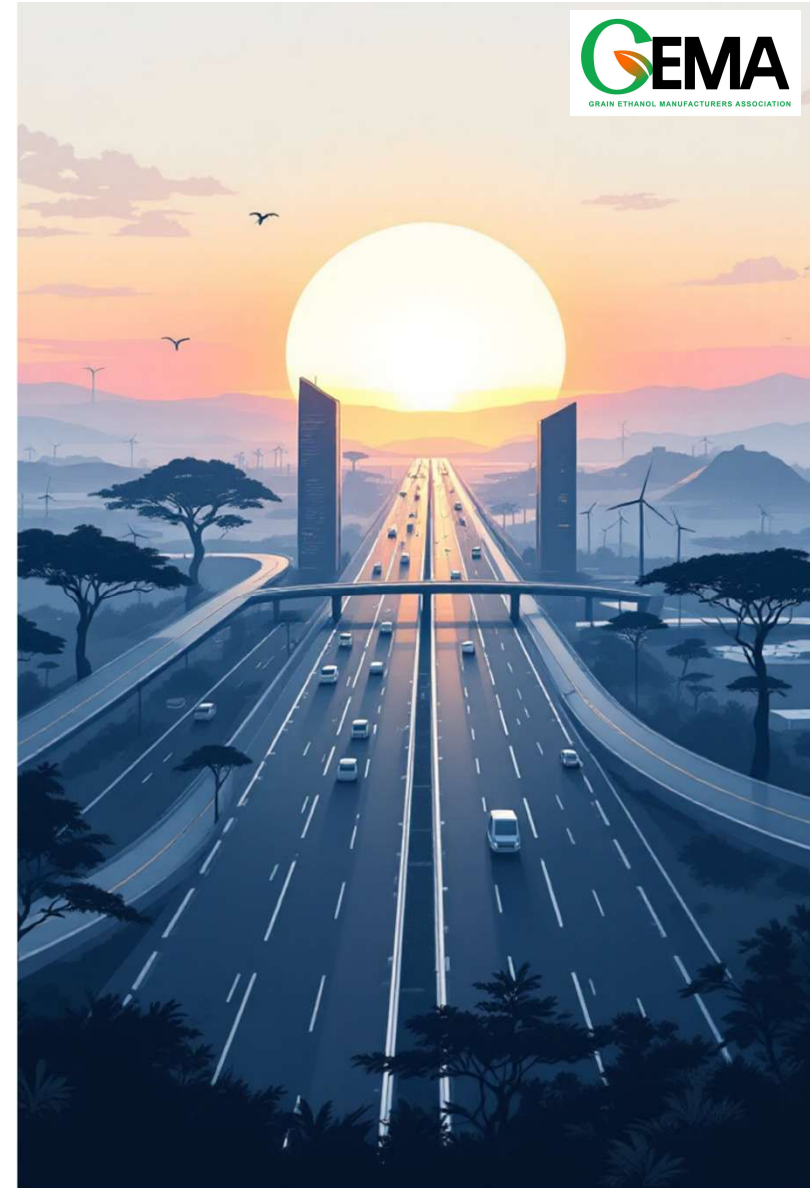


Build Financial Resilience

Design business models that remain viable even if carbon credits are delayed or restricted

Learning from Kenya, Building for India

The KOKO case demonstrates that clean cooking ethanol models can achieve strong consumer adoption and scalability. For India, success will depend on building financial resilience through cost-reflective pricing, robust domestic supply economics, and minimal dependence on volatile carbon markets.



Fast-Track Adoption Strategy

Targeting Commercial Cooking Segment for Ethanol Fuel Transition

A strategic roadmap for implementing ethanol-based cooking fuel in India's commercial sector, leveraging existing infrastructure to reduce LPG dependency and enhance energy resilience.



India's LPG Consumption Landscape

3.2K

Crore kg/year

Total LPG consumption across India

10-15%

Commercial Segment

~300-450 crore kg/year high-value
demand

85-90%

Domestic Segment

Subsidy-dependent, slower transition

The commercial segment represents a focused opportunity for rapid ethanol adoption without subsidy distortion or political sensitivity.

Why Commercial Segment First?



Market Pricing

No subsidy distortion enables straightforward economics-based adoption



High Consumption

Daily fuel demand creates immediate scale for ethanol production



ROI-Driven

Institutional users prioritize cost-benefit analysis over emotional attachment



Cluster Deployment

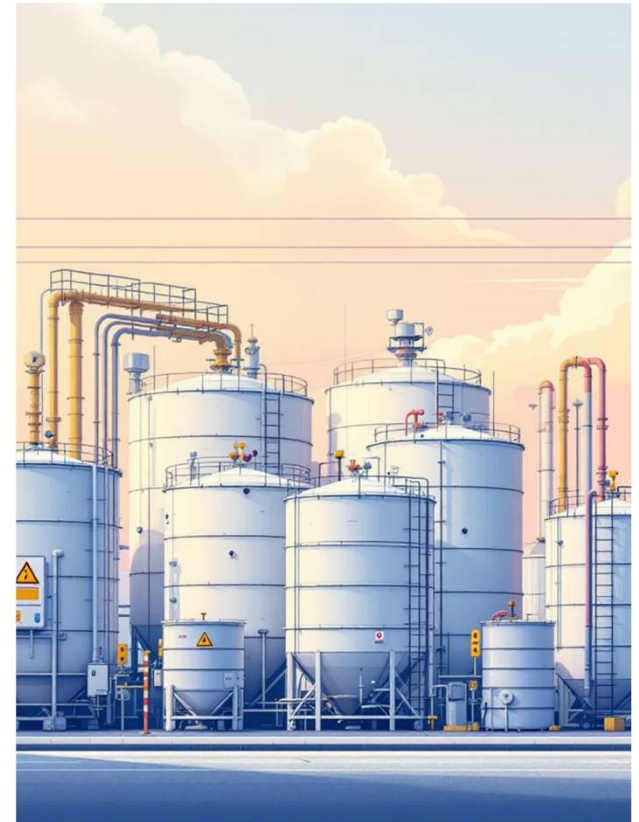
Restaurants and canteens enable efficient supply chain rollout



Strategic Impact Potential

Replacing Just 10% to 15% of Commercial LPG

- Generates 600-700 crore litres annual ethanol demand
- Immediate absorption of surplus ethanol capacity
- Reduces import dependency for 300-450 crore kg LPG equivalent
- Enhances energy security through domestic fuel source



Ethanol vs LPG: Commercial Viability

Parameter	LPG	Ethanol
Nature	Pressurized gas	Liquid fuel
Supply Risk	Import dependent	Domestic production
Storage	Cylinder required	Flexible containers
Efficiency	50-52%	55-60%
Safety	Explosion risk	Controlled flame

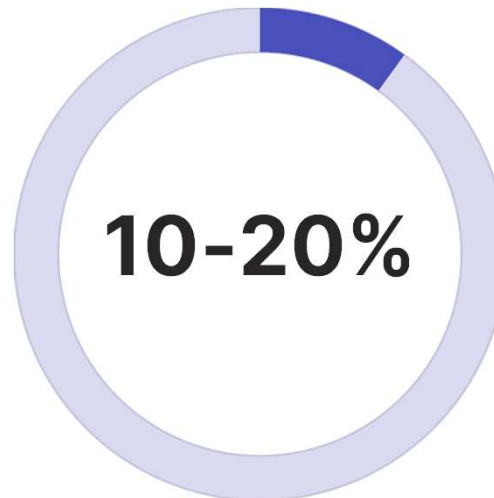
Higher efficiency narrows cost gap. Eliminates cylinder logistics and deposits. Enables pay-as-you-go model with lower working capital requirements.

Commercial Kitchen Economics



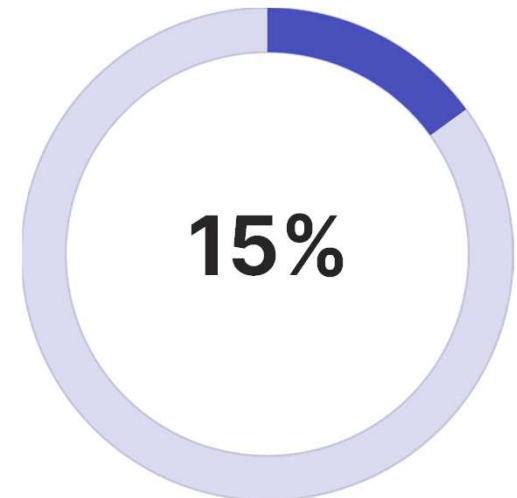
LPG Cost

19 kg cylinder price



Ethanol Premium

Slightly higher initial cost



Efficiency Gain

Burn time advantage

Ethanol's higher efficiency (55-60% vs 50-52%) narrows the cost gap significantly. Pay-as-you-go fuel model and elimination of cylinder deposits reduce working capital needs for small businesses.

Phased Implementation Strategy



Key Implementation Enablers

1

Regulatory Framework

- Create "Cooking Fuel Ethanol" category
- Relaxed storage norms for commercial users
- Streamlined licensing for fuel suppliers

2

Supply Chain

- Pre-packaged ethanol (5L/10L containers)
- Cartridge-based delivery systems
- Distribution through existing networks

3

Safety Standards

- BIS-certified cookstoves
- Standard operating protocols
- Training programs for commercial users



Strategic Positioning

Complementary, Not Replacement

Ethanol works alongside LPG to reduce dependency and enhance resilience

Domestic Fuel System

100% domestically produced ethanol reduces import vulnerability

Zero Subsidy Burden

Market-priced fuel requires no government subsidy or political intervention

"We are not proposing disruption of LPG. We are proposing a parallel, domestic, resilient fuel system for the commercial segment, which can be implemented immediately without subsidy burden."

Immediate Policy Ask

1

Regulatory Sandbox

Approval for pilot deployment under controlled conditions

2

Category Creation

Establish "Cooking Fuel Ethanol" classification

3

Storage Relaxation

Simplified norms for commercial users

Fast-track pilot program enables immediate demonstration of viability while building regulatory framework for nationwide scale-up.



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