Electrifying Indian Kitchens

***Mains**: GS-III – Science & Technology*

Why in News?

India spends $26.4 billion a year importing cooking gas, cooking with electricity is now cheaper than cooking with unsubsidised LPG, but moving hundreds of millions of kitchens from flame to wire raises a chain of questions about cost, grid stress, and who pays when demand spikes.

Why is gas-based clean cooking hitting a wall?

- **Growth of Domestic LPG connections** – It grew from 150 million in 2015 to 332 million by 2025.
- But India *imports 60% of its LPG and 50% of its natural gas*, yet 37% of households still burn firewood and dung.
- **Rising import cost** – The Institute for Energy Economics and Financial Analysis (IEEFA) estimates that the combined import bill hit $26.4 billion in FY24–25 — a *50% jump in six years*.
- **Geopolitical Vulnerability** – Every West Asian escalation sends a price shock straight into Indian kitchens.

Can electricity beat gas on cost, efficiency, and everyday cooking?

- **Advantage of Electric Cooking** – An IEEFA study found that *electric cooking is 37% cheaper than non-subsidised LPG* and *14% cheaper than piped natural gas* for a family of four in Delhi — without any electricity subsidy.
- Only PM Ujjwala Yojana's heavily subsidised LPG is cheaper, but that subsidy costs the government thousands of crores annually.
- **Efficiency Gap** – Induction cooktops transfer about 85% of energy to the vessel; an LPG burner manages roughly 40%.
- Electric pressure cookers, tested across the MECS programme's multi-country cooking diaries, use less energy than any other device assessed.
- **Cooking Complexity in India** – Indian meals often require multi-pot cooking (chapatis, tadka, dal simultaneously), knows that a standard single-plate induction unit is insufficient.
- TERI advocates for R&D on multi-pot and flame-replicating induction models as a precursor for mass adoption, explaining why electric cooking was only 5% in 2021.
- **Urban First Strategy** – Both International Institute of Sustainable Development and IEEFA recommend starting with urban kitchens, freeing imported LPG for rural areas

that still lack reliable electricity.

What is a 'peak,' and what does a utility do when demand outstrips supply?

- **Peak** – Electricity use rises and falls through the day; it climbs around 3 p.m. and again between 9–11 p.m., when households switch on lights, fans, TVs, and ACs together, this surge in demand is called the "peak."
- **Rising Peak Demand** – India's peak demand rose from 148 GW in 2014 to a record 242.5 GW in December 2025.
- For every degree rise in average daily temperature, peak demand now increases by more than 7 GW, according to the IEA.
- **Options when demand spikes supply** – When discoms face demand beyond contracted supply, they can
  - Buy power on the spot market, prices jump from ₹3.50/unit to ₹9–10/unit during peaks.
  - Run gas-based peaking plants, costly but quick.
  - Release stored hydropower.
  - Dispatch grid-scale batteries, e.g., BSES Rajdhani in Delhi's first commercial battery storage.
  - Impose load shedding — planned blackouts, disruptive and penalised by regulators.
- **E-Cooking Challenge** – Adding millions of induction cooktops to that evening peak would steepen the evening peak, raise spot-market costs, and increase the risk of outages.
- The question is not whether to electrify, but how to electrify without overwhelming the grid.
- That is where *automated demand response (ADR)* enters the picture.

Can smart technology flatten the peak automatically?

- **OpenADR** – It is a *two-way communication standard* that enables automated participation of smart thermostats, EV chargers, water heaters, cooktops in demand response, ancillary services (frequency/voltage), and DER coordination.
- These devices then *adjust their consumption automatically*, without anyone having to lift a finger.
- **Origin –** Born from *California's 2002 energy crisis*, its latest version plugs into modern energy systems using standard web protocols.
- **India's Early Deployment** – Tata Power Delhi Distribution ran the *country's first OpenADR pilot* across 167 commercial and industrial consumers, achieving an average peak reduction of 14%.
- The studies suggest 7% peak shaving if scaled across all Indian buildings.
- **Global Use** – South Korea's Auto DR pilot cut electricity use by 24%; such programmes typically pay for themselves within four years by deferring the cost of new grid infrastructure.
- **Challenges**
  - **Discoms still lack is the full stack** – OpenADR-compliant servers, smart-meter-embedded receivers, and aggregator platforms that can orchestrate

distributed loads into virtual power plants.
    - **Households as Grid Participants** – Building this stack is only half the solution, the other half is turning households into active grid participants.
    - From *passive consumers into active participants* alongside upgrading households load capacity from 3 kW to 5 kW through investment in transformers and feeder infrastructure.

Can rooftop solar and neighbourhood trading take the pressure off the grid?

- **Prosumer** – A rooftop solar panel paired with a battery turns a household into a *'prosumer' both producer and consumer*.
- The panel generates power by day; the battery stores the surplus; and the stored energy is discharged in the evening to run the induction cooktop.
- This offsets precisely the peak that mass e-cooking would otherwise create.
- **Global evidence** – A 2025 Australian study found that combining rooftop solar, batteries, and off-peak scheduling halved peak load & cut grid reinforcement costs by 75%.
- **India's Rooftop Push** – Solar capacity is projected to more than double from 24 GW in 2026 to over 41 GW by 2030, boosted by the PM-Surya Ghar Yojana, which aims to give 300 units of free electricity to 10 million households.
- **Peer-to-Peer (P2P) Trading** – P2P trading lets a household sell excess electricity directly to a neighbour using a digital platform, bypassing the traditional discom route.
- India ran *South Asia's first blockchain-based P2P solar trading pilot* in Lucknow.
    - Led by the India Smart Grid Forum and Australia's Powerledger
    - Under a regulatory sandbox approved by the UP Electricity Regulatory Commission.
- **Result** - a 43% reduction in the energy buy price compared with the retail tariff.
- The pilot's success led Uttar Pradesh to direct all its utilities to make provisions for P2P trading — a first for any State.
- In February 2026, Centre announced a P2P facility under the India Energy Stack for Delhi and western UP.
- **Neighbourhood Micro Power Plants** – If a cluster of homes on a single feeder can trade solar surpluses during the evening cooking hours
    - the local peak flattens,
    - the discom avoids buying expensive exchange power, and
    - the neighbourhood effectively becomes a micro virtual power plant.

What needs to happen, and how soon?

- **Global Policy** – New York's All-Electric Buildings Act mandates all-electric new construction under 7 storeys from Jan 2026, taller buildings by 2029.
- **India's groundwork**
    - Go Electric campaign & National Efficient Cooking Programme target 2 million induction stoves
    - BEE launched star labelling for induction hobs
    - PM-Surya Ghar Yojana links rooftop solar linked to household savings.
- **Redirect subsidies** – Estimated Rs.40,000 crore annual LPG subsidy towards one-

time capital support for induction cooktops.

- **Bulk procurement** – Expand EESL's bulk-procurement model to e-cooking appliances.
- **Smart tariffs & Tech standards** – Mandate time-of-use tariffs for e-cooking and require OpenADR compatibility in new appliances and smart meters.
- **R&D push** – Fund on multi-pot induction technology designed for Indian cooking.
- **Construction norms** – Mandate all-electric new residential buildings in Tier-1 cities.

What lies ahead?

- **Geopolitical risk & Economic sovereignty** – Every dollar we spend on LPG imports goes through a supply chain that's completely exposed to Hormuz choke points and whatever the oil producers decide to do that week.
- Transitioning from imported fuel to homegrown power is not just energy policy — it's national sovereignty.
- Urban India is the obvious place to start this shift.
- The question is whether the policy framework will catch up before the next oil shock forces the issue.

Reference

[The Hindu | Why India must electrify its kitchens at scale?]

